Chapter 1

Mind Out of Matter

The Mainspring of Ideas

I feel guilty, now that he is dead, because I could never bring myself to like him. Edgar was a senior colleague, to whom, when I was young, I had to defer. He had become a professor when universities were expanding unrestrainedly and jobs multiplied faster than the talent to fill them: competence rather than excellence and indifference rather than vocation were enough. Edgar concealed his inferiority behind complacency and self-congratulation. He bullied his students and patronized his peers. One of the ways in which he enjoyed annoying me was by deprecating my beloved dog. 'Imagine', he would say, 'how little goes on in that pea-sized brain – incapable of thought, just responding to nasty little stimuli from the scent of mouldering scraps and whiffs of other dogs' urine.'

'You can see how unintelligent he is', Edgar added, whenever the dog disobliged him by ignoring his commands.

Secretly and silently, I suspected that Edgar comforted himself by comparison with the dog only because his own mind would be wanting by any other standard. Gradually, however, I came to realize that his attitude reflected common prejudices and fallacies about the way we think. We humans tend to class ourselves as more intelligent than other species, even though the intelligences in question are of such different orders as to make any comparison largely meaningless: it would be no more intelligent, in a dog, to waste time devising an algorithm than for a human to sniff for a mate. We mistake for dumbness what is really dissent from or incomprehension of our priorities. My disappointment at

my dog's unresponsiveness to my efforts to make him fetch for me, for instance, is, from his perspective, no more puzzling than my neglect of old bones or my inability to detect an interesting spoor. We call animals intelligent when they do our bidding, whereas if we encountered the same subservience in fellow humans we should despise it as evidence of lack of initiative or critical thought.

The matter is beyond proof, but a lifetime's observation of my own family's dogs has convinced me that they discriminate between commands on rational calculations of interest. Ivan Pavlov thought canine behaviour was conditioned – which, like rare instances of human behaviour, it sometimes is; but dogs defy expectations when they try to solve doggy problems, rather than humanly designed puzzles: problems, that is, conceived not to interest us but to involve them. I once saw my dog, for instance, devise a new squirrel-catching strategy, after many unsuccessful experiments, by stationing himself at right angles to the path between two trees at a point equidistant from both. The plan did not yield a squirrel, but it was, by any standards, intelligently thought out. In his own way, for his own purposes, as two of the most dedicated researchers on canine intelligence say, 'Your dog is a genius.'[1] René Descartes decided that his dog had no more thought or feeling than a machine (and concluded that he could punish him without moral qualms);[2] the dog, I suspect, recognized Descartes, by contrast, as a sentient, ratiocinative fellow-being. If so, which of the two showed more common sense or practical wisdom?

As with intelligence, most other ways of trying to measure humans' distance from other animals in capacities we share with them are doomed to failure. The claim that we have a special property of consciousness remains just a claim, because there is no satisfactory way of seeing that deeply into other creatures' minds. To know that humans are uniquely sensitive or empathetic, or existentially intuitive, or aware of time, or gifted by God or nature with a peculiar, privileged faculty – such as a 'language acquisition device',[3] or an aesthetic tic, or a moral sense, or a discriminating power of judgement, or an eternally redeemable rational soul, or a meta-mental level of thinking about thinking, or an unparalleled skill in inference capable of deducing universals from instances, or any of the other supposed possessions that humans congratulate themselves on collectively monopolizing – we would need

to be able to talk it over with fellow-creatures in other species, or else craft objective tests that have so far eluded our efforts.

All that observation and experiment can guarantee, so far, is that humans' endowment of creative and imaginative mental properties that we share with other animals is palpably, visibly, stunningly enormous. It is proper to ask why and how the divergences in quantity arise, whether or not one suspects differences in quality, too.

This book is about what I think is the most conspicuous such divergence. Humans do exceed dogs and, as far as we know, all other animals, in ability of a peculiar and, to us, exciting and rewarding kind: the power to grasp (and even in some abnormally ingenious humans to generate) the imagined acts (or products of such acts) that we call ideas. The creativity gap between human animals and the rest is vastly greater than that in, say, tool use or self-awareness or theory of mind or effectiveness in communication. Only a human – I want to say – can imagine a canine Bach or a simian Poe or a 'literally' reptilian Plato or a cetacean Dostoevsky who insists that two times two might be five. I am not fully authorized to say so, because a chimp or a dog or a bacillus may secretly harbour such imaginings; but if so, he or it does nothing about it, whereas humans declare their fantasies and project them onto the world, sometimes with revolutionary effects. With peculiar frequency and intensity, we can picture the world to ourselves differently from the way it looks, or responds to our senses. When that happens, we have an idea, as I understand the word.

The results of this capacity are startling, because we often go on to refashion the world in whatever way we have pictured it. Therefore we innovate more than any other species; we devise more ways of life, more diversity of culture, more tools and techniques, more art and crafts, and more outright lies than other animals. A human can hear a note and compose a symphony; see a stick and turn it mentally into a missile; survey a landscape and envision a city; taste bread and wine and sense the presence of God; count and leap to infinity and eternity; endure frustration and conceive perfection; look at his chains and fancy himself free. We do not see similar outcomes from fancies other animals may have.

Anyone who wants to apply the words 'intelligence' or 'reason' to the faculty that enables ideas can, of course, do so. But the word that best

denotes it is surely 'imagination' or perhaps 'creativity'. The degree to which humans are, as far as we know, uniquely creative seems vast by comparison with any of the other ways in which we have traditionally been said to excel other animals.[4] So the first questions for a history of ideas are, 'Where does active, powerful, teeming imagination come from?' and, 'Why are humans peculiarly imaginative animals?'

The questions have been strangely neglected, perhaps in part because of an unsatisfactory assumption: that imagination is just a cumulative product of intensive thinking and needs no special explanation (see p. xxx). The nearest thing in the available literature to an evolutionary account of the origins of imagination credits sexual selection: imaginative behaviour, so goes the theory, is conspicuous exhibitionism, likely to attract mates – the human equivalent of unfolding a peacock's tail.[5] At most, the theory locates imagination in a class of evolved faculties, but fails to account for it: if imagination belongs among the results of sexual selection it occupies a pretty lowly place, compared with physical attractions and practical considerations. If only mental musculature were sexier than a six-pack, or a poet more recommendable as a mate than a plumber! I recall a story about one of Henry Kissinger's mistresses who reportedly said, when her sexual taste was questioned, 'Why have a body that can stop a tank when you can have a brain that can stop a war?' I make no comment on her judgement, her sincerity, or her representative value.

Neuroscientists, who like to make their own peacock-displays of brain scans, associating thoughts of every kind with neuronal activity, have not been able to trap a creature at a moment of especially imaginative thinking. In any case, brain scanning has limited powers of explanation: electrical and chemical changes in the brain show that mental events are happening, but are at least as likely to be effects as causes.[6] I do not mean that neurological evidence is contemptible: it helps us know when memory, for instance, is active, and helps us track constituents or ingredients of imagination at work. At present, however, no scientific narrative recounts satisfactorily how humans became imaginatively supercharged.

If we want to understand how humans generate the ideas that are the subject of this book, one good way of starting is by comparing our relevant resources with those of other animals: it can be no more than

a starting point because humans are at least as different from all other animals as every non-human species is from all the others. But, in the absence of angels and extra-terrestrials, the creatures with whom we share the planet are our obvious subjects. Our usual assumptions about the relative excellence of humans' equipment are not entirely false, but the comparison, as we shall see, is less to our advantage than we commonly suppose. For present purposes I focus on the brain, not because I think mind and brain are synonymous or coterminous but because the brain is the organ in which our bodies register thoughts. Ideas may exist outside the material universe, but we have to look at the brain for evidence that we have them. As we study the evidence, a paradox will emerge: some of our relative deficiencies of brainpower contribute to making us richly imaginative, and therefore abundantly productive of ideas.

Evolution is an inescapable part of the background. Ideas, as far as we can tell at present, are probably psychic, not organic or material. Except for people who believe in 'memes' (the 'units of culture' Richard Dawkins dreamed up to behave like genes)[7] ideas are not themselves subject to evolutionary laws. But they work with our bodies: our brains process and manage them, our limbs and digits and muscles and speech organs apply and communicate them. Everything we do with our thoughts, and *a fortiori* with ideas, which are thoughts of a special kind or special order, has to deploy the equipment that evolution has given us.

In the pages that follow I intend to argue that evolution has endowed us with superabundant powers of anticipation, and relatively feeble memories; that imagination issues from the collision of those two faculties; that our fertility in producing ideas is a consequence; and that our ideas, in turn, are the sources of our mutable, volatile history as a species.[8]

Big Brains, Big Thoughts?

One of Edgar's widely shared fallacies was his conviction that the bigger your brain, the better you think.[9] I once read that Turgenev had an almost uniquely big brain, whereas Anatole France had an almost

uniquely small one. I no longer recall where I learned this and have no means of verifying it, but *se non è vero è ben trovato*: both writers were great geniuses. Women have bigger brains, on average and relative to body size, than men; Neanderthals had bigger brains than *Homo sapiens*; Palaeolithic people exceeded moderns in the dimensions of their brains. Will anyone aver that these differences correspond to differences in power of thought? A few years ago, on the island of Flores in Indonesia, archaeologists discovered the remains of a creature with a brain smaller than a chimpanzee's, but with a toolkit comparable to what one might expect to find in excavations of our own ancestors of about forty thousand years ago, whose brains were, on average, bigger than ours.

Big brains are not necessary to big thoughts:[10] a microchip is big enough to do most of what most people's brains can achieve. Human brains are almost as much of an encumbrance as an amenity: to emulate the microchip they need more nourishment, process more blood, and use up a lot more energy than is necessary. As far as we know, most brain cells are dormant for most of the time. Neuroscientists have speculated about the purpose of the apparently inert astrocytes that vastly outnumber the measurably functional neurons – but no consensus has emerged on what most brain-volume is for or whether it is for anything at all.[11]

The size of human brains is not, therefore, a necessary condition for human-style thinking, but is probably what evolutionary jargon calls a 'spandrel' – a by-product of the evolution of the faculties that equip us to think.[12] Most of the human brain, to put it bluntly, is probably functionless junk, like tonsils and appendixes. To say that it would not be there unless it were useful – only we do not know how – is obviously fallacious or else an expression of over-confidence in the efficiency of evolution,[13] which, as Darwin acknowledged, perhaps in an unguarded moment, is no more consistently targeted than the wind.[14]

It is not hard to see how humans' brains might have become bigger than they would be if a conscious and competent designer were at work. Diet conditions brain growth: fruit is more nourishing and more demanding for foragers than leaves, and meat more so than fruit. As the most omnivorous of apes, our ancestors needed and nourished the biggest brains.[15] Or they may have added brain cells in order to live in

larger groups than most other creatures. The bigger your group, the more data you have to handle; rather than starting over and designing a brain fit for purpose, nature grows the brain you already have, stuffing your skull with cortex, multiplying folds and caruncles, extruding lobules. That is perhaps why brain size among apes (though not primates generally) is roughly proportionate to group size.[16] Advantages accrue: in consequence, more neurons can interact in our brains than in those of other species; but more efficient compression could contrive the same effect. By other animals' standards, we have brains with a lot more room for thought; but all the functions we can identify – by seeing, for instance, what people can no longer do if parts of their brains fail or are excised – are part of the equipment of various species. Brain size, in short, helps explain why we do more thinking than other apes, but not why we do thinking of a different order.

The Galactic Overview

Instead, therefore, of complimenting ourselves for our big brains, or congratulating ourselves on the superiority of human intelligence, it may be helpful to focus on the exact cerebral functions or instances of intelligent behaviour in which our species seems peculiarly well endowed or most adept.

We have to face an immediate difficulty: most humans do not do much thinking. 'Oh', they implicitly echo Keats, 'for a life of sensation, not of thought!' Usually, humans' brains are seriously under-employed. Most of us leave others to do our thinking for us and never have thoughts beyond those that outsiders have put into our heads: hence the success of advertising and propaganda. Imitation, repetition, and follow-the-leader may, by some standards, be classed as intelligent behaviour. Why not obey the tyrant who feeds you? Why not ape those apparently wiser or stronger than yourself? For limited purposes, such as survival in a hostile environment, or ease in more amenable circumstances, these may be well-chosen strategies. But domesticated non-humans show plenty of intelligence of that kind – the fawning hound, the submissive sheep. If we want to identify uniquely human thinking we have to focus on the large minority of humans who do a lot of it: those who

are responsible for the big, conspicuous differences between our lives and those of other creatures.

To understand what those differences are, we need to shift perspective. Difference-spotting is almost entirely a matter of perspective. If, for example, I ask members of one of my classes at the University of Notre Dame to identify the differences between classmates, they will point to small and often trivial details: Maura has more freckles than Elizabeth; Billy always wears long sleeves, whereas Armand is always in a T-shirt. Xiaoxing is a year younger than everyone else. An outsider, looking at the class with a degree of objectivity unattainable from the inside, will see the big picture and approach the question impersonally, looking for classifiable differences. 'Forty per cent are male', he or she will say, 'and the rest female. Most of your students are white, but three have features that look East Asian, two look as if they have South Asian origin, and two are black. The roster seems to have a surprisingly large number of names of Irish origin', and so on. Both perspectives yield true observations, but for present purposes we want data of the kind more easily visible to the outsider. To spot the big peculiarities of human thinking, compared with that of other animals, we have to try for a similar degree of objectivity.

A thought experiment will help. If I try to envisage the most objective standpoint accessible to my mind, I come up with a sort of cosmic crow's nest, where a lookout with godlike powers of vision can see the entire planet, and the whole history of every species on it, in a single glance, from an immense distance of time and space, like the onlooker who, in *The Aleph*, a short story by Jorge Luis Borges, perceived all the events of every creature's past simultaneously. How would such a privileged observer assess the difference between us and other animals? The cosmic lookout, I suspect, would say, 'Basically you're all the same – inefficient, short-lived arrangements of cells. But I notice some odd things about you humans. You do most of what all the other species do, but you do a lot more of it. As far as I can tell, you have more thoughts, tackle more tasks, penetrate more places, adopt more foods, and elaborate more political and social forms, with more stratification, more specialization, and more economic activities. You develop more lifeways, more rites, more technologies, more buildings, more aesthetic fancies, more modifications of the environment, more

consumption and production, more arts and crafts, more means of communication; you devise more culture, and – in short – turn over more ideas with more speed and variety than any other creature I can see. As far as I can tell, you put more time and effort than other animals into self-contemplation, the identification of values, the attempt to generalize or analyse; you devote vast mental resources to telling stories previously untold, composing images of what no one ever saw, and making music no ear ever heard before. By comparison with most of your competitor-species you are torpid, weak, tailless, deficient in prowess, and poorly fitted with fangs and claws (though you are, luckily, good at throwing missiles and have agile hands). Yet, despite your ill-endowed, ill-shaped bodies, your capacity for responding to problems, exceeding minimal solutions, and rethinking your futures has given you a surprising degree of mastery on your planet.'

These observations might not make the lookout admire us. He or she would notice the uniqueness of every species and might not think ours was of an order superior to all the others'. But though we may not be unique in being innovative and creative (that would be another self-congratulatory claim, belied by evidence), our power to innovate and create seems unique in range and depth and abundance. In these respects, the differences between humans and non-humans carry us beyond culture, of which, as we shall see, many species are capable, to the uniquely human practice we call civilization, in which we reshape the world to suit ourselves.[17]

Becoming Imaginative

How could our brains have helped us to this improbable, unparalleled destination? The brain, like every evolved organ, is the way it is because conditions in the environment have favoured the survival and transmission of some genetic mutations over others. Its function is to respond to the world outside it – to solve the practical problems the world poses, to meet the exigencies it demands, to cope with the traps it lays and the constraints it tangles. The repertoire of thoughts that belongs in this book is of another kind, a different order. They constitute the sort of creativity enchantingly called '*fantasia*' in Italian,

with resonances of fantasy that exceeds what is real. They create worlds other than the ones we inhabit: worlds unverifiable outside our minds and unrealized in existing experience (such as refashioned futures and virtual pasts), or unrealizable (such as eternity or heaven or hell) with resources that we know, from experience or observation, that we command. V. S. Ramachandran, a neurologist who has hunted valiantly for differences between humans and other apes, puts it like this: 'How can a three-pound mass of jelly ... imagine angels, contemplate the meaning of infinity, and even question its own place in the cosmos?'[18]

There are two traditional answers: one popular in scientific tradition, the other in metaphysics. The strictly scientific answer is that quantity becomes quality when a critical threshold is crossed: humans' brains, according to this line of thinking, are so much bigger than those of other apes that they become different in kind. It is not necessary for the brain to have a specialized function for creativity or for the generation of ideas: those events ensue from the sheer abundance of thinking of more mundane kinds that emanates from big brains.

On the other hand, the metaphysical answer is to say that creativity is a function of an immaterial faculty, commonly called a mind or a rational soul, which is unique to humans, or of which humans possess a unique kind.

Either answer, though not both, may be true. But neither seems plausible to everyone. To accept the first, we need to be able to identify the threshold beyond which brains leap from responsiveness to creativity. To accept the second, we have to be metaphysically inclined. Mind, according to sceptics, is just a fancy word for functions of the brain that neurology cannot quite pin down in the present state of knowledge.

So how can we improve on the traditional answers? I propose reformulating the question to make it less vague, specifying the exact thought-generating function we want to explain. The term that best denotes what is special about human thinking is probably 'imagination' – which covers *fantasia*, innovation, creativity, re-crafting old thoughts, having new ones, and all the fruits of inspiration and ecstasy. Imagination is a big, daunting word, but it corresponds to an easily grasped reality: the power of seeing what is not there.

Historians, like me, for instance, have to reconfigure in imagination a vanished past. Visionaries who found religions must bring to mind

unseen worlds. Storytellers must exceed experience to recount what never really happened. Painters and sculptors must, as Shakespeare said, 'surpass the life' and even photographers must capture unglimpsed perspectives or rearrange reality if they are going to produce art rather than record. Analysts must abstract conclusions otherwise invisible in the data. Inventors and entrepreneurs must think ahead beyond the world they inhabit to one they can remake. Statesmen and reformers must rethink possible futures and devise ways to realize better ones and forestall worse. At the heart of every idea worth the name is an act of imagination – experience excelled or transcended, reality reprocessed to generate something more than a snapshot or echo.

So what makes humans super-imaginative? Three faculties, I suggest, are the constituents of imagination. Two are unmistakably products of evolution. On the third, the jury is out.

First comes memory – one of the mental faculties we call on for inventiveness, starting, whenever we think or make something new, with what we remember of whatever we thought or made before. Most of us want our memories to be good – accurate, faithful to a real past, reliable as foundations for the future. But surprisingly, perhaps, bad memory turns out to be what helps most in the making of imagination.

Remembering Wrongly

Unsurprisingly, in most tests of how human thinking compares with that of other animals, humans score highly: after all, we devise the tests. Humans are relatively good at thinking about more than one thing at a time, divining what other creatures might be thinking about, and handling large repertoires of humanly selected symbols.[19] Memory, however, is one of the kinds of thinking at which, even by human standards, other animals can rival or outstrip us. Remembering information of relevant kinds is one of the most striking faculties in which non-humans can excel. Beau, my dog, beats me – metaphorically, not in the sense Descartes envisaged – in retaining memories of people and routes. He can reconstruct, unbidden, any walk he has ever been on. After six years without seeing an old friend of mine, he recognized her on her next visit, rushing off to present her with a toy that she had

given him on the previous occasion. Beau makes me willing to believe Homer's story of how only the family dog recognized Odysseus when the hero returned from his wanderings. He retrieves toys or bones unerringly, while I waste my time seeking misfiled notes and errant reading glasses.

Anyone who has a pet or a non-human work-partner can match stories of their enviable powers of memory. Yet most people still echo Robert Burns's pitying address to his 'wee, sleekit, cow'rin', tim'rous' mouse, whom, he thought, 'the present only toucheth', as if the little beast were frozen in time and isolated from past and future.[20] But this sort of distinction between brutish and human memory is probably another example of unjustified human self-congratulation. We do not have to rely on anecdotal stories of dogs of suspected shagginess. Controlled studies confirm that in some respects our memories are feeble by other animals' standards.

Scrub-jays, for instance, know what food they hide and remember where and when they hide it. Even without food-inducements, rats retrace routes in complex labyrinths, whereas I get muddled in the simplest garden mazes. They recall the order in which they encounter smells. Clearly, therefore, they pass tests of what specialists call episodic memory: the supposedly human prerogative of travelling back, as it were, in time by recalling experiences in sequence.[21] Clive Wynne, the apostle of non-human minds, whose fame is founded on the vividness with which he can imagine what it would be like to be a bat, has summarized some relevant experiments. Pigeons, he points out, retain for months, without degradation, memories of hundreds of arbitrary visual patterns associable with food. They home in on their own lofts after long absences. Bees recall the whereabouts of food, and how to find it in a maze. Chimpanzees retrieve from apparently casually selected locations the stones they use as anvils for cracking nuts. In laboratories, challenged to perform for rewards, they remember the correct order in which to press keys on a computer screen or keyboard. And 'vampire bats can remember who has given them a blood donation in the past and use that information in deciding whether to respond to a petitioner who is begging for a little blood'.[22]

Belittlers of non-human memory can insist that many non-human animals' responses are no better, as evidence of thinking, than the

fawning and cowering of Pavlov's dogs, who, back in the 1890s, started to salivate when they saw their feeder, not – according to the theory that became notorious as 'behaviourism' – because they remembered him but because the sight of him triggered psychic associations. The apparent memory feats of rats, bats, pigeons, and apes – any surviving behaviourist might claim – more resemble conditioned reflexes or reactions to stimuli than recollections retrieved from a permanent store. Apart from prejudice, we have no good grounds for making such a distinction. St Augustine, whom I revere as, in most other respects, a model of clear thinking, was a behaviourist *avant la lettre*. He thought that a horse could retrieve a path when he was following it, as each step triggered the next, but could not recall it back in his stable. Even the saint, however, cannot have been sure about that. No experiment can verify the assumption. Augustine's only basis for making it was a religious conviction: that God would hardly condescend to give horses minds resembling those of His chosen species. Equally dogmatic successors today make a similar mistake. Most psychologists have stopped believing that human behaviour can be controlled by conditioning: why retain the same discredited belief in trying to understand other animals? For material directly comparable with human experience we can turn to experiments with chimpanzees and gorillas. They resemble us in relevant ways. We can access their own accounts of their behaviour. We can converse with them – within the limited sphere our common interests permit – in humanly devised language. They do not have mouths and throats formed to make the same range of sounds that figure in humans' spoken languages but non-human apes are remarkably good at learning to use symbolic systems – that is, languages – of other kinds. By following examples and heeding instruction, just as human learners do or should do if they are good students, apes can deploy many of the manual signs and representative letters or images that humans use.

Panzee, for example, is an exceptionally dexterous symbol-juggling female chimpanzee at Georgia State University. She communicates with her carers via cards, which she brandishes, and keyboards, which she taps to access particular signs. In a typical experiment, while Panzee watched, researchers hid dozens of succulent fruits, toy snakes, balloons, and paper shapes. Without prompting, except by being shown

the symbol for each object in turn, Panzee remembered where the little treasures were and could guide keepers to them. Even after relatively long intervals of up to sixteen hours she recalled the locations of more than ninety per cent. No 'cheating' was involved. Panzee had never had to obtain food by pointing to places outside her enclosure before. Her keepers could provide no help, conscious or unconscious, because they were not privy in advance to any information about the hiding-places. Panzee, therefore, did more than show that chimps have an instinct for finding food in the wild: she made it clear that they – or at least she – can remember unique events. As well as displaying what we might call retrospective prowess, she displays a kind of prospective skill, applying her memory to advantage in predicting the future by foreseeing where food will be found.[23] In another intriguing experiment, using her keyboard, she guided a carer to the whereabouts of concealed objects – peanuts, for preference, but including non-comestible items in which she had no active interest. The head of her lab, Charles Menzel, says, 'Animal memory systems have always been underestimated – the upper limits are not really known.'[24]

Among Panzee's rival rememberers is Ayuma, a quick-witted chimpanzee in a research facility in Kyoto. She became famous in 2008 as the star of a TV show, beating human contestants in a computerized memory game. Participants had to memorize numerals that appeared on a screen for a tiny fraction of a second. Ayuma recalled eighty per cent accurately. Her nine human rivals all scored zero.[25] With practice humans can ape Ayuma.[26] Evidence in chimpanzees' favour, however, has continued to accumulate. If one discounts uncharacteristic prodigies, typical humans can remember sequences of seven numbers; other apes can remember more and can learn them faster. *Ape Memory* is a video game for members of our species who want to try to reach simian levels of excellence. King, a gorilla resident of Monkey Jungle, Miami, Florida, inspired a version called *Gorilla Memory*. King is good at counting. He communicates with humans by waving and pointing to icons printed on cards. When primatologists picked on him for memory tests he was thirty years old – too well stricken with maturity, one might think, to be receptive in learning new tricks. But he knew human peculiarities from long experience. He showed that he could master past events in time, arraying them in order. With a

level of performance significantly well above chance, he could recall each of three foods and could reverse, when asked to do so, the order in which he ate them.[27] He can connect individuals with foods they have given him, even when his keepers have forgotten who provided which treat, just as my dog can associate, in memory, his toys with the benefactors who bestowed them. Both King and Beau would, on these showings, make far better witnesses than most humans at a criminal identity parade. A team tested King by performing acts that were new to him, including physical jerks and charades – pretending to steal a phone, or playing 'air guitar'. When they asked King who had done which performance, he got the answer right sixty per cent of the time. The score may seem modest – but try getting humans to emulate it.[28]

Chimps can locate memories in time, arrange them in order, and use them to make predictions. The work of Gema Martin-Ordas at Leipzig Zoo stands out among experiments that have challenged claims that such faculties are uniquely human. In 2009, eight chimpanzees and four orang-utans watched her use a long stick to reach a banana. She then hid the stick and another, too short for the job, in different locations for the apes to find. Three years later, with no promptings in the interval, the sticks returned to their former places. A banana was suitably installed, too. Would the apes be able to get at it? All the participants, except for one orang-utan, recalled the location of the right stick without effort. Other apes, who had not taken part in the previous exercise, were unable to do so. To capture memories and store them for future use, therefore, is part of the cognitive equipment humans share with other apes.[29]

A more sophisticated experiment designed by psychologist Colin Camerer and primatologist Tetsuro Matsuzawa tested chimps' and humans' ability to project predictions from remembered events. Subjects from both species played a game in which they observed other individuals' moves on a touch screen and then had an opportunity to win rewards by predicting what they would choose next. Chimps proved, on average, better at detecting the patterns than their human rivals, apparently because they could remember longer sequences of moves. The game tests for superior memory and strategic capability: how well the players recall opponent's selections; how well they detect patterns in choice-making; how cleverly they make their own

predictions. The results suggest that some chimps, at least, excel some humans in these skills.[30]

So Edgar was wrong, in the present connection, to belittle non-human intellects. I do not mean to suggest that human memories are incapable of prodigious feats. Preachers, performers, and examinees can often parade stupendous amounts of data. Vaudeville acts formerly hauled vast chains of facts before audiences, like Mr Memory in Hitchcock's version of *The Thirty-Nine Steps*. There are idiot-savants who can reel off the contents of the telephone directory. In some comparable functions, however, where memory is in play, non-human animals outclass us. Most people recoil when you tell them that human memories are not the best on our planet, but it is worth pausing to think about this counterintuitive notion. Humans have almost always assumed that any faculty that might justify us in classifying ourselves apart from other beasts must be a superior faculty. But maybe we should have been looking at what is inferior – at least, inferior in some respects – in us. Memory is not in every respect humans' most glorious gift, compared with that of other animals. Poverty, unreliability, deficiency, and distortions corrode it. We may not like to acknowledge the fact, because it is always hard to forfeit self-regard. We prize our memories and take pride in them because they seem so precious for our sense of self – something we are only just beginning to concede to other animals.

Literature – psychological, forensic, imaginative – is full of evidence of the weakness of most humans' recollections. Perhaps the most effective way of summoning up a sense of how badly memory works is to look at one of Salvador Dalí's most famous paintings – a bleak landscape scattered with disturbing, misshapen objects. He called the painting *The Persistence of Memory* but that is one of the artist's characteristic ironies: the real subject is how memory fades and warps. In the background is a westering sky, where the light is in retreat, over an indistinct sea, in which every feature seems to dissolve. Then comes a crumbling cliff, as if eroded, like memory, by the passage of time, and a blank slate, from which every impression has been erased. A dead, truncated tree, from which all life has withered, juts into the middle ground, over an almost traceless shore. Huge chronometers, stopped at different moments, sag and wilt, as if to proclaim the mutability

time inflicts, the contradictions it unwinds. Bugs seem to eat away at the casing of another watch in the foreground, while in the centre of the composition a monstrous, menacing shape seems to have been transferred from some evil fantasy by Hieronymus Bosch. Memories do turn into monsters. Time does subvert recall. Recollections decay.

The inefficiencies of human memory bridge the difference between memory and imagination. The difference is not, in any case, very great. Memory, like imagination, is a faculty of seeing something that is not present to our senses. If imagination is, as defined above, the power to see what is not really there, memory enables us to see what is there no longer: it is, in a sense, a specialized form of imagination. Memory works by forming representations of facts and events – which is also what imagination does.

Mnemotechnics, the ancient 'art of memory' that Cicero used to deliver speeches in the Roman courts and senate, assigns a vivid image – which may not be a naturally suggestive symbol – to each point the speaker wants to make. A bloody hand might stand for a humdrum point of procedure, a lovely rose or a luscious fruit for the deplorable vices of the speaker's opponent.[31] Observations of how the brain works confirm the contiguity of memory and imagination: as far as we can tell, both 'happen' in overlapping areas. Almost identical electrical and chemical activity goes on in the brain when imagination and memory are at work.

Memory and imagination overlap. But some philosophers are reluctant to acknowledge that fact.[32] I blame Aristotle. He insisted, with his usual common sense, that memories must refer to the past – and the past, he pointed out, was fundamentally unlike imaginary events because it really happened. Sometimes, however, life traduces common sense. In practice, memories and imaginings fuse.

But memories are closest to imaginings when they are false. Their creative power consists in distorting recollections. Misremembering recasts reality as fantasy, experience as speculation. Every time we misremember something old, we are imagining something new. We mingle and mangle the past with features it never really had. Life would be unbearable otherwise. Daniel Schacter, the Harvard cognitive scientist who monitors what happens in the brain when memories are registered and retrieved, points out that evolution has given us bad

memories to spare us from the burden of cluttering our minds. We have to make space in the lumber room, discarding relatively unimportant data to focus on what we really need.[33]

Women who remember faithfully the real pain of childbirth will be reluctant to repeat it. Socialites and networkers have to filter the names and faces of people they do not need. Soldiers would never return to the trenches, unless they suppressed or romanticized the horrors of war. Old men remember their feats – according to Shakespeare – 'with advantages'. To these self-interested modifications of memory, we add outright errors. We mistake our imaginatively transformed recollections for literal copies of the events we recall. The memories we think we 'recover' in hypnosis or psychotherapy can really be fantasies or distortions, but they have life-changing power for good and ill.

We can live with the quicksilver slips and slidings of our individual memories; but when we share and record them in enduring forms, the outcome is social memory: a received version of the past, which can reach back to times no individual can claim to remember. The same vices raddle it: self-interest, the rose-tinting, and sins of transmission. Propaganda engraves falsehood on pedestals, copies it into textbooks, slaps it onto billboards, and insinuates it into ritual. In consequence, social memory is often unresponsive to facts or intractable to historical revision. If psychologists can detect false memory syndrome in individuals, historians can disclose it in entire societies.

Workers in jurisprudence may want to demur. The similarity of memory and imagination subverts the value of legal testimony. For law courts, it would be convenient to divide fanciful versions from real accounts. We know, however, that witness statements rarely tally in practice. The most widely cited text is fictional but true to life: *In a Grove*, a short story from 1922 by Ryūnosuke Akutagawa, inspired one of the great works of cinema, Akira Kurosawa's *Rashomon*. Witnesses to a murder give mutually contradictory evidence; a shaman releases the testimony of the victim's ghost. But the reader – or the audience of the movie version – remains unconvinced. Every trial, every comparison of testimony, confirms the unreliability of memory. 'You were all in gold', sings a reminiscent, ageing lover in the stage-musical version of *Gigi*. The lady corrects him: 'I was dressed in blue.' 'Oh yes', is his

rejoinder. 'I remember it well.' In our various ways, we all remember equally badly.

Poorly functioning memory helps to make humans outstandingly imaginative. Every false memory is a glimpse of a possible new future that, if we so choose, we can try to fashion for ourselves.