Thinking Big

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How the Evolution of Social Life Shaped the Human Mind

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with 57 illustrations

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1

Psychology meets archaeology

The history of human evolution is an iconic story that never ceases to mesmerize and enthral. Buried in our past is one of the triumphs of evolution, the story of how a common-or-garden African ape began to change both its body form and the way it lived its life – and how in doing so, it eventually became the dominant species on earth. It is only within the last century that we have really come to appreciate the grandeur of this story and the moments of uncertainty and near-extinction that threatened it.

From small beginnings

Some 7 million years separate us from the time that the ancestors of humans and chimpanzees were a single species: a small, undistinguished African Miocene ape.* We finished that part of our story in the last 5000 years as the only animal to have settled all the terrestrial habitats of the earth, from the tropical forest to the arctic tundra and from high mountain plateaux to small islands in the remotest oceans. During that long history the size of our brains trebled and our technology progressed from simple stone tools to digital marvels. We walked upright, spoke, made art in profusion and crafted worlds of enormous imaginative complexity in the name of religion, politics and society. Truly, we are no longer apes.

For most of these 7 million years we were not alone. Where our remote ancestors lived they often shared the space with other closely related species. This ancient pattern began to change within the last 100,000

* The Miocene dates from about 23 to 5.3 million years ago. It is followed by the Pliocene (5.3 to 2.6 million years ago) and the Pleistocene (2.6 million to 11,700 years ago).

years when people like us, modern humans, moved out of Africa and through the Old World. Older species like the Neanderthals of Europe and Western Asia were displaced and became extinct. These same modern people also passed beyond the boundaries of the Old World, peopling for the first time Australia and the Americas. By the time the last Ice Age ended 11,000 years ago, we were the only species in town; *Homo sapiens* was now alone, in an evolutionary sense.

Soon we also became a global species. The move to farming led in one direction to cities, civilizations and a massive increase in population. And in another direction the domestication of plants provisioned the voyages into the remote Pacific, beginning 5000 years ago, while harnessing the power of animals made it possible to traverse cold and hot deserts. No wonder then that the European voyages of discovery found people everywhere; what is more, these explorers tested time-and-again the historical circumstance of *Homo sapiens* as a single biological species through successful, if not always consensual, interbreeding.

We still carry this 7-million-year history in our bodies and our brains. The scientific insights that arise by comparing our own anatomy and that of the great apes have been essential for understanding the process of evolution, and a revolution in genetics has opened up new evidence for tracing ancestral lineages using both modern and ancient DNA. Fossil skeletons, skulls and teeth have also received forensic attention for the evolutionary information they contain. At the same time, archaeologists have charted the development of technology and tackled key issues concerning diet and the behaviour that ensured a reliable food supply. The result is a much richer and better-understood record of our earliest history.

We began our scientific careers in the late 1960s when the landscape of human evolution was very different. There were few fossils and science-based techniques of dating (led by radiocarbon) were still in their infancy. Getting to see sites and materials was both difficult and expensive until the jumbo jet transformed international travel in 1970. Computers filled entire basements and had to be programmed with punch cards. There were no touch screens or search engines and as postgraduate students the greatest luxury we had was a photocopier, expensively producing images on shiny paper.

It is easy to be dazzled by the rate of technological change and the speed with which new data about our earliest origins have built up. The beginning always seems small by comparison with the present. But small should not be taken to mean unimportant. We will show in this book that for all their sophistication those material changes are still directed at solving some age-old issues of being human. These concern our social lives, which we believe have been largely ignored in the study of our origins.

Our major proposition in this book is that a link has always existed between our brains, or more precisely the size of our brains, and the size of our basic social units. We see this link as essential to understanding our evolution as a single, global species that can live in cities the size of Rio de Janeiro, drawing daily on vast amounts of information to manage our lives. But inside today's global citizen is a social being who carries forward a social life that in its basics is very similar to one 5000 or 50,000 years ago. At the core of this social life is the observation that a limit of about 150 exists in terms of the size of your social network. This is known as Dunbar's number, as one of us, Robin Dunbar, did the research that established the figure. This limit is almost three times greater than the chimpanzee's, which immediately raises the evolutionary question of how did this increase occur? It also begs another question: if the limit is 150, then how come we can live in such large cities and align ourselves to massively populous nations the size of China or the United States?

Our aim in this book is to trace the evolutionary journey from our small beginnings to the present position. Our principal guides are psychologists and archaeologists, although many other disciplines have been involved. With our social perspective on human evolution, we have set out to learn about the following central issues:

- Is there a limit in our brains, our cognitive ability, that restricts the size of the social groups we can live in?
- If so, how did our cognitive ability evolve to cope with ever greater numbers of people, as societies grew from the small social worlds of hunters to today's mega-cities?

- Given that our ancestors had much smaller brains than ours, what do we mean when we talk of a social life in the remote past?
- Will it ever be possible to say when hominin brains became human minds?

The list above could of course be much longer, but these core questions indicate our interest, first and foremost, in the social rather than in a history of technology or the architectural details of fossil skulls. They also point to our concerns with cognitive matters, the business of understanding how and why we think and act the way we do. Our approach is underpinned by evolutionary theory and our goal is to apply the insights from an experimental subject such as psychology to a historical discipline such as archaeology. This is rarely attempted and never easy. But first some background.

The germ of an idea takes shape

In 2002, the British Academy, the UK's national body for the humanities and social sciences, launched a competition for a research project to celebrate the centenary of its foundation. It proposed to give the largest single grant it had ever made to a flagship project in the humanities and the social sciences. Although our individual perspectives and interests had been quite different, the three of us had spent most of our professional lives immersed in the story of human evolution. One of us was a Palaeolithic archaeologist with a primary interest in Africa, one a social archaeologist with a special interest in late Palaeolithic societies in Europe, the third an evolutionary psychologist with a principal interest in human and primate behaviour.

It seemed to us, contemplating the opportunities that such a project might offer, that we were perfectly placed to rise to the challenge that the British Academy had thrown down. We had the single biggest question one could ever ask (how did we come to be human?) and we could bring novel expertise to bear on the question. Where past studies of human evolution had been obliged to concentrate on the limited physical evidence that was available (the stones and the bones), we were fortuitously in a position to exploit recent findings about social behaviour and brain evolution in a way that might illuminate the significance and meaning of the stones and the bones. Moreover, archaeology was in the humanities half of the Academy and psychology in the social sciences half, so we could bridge the divide over which the Academy presided, offering an iconic example of how to do interdisciplinary research. We quickly became galvanized with enthusiasm, put our heads together and sent in a bid.

The possibilities that such an endeavour offered seemed positively limitless. The academic world was just beginning to grapple with the integration of psychology and archaeology. The previous decade had witnessed the creation of cognitive archaeology under the driving force of the British archaeologist Colin Renfrew and the American archaeologist Thomas Wynn. The main focus of this approach had been understanding the cognitive demands of toolmaking and the production of works of art. But we felt that recent developments in our understanding of the behaviour of our nearest living cousins, the monkeys and apes, and in the processes underpinning important areas such as brain evolution, would enable us to go one step beyond to say something about the social life of hominins (see Table 1.1), and to do so much further back in time than most cognitive archaeologists had previously dared to go. In particular, the theory that had become known as

Anthropoids	**All primates (monkeys and great apes and their fossil ancestors), hominins and humans**
Hominids	**All great apes (gorillas, orang utans, chimpanzees, bonobos, gibbons), hominins and humans**
Hominins	**All our fossil ancestors *(Ardipithecus, Australopithecus, Homo)***
Humans	**Only modern humans, *Homo sapiens***
Anatomically modern humans	***Homo sapiens* but without substantial evidence for our cultural accoutrements (art, burials, ornament, musical instruments)**

Table 1.1: *Common terms in human evolution.*

the social brain hypothesis – the idea that the brain had evolved to allow animals like monkeys and apes to handle an unusually complex social world – offered novel insights and rich seams to exploit in the exploration of hominin social evolution.

Our bid was grandly entitled *Lucy to Language: The Archaeology of the Social Brain*. Lucy was the iconic early australopithecine fossil that had been unearthed by the palaeoanthropologist Don Johanson and his team in the deserts of northeastern Ethiopia in 1974 (it was named after the Beatles' song *Lucy in the Sky with Diamonds*, which had been playing on a tape recorder when the fossil was unearthed). Lucy and her family had lived around 3.5 million years ago, and marked the earliest well-documented hominins. Since the australopithecines still shared many similarities with our common ape ancestors – at least in terms of brain capacity – it seemed like the obvious place to start our story. Language marked the appearance of modern humans, our own kind, and seemed like a natural end point. And so the project acquired its name.

After submitting our proposal, we could only sit back and wait. It is not easy to get funding for research in the sciences or the humanities these days in any country, so we were under no illusions about the outcome. The funding rates of the UK research councils are notoriously low, with only about 10 per cent of proposals actually receiving grants – despite the fact that almost all of those submitted involve exciting, novel and innovative science. We fully expected to be presiding over yet another failed bid. So it was with some surprise and excitement that we heard that our project had been shortlisted for the final interview stage. We were in with a chance!

In the end, of course, this particular story had a happy ending, or we wouldn't now be writing this book. Ours was the project that was selected by the British Academy as its Centenary Research Project. It turned out that the competition had been much tougher than we had imagined. There had been more than 80 other proposals submitted. Many other potentially exciting projects had faced disappointment, with all the attendant wailing and gnashing of teeth as is inevitable under such circumstances. But, with money for a seven-year project assured, all we had to do was put together a team of exciting young researchers and venture purposefully into the unknown. *Thinking Big* is the story of our project.

The social brain and its evolution

The centrepiece of our project was the social brain hypothesis. This had taken its first hesitant steps in the 1970s when it was pointed out that monkeys and apes had much bigger brains relative to body size than any other animals. Pondering this, a number of primatologists more or less independently suggested that this was probably because monkeys and apes live in unusually complex societies. Later, during the 1980s, the primatologists Andy Whiten and Dick Byrne, of the University of St Andrews, suggested that what made primate societies so complex was the behaviour of the animals themselves. A monkey group wasn't like a beehive, which has enormous structural complexity arising from the fact that different individuals are programmed to perform different tasks. Beehives are largely the outcome of strict chemical management of behaviour: individual bees do not choose to adopt the roles of worker or drone or queen, but rather are obliged to behave this way by a combination of their genes and the chemical signals imposed on them by the rest of the hive. Monkeys, by contrast, are individuals and, within the constraints of their individual psychologies, adjust their behaviour according to the exigencies of the particular circumstances in which they happen to find themselves.

The complexity of primate societies is created by the subtleties of how the individuals interact with each other. And, as every field primatologist will tell you, it is the soap opera of daily life in a monkey group that creates both its fascination and its intricacy. Whiten and Byrne lit on the fact that monkeys and apes are forever deceiving and outwitting each other in a perennial attempt to steal a fast one in the great race of life. A monkey might surreptitiously hide a desirable fruit to prevent another seeing it; or it might give an alarm call to distract everyone else from noticing that it had found a particularly nice bulb that needed some time to dig out of the ground. Whiten and Byrne named this the Machiavellian intelligence hypothesis, in honour of Niccolò Machiavelli, the Italian Renaissance political philosopher whose iconic book *The Prince* had spelled out the devious political strategizing that would best guarantee a late medieval ruler success and long life.

Because some people objected to the implied suggestion that primate politics were driven by the same deviousness as human politics, the name

for the theory was later changed and the social brain hypothesis was born. In part, this was in recognition that it wasn't just the behavioural complexity of monkeys and apes that was at stake, but also the sizes of their groups. The seal was imposed on this story during the 1990s, when it was shown that the average size of a species' social groups correlated with the size of its brain (see Figure 1.1); or to be more precise, correlated with the size of its neocortex (literally 'new cortex'), the outer layer of the brain, surrounding the so-called old brain (the brain stem and mid-brain, including the limbic system and the parts that run most of the body's autonomic activities). It is the neocortex that has exploded in size during the course of primate evolution. It was this massive expansion of the neocortex that was responsible for the fact that primates had larger brains than other mammals. The neocortex appears for the first time in the mammal lineage – although there is a comparable part of the brain in birds, too.

In the 60–70 million years of evolutionary time since the primates first appeared as a distinct group of mammals, the primate neocortex has gradually increased in size as species have evolved from one into another. It overlies what we might think of as the reptilian brain and it is what allows mammals to adjust their behaviour in more sophisticated ways to the exigencies of day-to-day circumstances. Although the complexity of behaviour and the psychology that underpins this is the key to the social brain story, the bottom line is that a species' brain size seems to impose a constraint on the size of its social groups. When groups exceed their species-typical limit, they begin to fall apart because the animals cannot manage to maintain coherent relationships with each other.

Two things seem to be important in this respect. One is the psychological sophistication of monkeys and apes, and their apparent ability to strategize and deceive. The other is the fact that this kind of social cognition is very expensive in computational terms: the neurons of the brain have to work hard. We will examine both in more detail in later chapters, but for the moment let it suffice to say that these two components are intimately related. We have been able to show that the skills on which the kind of sociality that humans have depend on a capacity known as mindreading or mentalizing – the ability to understand or infer what another individual is thinking. This allows us to keep several people's intentions in mind at the same time, and so adjust our

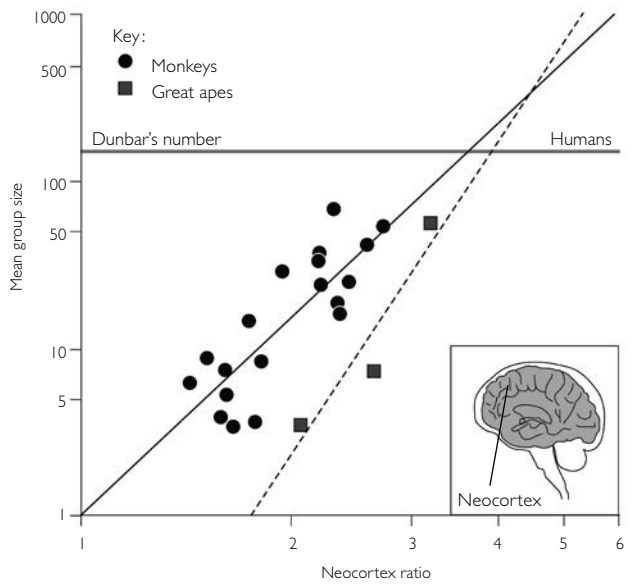

Figure 1.1: *Social group size for different monkey and ape species plotted against the species' relative neocortex size. The neocortex is the outer layer of the brain that is responsible for complex thought. The index of relative neocortex size (neocortex ratio) is neocortex volume divided by the volume of the rest of the brain: this allows us to standardize for differences in brain size.*

behaviour in such a way as to allow for their interests as well as ours when we act in a particular way. We have been able to show, in addition, that this capacity for coping with many individuals' mental states depends crucially on the volume of neural matter in particular parts of the neocortex. These regions, in the frontal and temporal lobes, form a network of neural clusters that are known to be crucial to mentalizing.

A key aspect of the social brain hypothesis of particular interest to our story is the fact that it makes a very specific prediction about the size of human groups. The equation that relates social group size in apes to a species' neocortex volume predicts that modern humans have a natural group size of about 150 individuals, the value that is, as we have seen, now known as Dunbar's number. One reason this is important for our story is the fact that the relationship shown in Figure 1.1 spans the sequence from chimpanzees (representative of the last common ancestor between great apes and humans) to modern humans: all the

now-extinct hominin ancestors must lie along the line between these two points. Our task will be to figure out just where they fall and what the implications of this are for their social and mental lives.

Dunbar's number in the modern world

The social brain hypothesis predicts that humans have a natural grouping size of around 150. But is this really true? We only have to look around where most of us now live to see what is surely obvious: humans live in towns and cities that are considerably larger than 150 people. Indeed, many of the great modern cities of the world today number their citizens in the tens of millions. So how is it that the social brain equation gives us such a low number? Perhaps the theory is just wrong. Or perhaps what the theory is telling us is that the number of people that can be crammed together in a tangled mess of electricity wires, winding lanes and sewage pipes doesn't bear much relationship to the world of our social relationships. We can live in cities of tens of millions, but our personal social worlds – the worlds that consist of the people we actually know – are formed of a pint-sized 150 people. If this second suggestion is true, perhaps what Dunbar's number is all about is the limit on the number of individuals with whom we can have relationships. After all, if we think about what is involved in the original equation for monkeys and apes, it is the number of individuals who live together in a group on a daily basis. These groups are small, and, with a few exceptions, the animals see each other every day and all day. By no stretch of the imagination can everyone who lives in London, New York, Mumbai or Beijing possibly see each other every day, or even every month, or every year – and never mind meet the people from any of these other cities. And even if by some chance they did, they certainly wouldn't be able to remember who they all are. In actual fact, it seems that the limit on the number of faces we can put names to is around 1500–2000, and that is well below the size of even a small village in the modern world.

This puzzle set us thinking about the kinds of evidence we really needed to test the prediction of the social brain equation. There seemed to be two obvious places to look. One was in the kinds of small-scale societies in which we have spent most of our evolutionary history as a species. There are still quite a few of these around, but they are confined to the more obscure tribal societies on the margins of the modern world. They are the societies we find among hunter-gatherers, people like the Kalahari San of southern Africa, the Hadza of East Africa, or many of the rainforest tribal societies in South America, and, at least historically, among the Aboriginal peoples of Australia. The other possibility was to look at ourselves and our own personal social worlds, the network of individuals with whom we had personal social relationships.

The literature on community size in hunter-gatherer societies is slight, partly because anthropologists haven't been especially assiduous about collecting such data. There is, moreover, another source of confusion, and this is the fact that it isn't at first clear just what counts as a community among hunter-gatherers. Not unreasonably, many people have supposed that the basic group for hunter-gatherers is the set of people that camp together on a daily basis. This has a typical size of around 35–50, only a third of Dunbar's number. However, hunter-gatherer societies, like our own, consist of a variety of types of communities, which are typically organized as a hierarchy – families clustered within kinship groups, kinship groups clustered within villages, and villages clustered within larger regional groups. It is this last that turns out to be particularly interesting because it is this level of social organization, and it alone, that has a typical group size of the right sort of magnitude. The average is almost exactly 150. So we have some evidence that natural human community sizes are in fact of just the size predicted by the social brain hypothesis.

Figure 1.2 shows what you see if you look down on a population from above, the picture created by the way the people are distributed in geographical space. But what about the size of personal social networks,

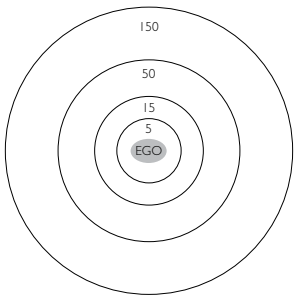

Figure 1.2: *The circles of friendship. The average person's social network consists of about 150 friends and family, arranged in a series of layers that correspond to different qualities of relationship, each of a very distinctive size. Each layer in this series is roughly three times larger than the layer inside it. The layers are roughly equivalent to intimate friends, best friends, good friends and friends.*

the social world seen from below, from the individual's point of view? Our first attempt to look at this involved Christmas cards. Each year, many of us sit down and spend a lot of time, effort and money sending cards to people we want to keep in touch with. So one year, we asked about 45 people to keep a list of all the people in the households to which they were sending cards. Figure 1.3 shows the result. There was a fair bit of variation, but the average was in fact 154, about as close to the predicted value as one could possibly wish.

This prompted us to be a bit more ambitious, and over the following years we put together a large database involving 250 individuals who made complete lists of all the people whom they regarded as important in their personal lives. This was, it must be said, an arduous undertaking because we also asked them to tell us a lot of details about the individuals they listed – how they were related to them, when they had last seen them, how close they felt to them emotionally. But the end result was very rewarding because, again, the number 150 emerged as critical.

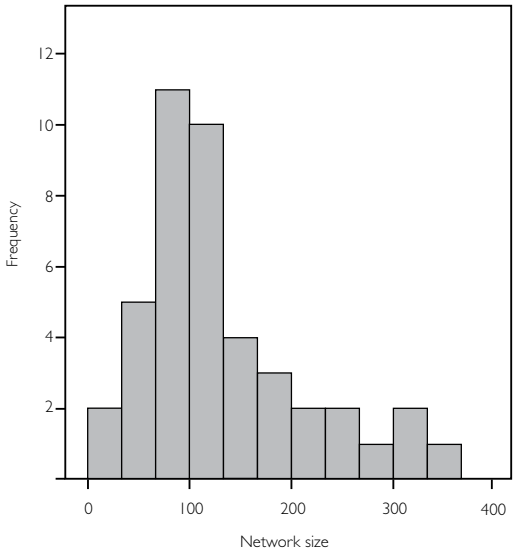

Figure 1.3: *The Christmas card lists of 45 people. While our social networks have a typical size of about 150 people, we vary a great deal in the number of friends and relations we have: some of us have very small networks (though we typically invest more time and effort in each relationship) and some have considerably larger ones (but typically invest less in each relationship).*

So between these various sources of data, we seemed to have strong evidence for the claim that our social world is quite small and limited to about 150 other people. From our big dataset, we were able to draw two more key conclusions. First, people varied quite a lot in the number of friends they had. In fact, the range of variation around the 150 mark is probably something like 100–200. Second, and this surprised us, about half the individuals included in people's 150s were family and half were friends.

Since all the people in our sample were Europeans (from the UK and from Belgium), we had assumed that family members would largely be represented just by close kin – mum, dad, brothers, sisters, grandparents, perhaps the odd aunt or uncle or cousin. But we thought the numbers would be quite small. Of course, kinship – and extended kinship – is important in traditional societies. Indeed, kinship has been the bread and butter of anthropological study since the discipline first got going a century-and-a-half ago. But we assumed that it was only traditional societies that still 'did' kinship in the extended sense: we in the developed world had abandoned such notions, preferring the advantages of social mobility over the ties of hearth and home, and as a result, while of course we still valued immediate family, our social worlds were dominated by friendships and acquaintances from work. This turned out not to be so. About half the people we include in our social network are members of our extended family. In fact, we could even show that people who come from big extended families list fewer friends in their social networks. So it seems that the figure of 150 is a real limit on the number of relationships you can have. You have just 150 slots, you give priority to family members first, and then fill the rest up with friends.

Of course, there are many ways to outflank the limits. You don't *have* to include your family in the list. Some people fall out with their close family and never see them again. Rather, the point is that, typically, people prioritize family above friends. If you don't have many family members, or you have fallen out with them, then you fill your slots with friends – or your favourite soap opera characters, or your pet, even your favourite potted plant if you genuinely feel you have a relationship with it! And of course, you can even include people who don't physically exist, like God or the saints, if you feel so disposed. The important thing

to remember is that relationships, ties, bonds – call them what you will – are built up by us as we pursue our social lives. Who your mother and father are is given to you, as are those other biologically based kinship categories. But most of what we do is better described as a process of negotiation, building up and selecting a personal network of friends, loved ones and acquaintances. That number of 150 is a sample drawn from many possible choices.

The reason for this limit, Dunbar's number, will be explored in later chapters. But at this point we need to briefly introduce the idea of cognitive load, which is a way of thinking about our mental capacity to remember and act on information, in this case about others in our social community. We all know the feeling before an exam or an important presentation that our brains are full up, bursting with data, and as the number of our social relationships increases, so we are similarly faced with an overload issue. Can we remember names, personal histories and fulfil our obligations to others? It seems that the figure of 150 stretches to the limit our cognitive ability to remember, recall and react in consistent and socially productive ways. Cognitive load thus acts as a brake on our social ambitions.

The age of the past

Enter, at this point, archaeology – and the past. So far, we have given one side of the coin, the relationship between the brain and the social world in living species. Now we must turn to something just as crucial in our frame – the exploration of deep-history.* This is the forte of archaeology, which has its roots in the antiquarian movement that began more than 300 years ago and became one of the foci of intellectual curiosity throughout the Enlightenment. The archaeology we recognize today, however, was a product of the 19th century. During the first half of that century materials were classified into a three-age system – Stone, Bronze and Iron – which later would form the evidence for a simple evolution of society from hunters to farmers and ending with civilizations.

The question that archaeologists and geologists most keenly wanted an answer to was the antiquity of humans. Did they date to the Ice Age,

* We use deep-history in preference to prehistory to describe the remote history of our earliest ancestors.

which would make their origins very old, or only to the most recent geological period, as advocated by many who looked no further than the Bible for a chronology? The answer came 150 years ago, in 1859. Two Englishmen, Joseph Prestwich and John Evans, who went on to dominate their respective fields of geology and archaeology, were following up Frenchman Boucher de Perthes' claims that, in the Somme Valley in northern France, there was evidence that humans and extinct animals such

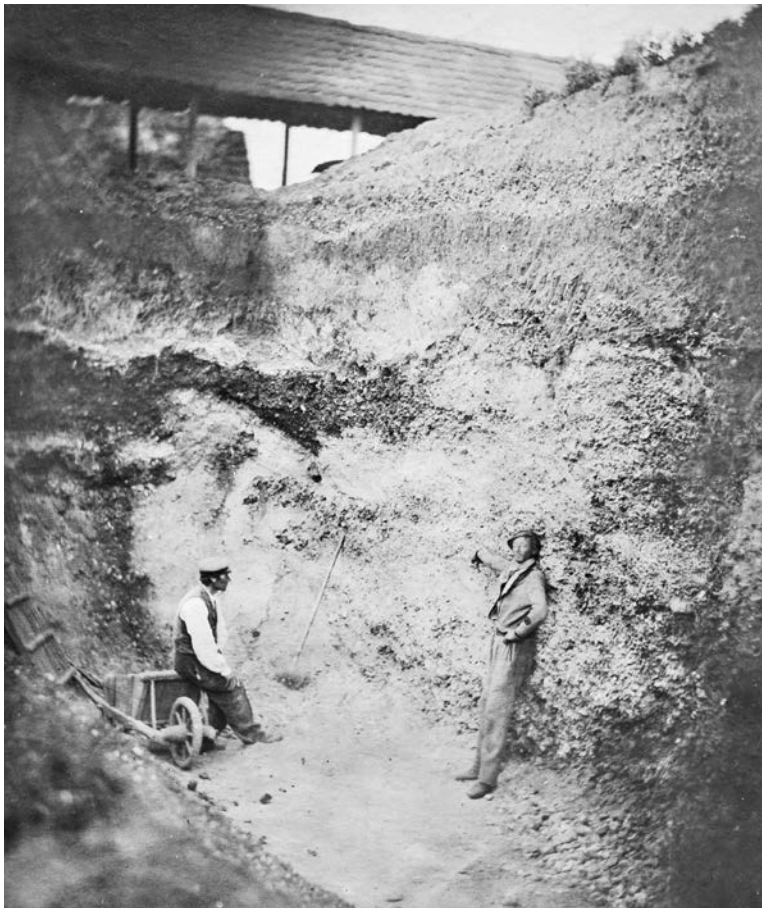

Figure 1.4: *The St Acheul gravel pit in the suburbs of Amiens in the Somme Valley, France. This photograph, taken on 27 April 1859, shows a quarryman pointing to a handaxe (Figure 1.5) found in place in the Ice Age gravels.*

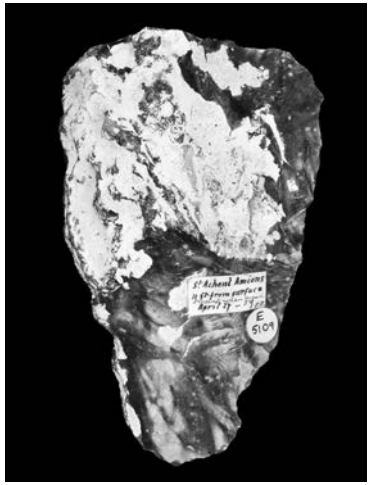

Figure 1.5: *A handaxe crucial to the history of Palaeolithic studies was recently relocated by Clive Gamble and Robert Kruszynski, still bearing its label of 1859.*

as woolly rhino and mammoth had lived at the same time. On an April afternoon Prestwich and Evans found what they were looking for in a gravel pit at St Acheul in the suburbs of Amiens (hence the term 'Acheulean', subsequently adopted for this toolmaking epoch). They even took a photograph of the moment of discovery, which shows a stone tool, in situ, sticking out of the gravels in which they had also found the bones of extinct animals. Their results were immediately accepted back in London by the Royal Society and the Society of Antiquaries. The science of human origins had scored a notable success although intriguingly the stone handaxe that proved their point was lost from sight until Clive Gamble and Robert Kruszynski re-found it exactly 150 years later – it was safely stored in the collection of artifacts that Prestwich's widow had donated to what is now the Natural History Museum after he died in 1896. This was very definitely a stone that changed the world, shattering biblical chronologies and opening up a deep-history whose enormity, in the absence of dating techniques, could only be guessed at.

This same science of human origins did have an interest in ancient society. Sir John Lubbock subtitled his popular *Pre-Historic Times* of 1865 *as Illustrated by Ancient Remains and the Manners and Customs of Modern Savages*. People who lived by hunting and gathering, such as the Aboriginal Tasmanians, were seen as the modern representatives of the people who made the St Acheul handaxe – the people of Lubbock's Palaeolithic (Old Stone Age). They were distinct from the polished axe users of his later Neolithic (New Stone Age), when farming had replaced hunting as the means of subsistence. Such comparisons continued for many years until it was recognized that drawing direct parallels between the past and the present was both poor history and entirely misleading. Besides, such an approach erroneously assumed that people living today had not changed but were instead living fossils.

Archaeologists concentrated their subsequent efforts on amassing information, first from Europe and then from Asia and Africa. During the 20th century they became less interested in the social lives of these early humans and more in what they made and what they ate. But the social is inevitably at the heart of archaeology's ideas. It was dragged fully back into the picture by a brilliant Australian scholar, Vere Gordon Childe, in his *Social Evolution* published in 1951. He argued that archaeology must play the same role for anthropology as palaeontology for zoology, although for Childe society, as we shall see in Chapter 3, really took off with farming. However imperfectly the traces were preserved, what archaeologists studied was societies. And so, when Grahame Clark and Stuart Piggott went on to write a grand outline of human progress in 1965, they entitled it *Prehistoric Societies*.

These were the aspirations, but the frame of evolution – the necessary backdrop to our 'becoming human' – always depended on the earliest and sparsest evidence. It took pioneering resolve and major discoveries to catapult us forward into a modern evolutionary age. The greatest landmark was the discovery by Louis and Mary Leakey in 1959–60, at Olduvai Gorge in East Africa, of early hominin fossils, together with stone tools, in a setting that could be dated to nearly 2 million years ago.

At a stroke, the record became three times longer than most had thought possible. A time-depth to human origins was opened up that would have amazed Prestwich and Evans, who guessed a few hundred thousand years at most. That field season at Olduvai was the moment when the scale of the human past was mapped out in modern terms, with scientific methods of dating, such as potassium–argon, that are crucial for giving substance to the findings. Yet again other sciences, psychology included, were knocking on the door. Louis Leakey's timing was impeccable – he managed to get his key findings out for a volume published to celebrate the centenary of Darwin's *Origin of Species*. There, Leslie White conceived of 'four stages of minding' and Irving Hallowell wrote about 'self, society and culture'. So why did we not leap forward into a full appreciation of the early mind?

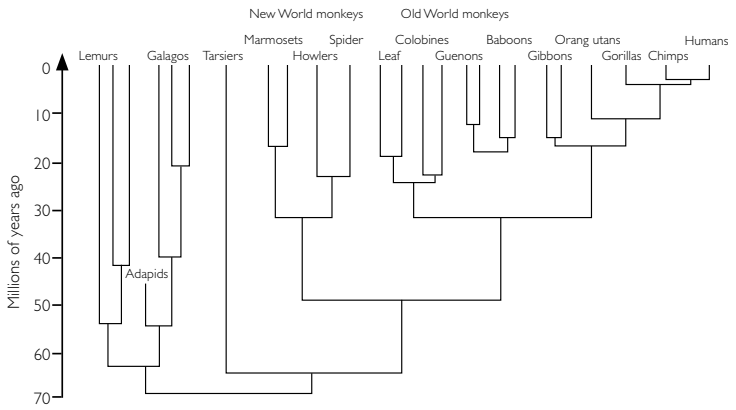

Figure 1.6: *A chart of primate evolution, showing the major divisions and the dates when they first appeared. On the left are the prosimians (represented today by lemurs and galagos); on the far right are the ape family (gibbons, orang utans, gorillas, chimpanzees and ourselves), with the New and Old World monkeys in between.*

Part of the brake came from other seemingly positive developments. One was a revolution that stirred up archaeology in the 1960s – a revolution that became known as the 'New Archaeology'. For us, it was a two-edged sword. Some of its greatest exponents, among them Lewis Binford, exposed the limits of archaeological evidence by showing how selective preservation could distort the record, and how easy it is to create 'modern myths' about the ways that human life could be recovered. When stone tools were found clustered with animal bones, even with human fossils, you could not simply assume that this was a 'campsite' or even a 'kill site'. Too many other natural factors could produce the same configuration.

The human club and WYSWTW

Two aspects were frustrating not just for archaeologists, but for scientists in other disciplines trying to interpret the record. First, in the New Archaeology the traditional narrative account was spurned on the grounds that our record was not history and could not make a connected story like history. Second, and more importantly, a view began to emerge insisting that *what you could not observe directly in the record you were forbidden even to think about*. At a stroke this idea, that What You See is What There Was (WYSWTW), excluded large areas of what

it is to be human – emotions and intentions for example – from the scientific study of human origins. There were shades here reminiscent of the behaviourism that had dominated much of psychology from the First World War until the 1970s. Psychology is in origin about the working mind, and the behaviourists had argued that since the mind itself could not be observed directly, it was not even open for discussion. For human origins, too, many scholars felt that any advanced capabilities had to be demonstrated beyond reasonable doubt. Only if they expressed their ideas in material form – as art or skilled crafts – could earlier humans hope to be included in our modern club.

This idea of the modern human club has permeated archaeology since the 1970s, when a new phrase, 'the anatomically modern human', appears in the literature. This was coined to describe ancestors that looked like us and even had our genes but who did not behave like us. They had neither art nor basic architecture. Their burials were usually simple rather than rich, without grave goods or evidence for ceremony. The anatomically modern humans found in these burials date to between 200,000 and 50,000 years ago in Africa and the Middle East. With hindsight we can see that by membership of the modern human club what was actually meant was membership of the European club, where art and elaborate burials had been known for some time as a component of its Upper Palaeolithic.

But which sense of 'becoming human' do we mean here? For some people, there is only full membership: the ancestors have to be 'like us' to qualify, and that pretty much limits us to the last 200,000 years of hominin evolution. In this book, however, we are interested in a broader view, for we are primates, bound to our primate relatives such as the chimpanzee and the bonobo by a family tree that stretches back through several million years at least (see Figure 1.6). All of it is there to be explained, not merely the last few per cent.

Building the long record

Fortunately, that longer record has had a huge appeal. The new extended domains of deep-history made it seem as if archaeologists had pulled out a folding bed, and suddenly realized how much space they had. Pioneers possessed enormous enthusiasm and energy, launching

Figure 1.7: *The late Glynn Isaac was one of the leading thinkers in the generation of the 'New Archaeology'.*

fieldwork ventures that reached back 2 million years, and that drew in scientists from many other disciplines. Few people realize quite how much archaeology there is, and how many of its aspects interrelate with one another. Some biologists believe that archaeologists have just 'a few stones and bones'. But if we take the work of just some of the great Clarks of archaeology – Grahame Clark, the European prehistorian, J. Desmond Clark, the Africanist, F. Clark Howell, the palaeoanthropologist, or David L. Clarke, the brilliant theoretician who died at the tragically young age of 38 – you can see the immense variety of activity that has built up a record that is actually far too big for any one person to take in.

One of the pioneers, Louis Leakey, played a crucial part in encouraging research into both past and present, including the great apes, and in this way transformed our knowledge about the background of human evolution. Born in Kenya in 1903, he drew from his upbringing in Africa a particular appreciation of animal and human behaviour in wild environments. Alongside this bush experience he acquired a western education and was able to investigate sites of all periods, not just at the famous Olduvai Gorge, but also early Miocene ape sites around Lake Victoria, and later Stone Age sites in the Rift Valley – including, quite coincidentally, a site named Gamble's Cave!

While this very breadth, combined with a somewhat headstrong and maverick personality, often irritated his European colleagues, it allowed Leakey to focus on the essentials of actual life in the savannahs and forests as it might have been. His colleague, the anatomist Philip Tobias, once remarked that Leakey epitomized the idea that no one achieved much who never made mistakes, and commented especially on his vision. Leakey realized that we could only hope to understand extinct animals by using modern animals to help interpret 'their structure, functioning and behaviour'. He was far ahead of his time in appreciating how much the apes had to teach us, not just about themselves, but about the framework of human evolution and our own nature. Among his many activities, he paved the way for outstanding research by Jane Goodall on chimpanzees, Diane Fossey on gorillas and Birutė Galdikas on orang utans.

Through the 1960s to the 1980s, there was a buzz of excitement in palaeoanthropology. In the field, it was a period of great international research expeditions, focused mainly on Africa, which drove our detailed knowledge of human origins back towards 4 million years, back towards the last common ancestor with the apes. Louis' son, Richard Leakey, and the energetic South African-born archaeologist Glynn Isaac opened up the expanses of East Turkana; F. Clark Howell and the Harvard group worked at Omo to the north; Don Johanson and Maurice Taieb led a breakaway expedition that culminated in the spectacular discoveries around Hadar in the north of Ethiopia – the home of Lucy and her *Australopithecus afarensis* kin. So rich were

Figure 1.8: *Olduvai Gorge in Tanzania was for many years the focus of research by the Leakeys. Streams have cut a great scar across the landscape exposing ancient lake beds and the activities of early hominins. The latter transported stones for toolmaking from the rocky hills in the background, providing one of the first clues that their networks of operation could be explored.*

the findings in the same area by palaeoanthropologist Tim White and his team that many of the implications are still being unravelled. Nor was it just Africa: Europe was re-explored, and then the Far East and Australia. All have contributed crucial evidence that allows us to fashion the synopsis that follows.

1.	**After at least 20 million years of apehood, our last common ancestor with the apes lived about 7 million years ago**
2.	**Upright walking and changes in the teeth started at least 4.4 million years ago, as the first hominins appear in the fossil record**
3.	**Stone technology became increasingly important from about 2.6 million years ago**
4.	**The brain began to enlarge significantly around 2.4 million years ago with the appearance of the earliest hominins who can be called *Homo***
5.	**After 2 million years ago early humans moved out of Africa and around the Old World, reaching in places to above 55 degrees north**
6.	**Brain growth showed a marked rise with *Homo heidelbergensis* at 600,000 years ago; language was probably present but not necessarily as we know it**
7.	**Anatomically modern humans appeared in Africa about 200,000 years ago, as indicated by fossil and genetic evidence**
8.	**By 60,000 years ago (or earlier) modern humans had spread from Africa; they displaced existing hominins and moved into new lands such as Australia and, after 20,000 years ago, the Americas; the age of the single, global human species had begun**
9.	**Evidence for art, ornament and symbolic behaviour started in Africa with anatomically modern humans and before they left that continent; worldwide after 40,000 years ago, it increased in complexity and multiplied in frequency**
10.	**Major changes in the scale and organization of society began in the last 10,000 years when farming replaced hunting and gathering as the economic mainstay**

Table 1.2: *Ten steps in the hominin–human story.*

The story of hominin evolution that has emerged from a century of fossil-hunting and careful fieldwork and museum analysis has, of course, changed considerably over the decades as new knowledge has become available. This is neither the time nor the place to recount that history of discovery. However, we do need at this point at least to sketch out the human story as we currently understand it, although parts of it will no doubt change as new fossils are discovered in the decades to come. But for present purposes we need a framework, summarized in Table 1.2 and Figure 1.9, round which to build the chapters that follow.

Our tale begins with the last common ancestor, or LCA, that our lineage had with the African great apes, and in particular with the chimpanzees (the ape to whom we are most closely related) some 7 million years ago. We have no idea what this ancestor looked like, because no fossils that can be identified as the LCA are known. It will not have looked exactly like a chimpanzee, since, like us, the chimpanzees themselves have had 7 million years of evolution of their own since the LCA roamed the forests of central Africa. Indeed, there is precious

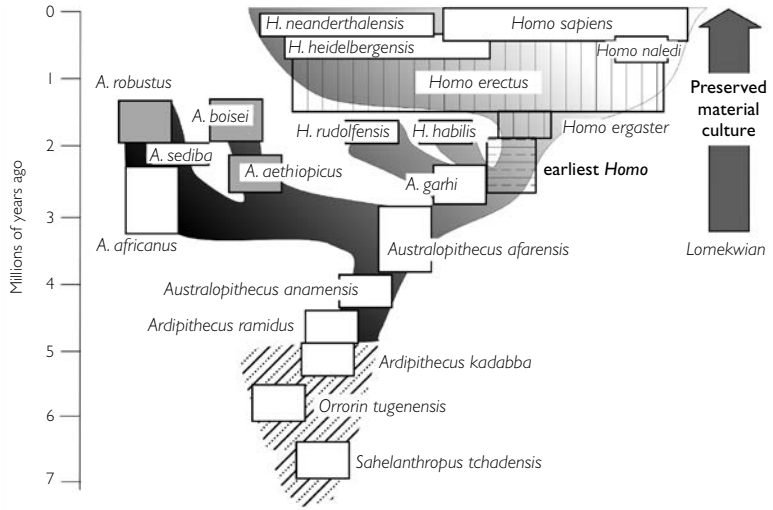

Figure 1.9: *A chart showing the main hominin species known through the last 7 million years. The relationships are much debated, but our interpretation indicates an ancestral stem and a radiation of species that began around 3 million years ago. The species* Homo naledi *announced by Lee Berger and colleagues may be a late form of* Homo erectus. *Stone tool finds made at Lomekwi in northern Kenya by Sonia Harmand and colleagues extend the technological record back to about 3.3 million years ago.*

little to show for the first 2 million years post-LCA – a handful of recently discovered bones in East Africa and an impressive skull from the edge of the Sahara desert in West Africa. What seems to mark these fossils out as different is an upright stance, a unique two-legged form of bipedal locomotion. All the other apes and monkeys walk on all-fours, and in the apes this takes the form of a distinctive body shape with short legs and long arms – a body shape associated with shinning up the vertical trunks of massive forest trees. Our lineage seems to have been distinguished right from its outset by an upright body with longer legs and shorter arms, a body shape adapted to striding across the open ground between the trees. While the earliest hominins don't have quite as elegant a bodyline as we do, they are nonetheless characterized by this distinctive trait. Indeed, it is just about the only trait that actually distinguishes the members of the hominin family from the other great apes.

However, broadly speaking, we seem still to be dealing with ecological apes. But they were apes that had diversified into a variety of niches that would not have been habitable for living apes, because fruits and soft shoots would not have been available in the extremes of dry and wet seasons. They include the robust australopithecines with their massive teeth, the so-called gracile australopithecines, with less heavy jaws and teeth, and the more lightly built and perhaps more 'generalist' early *Homo*. Compared with apes, probably all were more dependent on roots, tubers, nuts, seeds and animal protein, as confirmed by modern isotope and microscope studies, which are still exploring the details of their diets. *Homo habilis* – once thought by Leakey and Tobias to have been the first members of the genus *Homo* (but now preceded by some other candidates) – occupies an important place in the history of palaeoanthropology. It was found at Olduvai Gorge in the same levels as a robust australopithecine (*Zinjanthropus*, or properly *Australopithecus boisei*) and among the simple stone flakes and cores known as the Oldowan tradition. The maker of these tools was thought to be the more gracile and human-looking fossil, hence their Latin species name, *Homo habilis* or 'handy man'. Now we know that stone toolmaking began more than half a million years earlier, and which species made them is open to question. It most certainly does not have to be a member of the *Homo* lineage – after all chimpanzees are adept toolmakers and users, and we cannot be sure that any of the later australopithecines did not make stone tools. Although the roots of *Homo* are hard to discern because of a paucity of fossils between and 2.0 and 2.5 million years ago, the diversity of finds from just after this period suggests a complex early history. This was a period of rapid climatic change and was associated with many extinction and speciation events, so tracing the links is not easy, but rare finds from Ethiopia and Kenya dating to 2.3 to 2.4 million years show that some form of early *Homo* was certainly present.

By 1.9–1.8 million years ago we find a diverse group of early *Homo*, among which one species – *Homo erectus* – was highly successful as measured by its evolutionary longevity. Including the local varieties often known as *Homo ergaster* in East Africa and *Homo georgicus* in Georgia, the *H. erectus* group dominates the record of the next million years. They were probably the first hominins to escape from the confines of Africa to colonize large parts of Eurasia.

Although it is customary to distinguish between early African (*Homo ergaster*) and later Asian (*Homo erectus*) species, these are in reality part of a single group of highly successful Old World species that shows a good deal of temporal and geographical variation. *Homo erectus* developed a distinctive toolkit, focused around the handaxe, whose design and functions remained largely unchanged for a million and a half years. These first members of our genus differed from their australopithecine predecessors in their taller, more elegant body shape, and their significantly larger brains. They were clearly more nomadic, built to travel distances and even, some argue, for endurance running, which would have given them an edge in hunting. Throughout their long history we might expect to find *Homo erectus* as a restless species with small populations budding off on a regular basis and moving in either direction between Africa and Europe.

While *Homo erectus* survived in Asia until as recently as 50,000 years ago, there were changes afoot as early as 600,000 years ago in Africa. One of the African *Home ergaster* populations began to develop larger brains and evolved, perhaps via a series of short-lived intermediate species, into *Homo heidelbergensis* (named after the town of Heidelberg in Germany where the first specimen was unearthed in 1907). The

toolkit of *Homo heidelbergensis* was an advance over the handaxes of *Homo erectus*, and included some of the first composite tools, where stone was bound to wooden hafts to create spears.

Homo heidelbergensis underwent further evolutionary development, gradually giving rise to the Neanderthals (*Homo neanderthalensis*) in Europe and anatomically modern humans (*Homo sapiens*) in Africa. It was not until around 60,000 years ago that anatomically modern humans left Africa and skirted the southern coasts of Asia as far as Australia. Though they had surely crossed paths with Neanderthals in the Levant, it was only around 40,000 years ago, when they peeled back into Europe from the steppes of southern Russia, that they really came into contact with these northern hominins.

The Neanderthals had survived in Europe for several hundred thousand years by then, and had evolved effective anatomical adaptations to the harsh, sometimes freezing, conditions there. They had developed a lifestyle based around close-quarters hunting of large game, everything from deer and horses to rhino and mammoths – species that while plentiful and meat-rich are nonetheless dangerous to hunt face-to-face with thrusting spears. However, a significant change in the development of tools had to await the long cultural gestation of anatomically modern humans, who appeared around 200,000 years ago. It was not until 100,000 years later that we see in Africa the first evidence for sophisticated tools and artwork such as necklaces. We have to wait a further 60,000 years until Europe, with its profusion of figurines, bone flutes, beads and cave art – the Upper Palaeolithic Revolution – catches up in the game of symbols.

The last Neanderthals died out in southern Spain perhaps less than 40,000 years ago, as the height of the last Ice Age advanced. In the end, they proved to be less successful at coping with the rigours of these northern climates than anatomically modern humans, perhaps because they were lacking in cultural versatility. By then, modern humans had colonized Australia and they stood on the brink of crossing the Bering Strait to colonize the Americas. The great 'land-grab' by modern humans was almost over. Only the remote oceans remained for this single species to settle and thus complete its global journey – although that only happened in the last 5000 years.

Working together

What palaeoanthropologists and archaeologists have achieved over the last 50 years has been to make their Pandora's box of discoveries much bigger. If we set out to be archaeological purists, we could tell an entire story from this archaeology – we could insist that only archaeology can describe and interpret the human past from its material remains. Then we could get by, perhaps, just doing a double act with the human fossils that adorn the record. But in the end this will not do. Although the archaeology is the core of the cultural record, it has always depended on a host of scholars in other fields for illumination. Geologists, environmental scientists and dating specialists all play crucial parts in building the record. Then latterly primatologists, geneticists, neuroscientists – and of course evolutionary psychologists – have all now made their contributions.

Does this interaction mean that an integrated evolutionary story has emerged? Not yet, would be our answer. First, as our colleague the palaeoanthropologist Rob Foley has often noted, there has been too little effort to bring evolutionary theory into explanations of human evolution. Archaeologists have always treated human evolution as something unique, rather than as a 'normal' product of conventional evolutionary forces – just one of many hundreds of thousands of unique species. If we try to define humans as separate, we are forgetting the evolutionary gradient of the past – and the fact that nearly always our close relatives show some of the same features. Our aim should be to show how and why we diverged from the other apes and came to be as we are, not to make ourselves totally and artificially separate.

Two generations ago thinkers such as Julian Huxley came to appreciate the great importance of what he called psychosocial evolution. Mind was the preoccupation of several of the great evolutionary biologists of his day, including Bernhard Rensch and Theodosius Dobzhansky. What was missing, when we look back, was that these scientists focused nearly always on the anatomical and behavioural adaptations that characterized species – they scarcely considered the internal dynamics, how interactions between individuals shape a society, and influence the course of its evolution. A new cycle of interactions with psychology has been necessary to highlight these forces.

For all the developments that we have explored, there has remained a gap, first clearly outlined by the French thinker Pierre Teilhard de Chardin. The psychosocial domain of Huxley was for him the noosphere, or sphere of human thought; he talked of the 'irresistible tide that for the last hundred years has been bringing natural history and human history closer together'. Even so, historians have treated social evolution as outside and separate from biology. As Teilhard de Chardin put it, 'The domain of zoology and the domain of culture: they are still two compartments, mysteriously alike, maybe, in their laws and arrangement, but nevertheless two different worlds.' Yet the one necessarily shades imperceptibly into the other.

In recent years, primatologists such as Andy Whiten and Bill McGrew, and psychologists like Michael Tomasello, have attempted to come to grips with these issues of culture. Compared with the activities of chimpanzees, of course, the permutations of human culture remain undeniably complex. As a result, socio-cultural anthropologists have often regarded the biologists' efforts as absurdly 'reductionist'. However, in doing so, they have misconstrued what the biologists are trying to do. Seen in proper perspective, biologists are exploring foundations, the underpinnings of social behaviour, not explaining why we go to the theatre, hold weddings or go to art exhibitions.

Summary

In the following pages, we try to grapple with all these conundrums. The Lucy project brought to the table two rather different ways of tackling human evolution: the psychologists introduced the perspective of an experimental science to which the archaeologists added the methods of a historical science. Bringing together the quite different spheres of archaeology and evolutionary psychology, we aim to stake out some of the main positions. We attempt through the social brain to find a better approach than the purely archaeological–material, or one based on just projecting ideas from the present. In particular, how could archaeologists benefit from perspectives provided by the social brain? Perhaps they need an impetus to escape from their intellectual paradigm – it seemed so obvious that creatures who evolved to be clever would end up on top, that the drive to be clever does not need explaining. When, in 1921, the archaeologist Osbert Crawford said, 'It may seem a far cry from the first generalized stone implement to the latest highly specialized aeroplane; but once the first step is taken, the rest is comparatively easy', we have to ask 'Yes, but why?' Why go through such an astounding series of changes? Those of us alive today are, of course, the end point for the great sweep of human evolution. From the traits we have evolved flow the capacity for everything that makes us who we are – the capacity to live in large political organizations, to engage in warfare, culture, storytelling, religion and science. At the other end of this trajectory lie the apes, about whom we also know a great deal.

Nonetheless, our task will not be to try to explain this diversity or why some species failed and others lived. This is not a story of a steady progression up the grand staircase of evolution. Our family history has been one of myriad branches that have explored any number of alternative pathways to survival. Some, like the Neanderthals and many of the australopithecines, were very successful in their time, but eventually succumbed to the vagaries of climate change and ecological competition. Rather, our task will be to explain the convoluted story of our particular species, the twists and turns that led from a perfectly ordinary ape in the forests of Africa to the species that has eventually, for better or for worse, come to dominate the planet on which we live.

The conventional way of telling this story is in terms of the succession of fossils and tools, of the anatomical and sometimes ecological differences between ancestor and descendent species. We will attempt a different approach: what does it mean to be human, and how did we come to be that way? The focus is on psychology as much as anything, and on the interplay between the cognitive and social aspects of our behaviour and the tools and artifacts that our ancestors used, and then left behind.