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is fido a zombie?

A few years ago, I was lucky enough to find myself 11,000 feet up on the side of a volcano in Rwanda. This central African country is really one of the most charming, eccentric and surreal places on Earth. I don't think I have ever been anywhere, certainly not in Africa, that felt more serene, cheerful and at ease with itself. And yet, just a little more than a decade before my visit, this country was consumed by a carnal spasm of bloodlust rarely equalled anywhere in history.

Rwanda is not just a horror story. It also contains some of the oddest and most picturesque scenery on the planet – the 'land of a thousand hills'. Rwanda is also home (along with some of its neighbours) to one of the world's most magnificent animals: the fabulous, critically endangered mountain gorilla.

And it was the gorillas we were here for. I was writing a story for my newspaper about how these huge beasts had managed to cope with decades of civil war and strife in their homelands. There were tales of how poachers were killing and eating the last of these magnificent animals, whose numbers were down to the mid-hundreds. From what I have heard, it seems probable that the great mountain gorilla may well be on its way out.

Mountain gorillas, like their lowland gorilla cousins, chimpanzees, bonobos, the orang-utans of the East Indies and, of course, us, comprise the great apes. We hold our heads high as if atop the evolutionary tree, although we deserve no such accolade. All extant species are at the 'top' of whatever branch begat them. We are no more 'advanced' than the humblest *Escherichia coli* bacterium, although, like the gorillas and chimps, we are certainly the brightest of the beasts. What we also are is self-aware (which is not necessarily the same as brightness; more of which later). Are we alone in this?

To get to the mountain gorillas of Rwanda's Virunga mountains entails some serious hiking. This is not hot, sweaty Africa, but surprisingly cool-and-misty Africa. Climbing up to the gorillas' lair is something like walking through the New Forest

– angled at 45°. It takes ages and you keep slipping and sliding through the mud, but it is worth it.

We were extremely lucky, that cold June day. We stumbled upon the Susa group, an extended family of some 30-odd gorillas, the largest single tribe of the animals (comprising, rather frighteningly, some 5% of the world's total extant population). There were a couple of large male silverbacks, several mature females, and some dangerous babies playing with the bamboo and celery.

The babies are not dangerous in themselves, of course. But we were told that they were to be avoided at all costs. Like all primate youngsters, they are mischievous, basically friendly and really only want to play. And if they do there can be trouble. 'A Japanese tourist made a mistake a few months ago', one of our guides told us. 'The baby came up, and he picked it up and held it. The silverback, ha! He didn't like this at all. He picked up the tourist – after taking back the baby – and threw him up into a tree. Broke a leg. Very nasty.'

In fact, it is something of a mystery why these animals are quite so powerful. They have, quite literally, the strength of 10 men, and are capable of snapping branches as thick as a leg. This strength seems to confer no obvious advantage on these animals. They are not especially aggressive towards each other, and have no natural predators except for us. It is either a hangover from a more red-in-tooth-and-claw evolutionary past (their dentition certainly says 'carnivore' rather than 'salad muncher', and in fact there is some evidence that gorillas are not pure herbivores to this day), or it is the result of some rather complex form of sex selection, a bit like the preposterous feathers of some tropical birds.

It is also a mystery why they are so bright (neither the environment nor the frankly catatonic lifestyle of the mountain gorilla is particularly intellectually demanding). But bright they most certainly are. After hanging around for 15 minutes

or so with the group, they started to get bored with us. It was disconcerting to be this close to animals completely aware of and yet so utterly indifferent to human presence. Most species show either naked aggression or blind panic when *Homo sapiens* is around (quite sensibly, as it must have seeped into their brains that these nasty two-legged things will have their hide for a rug as soon as look at them). This mild curiosity plus studied aloofness is quite unusual. Anyway, a small group of the animals decided to wander off through the woods, and we decided to follow them.

The breakaway group consisted of, as I remember, two not-quite-mature females and a young male. They looked for all the world like a group of teenage friends going for a walk, and that is what, I suppose, they were. They padded almost silently through the bamboo, and led us to a small gorge, a tangled mass of spider webs and greenery under the canopy of the forest. In the gorge, a small but dramatic cleft in the mountain, was a stream, and in one place this widened out into a small pond, maybe three metres across. The three apes then sat down around the pool. One, a female I think, stared very intently at her reflection. I could swear she ran her digits through her hair, looking at her face in the water-mirror as she did so. Then one of the others, also staring at the reflections, jabbed a hand into the water, which of course broke up into ripples. At that point the three animals fell about, laughing at their now-wobbly reflections.

OK, these were animals. They were making sound, appropriate to their species, that consisted of a certain degree of whooping and whistling. A proper scientist, as opposed to a journalist or tourist, would no doubt describe their change in posture and body attitude using very different terms than 'falling about'. 'Who knows what is going through their minds?', scientists would say, so best not go there.

I'm sorry, but this will not do. Sometimes, if it looks like a duck, walks like a duck and quacks like a duck it is easier just to assume you are in fact dealing with a duck, rather than some sort of complex analogy. These gorillas were falling about laughing at what passes for entertainment in the Virunga forests. And if a sense of humour is not a sign of intelligence and self-awareness, it is hard to see what is.

Our attitude to animal self-awareness has historically been odd and self-contradictory, and at the heart of it are some very uncomfortable truths. The science of animal cognition has undergone something of a revolution in the past 30 years or so, and the findings are all pointing in one direction: the mental life of animals is far more complex and sophisticated than we thought.

Not only are animals cleverer than we once believed, they are probably also more emotional, more self-aware and in many ways more like us than we ever believed possible. Here, science is on a collision course with the world of accepted ethics and morality, and in the near future it is easy to see a revolution occurring thanks to what we are learning. If we decide that Fido is not a zombie, the entire relationship between humanity and the rest of the animal world will have to change.

Historically, as we shall see, the subject of animal rights has largely been a matter for theologians and philosophers. Latterly, it has been an issue for campaigners and activists. But today, the whole issue of what 'rights' we grant our fellow species has moved into the scientific domain. Not so long ago, anyone who suggested that other species could think, use language and tools, and show 'human' emotions such as love, kindness or empathy would have been accused of hopeless anthropomorphism and sentimentality.

Once, 'intelligence' in an animal was seen as purely 'instinctive', and 'instinct', however you chose to define that

rather nebulous quantity, was one of those things that marked out a safe boundary between animals (whose every move, however complex, was deemed to be guided by it) and us (who, being 'higher' beings, are not so driven). The cleverness of species like dogs and chimpanzees has long been acknowledged, but until quite recently many scientists held these behaviours to be little more than party tricks, simulacra of conscious reasoning. They may look clever, the reasoning went, but this is an illusion. Behind those bright eyes is in fact nothing. Even the brightest animal is no more than a machine, a zombie.

But the mood has changed. The more zoologists study the behaviour of animals, the more complex and 'sentient' their behaviour becomes. Science has also come close to a quantifiable definition of sentience, a checklist against which we can measure the 'performance' of various species. And, inevitably, all this raises uncomfortable questions.

It has long been recognized that the great apes deserve special recognition for their intelligence and presumed sentience. Indeed, in many countries, such as Britain, species such as gorillas and chimpanzees have acquired a unique legal status, particularly regarding animal experimentation laws, that separates them from the rest of the non-human animal kingdom. But the more we find out about animal abilities the more awkward these questions become. Awarding 'rights' to chimps and gorillas is one thing, but what about dolphins? And if dolphins, what about other mammals, such as dogs and cats? Sheep and pigs? Crows? Fish? Hang on a minute: we eat some of this stuff. Unlocking the secret mental life of the beasts means opening a very nasty can of worms indeed according to some scientists and philosophers.

We need of course to first define what exactly we mean by *sentience*. There are seven 'markers' upon which scientists can perhaps agree. All are possessed by humans and some by

many other species as well. A very few species seem to possess all of them.

This list of markers begins with a '*theory of mind*': the ability to know or guess what another being is thinking. A typical 'theory of mind' test would be to ask: 'What can that person over there see?'. Humans older than about four can do it; adult chimps and bonobos possibly. No other species demonstrate this highest-order cognitive skill (severely autistic people and young children of all abilities seem to lack a theory of mind).

Tool use, once thought to be the preserve of humanity, turns out to be very common. Various apes and birds, and even marine otters, can and do adapt natural materials to a variety of uses.

Plenty of species show evidence of strong *emotional and empathetic 'abilities'*, if that is the right word.

Another 'sentience' trait is the *ability to mimic*. In primates, neurons called 'mirror cells' seem to fire up when we try to copy others in performing tasks. Apes, obviously, can *ape*, as can (somewhat less famously) octopuses.

Language is certainly no longer considered to be an exclusively human trait and the '*mirror test*' – 'Do I recognize the being in the looking glass to be me?' – once seen as a key divide between the sentient and the 'zombies', has been passed by animals as diverse as pigeons and elephants (and it is questionable how good a test it can be for species whose visual abilities are far outstripped by other senses, such as smell).

Perhaps the 'highest' quality of sentience is *metacognition*, the ability to think about thinking. 'I think, therefore I am' was Descartes' famous summation of what it means to be self-aware, and until recently it has been our ability to ruminate, to live in a mental world apart from the world of the 'immediate now' that is assumed to constitute animal thinking, that has separated us from the beasts. That may be about to change.

Not everyone will be convinced. For, despite these advances, despite the papers in *Science* and other journals highlighting the case of genius crows and dolphins, despite the reports of extraordinary feats of sign language performed by some captive apes and even the apparently real linguistic abilities of some birds, there remains the whiff of pseudoscience about the whole field of animal cognition. It is, after all, impossible to really know what is going on in an animal's mind. We cannot, as the philosopher Thomas Nagel once pointed out, know what it is like to be a bat.

Sceptics – or cynics – like to say that research in this field is held back by an assumption that the plural of 'anecdote' is 'data'. Nevertheless, casting aside sentimentality, the undoubtedly dubious assertions of humanlike skills which have been made by some researchers, and the paucity of hard and fast information, there remains the important truth that the more we learn about animals the more like us, in certain respects, they are turning out to be.

This is new science. The evolutionary basis of intelligence and cognition in general is still very poorly understood. We do not know why humans became so bright. Our brains consume vast amounts of energy (about one in eight of every calorie we consume goes towards powering the computer in our skull) and their sheer size makes human birth a trauma not seen in most mammal species.

We tend to assume that our intelligence arose due to simple natural selection – the benefits of a sharp mind for survival seem obvious – but in fact the road to human intelligence may have been sparked by something far more 'trivial' – sex selection, perhaps. Our ability to gossip and form complex social relationships is mirrored by some other primates, but we have no idea why we, and not they, should have become quite so bright.

Of course, we *are* animals, but until recently it has been considered that intellectually *Homo sapiens* almost belongs in a

separate kingdom. Now we cannot be so sure. And in a century when the roles and possible rights of animals, especially of species that are in mortal danger like the mountain gorillas, is likely to be thrown into ever sharper focus, then the science of animal sentience is likely to become more than a purely academic or philosophical debating matter.

Traditionally, the view of animal sentience was much influenced by religion, at least in the Middle East and Europe. Followers of the Abrahamic faiths held that the birds and the beasts are essentially chattels, ours to do with as we will. *Genesis* 1:26 states: 'And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth'.

This view has arguably dominated the whole issue of how most Westerners have thought about animals right up to the 20th century. In was never the only view though. In other, non-Abrahamic, societies animals can be viewed quite differently. In Buddhism for example every living creature is seen as part of a spectrum that includes human beings. Hindus see certain animals, particularly cattle, as sacred and will not eat or even harm them. But the Biblical view took hold in the society that ended up developing the sciences of evolutionary biology, ethology (the study of animal behaviour) and neuroscience. This rather uncompromising underlying belief about animals could be seen to have shaped our study and interpretation in a rather unhelpful way.

But even in Biblical times there were contradictions and paradoxes. Animals were treated badly, but religious codes arose forbidding cruelty. Animals were so much meat, yet in mediæval Europe they could be – and were – tried for murder.

Science, for once, took what can be seen as the traditional view. René Descartes famously asserted that all animals were

automata, true zombies whose responses to things like pain were simply programmed reflexes.

He believed that only humans displayed sufficiently complex and refined behaviour to indicate the presence of a dualistic 'soul', a ghost in the machine necessary for consciousness. This idea was persuasive and it persuades still. An animal in pain, certainly a mammal or a bird which is in pain, appears to be suffering in the same way that a human who is in pain suffers. There will be screams, yelps, and the writhing of muscles, ligaments and skeleton suggestive of agony. We can monitor the animal's brain and its blood chemistry, detecting the presence of stress hormones like cortisol and adrenaline and note that its physical responses are identical to those of people.

Yet can we be 100% sure that the animal is actually *experiencing* pain in the same way as a human being? Of course not. It is quite possible to imagine a computer program or a robot designed to mimic the outward signs of pain, yet clearly there is no suffering to be had. I can quite easily program the machine on which this book is being written to shriek 'Ow!', or something like that, whenever I press, say, the letter 'Q'. Yet I'd have to be a moron to believe that my PC was actually in torment.

I'd also have to be a moron to assume that when an amoeba is challenged by nasty chemicals or intemperate heat or cold, and wriggles and squirms, that some meaningful perception of pain or even mild unpleasantness is going on. An amoeba is just a biological machine, a bag of proteins and nucleic acids, fats and water and various other bits and pieces no more likely to 'suffer' than my telephone or car. This used to be seen as a persuasive argument to 'prove' that animals are not conscious, but is not now generally accepted. An amoeba is as different from a dog as the latter is from a computer.

But not so long ago it was scientifically incorrect to argue that animals had a mental life at all. In the 1950s and 1960s,

the behaviourists, a radical school of psychology, argued that just as it was a nonsense to argue that animals had a mental life, it was a nonsense, too, to argue that humans had one either. The arch behaviourist B. F. Skinner put pigeons in boxes and mapped out complex relationships between stimuli and responses, working on the premise that the birdbrain was a calculating engine.

Skinner trained his pigeons to perform extraordinarily complicated 'tricks', pressing sequences of levers in order to elicit a supply of tasty food and so on. What went on between the pigeon's ears was, he thought, not more than a continuation of these levers, an interconnected series of unknowing mental gearages that eventually made the animal do one thing or another. Skinner even tried the same trick with his daughter.

To the behaviourists, what went on inside the skull was unknowable and thus not worthy of study or even consideration. Discussion of the 'conscious' mind and what this might mean was like discussing fairies. Thoughts, such as they were, were at best merely an internalized form of language.

There is no doubt that behaviourism had a lot of useful things to say about how the mind works, and blew some useful mathematical rigour into the messy and colourful playroom of ideas that psychology was becoming. But there was a big problem. We all know we have internal, mental lives, because we experience them. Denying their existence because they cannot be meaningfully studied is like denying the existence of the Andromeda galaxy because no one has been there and probably never will. Of course, the behaviourist could take a solipsistic argument and assume that he or she was the *only* organism alive with a mental life, and his pigeons and fellow experimenters were mere zombies, but this would add unnecessary complexity to the argument (why should he be the only conscious being out of all the billions of others?). That fact alone would take a huge amount of explaining. Today you

would be hard pressed to find someone taking a hard-line behaviourist view of animal or human consciousness.

But what does it mean to be self-aware and, indeed, conscious of anything? After all, it is perfectly possible, as a human being, to perform complex mental processes and not be conscious of them. If you drive to work along the same route every day, the chances are that during most journeys, most of the time, you will be no more conscious of your actions than you are of your heart beating or of your kidneys processing urine. Try to remember your trip the next time you end up in the office car park.

And yet, despite the fact that driving a car is a hugely complex and difficult mentally driven process that takes some time to master (and we can *all* remember what *that* was like), most of the time you do not crash in a heap of tangled metal despite having been a zombie for most of the journey. Many of our most complicated and impressive actions do not seem to be carried out under any sort of conscious control. We admire the 'skill' of elite footballers and tennis players, but what is it that we are really admiring when we see Roger Federer make an outlandish return of a 140 mph serve, or Ronaldo turning on a sixpence and blasting the ball into the net from 40 yards? After all, these actions must almost by definition be unconscious. The skill sinks in with the training, the hours of practice, and the guts and determination that is needed to be in the top 1% of any professional sport. Actually playing, at world-class level, is a spectator sport as much for the players as for the spectators.

If humans can be largely unconscious of their actions while playing tennis or driving, then chimpanzees can certainly be unconscious while hunting or grooming. But this does not mean that animals or humans are not self-aware. The question of self-awareness is one of the trickiest in science, but what is of the essence here is whether whatever-it-is is something possessed uniquely by *Homo sapiens*.

We cannot know what it is like to be a bat, a bird or a whale. But that is not to say we cannot study and discover some useful things about animal awareness. In 1970, the psychologist Gordon Gallup developed the 'mirror test' to determine whether animals were self-aware. In essence, the test uses a mirror to see whether an animal can recognize its own image as being one of itself. Plenty of animals are fascinated by mirrors, but to see whether they know the creature in the glass is themselves, the Gallup test involves marking the animal with a dye or paint mark (which it cannot see except in the mirror) and seeing whether the animal behaves in a way that indicates that it realizes that the reflected body, with the mark, is its own.

So far eight species have passed the mirror test, six unambiguously (humans, chimps, bonobos, orang-utans, dolphins and elephants) and a further two (gorillas and pigeons) under more controversial circumstances. Children under the age of two fail the test, as do (perhaps surprisingly) dogs and cats. One species of monkey, the capuchin, seems to be a 'borderline pass'.

The most recent alumnus of the mirror test was the African elephant. In November 2006, the *Proceedings of the National Academy of Sciences*[1] reported that three elephants, Happy, Maxine and Patty, who live at the Bronx Zoo in New York City, had spots painted on their foreheads and were then shown a mirror. All reacted in a way that indicated that they realized that the animals in the reflections were themselves. They poked their trunks into their mouths and watched the reflection in fascination. One, Happy, passed the spot test – she tried to wipe off the mark on her face with her trunk after spotting it in the mirror. 'The social complexity of the elephant', said Joshua Plotnik, one of the scientists behind the study, 'its well-known altruistic behaviour and of course its huge brain made the elephant a logical candidate species for testing in front of a mirror.'

The mirror test could be a good indication of self-awareness in species which are wired up in a certain way. But it is an exclusively visual 'test', and for many species vision is not their primary sense. Dogs, for instance, recognize each other mostly by smell. If some sort of smelly version of the mirror test were devised, we'd probably flunk. Neither we nor elephants nor chimps could pass a test based on echolocation, yet a bat might. The mirror test imposes a purely human (perhaps purely primate) criterion on the measurement of self-awareness. It still doesn't tell us much about what it is like to be a bat, a beagle or a badger.

What other criteria could we use to determine whether animals are conscious or zombies? There are a range of emotions that seem to depend on a sophisticated sense of one's place in the world and one's relation to it. Emotions like jealousy, sarcasm or humour seem to demand a sophisticated sense of self (less sophisticated emotions like love and hate, or fear and rage may not require anything like the same degree of mind). So, can animals get jealous? Can they be sarcastic? Most scientists are doubtful, but ask any dog owner and you will get the same answer. There are endless anecdotal stories of mutts creeping off to sleep under the bed in a huff when the new baby arrives, or naughty puppies 'hiding' socks and gloves behind the sofa and expressing great delight when their owners express suitable frustration. Much of this comes under the category of 'play' and, again anecdotally, there is a lot of evidence that many, many species engage in play. But how much of this is scientific and how much mere anthropomorphizing? And, most importantly, how much data do we have?

Not a lot. One recent anecdotal report claimed to confirm that jealousy can be experienced by dogs. The research, carried out at the University of Portsmouth in the UK, involved 1000 pet dogs and their owners across southern England. The

owners reported many instances of jealousy, where dogs would become upset when affection was bestowed upon people or other animals.

The way in which this was expressed was usually by the dog forcing itself between its owner and the person it felt was usurping its emotions. Many dog owners report instances of their animals trying to place themselves physically between their master or mistress and new significant others, especially when they are being affectionate. Such behaviour is amusing, but may become less so when the significant other is a baby.

Persuasive though such stuff is, it isn't really science. Owners reporting on their dog's or cat's behaviour means little on its own; this is hardly a double-blind trial. Perhaps more persuasive are some neurological findings which suggests that animals may be able to fall in love.

In the brains of the great apes and in humans there is a structure composed of specialized neurons called spindle cells. They are found in the parts of the cerebral cortex which have been linked to social organization, empathy, sympathy, speech recognition, intuition about the feelings of others and emotional attachments. One area of these brain areas, the anterior cingulate cortex, seems to be associated with an emotional response to things like pain, sexual arousal and hunger. Another part of the brain, the frontoinsular cortex, generates a similar response when pain or suffering is seen in others. The strong emotional responses we get to other individuals – hate, fear, lust, love or affection – seem to depend in large part on the presence of these rapid-firing spindle cells.

And it seems that the great apes (including us of course) may not be unique. In what may be a classic case of parallel evolution, Patrick Hof and Estel Van Der Gucht of the Mount Sinai School of medicine in New York have found spindle cells in the brains of humpback, fin, killer and sperm whales, and what is more, they found a far greater concentration of them

in the brains of cetaceans than in humans. Whales, Dr Hof told *New Scientist* in January 2007, 'communicate through huge song repertoires, recognize their own songs and make up new ones. They also form hunting coalitions to plan hunting strategies... and have evolved social networks similar to those of apes and humans'.

Perhaps the best way to determine sentience is the presence of abstract thinking. Humans can 'think about thinking', a skill called metacognition. It was this skill that was identified in Descartes's famous aphorism '*cogito ergo sum*'. Knowing what is, literally, on your mind would seem to be a key part of self-awareness. One traditional assumption has been that, lacking a language with which to internalize their thoughts, animals cannot do this. They can think about the pain they are in, but cannot worry about the pain to come. Lacking metacognition, animals could be said, if not to be zombies, then certainly to lack a key property of non-zombiehood, their inner worlds a clouded non-reflective series of stabbing consciousnesses.

But some researchers say that it is possible to unlock the inner lives of some species, and that they do show this property. A psychologist called David Smith, who works at the University of Buffalo in New York state, has been working for some years with a bottlenose dolphin called Natua in a harbour in Florida. He trained the animal to press buttons depending upon the frequency of the sounds it was hearing. When the differences between the sounds was obvious, the dolphin had no problem (a snack was the reward for getting the right answer). But as the sounds to be compared got closer in frequency, to the point where even the dolphin's impressive hearing apparatus is unable to distinguish between them, Natua learned to press a third button, effectively a 'don't know' or 'pass' button, that moved the test on to the next 'question'. Similar results were found with rhesus

monkeys, this time using symbols in a computer game. The tests have been refined to determine the level of confidence that the animal feels that it has the 'right' answer. Smith told *New Scientist* in 2006: 'I can't claim these monkeys show fully-fledged consciousness, but I have shown the exact cognitive analogy to what we have in humans, and for us it is consciousness'.

Animals can be very bright. Apes, perhaps dolphins, and certainly some crows have astonished scientists and the public in recent years with displays of intelligence that were not anticipated by early researchers. Every year it seems we get new data that show that animals are probably cleverer than we thought. One of the attributes previously thought to be unique to humans was toolmaking. That notion went by the board as soon as it was discovered, in the 1980s, that chimps in east and central Africa could use moistened sticks to fish for termites. One West Lowland Gorilla in the Republic of Congo, a male named Kola, has learned to test the electric fence surrounding his forest reserve by holding a grass stem up to the wire. The stem will conduct a bit of current, enough to show Kola the fence is turned on, but not enough to give him a shock. Not all humans would be able to do this.

The fact that apes, our closest relatives, can be this bright is perhaps not surprising, but what has taken more than a few scientists aback is just how intelligent some birds, a group whose very name was previously a byword for stupidity, are turning out to be.

In the BBC television series *Life of Birds*, shown in 1998, some extraordinary footage was shown in which crows in Japan dropped hard-shelled nuts onto the road at a pedestrian crossing. After waiting first for the nut to be cracked open by a passing car and then for the traffic to be stopped when a pedestrian pushed the button, the crows would land to retrieve their nuts.

This is hardly very scientific. But In 2002, a New Caledonian crow called Betty starred in *Science*[2] magazine after she had learned to fashion a hook out of a piece of wire and use this tool to fish food out of a glass pipe. That really took scientists aback, especially as this level of toolmaking skill has never been observed even in chimpanzees. 'Primates are considered the most versatile and complex tool users', the authors of the study wrote, 'but observations of New Caledonian crows raise the possibility that these birds may rival nonhuman primates in tool-related cognitive capabilities.'

What was really extraordinary was that the hooks made by Betty were constructed from flexible steel wire, not a material readily available in the bird's natural habitat. Even more impressive was the way Betty made the hook. Crows lack hands, opposable fingers and thumbs. To make the hook, Betty first wedged one end of it in the sticky tape wrapped around the bottom of the glass tube and then pulled the other end at right angles with her beak. Betty had no prior training and had not watched any other crows doing this. Chimpanzees have, in similar experiments, shown themselves incapable of grasping the principle of bending a pliant piece of wire to make a hook and retrieve food. Some people would probably have trouble.

The fact that at least some birds are so clever comes as a surprise, partly because birds are so distantly related to humans. They are not even mammals. But of course there is no reason to suppose that 'IQ' (whatever that means in an animal context) should have any relationship to evolutionary closeness to *Homo sapiens*. In a review published in *Science*[3] in 2004, the question of corvid (crows, jays, rooks, magpies, ravens and jackdaws) intelligence was discussed. In fact, despite the pejorative term 'birdbrain', the smartness of these species has been known about for some time. In one of Aesop's fables, a crow, unable to drink from a pitcher of water because the sur-

face was too low for its beak to reach, started dropping stones into the pail, displacing water until it was within reach. For a very long time, tales like this have always been dismissed as hearsay and folklore, which of course they are, but it is interesting that it has only been very recently that science has started to discover that many of the things lay people have thought about animal intelligence might be true. 'Recent experiments', the authors wrote, 'investigating the cognitive abilities of corvids have begun to reveal that this reputation has a factual basis.'

The authors speculate that intelligence evolves not to solve physical problems but to process and use social information, such as who is allied to whom and who is related to whom, and to use this information for personal gain and deception. This is all very well, but you need the equipment for the job, and here the crows and their relatives seem to tick this box as well. The crow has a significantly larger brain than would be predicted for its body size – in fact, on this measure it is similar to that of a chimpanzee.

Among the bird family, only some parrots have larger brains in relation to body size. The crow's brain is also particularly well developed in those areas thought to be responsible for 'higher' thought processes, a region of the brain dubbed the 'avian prefrontal cortex' as it is thought to be analogous to the structure seen in mammals.

Not only have crows been seen making hooks in captivity, their behaviour in the wild shows some extraordinary abilities. For instance, they cut *pandanus* leaves into a series of sawtooth spikes and use these to impale grubs and insects gathered from under vegetation. Many corvids store food for future consumption; they are not alone in this of course, but what is extraordinary is that they seem to be able to distinguish between perishable and longer-lasting supplies, and return to their cache before their stores have gone off. In labo-

ratory studies, birds will not bother to return to a store of dead grubs, say, after a long time has elapsed, but will return to find seeds. This suggests a 'what, where, when' memory much like ours. These birds are also able to create complex strategies to cope with thieves. They hide their food where other birds cannot see it, or wait, their beaks stuffed, for other birds to fly away or turn aside before hiding their store. And birds who are habitual thieves tend to be better at hiding their food than ones who have not.

These birds, in other words, show flexibility, seem to be able to work out what others may be thinking, understand the principles of causality, show imagination and can plan. Most importantly, their behaviour strongly suggests that they are able to put this 'cognitive toolbox' together to construct an internalized image of the world. Does this mean they are fully sentient and conscious? We don't know. But it is good evidence, surely, that they are.

Betty and her relatives are impressive enough, but they cannot talk. Some birds are, of course, able to mimic human speech, but it is only quite recently that anyone has suggested that they are able to understand what they are saying. Alex, an African Grey parrot, has been studied for nearly 30 years by the animal psychologist Irene Pepperberg in the US. His vocabulary is about 100 English words, and he seems to understand what they mean. Pepperberg has claimed that Alex understands concepts such as shape, colour and material, and can use English correctly to describe these concepts. Alex also apparently shows remorse. He was even able to make up a word – 'bannery' – when shown an apple for the first time (he already knew about grapes and bananas). Another African Grey in the US, N'kisi, is, its owner insists (some scientists are skeptical about N'kisi), capable of using language to have a real conversation (a claim that has not been made about Alex). N'kisi is supposed to be capable of humour and even sarcasm. He invented a new term when faced

with aromatherapy oils – 'pretty smell medicine' – although whether his sarcastic attitude extends to alternative therapies is not known. And it's not just parrots and crows. Sheep have now been found to recognize dozens of individual people. And earthworms have been spotted doing differential calculus (just kidding).

Cleverness is not self-awareness. The fact that crows can make tools out of wire does not necessarily mean that they are sentient. But intelligence may well be linked to consciousness. That the brains of mammals, reptiles, birds amphibians and even fish share common structures and genetic backgrounds suggests quite strongly that our self-awareness is almost certainly not unique. Because not to draw this conclusion would be to assume something very strange indeed, something along Cartesian lines – that somehow, at some point in the evolution of *Homo sapiens*, and *Homo sapiens* alone, something magical invaded our skulls in the Pleistocene and set up home.

So where does all this leave us? In an uncomfortable place, that's where. If we assume, as I think we must, that animals are sentient, aware beings capable of conscious thought and of distinguishing themselves from the rest of the world around them, if animals are not zombies, then the distinction between them and ourselves becomes somewhat arbitrary. As some people have argued, eating them is no different, morally, to cannibalism (indeed it is worse, because at least with cannibalism there is the possibility that the meal can give his or her consent to be eaten).

It is certainly uncomfortable for us that the more we learn about animals the more impressive their intellectual capabilities appear to be and the more, biologically, we seem to have in common. This can of course be overstated. It is an overquoted factoid that humans and chimpanzees share more than 99% of our DNA, but it is a much less quoted factoid that

we share two-thirds of our DNA with the halibut, and we are well into double figures with yeast. And anyway, what does this mean?

Humans and chimps may be on neighbouring twigs on the evolutionary tree, but mentally we might as well be in different forests. Nevertheless, things like tool-using, language, a sense (perhaps) of fairness, and even emotions like humour and jealousy – all once thought to be the preserve of people – have now been observed, to greater and lesser degrees, in animals. It is likely that the more we probe the minds of the apes and monkeys, elephants, dogs, birds and probably even fish, the more impressive will be the intellectual machinery we will discover. Even invertebrates are not immune to this animal 'intellectual revolution'; some cephalopods – the squids, cuttlefishes and octopuses – are so bright that they have won legal rights in some jurisdictions to be protected from certain painful experimental procedures.

It is incontrovertible that we equate sentience with both humanity and a right to humane treatment. Throughout history, the worst cruelties perpetrated by humans upon each other have often come about when the offenders persuade themselves that their victims are not really human and not really sentient. In the early 19th century, a famous advertisement was placed in a British newspaper for 'guns' (i.e. men with guns) to join a hunting expedition – to kill Tasmanian aborigines. In 1800 there were about 5000 of these people alive, but by 1867 they were all dead, reduced to a series of body parts displayed in museums. This shameful genocide was not considered as such by these 'guns' simply because the Tasmanian aborigines were not considered, by them, to be people.

Animals are not people, but then again if we are talking about intellectual ability (and sentience) many people aren't really people either. The critically senile, accident and illness

victims in comas, the newborn – all have intellectual capabilities and sentience well below those of, say, an adult chimp or Kola the gorilla, yet across all societies and cultures the human will be granted far more rights under law than the ape.

As the Australian philosopher Peter Singer, who takes an extreme but persuasive reductionist approach to animal rights, argues, this is illogical. If it is right to take a chimp's life to save a human then it may also be right, under certain circumstances, to take a human's life to save a chimp. To argue otherwise is simply wrong and makes one guilty of arbitrary speciesism. The Great Ape project (the name of which, ironically, indicates a certain amount of arbitrary speciesism itself) is a loose group of scientists and philosophers which argues that we should extend certain legal rights to at least the 'higher' primates, our closest cousins, as a first step. This would mean that experimentation, for any purposes, even to test potentially life-saving medical procedures, should be banned on these animals, everywhere and in all circumstances. The great apes would in fact have similar legal rights in law as human beings.

If non-human primates can show evidence of *metacognition* – thinking about thinking and reflecting upon memories – that puts them in a wholly different light. They, and perhaps many other species, can no longer be thought to live in an eternal present, responding to hunger and pain, fear and pleasure with no concept of anticipation or reflection. It is, perhaps, one thing to cause pain to an animal which can neither anticipate nor reflect on its experience, but quite another to lead into a laboratory or abattoir a terrified creature which has already created a distressing mental picture of what is about to happen to it in its head.

Most people do not think like this of course. I know many scientists who argue, persuasively, that granting an ape 'rights' over, say, an elderly person suffering from Parkinson's

Disease is ludicrous. By experimenting on the brains of monkeys and apes scientists have made great strides in learning how this most debilitating and terrifying of illnesses works, and have taken steps towards finding a cure. Stopping this experimentation, in labs in Europe and America, has become the *raison d'être* of many animal rights organizations, some of which have resorted to terrorism to get their point across, and this we all agree is despicable.

And what about the 'rights with responsibilities' argument? Again, many scientists and lay people say, it is ludicrous to grant 'rights' to an animal that can have no concept of its responsibilities under the laws that are giving it protection. If we protect chimpanzees from vivisection, should we also not be prosecuting chimps when they murder each other, or indeed us (as happens)? Should gorillas get the vote? This is ludicrous, clearly, so perhaps we should think again about these 'rights' and dismiss the idea out of hand.

But actually the 'responsibilities' argument falls down very quickly. Because we grant a whole host of rights to human beings from whom we demand no responsibilities whatsoever. Again, we are talking about the very young, the very old, the sick, senile and the mad. Lunatics cannot vote and neither can babies, but we are quite rightly not allowed to stick electrodes into their brains in the advancement of medical science. Young children are absolved from full responsibility when they commit criminal acts. We have no problem in granting humans rights without responsibilities, so why not animals?

The best guess is that we will have to muddle through, perhaps tightening the cruelty laws a little, but essentially maintaining the same troubled relationship with the animal world that has held sway ever since we diverged from our closest relatives. But this state of affairs may not be able to continue forever. The more we learn about the most intellectually

advanced of the animals, the more squeamish we will inevitably become. Every second humans kill some 16,000 animals for food – that is 50 billion lives taken per year. While this slaughter may be carried out in fairly humane conditions in wealthy countries with strict laws governing farm animal welfare, we can assume that the vast majority of these lives are ended in a relatively disgusting and brutal way.

It may well be the case that in decades or centuries to come we may look back upon the way we treat our fellow creatures today with the same sort of revulsion with which we now treat slavery – a practice which 250 years ago was widely accepted in most of the 'advanced' societies on the planet. This is not an argument for vegetarianism, but it is an argument for a lot more compassion.

So, where does the science go from here? While behaviourism, 'anti-mentalism', is probably defunct as a philosophy, behaviourist techniques have survived and the rigour of behaviourist thinking is, ironically, exposing the mental life of animals as never before. Scientists study – or try to study – animals both in the laboratory and, increasingly, in their natural environments as rigorously and methodically as if they were conducting a double-blind drug trial. This is not easy. When observing the behaviour of an animal as complex as the chimpanzee, for instance, over long periods, it is probably asking too much of even the most diligent human researcher to avoid drawing all sorts of emotional inferences about their subject matter.

The harsh truth is that highly intelligent animals are often extremely endearing and form close emotional bonds with their observers. But this doesn't mean that the extraordinary fieldwork such as that conducted by Jane Goodall with 'her' chimpanzees has not added hugely to our knowledge of these extraordinary animals. More and more ethologists want to study the cognitive abilities of apes and cetaceans, animals

too large, demanding and expensive to observe in any numbers until quite recently. Controversially, some scientists have tried to push animal cognitive abilities to the limit – trying to teach chimps sign language, for example.

Clever new techniques have been used to unlock the animal mind. The Gallup mirror test, while imperfect and probably not definitive, is giving us startling new insights into animal consciousness. It is now considered that what may be a defining characteristic of true sentience – a theory of mind, or 'knowing what the other guy is thinking' – is possessed by at least some primates. Finally, there has been the growing cultural awareness of what science has known since the 19th century: that humans are animals. The biochemical, neurological and evolutionary relationships that led to our minds and the minds of other species are now being mapped. Hardly anything now is considered to be definitely, absolutely, 'unique' to humans. Intelligence, tool use, language, fear, jealousy and anger have all been observed in many species.

Chimpanzees have been observed engaging in behaviour that it is hard to interpret as anything but extremely violent, vindictive and even sadistic. Even the humble rat has been found to be alarmingly 'humanlike' in many of its traits, displaying signs of affection, bloody-mindedness and even addiction to various narcotics (it is quite easy to make many animals alcoholics, nicotine addicts or even persistent and enthusiastic users of cocaine). While many animals may mirror 'our' finer cognitive traits, they are not immune to our baser ones either. The old line about it being unfair to compare thuggish people to animals because 'animals never stoop that low' is not correct. In essence, the study of animals' brains has become more like the study of human brains and vice versa.

This remains a hugely controversial field. Behaviourist thinking survives, and acts as a useful antidote to those who see

evidence of profundity every time a dog barks or a whale flips its tail. The attempts to teach animals to 'talk', or at least sign, look, say sceptics, far more impressive in TV documentaries than in the cold hard light of laboratory trials. Perhaps inevitably, this is a field which attracts flaky thinking like moths to a candle – to some, it is only a short step from talking parrots to telepathic parrots.

We may no longer be alone, and this will, inevitably, affect the way we treat our fellow consciousnesses. Hurting a zombie is fine because the zombie cannot mind. But how many scientists now believe that even their rats are zombies? For the moment the mainstream scientific establishment considers that it is, just about, OK in extreme circumstances to experiment on a chimpanzee. Will this still be the case if the chimpanzee asks us to stop?

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