

Pieces of Light by Charles Fernyhough

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Casting a Line

‘Can you remember?’

It starts with a question from my 7-year-old son. We are in the grounds of our rented cottage in the Baixa Alentejo, killing time before we head to the Algarve coast for a boat trip. With his holiday money, Isaac has bought himself a hand-held toy that fires little foam rockets prodigious distances up into the air, and he has lost one of them on the gravelled ground behind the swimming pool. As we search, he has been chattering away about how he wants to go fishing with me when we get home from Portugal. I have told him that I used to go fishing, as a child of about his age, with my uncle in the lake in the grounds of my grandparents’ house in Essex. Then, out of the blue, he asks the question:

‘Can you remember the first fish you ever caught?’

I stand straight and look out at the farmland that slopes away from our hillside vantage point. I have not been fishing in thirty-five years, but my thoughts have occasionally returned to my outings with my uncle. When they do, certain images rise out of the past. I can picture the greenish lake with its little island in the middle, how mysterious and unreachable that weeping-willowed outcrop looked to my small-scale imaginings. I can sense my jocular young uncle next to me, his stretches of silence punctuated with kindly teasing. I remember the feel of the crustless bits of white bread soaked in pond water that we used to squidge on to the fish-hooks as bait, and the excitement (for a keen young amateur naturalist) of an afternoon visitation from a stoat, scurrying along by the bullrushes with its black-tipped tail bobbing. I remember the weird, faintly gruesome exercise of extracting the hook from a rudd’s mouth and then throwing the muscular sliver back into the lake to restart its perforated life. But I have never thought about the moment of feeling the tug on the line, the thrill that prefigured the landing of a fish. And I have certainly not had the question framed like this, narrowing my remembering down to the first time it ever happened.

‘I don’t know,’ I reply. ‘I *think* so.’

What accounts for my uncertainty? The image of lifting a fish from the water was not there in my collection of ready-made fishing memories. Because I have never (as far as I can remember) been asked this question, I have never had to come up with a corresponding memory. But I try. I ask myself: What would that first-catch moment look like? Into the well-remembered scene of the lake I insert the detail of an extended fishing rod, seen from the perspective of my childhood self, with something silvery dangling from the end of the line. I feel a pang of recognition, and then a shiver of boyish excitement. And then I ask myself: Did it happen? I *feel* that it did. It seems to me that the event really took place; it feels as though it belongs in the past; it comes with appropriate corresponding emotions; and it feels as though it happened to *me* rather than to anyone else. When I think of the memory now, a month or two after our conversation in Portugal, it has taken on an independent existence. I no longer agonise about whether it was a product of imagination, generated on demand to satisfy a small child’s curiosity.

What is it like to have a memory? What *is* a memory? How is it possible to have ‘new’ memories, like this one of catching my first fish? Have I always ‘had’ the memory, but only just unearthed it, or have I somehow created it out of something else? What about all the other potential memories I could conjure up from that period of my life – those that are not in my consciousness right now, but which could become so, with the appropriate cues? Do I ‘have’ them or not? What status do they have, before and after they come into my mind?

The list of questions goes on. Why did I remember this particular event and not some other? Presumably it was because my memory was clearly cued. I remembered the first fish I caught because I was specifically asked about it. But what about when a memory simply pops into my head for no apparent reason? Yesterday, for example, I suddenly had an exasperatingly random memory of the little blue-and-whitestriped plastic carrier bags that were common when I was a child. We are often struck by the randomness of what we remember, and dismayed by our forgetfulness for the really important stuff. In the words of the American writer Austin O’Malley, memory is ‘a crazy woman that hoards coloured rags and throws away food’. This randomness determines what information we choose to encode about an experience, how we recall what we do actually store, and the triggers that can elicit such memories. Memories that are resistant to the ordinary processes of cueing might nevertheless be flushed out by trivial,

apparently disconnected cues. Even spontaneous memories, which flash into our heads for no apparent reason, may be triggered by some subtle internal or external connections.

For all these reasons, it's impossible to answer the question of whether I 'had' my first-catch memory before Isaac asked me about it. In this book, I want to show that the question is impossible because it relies on a mistaken view of what memories are.

Here's a memory, from an accomplished writer with a special interest in the topic:

It is seen from the point of view of a small person just seeing over the wall of a playground in East Hardwick Elementary School. The stone is hot, and is that kind that flakes into gold slivers. The sun is very bright. There is a tree overhead, and the leaves catch the light and are golden, and in the shade they are blue-green. Over the wall, and across the road, is a field full of daisies and buttercups and speedwell and shepherds' purse. On the horizon are trees with thick trunks and solid branches. The sky is very blue and the sun is huge. The child thinks: I am always going to remember this. Then she thinks: why this and not another thing? Then she thinks: what is remembering? This is the point where my self then and my self now confuse themselves into one. I know I have added to this Memory every time I have thought about it, or brought it out to look at it ... It has got both further away and brighter, more and less 'real'.

The writer is the novelist A. S. Byatt. 'The Memory', as she dubs it, is an example of an *autobiographical memory*, which psychologists define as those acts of remembering that relate to events and details from our own lives. You could call on anyone to recount a memory from their childhood, and they would come up with something like this. At one level, Byatt's account illustrates the predominant view of what a memory is: a more or less stable depiction of a past event. Memories are not always as accessible as we might like – they don't always come when they are called – but they are essentially enduring representations which you carry with you, claim as your own and guard jealously. Some remember their first day at school, first kiss or first wedding day, and some don't. No one would doubt, though, that the question of whether you 'possess' a particular memory makes sense.

It could surely not be otherwise. Without our memories, we would be lost to ourselves, amnesiacs flailing around in a constant, unrelenting present. It is hard to imagine being able to hang on to your personal identity without a store of autobiographical memories. To attain the kind of consciousness we all enjoy, we probably rely on a capacity to make links between our past, present and future selves. Memory shapes everything that our minds do. Our perceptions are funnelled by information that we laid down in the past. Our thinking relies on short-term and long-term storage of information. As many artists have noted, memory underpins imagination. Creating new artistic and intellectual works depends critically on the reshaping of what has gone before. We need our memories, and we find ways of hanging on to them. According to the conventional 'possession' view of memory, we do that by filing them away in a kind of internal library, ready to be retrieved as soon as they are needed.

This view is everywhere in popular culture. In *Harry Potter and the Chamber of Secrets*, the second book of J. K. Rowling's world-famous series, Harry is threatened with having his memories 'stolen', as if they were items of mental property. (If that happens, we know that Harry will stop being the person he is.) In the sixth, *Harry Potter and the Half-Blood Prince*, Voldemort's memories are capable of being accessed, distilled and transferred by Professor Dumbledore. In the hit 2009 movie *Avatar*, the hero Sully and his Na'vi comrades are able to look into Grace's memories before she dies, as though they are diary entries at which one can sneak a peek. The internet is frequently a-buzz with news stories about how scientists are coming close to targeting individual memories, confirming the impression that individual moments of experience are distributed around the brain like books in a library. Metaphors of memory are overwhelmingly physical: we talk of filing cabinets, labyrinths and photographic plates, and we use verbs such as *impress*, *burn* and *imprint* to describe the processes by which memories are formed.

This view of memories as physical things is guaranteed to mislead. The truth is that autobiographical memories are not possessions that you either have or do not have. They are mental constructions, created in the present moment, according to the demands of the present. Scientists try to understand this process at the cognitive level (that is, at the level of thoughts, emotions, beliefs and perceptions) and at the neural level (in terms of activations in the brain). Cognitively and neurologically speaking, Byatt does not 'bring her memory out to look at it'; she constructs it anew each time she is required to do so. That is quite a different concept to the idea that a memory is a static, indivisible entity, an heirloom from the past. Rather, the view that I want to explore in this book is that a memory is more like a *habit*, a process of constructing something from its parts, in similar but subtly changing ways each time, whenever the occasion arises.

This reconstructive nature of memory can make it unreliable. The information from which an autobiographical memory is constructed may be more or less accurately stored, but it needs to be

integrated according to the demands of the present moment, and errors and distortions can creep in at every stage. The end result may be vivid and convincing, but vividness does not guarantee accuracy. A coherent story about the past can sometimes only be won at the expense of the memory's correspondence to reality. Our memories of childhood, in particular, can be highly unreliable. Thinking differently about memory requires us to think differently about some of the 'truths' that are closest to the core of our selves.

Novelists give us a sophisticated view of what psychologist Daniel Schacter has called the 'fragile power' of memory. In her description of 'The Memory', Byatt is careful to acknowledge its unreliability, malleability and deceitfulness, and the fact that it is vulnerable to a constant process of telling and retelling. She describes her awareness, even as a child, of the effort needed to construct a memory in such a way that it will not be allowed to fade: 'The child thinks: I am always going to remember this.' Fiction writers have much to tell us about memory, and I will be relying on their insights as I go. When they steer too close to a 'possession' view of memory, however, I will look to the science of memory to set them straight.

This new, reconstructive account of memory is my real focus in this book. It is one that is largely accepted by memory scientists (with, of course, plenty of rumbling disagreements) but not yet, I think, the general population. I want to argue against the view of memories as mental DVDs stored away in some library of the mind. In fact, I would like to suggest that this mistaken 'possessions' view is itself a product of the compelling storytelling (and restless search for psychological causes and effects) with which our brains are constantly busy. I want to persuade you that when you have a memory, you don't retrieve something that already exists, fully formed – you create something new. Memory is about the present as much as it is about the past. A memory is made in the moment, and collapses back into its constituent elements as soon as it is no longer required. Remembering happens in the present tense. It requires the precise coordination of a suite of cognitive processes, shared among many other mental functions and distributed across different regions of the brain. This is how Schacter, one of the pioneers of the approach, sums it up:

We now know that we do not record our experiences the way a camera records them. Our memories work differently. We extract key elements from our experiences and store them. We then recreate or reconstruct our experiences rather than retrieve copies of them. Sometimes, in the process of reconstructing we add on feelings, beliefs, or even knowledge we obtained after the experience. In other words, we bias our memories of the past by attributing to them emotions or knowledge we acquired after the event.

This is a very different view of memory to the one that I think most non-psychologists hold. Understanding how it emerged involves taking a fascinating journey into the science of how we are shaped by our pasts.

For a long time, autobiographical memory was not a topic that appealed very much to me. As a psychology undergraduate in the late 1980s, I was interested in those details of mind and behaviour that would submit themselves to formal analysis. Memory was too unmeasurable, too unreliable, too subjective, too fuzzed up with messy human detail. Everyone remembers the past differently, because everyone lives it differently. It was hard to know how to make a science out of memories, and I was drawn instead to questions where the answers were more quantifiable. I wanted to get scientific about hard numbers (which I thought, at the time, was the only way of getting scientific), and all memory seemed to offer me was personal stories.

Now, as someone who divides his time between scientific psychology and the writing of fiction and non-fiction, these are precisely the qualities of autobiographical memory that appeal to me most. I am interested in it for some of the same reasons that a novelist might be: because it gives the richest illustration of the complex ways in which human beings make sense of their own existence. The painstaking work of generations of memory scientists has illustrated those interactions between different cognitive systems that underpin even the most ordinary act of remembering. To have any chance of being later recalled as an autobiographical memory, the details of an episode must be encoded, stored, labelled and eventually retrieved. They must make connections with areas of the brain subserving sensory perception, navigation, emotion and consciousness. Above all, they must be stitched together by a sometimes effortful process of imaginative reconstruction.

None of this would be possible unless the rememberer had a sense of his own self as unfolding through time. In my last book, I traced the emergence of this self-understanding in the case of my own young daughter, Athena. A theme that emerged for (and rather surprised) me in writing that book was the

impressive effort of the young child to make sense of her experience in terms of a narrative. In this book, I am going to pick up and build on this theme. I want to explore how an ability to move mentally through time underpins both the looking backwards of autobiographical memory and the projections into the unknown involved in future-oriented thinking. To do this, I am going to focus on human stories. By letting memories speak through narratives, I hope to expose some common myths about how memory works.

I am not the only one who is getting interested in memory again. It is arguably a basic human need to try to understand one's past and create a coherent narrative about where one has come from. Findings that many of our cherished memories may well be inventions, therefore, seem to challenge our sense of identity in potentially catastrophic ways. Some of the most powerful and influential artworks of recent times have been concerned with the deceptions of autobiographical memory: W. G. Sebald's genre-defying novel *Austerlitz*, for example, or Christopher Nolan's 2000 film *Memento*. Memoir is an increasingly popular literary genre, and yet it rarely examines its own workings in the sense of asking whether the memoirist should trust his or her recollections.

Many of us feel that our memories let us down, and scores of self-help books promise to help us improve our remembering. Loss of memory can be a sign of encroaching dementia, and our interest in improving our memory must tap into our anxieties about Alzheimer's disease. On the other hand, some people remember too much. For those affected by trauma, remembering can be a vicious cycle leading to crippling psychiatric problems. And the foibles of memory can have desperately important implications when it comes to witnesses and victims remembering events in court. The work of the American psychologist Elizabeth Loftus and others has shown that memories are very susceptible to being distorted by information provided after the event, and that in certain conditions it is even possible to 'implant' memories just by giving people appropriately suggestive information. The evidence that people can vividly remember events that never happened must make us rethink our emphasis on eyewitness testimony in legal proceedings.

Too often, though, the fallibilities of memory are insufficiently acknowledged. Even supposed psychology experts can turn out to be not much better informed than the general public about how memory works, as one recent study of Norwegian psychologists showed. Around 850 psychologists were presented with twelve statements about memory, and asked whether they agreed or disagreed with them. For example, one statement read: 'At trial, an eyewitness's confidence is a good predictor of his or her accuracy in identifying the defendant as the perpetrator of the crime.' Respondents' answers were then compared with those that were considered to be the 'correct' answers according to current scientific knowledge. The psychologists got an average of 63 per cent 'correct' (compared with 56 per cent for members of the general public). A link to the test items and the correct responses is given in the notes at the back of this book.

If you didn't do so well on these questions, you are in good company. Another recent study involving a telephone survey of a large sample of ordinary Americans asked people whether they agreed with six statements chosen to conflict with the expert consensus. Topics included amnesia and identity, confidence in testimony, the analogy between memory and video cameras, the influence of hypnosis on memory, attention to unexpected objects and the permanence of memory. Considerable proportions (in two cases, substantial majorities) of people agreed with the false statements. For example, 83 per cent of people thought that amnesia resulted in an inability to remember one's own identity, and 63 per cent thought that memory works like a video camera.

It seems that we get memory very wrong. And yet, when the topic appears in the media, the public appetite for information seems voracious. The American journalist Joshua Foer reportedly gained a seven-figure advance from a publisher for his study of the 'mental athletes' who compete in memory contests. As I write this, in January 2012, an edition of *Scientific American Mind* is overturning some common myths about memory and forgetting, while a special supplement of the *Guardian* shows how we can make the most of our memory's power. An online memory experiment accompanying the *Guardian*'s supplement was visited by more than 80,000 people worldwide, while an earlier web survey for the BBC generated much controversy, particularly concerning the authenticity of preverbal childhood memories.

This interest in memory is part of a spreading fascination with the often counterintuitive discoveries of modern psychology and neuroscience. We are now used to reading about research that calls into question deeply held assumptions about how our minds work. We know that there is not one single centre of experience in the human brain; we are told by the scientists that our minds are ragtag collections of semi-independent processors, each evolved to do a specialised task. We know that when we look out at a visual scene, we don't actually see the scene in its entirety; we see fragments that are later stitched together to

create the illusion of a unified scene. Memory doesn't stand out in this respect, if you consider it alongside the other fragmentary kinds of cognition with which our brains are constantly busy.

That said, the study of memory does pose some very specific challenges. My undergraduate pessimism about whether it was possible to have a science of personal stories is still grounded in some real uncertainties. Asking people about their memories is fraught with difficulties. Memories are changed by the very process of reconstructing them, and every memory that an experimental participant reports is likely to have been contaminated by previous acts of remembering.

But scientists have found ways to study autobiographical memory, and have been doing so systematically for over a hundred years. Beginning with the pioneering (and very different) self-examinations of memory conducted in the 1870s and 1880s by Sir Francis Galton in England and Hermann Ebbinghaus in Germany, memory researchers have subjected their participants to tests of recall for nonsense syllables, interviews about their earliest memories, and experiments on the power of sensory stimuli, such as music and smells, to trigger recollection. The reconstructive view of memory has its origins in the work of Sir Frederic Bartlett, first professor of experimental psychology at the University of Cambridge, whose most famous work was summarised in his 1932 book *Remembering*. Bartlett asked his participants to read a North American Indian folktale called 'The War of the Ghosts', involving a battle between ghostly warriors, and then to retell the story under a range of different conditions. He found that people's memory of the story was affected by their own beliefs about how the world worked, and that they distorted the story to fit their own knowledge structures, missing out bits that seemed to them irrelevant and changing the emphasis and structure of the story to fit their own understanding. Bartlett concluded that our memory of events reflects the information we encoded at the time, mixed up with inferences based on all sorts of other bits of knowledge, expectation and belief.

The modern inheritors of Bartlett's reconstructive view of remembering are researchers like Daniel Schacter, Elizabeth Loftus, Endel Tulving, Donna Rose Addis, Antonio Damasio and Martin Conway. Drawing on a distinction made by the philosopher Bertrand Russell, Conway has distinguished between two forces in human memory: the force of correspondence, which captures memory's need to stay true to the facts of what happened, and the force of coherence, which works to make memory consistent with our current goals and our images and beliefs about our own selves. Memory is an artist as much as it is a scientist. Among those who study it scientifically, the conventional view of autobiographical memory has been upended by one in which memories are constructed, through a process which combines stored sensory and emotional information with more formal and schematic descriptions of knowledge about one's past life, and which requires the simultaneous functioning of many different cognitive systems.

'Memory' means different things to psychologists. Autobiographical memory is an interesting case because it straddles the most basic of the distinctions that scientists make between types of memory: that between *semantic memory* (memory for facts) and *episodic memory* (memory for events). Our memory for the events of our own lives involves the integration of details of what happened (episodic memory) with long-term knowledge about the facts of our lives (a kind of autobiographical semantic memory). Another important distinction is that between *explicit* or *declarative* memory (in which the contents of memory are accessible to consciousness) and *implicit* or *non-declarative* memory (which is unconscious). As we will see, this distinction is particularly important when it comes to the question of how memory is affected by trauma and extreme emotion.

Autobiographical memory is also a form of long-term memory, and so I will not be saying much about the world of short-term memory, or *working memory* as it is more commonly known. None of these varieties of memory is unitary and freestanding, but rather all depend on several different cognitive systems and neural pathways. Implicit memory, for example, relies on different neural circuits to autobiographical memory. When you learn a new motor skill, your cerebellum (tucked away inside your skull behind the nape of your neck) buzzes into action. When you take a wrong path out of habit, you are seeing the evidence of information patterns stored in your basal ganglia, situated deep down in the middle of the brain above the brainstem.

When it comes to autobiographical memory, it is a mistake to think that memory traces are stored in any one part of the brain. Indeed, the search by early memory researchers for what became known as the 'engram' – the single bioelectrical trace that a memory leaves in the brain – was always destined to end in failure. Although not my focus in this book, much progress has been made in understanding the process of *long-term potentiation*, the structural changes in neurones which underlie the brain's storage of information. You will doubtless have seen news stories about how 'memories' are formed when certain chemical changes happen in the synapses of your brain's nerve cells. Although this research is fascinating

and important, these are not memories as I am interested in them: they are about individual cells, not human beings. They work at a different level of explanation.

A similar point can be made about the process of *reconsolidation*, according to which ‘memories’ are reformed at the molecular level each time they are activated. Reconsolidation became a hot topic in memory science after researchers at New York University used a chemical proven to disrupt the formation of memory traces in rats that had learned to avoid an electric shock. The big discovery was that the chemical (a protein inhibitor) was also effective at the *recall* of a memory (when rats were remembering the electric shock) as well as at its initial encoding. If the memory trace had been permanent, this should not have happened. Instead, the data showed that a memory trace can be altered after the event, in the absence of the original stimulus. Reconsolidation seems to point to a molecular mechanism through which memories can be changed by subsequent events. But it does not show *how* they are changed. For that we also need to investigate memory at the cognitive level, that is, at the level of individual people’s thoughts, beliefs and biases.

A similar note of caution needs to be sounded about other neuroscientific findings. The new science of neuroimaging offers an entirely new perspective on the age-old question of where in the brain our memories, and therefore in some sense our selves, reside. Memory scientists have studied the remembering brain through neuroimaging scans, electroencephalography (EEG) experiments and the careful interviewing of brain-damaged patients. Brain imaging shows activity in the frontal lobes, where the efforts to reconstitute a remembered experience are initiated, through the emotional circuits of the amygdala system and the associative centres of the neocortex, to the occipital lobe at the back of the brain, where the characteristically visual qualities of autobiographical memories are stored as sensory fragments.

Understanding these neuroanatomical patterns is very valuable. If we are to have a science of human experience, we have to tackle it on different levels, which would include at least the molecular, neural, cognitive and social. And the study of brain processes of learning and memory has contributed a great deal to our understanding of how memory works. For that reason, I will be referring in particular to new research in cognitive neuroscience, the discipline that integrates findings from experimental psychology, neuroimaging and neuropsychology (studies of brain damage). The neural tentacles of memory spread far and wide, and many different brain systems are involved. To set the scene, here’s a brief overview of the main brain areas that will come into focus (see diagram, p. 284).

If you place a finger above your ear and imagine being able to push it in about two inches, your virtual fingertip would touch on the single most important structure for autobiographical memory. Over the decades that it has been studied, the hippocampus has been implicated in psychological processes as diverse as memory, spatial navigation and anxiety. Often likened to a seahorse because of its curved, flowing shape, it sits at the centre of a network of memory circuits in the medial temporal lobes (you have a hippocampus, and a medial temporal lobe, on each side of the brain). The hippocampus works closely with areas of cortex nearby, known as the perirhinal and parahippocampal cortices, which sit just under the hippocampus at the front and back respectively. This relatively small area of the brain extends into a wider network of memory-related regions, including the amygdala, which is connected to the front of the hippocampus and is crucial for learning about the emotional significance of stimuli. Moving further towards the front of the brain, the medial temporal lobe memory circuits connect with the control systems of the prefrontal cortex. At the back of the brain, the occipital cortex stores the visual perceptual details that are so important in autobiographical memory.

There is, of course, more to remembering than neural systems. I think that if we are really to unpick the mysteries of memory, we need to put the story back into the science. One of my aims in this book is to capture the first-person nature of memory, the rememberer’s capacity to reinhabit the recalled moment and experience it again from the inside. The great memory scientist Endel Tulving called this quality of memory ‘autonoetic consciousness’, and explaining it is one of the biggest challenges for memory researchers. The scientific need for replicable experimental findings has meant that the personal, subjective quality of memory has often been ignored, although this tendency has begun to be redressed in recent years, with a new movement towards exploring the qualitative and the narrative. Memory researchers now spend more time getting to know their participants’ individual stories, whether they concern the beguiling confabulations spun by those whose memory systems have failed them, or the sensually rich ‘first memories’ produced when people are interviewed about their very early childhoods. I want to do the same thing, letting the stories speak for themselves in illustrating the fragile and complex truths of memory.

I start my journey by getting lost. Returning to a city that I used to know very well, and trying to find my way through once-familiar streets, I am given a persuasive lesson in how memories are mediated by previous acts of remembering. Finding your way in a landscape requires that you have accurate memories

of where you have been, but it also depends on your ability to encode knowledge about space and time. I explore how this kind of information is processed by the hippocampus, ultimately producing an internal map of one's location in the terrain. When you are lost, as I am when I return to another once-familiar city, these maps go awry. I ask what the workings of this kind of geographical amnesia tell us about how memory operates, in landscapes of the imagination as well as of reality. My wanderings in my old home cities demonstrate that we can get lost in our pasts in the same way that we get lost in an unfamiliar terrain.

I then look at the role of the senses in autobiographical memory. Writers as diverse as Marcel Proust and Andy Warhol have been eloquent in describing the power of sensory stimulation to unlock the past. Smells and music are known to be strong triggers for involuntary memories, and I ask whether there is anything special about these sensory modalities that make them particularly effective at unlocking memories. These examples show how making autobiographical memories is intimately linked to our sensory and emotional experience of the world, and demonstrate how memory depends on seamless collaborations between many different cognitive and neural systems.

Memory's complex synergy of cognitive and neurological functions must take time to develop. Infants and small children remember things, but they need to achieve certain milestones before they are able to do genuine autobiographical memory: to put themselves at the centre of the events they are describing. Asking when memory gets started tells us a great deal about the different psychological capacities that allow us to trace our own selves back into the past. In Chapter 4, I look at why we mostly cannot recall our childhoods, and why our earliest memories are so full of rich sensory detail.

In Chapter 5, I return to a landscape from my own childhood, for a lesson in how your memories of a person can be unlocked by a return to the places you used to share. It is a well-established finding that we are better at remembering events and information when we are asked to recall them in the same context in which we laid the memories down. I look at how memory attunes itself to the meaning of information rather than its surface details, and examine how memories for events are framed by their context, so that having a memory is a process of matching the cues that are present at retrieval with the information that was encoded at the time.

One striking fact about childhood memories is that they are built up through collaborative acts of recollection with parents and other caregivers. As I describe in Chapter 6, talking together about the past seems to be vitally important in children's creation of a self that extends through time. In adulthood, memory can be something that has to be negotiated socially. The idea that the past is a story that we tell ourselves, whose vividness can be no guarantee of its authenticity, highlights our reliance on language for social acts of remembering. If our autobiographical memory system serves to create a coherent narrative of our own past, it is a system that can frequently fool us into believing stories that are not true, as evidenced by the fact that many of us 'remember' events that we no longer believe actually happened.

In Chapter 7, I ask what memory is for. Doing good psychology has always involved taking an evolutionary perspective, and the study of memory is no exception. In fact, there are some very good reasons for thinking that memory evolved not to keep a record of what has happened, but to predict what will come next. If memory is fallible and prone to reconstructive errors, that may be because it is oriented towards the future at least as much as towards the past. Some of the most exciting recent research in this area has shown that similar neural systems are involved in both autobiographical memory and future thinking, and that they both rely on a form of imagination.

If our memories are constructions of an imaginative process, we nevertheless need some way of keeping track of what mental experiences actually happened to us in the past, as opposed to events that we have simply imagined. In Chapter 8 I explore the feelings that tell us when we are remembering. It turns out that one of the biggest challenges of memory is keeping track of the source of our experiences, and some of the most distinctive memory errors occur when we fail to distinguish what we have remembered from what we have merely imagined.

More than anything, memory is a great storyteller. Not only do we stretch our narrative capacities to the limit when we construct an autobiographical memory, but we also eagerly spin tales whenever our memories leave us with gaps in the record. In Chapter 9, I look at what we have learned about autobiographical memory from the study of patients with brain damage. I meet a woman who has lost the ability to form new memories, and hear the story of another who lives his life in a state of continual *déjà vu*. In both cases, incongruous experiences of remembering can lead the sufferer to create elaborate stories, or confabulations, around them.

The subject of Chapter 10 is memory for trauma. I meet a man whose life was ripped apart by a tragic accident, and ask whether traumatic memories function in the same way as non-traumatic ones. When I talk to Colin about his treatment for post-traumatic stress disorder, I realise that the crucial thing seems to

be the way in which fragments of remembered experience are integrated into a coherent whole by the parts of the brain that are involved in stitching together autobiographical memories. The goal of therapy in such cases is not forgetting, but a more accurate, inclusive and unbiased remembering.

In Chapter 11 I look at memory in old age. None of us are immune to the 'reminiscence effect', the phenomenon whereby events from one's late teens and early twenties stick in memory better than anything else. In the case of my 93-year-old grandmother, the memorable events from her life happened in the 1930s, when she was a teenager growing up in the Jewish East End of London. I ponder the effect of this continual salience of one's youth on a mind that has outlived those years by many decades. I ask how remembering is dependent on finding a match between the language used when the events were encoded and that used at retrieval. I ask why life speeds up as we get older, and why (paradoxically) time also drags. The theme of this chapter is reminiscence: the act of recollection on demand, the effortful process of casting back to the past. But it is also about some of the particular qualities that distinguish remembering in old age.

I end by thinking about the future of memory. Some of the remaining mysteries of memory look set to be solved by recent breakthroughs in molecular science and neuroimaging. Others will probably continue to puzzle us for decades to come. The more we learn about our memories, the greater our opportunities for manipulating them, changing them and possibly even getting rid of them. The ethical implications of understanding memory may be more far-reaching than we can currently imagine. I ask how collections of people, even entire cultures, can 'remember', and what happens when memory becomes politicised. In another context, that of law and eyewitness testimony, the scientifically acknowledged frailty of human memory is beginning to be factored in to legal judgements. I end by considering memory as a form of knowledge with a disputed status, serving the self as much as it serves truth.