NOT A CHIMP

The hunt to find the genes that make us human

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CHAPTER 1

From Distant Cousins to Close Family

An American tourist becomes lost in the wilds of Western Ireland. Spotting a farmer working in a nearby field, he edges his car toward the kerb, gets out, and walks over to him. 'Excuse me, sir', he says, 'Could you possibly tell me how to get to Kilkenny?' The farmer ruminatively scratches his stubbly chin, before answering: 'Well now, if I were going to Kilkenny, I wouldn't start from here!'

One of mankind's greatest intellectual journeys has been the quest for our evolutionary human origins. Increasingly, we search in our genes and the genes of other species for vital clues to where we come from and what makes us human. And, like the hapless traveller in the Irish landscape, we have not chosen the ideal place from which to start, for we have chosen the chimpanzee. We have had no choice in the matter because the modern coordinates on the map of our evolutionary history are marked in DNA and the chimpanzee is our nearest living DNA relative. It would have been preferable to set off gradually down the road into our evolutionary past, following our DNA way-points one step at a time, checking our bearings. But this is not possible. After the Neanderthals, a mere 35,000 years ago,

the DNA simply peters out. Like the sign-posts in the maze of Irish country roads that so befuddled our tourist, the DNA has rotted away.

How helpful it would have been if there had still existed a knot of *Homo erectus* in a remote enclave in the Caucasus, or a carefully nurtured tribe of *Homo heidelbergensis* in an ecological preserve in southern Spain, or if the 'Frodos' of *Homo floresiensis* were still valiantly slaying Komodo dragons in Indonesia. But they have all gone, and their DNA and behaviour has gone with them. All we have is a jigsaw of hominin fossils, which, after well over a century of field work, is still so surprisingly small and fragmented that one wag, rather stretching his point, once exclaimed that the whole lot could be contained within a decent-sized wheelbarrow. The jigsaw comes without the big picture and with most of the pieces missing.

Over the past fifteen years we have seen an explosive growth in the power of technologies that allow us to sequence vast tracts of DNA in our genome, culminating in the first rough draft of the human genome in 2000, and a more detailed, polished version, in 2003. Since 2005 we have also had a good quality read of the chimpanzee's 'Book of Life'. This has allowed us to leapfrog back in time, over the heads of our more immediate hominid ancestors, to compare human genes with chimpanzee genes. It means that we have begun in earnest the task of defining what makes us human by virtue of the genetic differences between us and a species from whom we became separated approximately 6 million years ago. And, since chimpanzees have also been evolving, this means that 12 million years of evolutionary time separate us—6 million for each branch of the tree since the split from the common ancestor.

Although this massive and audacious scientific exercise makes sense to the myriad genome scientists it employs, it has also given rise to a number of fallacies, including the assumption that we are descended from the chimpanzee when we are not, and the idea that

our humanness may be traceable to a handful of mutated genes among those relatively few that appear to differ between us and apes. It has also led to a very blinkered view of human evolution due to exclusive comparison between humans and chimpanzees. We also find ourselves in the unfortunate position of adopting chimpanzees as the most important reference point for charting our evolution when they are in grave danger of falling off the map altogether—of becoming extinct.

This obsession with ape–human comparisons began when pre-Victorian explorers first brought back to Europe their disconcerting accounts and examples of the bewildering variety of monkeys, apes, and sub-Saharan Africans retrieved from 'The Dark Continent'—West Africa. In the days well before palaeontology had begun making major contributions to studies of human origins, this rich broth of hominoidae, with feral children and the mentally sub-normal thrown in for good measure, was *the* food for thought about the relationship between man and the animals. How best to order Nature, and chart the origin of faculties like language and the propensity for civilization and culture that were thought to define human beings? Here, in the seventeenth century, are the roots of anthropology and primatology, and the acknowledgment that asking questions of the great apes would lead to an understanding of the nature of 'humanness'.

According to Thomas Huxley, the first coherent descriptions of the great apes began coming out of Africa during the 17th century. Particularly colourful are the accounts of Andrew Battell, published around 1625, of a monstrous creature encountered during his extensive exploration of Angola:

> The Pongo is in all proportion like a man; but that he is more like a giant in stature; he is very tall, hath a man's face, hollow-eyed, with long haire upon his browes. His face and eares are without haire; and his hands also. His body is full of haire, but not very thicke; and it is of a dunnish colour.

Battell's beast, clearly a chimpanzee, couldn't speak, slept in trees, built shelters from the rain, ate fruits, and had a nasty habit of attacking and killing Africans as they worked in the forest.

Were these apes primitive humans, or another animal group? Were they capable of language? Soon, live specimens were making their way back to the UK. In 1661, a large primate from Guinea certainly had Samuel Pepys fooled:

> I do believe it already understands much English: and I am of the mind that it might be taught to speak or make signs.

In 1698 a young chimpanzee that had died from infection soon after its voyage from Africa was dissected by the anatomist Edward Tyson. Tyson, a man very much before his time, and a scientific pioneer of comparative ape–human studies, published an exhaustive account of the similarities and differences between the anatomies of ape and human, noting 47 anatomical similarities. He was particularly surprised by the apparent similarity between the chimpanzee and human brain.

In the 18th century, natural philosophers resurrected the Aristotelian idea of a *scala naturae*—a linear Great Chain of Being running from the lowest forms to man—from religious dogma and applied it across the mineral, plant, and animal kingdoms up to monkeys, apes, feral children, black Africans, and modern Europeans. Man was the God of this Chain of Being, lower only than the Deity Himself. This *scala* was the forerunner of a theory of evolution. Foremost among these thinkers was the extraordinary Scottish peer Lord Monboddo who declared that man had progressed from an animal, through an orang-utan (he could have meant any ape—the terms were interchangeable in those days), and he was convinced that the only reason orang-utans had not acquired language was because they had not yet advanced enough culturally.

Carolus Linnaeus, the great Swedish taxonomist, produced the first grand classification of all plants and animals known on Earth.

He had enormous trouble incorporating this flood of humans, apes, and in-betweens from the New World and even made room for mythical animals in his classification. He rejected a simple, linear Chain of Being by broadening its vertical axis to create Groups which split into Genera and Species: for instance, the Primates, in which group he placed humans, monkeys and apes, lemurs, and bats. He first grouped chimpanzees and orang-utans into the species *Homo troglodytes*, and dubbed us *Homo sapiens*. However his schema was still, in essence, a grand *scala naturae*. All species were fixed, immutable, graded vertically according to their external characteristics, knew their place, and were made by God.

Darwin should have obliterated the idea of the Great Chain of Being, the *scala naturae*, with his publication of *The Origin Of Species* in 1859, which fatally challenged ideas of the fixity of Nature—and he was quite clear that humans had evolved with chimps from a common ancestor. Both Darwin and Thomas Huxley sought to minimize the cognitive distance between man and the apes, the better to resist clerical criticism from churchmen like 'Soapy Sam' Wilberforce. Language was the stumbling block for Darwin, because neither he nor Huxley could offer a persuasive account of how language could have evolved in the tiny, gradualistic steps he claimed typified evolution by natural selection. This opened the door for his main critic, Max Muller, of the University of Oxford, who threw down a gauntlet that we are still facing today, when he exclaimed:

> The one great barrier between the brute and man is language. No process of natural selection will ever distill significant words out of the notes of birds or the cries of beasts.

Today we are still asking the same two linked questions that so obsessed those earlier natural philosophers: How did we evolve from the apes? How did we become human? Since the days of these pre-Victorian pioneers we have added over a century of palaeontological research, decades' worth of field primatology, and powerful modern

laboratory techniques of comparative genetics, neuroscience, and cognitive psychological testing. In Victorian times free-thinking natural philosophy crossed swords with religion. Ironically, religion, in the form of creationism and intelligent design, still mounts a challenge to orthodox evolution for those credulous enough to find its arguments convincing. But today we have to add another factor that has muddied the water and muddled the thinking on our evolutionary relationship to the apes. It is the very imminent threat to the existence of chimpanzees in the wild. This has led to the drastic need to safeguard ape species and conserve their habitat, and conservationists have searched for the most potent argument to galvanize us into action. All this has led some scientists, intentionally and unintentionally, to exaggerate the narrowness of the gap between chimpanzees and ourselves because it is argued that if the genetics and neurobiology of chimps is virtually indistinguishable from our own then so must be their behaviour. And if they are one of us, then we are morally bound to their welfare. This is one version of the so-called argument from analogy. It is a view, I will argue, that is as wrong as it is misguided. It plays into the hands of our natural propensity to anthropomorphize our pets and other animals, and even our inanimate possessions, and it has allowed us to distort what the science is trying to tell us. I want to set the record straight and restore chimpanzees to arm's length. I also want to show how science over the past few years really is beginning to point the way to how we became human and how much, and in what way, we are different to chimpanzees. I will do it using three weapons from the sciences that compare chimpanzees to humans: genomics, neuroscience, and cognitive psychology. First, however, let us examine our relationship to the chimpanzee a little further.

At the beginning of March 2005, St. James and LaDonna Davis travelled to the Animal Haven Ranch in Caliente, California to celebrate the 39th birthday of Moe, a male chimpanzee they had previously owned and raised at home. They had arrived with lots of

new toys for Moe and a 'beautiful sheet cake with raspberry filling'. LaDonna first spotted, out of the corner of her eye, that one of the neighbouring chimps was free, just as she was about to cut the cake. CNN reported what happened next:

> The couple had brought Moe a cake and were standing outside his cage when Buddy and Ollie, two of four chimpanzees in the adjoining cage, attacked St. James Davis. He sustained severe facial injuries and his testicles and a foot were also severed. Buddy, a 16 year old male chimp, initiated the attack and after he was shot, Ollie, a 13 year old male, grabbed the gravely injured man and dragged him down the road.

A local TV station, NBC4, reported LaDonna Davis saying that the attack swiftly overwhelmed her husband:

> When we made eye contact, the charge was on. There was no stopping anything, and the big chimp came around from behind me and pushed me into my husband. The male came around from behind and chomped off my thumb . . . my husband must have realized we were in deep trouble because he pushed me backward. At that time, they both went for him. One was at his head, one was at his foot. But all the time *he was trying to reason with them*. They virtually were—I don't know how you say it—eating him alive.

They further reported that, in addition to his testicles and one foot, St. James Davis lost all the fingers from both hands, an eye, part of his nose, cheek, lips, and part of his buttocks in the ferocious attack. He was removed to the Loma Linda Medical Center where he was placed into an induced coma while he fought for his life.

A couple of months later, thanks to the *Washington Post*, details of the Davises' relationship with Moe emerged. St. James had retrieved the baby chimp from Tanzania in 1967, before the two got married. He was a former Nascar driver and would carry the infant around his auto body-shop in West Covina, in a sling. Moe was their illegitimate child and best man at their wedding. He slept in the Davises' bed until

he got too big. He learned to use the toilet. He used to love watching Westerns on TV. Cancer had left LaDonna infertile. Moe was the son they could never have.

Unfortunately, a shadow was eventually cast over the Davises' domestic bliss. Moe escaped from his enclosure and rampaged through the neighbourhood, biting a police officer's hand while under restraint. He later bit a woman's finger off when, against their warning, she had poked it, with her red-painted fingernails, through the bars of Moe's cage. The Davises claimed he had mistaken it for liquorice. City officials stepped in and demanded Moe's instant removal to the animal sanctuary. They were devastated.

By May 7th *Racing West* was able to publish a follow-up about the Nascar veteran, who, by then, had been brought out of coma:

> He made an effort to speak but it was nearly impossible because his lips were missing. Doctors gave him an electronic voice box, to hold against his throat, and his first ever words were 'How is Moe doing?'

This story left a lasting impression on me because nothing I have ever heard so graphically demonstrates the ambivalent world of chimpanzee–human relationships: huge emotional attachment of human to chimp; bizarre levels of anthropomorphizing; an animal species capable of thrilling us with its human-like behaviour on the one hand and horrifying us with its brutal aggression on the other. And a man appealing, verbally, to a chimpanzee's better nature while it was in the act of emasculating him.

Why is it that so many of us find it so important to identify ourselves with the chimpanzee—even when nature bites back? Why is it that we are encouraged to identify with them in order to support their ecological salvation? Why is it that human uniqueness has become such a shameful idea? Is it that we, as laymen, simply cannot prevent our innate ability to anthropomorphize chimps from cloaking them in our cognitive clothes? Is it that we, as biologists, are so petrified of

creationists that we not only stress the biological continuum between us and chimpanzees, but seem to find it obligatory to collapse that distance into close proximity? Does it involve an exaggeration of the sagacity and wisdom of chimps, a loss of confidence in where the power of human intellect has got us, or both?

Before genome science allowed us to open up a second front in our quest for human origins, we relied upon palaeontology. Back in the 1950s, the world-famous palaeontologist Louis Leakey acknowledged two key problems with this approach, which are that neither DNA nor behaviour fossilizes, forcing us to deduce the behaviour of our ancestors indirectly from what clues we can garner from their fossilized skeletal remains. This is why he decided that man's origins needed collateral investigation through the field study of the three major great apes. He hoped it would provide crucial insights into how our evolutionary ancestors behaved. Certainly, much of what we now know about the behaviour of great apes in the wild was spawned by the field work of Jane Goodall on chimpanzees, Dian Fossey on gorillas, and Birute Galdikas on orang-utans, Leakey's 'angels'.

I would not dispute for a moment the value of much of this field research. It has told us a great deal we did not know about primate behaviour and social organization. What is more in question is how much it has told us about the evolution of human behaviour. It is quite clear what Jane Goodall's Institute thinks:

> Various mental traits once regarded as unique to humans have been convincingly demonstrated in chimpanzees; reasoned thought, abstraction, generalization, symbolic representation, and concept of self. Non-verbal communications include hugs, kisses, pats on the back, and tickling. Many of their emotions, such as joy and sadness, fear and despair, are similar to or the same as our own. Once we admit that we are not the only beings with personality, reasoned thought, and above all, the ability to feel and express emotions such as joy, despair and empathy,

> then we develop a new respect for chimpanzees. *The line between human and other non-human beings, once thought so sharp, becomes blurred.* (emphasis added)

That line has sometimes seemed close to disappearing altogether. We have Jane Goodall to thank for the first recorded instance of chimpanzee tool use. Her observations, in 1960, that one of her favourite male chimpanzees at Gombe, David Greybeard, was using grass stems to fish for termites in a mound, licking off the insects that clung to the probe, led to Louis Leakey's famous overreaction: 'Now we must re-define Tool, re-define Man, or accept chimpanzees as humans.' Goodall further observed her chimpanzees breaking off twigs from trees and stripping them of their leaves to fashion a more suitable fishing tool. Since then, chimpanzees across Africa have been observed using twigs to dip for honey and probe for bees, termites, and algae; have been seen to use leaves to sponge up liquid; crack nuts against hard surfaces, or by using crude stone hammers and anvils; pound nuts as if using a crude mortar and pestle; and use simple hooks, picked out of vegetation, to forage for insects. They have recently been observed using sharp-tipped branches as crude spears, using sticks as clubs, and throwing rocks at retreating prey. There is little doubt as to where Goodall now stands on the relationship of humans to chimps. Her famous movie is titled *Chimps: So Like Us*. For Goodall, it seems, chimps are 'virtually human beings'.

Scientific talk about chimp–human proximity boils over readily into popular human culture. James Mollison's beautiful portraits of chimpanzees and the other great apes invite us to 'Look Into My Eyes' to see ourselves reflected back. In 2006, the BBC's flagship science television series *Horizon* aired a programme, fronted by the comedian Danny Wallace, called 'Chimps Are People Too'. 'Danny is on a mission', ran the blurb, 'to convince the world that chimps are people too. He believes the time has come to make our hairy relatives part of

the family.' In early 2008, the UK's Channel 5 showed a documentary film on Tetsuro Matzuzawa's chimpanzee research in Japan, which had already drawn a blizzard of 'Chimp beats college students at math' newspaper headlines. The film documented Matzuzawa's star chimpanzee, Ayuma, beating humans at a computer game where all the numerals 1 to 9 are flashed up in boxes in random pattern on the screen, for a minute length of time, before being replaced by the empty boxes. The subject has to touch the screen to re-conjure the numerals in order. Chimps are very good at this—better than humans—and typically remember up to 80% of the numerals even when the original pattern is displayed for less than half a second. 'The human race may be about to lose their reputation as the cleverest species on the planet!' sang the commentary. At last, the sheer arrogance of humans, in their assumption of superiority to other apes, had been exposed! Such was the implication. Yet this was a test of eidetic—or photographic—memory, not mathematical skills. Tiny children have this skill before it becomes engulfed by language and a genuine symbolic understanding of numerals. Idiot savants have excellent eidetic skills alongside profound cognitive deficits. In what real sense, then, has the chimpanzee leapfrogged us?

Evidence from the wild on chimpanzee tool use and the way they play tricks on each other—appearing to intentionally deceive each other—has been presented as clear evidence that the barrier of human uniqueness has been fatally breached. Yet, as we shall see, cognitive scientists today are hopelessly divided over how much a chimpanzee knows about the nature of physical forces in the world when it shapes its crude tools and how much it knows about the mental life of other individuals when it interacts with them.

Just as field primatology has been interpreted so as to close the gap between humans and chimpanzees, so too has evidence from protein chemistry and genome science. Prior to 1960, anthropology had relied on traditional methods of classification to design taxonomic trees representing the relationships between the various

genera, families, and orders of the primates. This traditional method uses the concept of grades of evolutionary advancement based on a distinction between primitive and more advanced features to group primates together. Brain size would be one such feature. Thus, all the great apes were classified together in the *Pongidae*, and humans were seen as a special and more advanced case. To Morris Goodman, then at the Detroit Institute of Cancer Research, this seemed suspicious and he set about re-drawing the primate family tree.

Conventional wisdom at the time had gibbons first splitting off from a branch to the common ancestor of all the other great apes and humans. The next oldest split separated the human line from chimps, orang-utans, and gorillas, while subsequent events first split off the orang-utan, and then separated the chimpanzee and the gorilla. Goodman queried this taxonomic remoteness of humans to the rest of the apes, and the close relationship drawn between gorillas and chimpanzees. These were primitive days for molecular biologists. It was less than a decade since the structure of DNA had been discovered by Crick and Watson, there was no technology for sequencing DNA, nor sequencing amino-acids in the proteins that DNA codes for. He discovered that human serum proteins reacted far more strongly with those of gorilla and chimpanzee than with orang-utan and gibbon—suggesting that they were much more closely related. He presented his results at a symposium called 'The Relatives of Man' in 1962, arguing that his fledgling science of molecular taxonomy would logically place chimps and gorillas alongside Man in the *Hominidae*. The idea was brusquely thrown out by the great evolutionary biologists George Gaylord Simpson and Ernst Mayr. To Goodman, these traditional biologists were perpetuating an anthropocentric view of nature, hearkening back to the dark old days of the pre-Darwinian idea of a *scala naturae* with Man at the top of the ladder. He rushed back to Detroit to develop his new science. Early computer programmes now existed for comparing amino-acid and limited amounts of DNA nucleotide sequence data and he developed

these into a way of grouping animal species by how close they were in terms of protein sequence. By the early 1980s he had compared the sequences of six types of globin protein, and four further proteins; two fibrinopeptides, cytochrome C, and an enzyme, carbonic anhydrase. *Homo* and *Pan* (the chimpanzee) showed 99.6% identity in amino-acid sequence versus 99.3% identity between *Gorilla* and either *Homo* or *Pan*. Further, the genetic distance between chimpanzees and humans was less than that between chimpanzees and gorillas. The conclusion was that chimps and humans belonged together in the same genus. By then, several research groups had calculated, based on the rate of DNA nucleotide substitution over time, a molecular clock of evolution which put the divergence of chimpanzees from the human line at 5.9 million years, whereas previous estimates, based on fossil evidence, had put it at 20 million. Our distant cousins were rapidly becoming part of our nuclear family.

In his 1989 book *The Rise And Fall Of The Third Chimpanzee* Jared Diamond picked up this molecular data and ran with it. He invited us to consider an arresting thought experiment. Create a new enclosure in your local zoo, he suggested, and fill it with a number of human beings who have been stripped naked and reduced to visceral grunts. A visitor from outer space, armed with reasonable powers of observation, 'would have no hesitation in seeing us for what we are—chimps with little hair that walk upright—and would immediately classify us as a third species of chimpanzee, along with the pygmy chimp of Zaire and the common chimp of the rest of tropical Africa'. The chimp had the genetic right to be called *Homo troglodytes*, or, in another way of establishing a level genetic playing-field, we should be renamed *Pan sapiens sapiens*.

Goodman went on, in the late 1990s, to argue that, since humans appeared to share more than 98.3% of their non-coding DNA with chimps, and likely would be found to share up to 99.5% within genes actively coding for protein, we should see humans as little more than slightly remodelled apes. All apes should join humans

in the family *Hominidae*, and chimps and the closely related pygmy chimp, or bonobo, should join humans in the genus *Homo*. In 2000, he joined forces with a number of prominent American scientists with interests in molecular evolution to lobby for a Human Genome Evolution Project that would allow scientists to directly compare the entire human genome (then only months away from publication) to that of chimpanzees, bonobos, and more distantly related higher primates. In their proposal they noted that the behavioural distance between humans and chimps was much smaller than originally thought and the genetic distance minuscule. They also noted that the New Zealand parliament was considering legislation, based on scientific advice and those interested in animal rights, that all hominids be given three basic legal rights: the right not to be deprived of life, the right not to be subjected to torture or cruelty, and the right not to be subjected to medical or scientific experimentation. Since, thanks to Goodman, there was a good argument for including chimpanzees in the genus *Homo*, that could mean extending human rights to chimps.

Between 2001 and 2005, four important scientific studies confirmed Goodman's earlier work on human–chimp DNA sequence similarity. In 2001, Feng-Chi Chen and Wen-Hsiung Li, from National Taiwan University and the University of Chicago, compared 53 regions of DNA that did not contain any known genes, between all the great apes. Earlier work, like Goodman's, they reminded us, had relied on cruder techniques and very localized areas of DNA and had put the difference between the chimpanzee and human genomes at about 1.6%. To increase confidence, many areas ought to be sampled, and genes, which might have been subject to natural selection that might locally skew the difference, should be avoided. They found that sequence divergence between chimp and human was only 1.24%. In 2002, Ingo Ebersberger and colleagues at the Max Planck Institute for Evolutionary Anthropology in Leipzig, compared 8,859 DNA sequences from all over the genome, totalling around 2 million pairs

of DNA nucleotides, between chimpanzee and human. They also put the average sequence divergence at 1.24%. In 2004, Derek Wildman, Morris Goodman, and colleagues from Wayne State University took 90,000 DNA base-pairs of coding sequence (part of the small proportion of the genome that actually contains functional DNA in the form of genes for making proteins), which represented parts of 97 human genes, and compared them to their chimpanzee equivalents. They were 99.4% similar. Again, they stressed the behavioural similarity between the two species, which appeared logical when you considered their genetic proximity. Finally, in 2005, the Chimpanzee Sequencing and Analysis Consortium, a massive collaboration of 67 top genome scientists representing 24 laboratories world-wide, published their comparison of the initial complete sequence of the chimpanzee genome with its human counterpart. This meant comparing over 20,000 shared genes and 3 billion base-pairs of DNA. Over 96% of each genome was directly comparable and within those regions, on average, the two genomes were 98.8% similar. Nevertheless, they noted, even such high sequence similarity accommodated 35 million instances where a single DNA nucleotide had been substituted between the two species, 5 million sites where larger substitutions were present, and some loss or gain of genes by duplication or deletion, which brought the overall total sequence similarity down to 96%.

Naturally, *Science* magazine made the discovery their 'breakthrough of the year'. Elizabeth Culotta and Elizabeth Pennisi noted that now, armed with both sequenced genomes, scientists could examine, one by one, the 40 million evolutionary events that separated humans from chimps. 'Somewhere in this catalog of difference lies the genetic blueprint for the traits that make us human: sparse body hair, upright gait, the big and creative brain.' One of the senior Consortium scientists, Svante Paabo, said: 'I'm still sort of taken aback by how similar humans and chimps are in their DNA. I'm still amazed, when I see how special humans are and how we have

taken over the planet, that we don't find stronger evidence for a huge difference in our genomes.' The Consortium saluted Darwin:

> More than a century ago Darwin and Huxley posited that humans share recent common ancestors with the African great apes. Modern molecular studies have spectacularly confirmed this prediction and have refined the relationships, showing that the common chimpanzee and pygmy chimpanzee are our closest living evolutionary relatives. Chimpanzees are thus especially suited to teach us about ourselves, both in terms of their similarities and differences with humans.

They concluded by ruing the fact that the very existence of chimpanzees was threatened just at the time they were helping us establish the genes that made us human. Their genetic proximity to us should be a clarion call for action to preserve them:

> More effective policies are urgently needed to protect them in the wild. We hope that elaborating how few differences separate our species will broaden recognition of our duty to these extraordinary primates that stand as our siblings in the family of life.

Accompanying the publication of the paper with Derek Wildman, Goodman was quoted in *National Geographic* as saying:

> The loss of the wild chimp and gorilla seems imminent. Moving chimps into the human genus might help us to realize our very great likeness, and therefore treasure more and treat humanely our closest relative.

From the work of the early pioneer of chimp–human proximity, Morris Goodman, up to the conclusions of the Genome Consortium in 2005, increasing evidence for the genetic similarity of humans to chimpanzees has been allowed to suggest that it is logically mirrored in terms of behavioural similarity, and these scientific conclusions have been conflated with preservation issues by arguing, in effect, that chimpanzees, and the other great apes, are a special case

because they are virtually human beings. For some years this has been enshrined in the philosophy of the Great Ape Project, started in 1993 by the philosophers Peter Singer and Paula Cavalieri. The logo on their website, showing the tips of a chimpanzee finger and a human finger nearly meeting through the bars of a cage, is a crude pastiche of Michelangelo's 'Creation of Adam', from the ceiling of the Sistine Chapel, which portrays God imparting the spark of life to humanity. Is this simply used as a symbol of brotherhood, or, in a reversal of the geometry of the original painting, is the chimpanzee imparting the spark of humanity to the human? This is their declaration:

> We demand the extension of the community of equals to include all great apes: human beings, chimpanzees, bonobos, gorillas and orang-utans.
>
> The community of equals is the moral community within which we accept certain basic moral principles or rights as governing our relations with each other and enforceable at law. Among these principles or rights are the following: The right to life, the protection of individual liberty, and the prohibition of torture.
>
> The idea is founded upon undeniable scientific proof that non-human great apes share more than genetically similar DNA with their human counterparts. They enjoy a rich emotional and cultural existence in which they experience emotions such as fear, anxiety and happiness. They share the intellectual capacity to create and use tools, learn and teach other languages. They remember their past and plan for their future. It is in recognition of these and other morally significant qualities that the Great Ape Project was founded.

This philosophy has been put into practice with a vengeance in 2007 in both Spain and Austria. In Austria it has been used to attempt to get the courts to grant a chimpanzee, Hiasl, human rights. The *Guardian* newspaper published its story on Hiasl, the 'Austrian' chimp, on April Fool's Day. Unfortunately it was no joke. Science had given way to something approaching legal lunacy.

Hiasl had arrived in Austria in 1982, smuggled in from Sierra Leone as fodder for biomedical research. Customs officers intervened and he ended up being raised in a human family until he was 10 years old, before being housed in an animal sanctuary. It was the closure of the sanctuary that precipitated the legal clamour for rights for Hiasl, now 26 years old, because sale of Hiasl to a zoo or pharmaceutical company (unlike the UK, chimps can be used for medical research in Austria) would have helped pay off the sanctuary's debts. An Austrian businessman donated 5,000 euros—roughly equivalent to a month's food supply and veterinary bills—jointly to Hiasl and Martin Balluch, president of the welfare group Association Against Animal Factories, with the odd proviso that both man and chimp had to agree on how the money would be spent. Unfortunately, under Austrian law, only a human can receive a personal donation. It would seem sensible to have created a little foundation to administer this cash, and any other donations to Hiasl's welfare the seed money prompts in the future, but, instead, it has prompted Balluch to seek a legal guardian for Hiasl, now re-christened Matthew Hiasl Pan, and, since only a human can be granted a legal guardian under Austrian law, Balluch's request, essentially, is that Hiasl be accorded human rights. The proposed legal guardian is a British woman, Paula Stibbe.

Much has been made in the popular press of Hiasl's 'humanoid' behaviour. He loves hide-and-seek games, likes being tickled, watches TV, paints pictures, and recognizes himself in a mirror. 'Our main argument is that Hiasl is a person and has basic legal rights,' said Eberhart Theuer, the lawyer representing the group. 'We mean the right to life, the right to not be tortured, the right to freedom under certain conditions,' Theuer said. 'We're not talking about the right to vote here.'

Two world-famous primatologists, Jane Goodall and Volker Sommer, backed Hiasl's case. Sommer's brief to the court said 'It is untenable to talk of dividing humans and humanoid apes because there are no clear-cut criteria—neither biological, nor mental, nor social'. Both

Goodall and Sommer trotted out the by now standard argument that chimps and humans are nearly 99% genetically similar.

Not all biologists found the 'scientific' argument in the Hiasl case convincing. The BBC reported Professor Steve Jones, of University College, London, retorting:

> As most people know, chimpanzees share about 98% of our DNA, but bananas share about 50%, and we are not 98% chimp or 50% banana, we are entirely human and unique in that respect. It is simply a mistake to use an entirely human construct, which is rights, and apply it to an animal, which is not human. Rights come with responsibility and I've never seen a chimp fined for stealing a plate of bananas!

Eventually, the judge in the case, Barbara Bartl, ruled that Hiasl was neither mentally handicapped nor in imminent danger (the two main criteria under Austrian law for appointing a legal guardian) and his legal representatives are now busy planning an appeal.

What is happening in Austria is part of a trend. In 1999, New Zealand had granted all species of great apes rights as 'non-human hominids'. The Great Ape Project today is behind a more wide-ranging attempt to enshrine human rights for apes into Spanish law. They were also responsible for the New Zealand law. The proposed Spanish law goes beyond granting apes the right to life, protection of individual liberty, and prohibition of torture, to include banning private ownership of apes or their use in entertainment. It would also, if passed in its present form, oblige the Spanish government to convene an international forum on the issue of granting rights to apes world-wide. In mid-2008 this recommendation was passed by the Spanish parliament.

The Green MPs supporting the motion in the Spanish parliament use stock phrases such as 'so close to humans', and 'they show a degree of intelligence and awareness and, indeed, self-awareness', and 'their social and emotional needs are at the same level as handicapped

people, small children, elderly, mentally impaired people—and they all have rights'.

I personally find it quite distasteful to see chimpanzees described as equivalent to tiny children or the mentally impaired simply because, while both latter categories have human rights, they need to be cared for due to either their immaturity or mental frailty. It suggests that chimpanzees are mentally sub-normal human beings, which I find insulting to both species. Claims for genetic and cognitive proximity of chimpanzees to humans are used time and time again to bolster this equivalence. Even if chimpanzees are 99% genetically similar to human beings, that does not make them humans, and it does not make them persons—the only category which, by law, can be granted human rights. Rights, as Steve Jones points out, have nothing at all to do with genetics; they are a human social construct.

Sometimes, amid all this scientific talk of genetic and cognitive similarity we can lose sight of the most important facts that separate the two species. It is humans that have speech and language, humans that have culture, art, music, science and technology, humans who remember the past, plan for the future, fear death, and pay taxes. Simplistic commentators who evoke the 98.5% genetic similarity between chimps and humans invite us to think this means humans are 98.5% chimps and chimps are 98.5% human. In the days before any type of protein or DNA comparison was possible, when we only had palaeontology and African fossils with which to chart human origins, chimpanzees were not part of the picture. Only one fossilized find claiming to be that of a chimpanzee has ever been made—and that quite recently. Humanity began after the split from the common ancestor with the Australopithecines and then the genus *Homo*. The need to compare living DNA with living DNA has forced us to extend our embrace to chimpanzees and we sometimes forget that we are not descended from them, but something that might have looked and behaved quite like them, or equally well might not.

Some commentators on human evolution doubt very much whether we will find the answer to human origins in genes. I disagree. I believe we *will* find much of what we are looking for in the comparison of genomes, and that genetic differences between us and chimpanzees, and the other great apes, *properly interpreted*, are already providing us with a number of tantalizing clues. The job would be easier if the three comparative sciences involved were better integrated, but, all too often, the links between genetics, cognition, and behaviour, and the functional structure of our brains and nervous systems, have not yet been properly made. The job would also be easier if scientists, conservationists, and philosophers refrained from conflating species comparisons between chimps and humans with the need to protect chimps and the other great apes because they are 'nearly men'. I want to take a hard look at recent science to see if it really supports the 'chimps are us' argument, and suggests that the differences between humans and chimps are 'merely' quantitative. Are we simply remodelled apes or unique primates after all? This is science in the making: we are trying to hit a moving target—and that target is moving rapidly. Today these inroads are increasingly being made using powerful genome technology to sequence and compare vast tracts of chimp and human genomes. This tends to overshadow research that has already stumbled over tantalizing clues to human cognitive evolution as a by-product of work in psychiatric genetics. These were among the first proposed 'genes that made us human' and it is with a few examples of this serendipity that I want to start my own exploration of chimp–human differences.