

PREFACE

In many ways, this book is born out of frustration for a professional career in popular science television where ideas about comparative primate cognition, and the similarities and differences between us and our primate relatives, have continually circled me but constantly evaded my grasp in terms of the opportunity to transform them into science documentary. On the plus side, keeping a watching brief for over a quarter of a century on subjects like comparative animal cognition and evolution allows you to watch a great deal of water flow under the bridge. Fashions come and fashions go—specifically, perspectives on the similarity—or otherwise—of human and ape minds.

I remember the first *Horizon* science documentary about the chimpanzee Washoe, the great ape communicator, using American Sign Language to breach the species barrier. And, later, Kanzi the bonobo, jabbing his lexicon. These were the apes, as Sue Savage-Rumbaugh put it, that were ‘on the brink of the human mind’.

I remember when the pre-print of *Machiavellian Intelligence*, by Andrew Whiten and Dick Byrne, plopped onto the doormat of the BBC *Antenna* science series office in 1988. Suddenly primatology had become a great deal more exciting. Could primates, and particularly higher primates like chimpanzees, really be as full of guile, as dastardly, as cunning, and as manipulative as the eponymous Florentine politician? Could they really reach deep into the minds of other

individuals to see what they believed and what they wanted, and turn that information into deception?

I remember discussing primate cognition with a young Danny Povinelli, as we sat finger-feeding ourselves shrimp gumbo and new potatoes out of plastic Tupperware containers in a Lafayette restaurant surrounded by an alligator-infested moat, before returning to his kingdom—the New Iberia Research Centre—where the University of Louisiana had lured him back to his native deep South by turning a chimpanzee breeding centre for medical laboratory fodder into a primate cognition laboratory with one of the largest groups of captive chimpanzees in the country. He looked like a kid who had just been thrown the keys to the tuck shop.

In those days Povinelli shared the *zeitgeist*—spread by Whiten's and Byrne's work, and started by Nick Humphrey and Alison Jolly before them—that, since the most exacting and potentially treacherous environment faced by chimpanzees and other primates was not physical, but the social environment of their peers, they had evolved a form of social cognition very much like our own, in order to deal with it. This was further elaborated into a full-blown 'social brain' hypothesis by Robin Dunbar, who related brain neocortex size to social group size throughout the primates and up to man. Povinelli's early work reflects this optimism for the mental life of apes, but both ape-language and ape-cognition research were subjected to a cold douche of searching criticism during the 1990s, and misgivings set in regarding the effectiveness of the experiments that had been constructed to gauge ape cognition. Now the worm has turned again, with a number of research groups emerging with bolder and bolder claims for the Machiavellian machinations of primate minds, only to be powerfully countered by the curmudgeonly scepticism, chiefly by Povinelli, that these researchers are merely projecting their mental life onto that of their subjects; that, rather in the frustrating manner of Zeno's arrow that could never quite reach its target because it continually halved its distance to it, no experiment constructed thus far

can actually get inside the mind of a chimp and show us exactly what it does and doesn't know, or how much, about the minds of others or the way the physical world works. One influential part of the world of comparative animal cognition talks of a continuum between ape and human minds and shrinks the cognitive distance between us and chimps to almost negligible proportions, while another returns us to the unfashionable idea that human cognition is unique, among the primates, after all.

When I began writing this book the working title was 'The 1.6% that makes us human'. My aim had always been to scrutinize the impression put about in the popular science media that humans and chimps differ by a mere 1.6% of our genetic code—or even less—and that it therefore makes complete sense that this minuscule genetic difference translates into equally small differences in cognition and behaviour between apes and man. However, contemporary genome science and technology, over the last few years, have dramatically advanced the power and resolution with which scientists can investigate genomes, eclipsing the earlier days of genome investigation that gave rise to the '1.6% mantra'.

As with comparative cognitive studies, conclusions on chimp–human similarity and difference in genome research depend crucially on perspective. To look at the complete set of human chromosomes, side by side with chimpanzee chromosomes, at the level of resolution of a powerful light microscope, for instance, is to be overwhelmed by the similarity between them. Overwhelmed with a sense of how close our kinship is with the other great apes. True, our chromosome 2 is a combination of two chimp chromosomes—giving humans a complement of 23 chromosome pairs to 24 in chimps, gorillas, and orang-utans—but even here, you can see exactly where the two chimp chromosomes have fused to produce one. The banding patterns you visualize by staining the chromosomes match up with astonishing similarity—and that banding similarity extends to many of the other chromosomes in the two genomes. However,

look at a recent map of the chromosomes of chimps and humans, aligned side by side, produced by researchers who have mapped all inversions—end-on-end flips of large chunks of DNA—and the chromosomes are all but blotted out by a blizzard of red lines denoting inverted sequence. Now you become overwhelmed by how much structural change has occurred between the two genomes in just 6 million years. True, not all inversions result in changes in the working of genes—but many do—and inversions might even have been responsible for the initial divergence of chimp ancestor from human ancestor.

The extent to which you estimate the difference between chimp and human genomes depends entirely on where you look and how deeply. Modern genomics technology has led us deep into the mine that is the genome and has uncovered an extraordinary range of genetic mechanisms, many of which have one thing in common. They operate to promote variability—they amplify differences between individuals in one species. We now know, for instance, that each human is less genetically identical to anyone else than we thought only three years ago. When we compare human genomes to chimpanzee genomes these mechanisms magnify genetic distance still further. I have tried, in this book, to follow in the footsteps of these genome scientists as they dig deeper and deeper into the ‘Aladdin’s Cave’ of the genome. At times the going gets difficult. Scientists, like any explorers, are prone to taking wrong turnings, getting trapped in thickets, and covering hard ground, before breaking through into new insights. I hope that those of you who recoil from genetics with all the visceral horror with which many regard the sport of pot-holing will steel yourselves and follow me as far as I have dared to go into Aladdin’s Cave. For only then will you see the riches within and begin to appreciate, as I have, just how limited popular accounts of human–chimpanzee genetic difference really are.

Let me try and persuade you that this is a journey, if a little arduous at times, that is well worth taking. There are a number of scientists

around the world who have the breadth and the vision to have begun the task of rolling genetics, comparative animal cognition, and neuroscience into a comprehensive new approach to the study of human nature and this is part, at least, of their story. They strive to describe the nature of humans in terms of the extent to which we are genuinely different to chimpanzees and the other great apes. Somehow, over 6 million years, we humans evolved from something that probably resembled a chimpanzee (though we cannot yet be entirely sure) and the answer to our evolution has to lie in a growing number of structural changes in our genome, versus that of the chimpanzee, that have led to the evolution of a large number of genes that have, effectively, re-designed our brains and led to our advanced and peculiar human cognition. If you don't believe me, hand this book to your nearest friendly chimpanzee and see what he makes of it!