Animal Minds

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What is it like to be a snake? Can you imagine how it feels to slither along through wet grass in search of prey? Maybe you can. But, as Nagel pointed out in "What is it like to be a bat?" (1974), you are probably imagining what it would be like for you to be the snake, and that is not the point. The point is what it is like for the snake—that is, if it is like anything at all for the snake.

How can we ever know? We cannot ask the snake to tell us. And even if we could we might not believe, or understand, what it said. This is essentially the problem of other minds again. Just as you can never know whether your best friend is really conscious, so you can never know whether your cat, or the birds in your garden, or the ant you just stood on are (or were) conscious. Humans and other animals show similar expressions of emotions and similar reactions to pleasure, pain and fear, as Darwin (1872) long ago showed. Even so, we must avoid assuming that just because another animal appears to be in pain or to be feeling guilty, or happy or sad, it really has the feelings we attribute to it. As we shall see, our impressions can sometimes be completely wrong.

There are two extreme positions to consider. One is that only humans are conscious. For example, Descartes believed that because they do not have language, all other animals are unfeeling automata, without souls or consciousness. A modern version of this viewpoint is given by Macphail, who argues that "animals are indeed Cartesian machines, and it is the availability of language that confers on us, first, the ability to be self-conscious and, second, the ability to feel" (1998: 233). In his view there is no convincing evidence for consciousness in other species. They are not just devoid of speech and self-awareness, but devoid of feeling too.

At the other extreme lies the view that because so many species are physically similar, they must all be conscious. For example, Baars (2001) points out that the known correlates of consciousness are phylogenetically ancient, going back at least to the early mammals. He argues that there are no fundamental biological differences that could justify denying subjectivity to other species when we so readily attribute it to other people. Between these extremes lie theories that, for various reasons, attribute different kinds of consciousness to different species.

DIFFERENT WORLDS

Every species has evolved sensory systems to suit its way of life. This simple fact leads to the odd realization that when you have several different species in the same place, they may all be inhabiting essentially different worlds. Let's take the example of an ordinary garden pond with fish, frogs, newts, snails, insect larvae, flies and a human child with a fishing net. We can easily imagine (or think we can) how the pond looks to the child, but the others must experience it in completely different ways. The fish have sense organs for detecting vibrations in the water from which they know what to avoid, what to seek out and when to dive for safety. We have nothing comparable to help us imagine it. The insects have compound eyes quite unlike our image-forming eyes, and many of the animals have chemical senses far more sensitive than our feeble senses of smell and

taste.

The frog is particularly interesting. Frogs have eyes with lenses and retinae somewhat like ours, sending signals along the optic nerve to the optic tectum in the brain. It is tempting to imagine that a picture of the frog's world is somehow constructed in its brain to enable it to see, but this is not so. The frog's eye tells the frog's brain just what it needs to know. It tells it about stationary and moving edges, changes in overall illumination, and bugs. The "bug detectors" respond specifically to small moving objects, not to large moving objects or stationary small objects, and direct the frog's tongue to catch flies. An extraordinary consequence of the way this system works is that a frog can literally starve to death surrounded by freshly killed flies. If the fly does not move, the frog does not see it.

We can learn much from thinking about this frog. We might be tempted to think that the child gazing into the pond really does have a picture of the world in her head—a full, rich and detailed picture of the scene—and that by comparison the frog's vision is simply stupid. But think again. The work on change blindness and inattentional blindness shows that we do not hold a detailed picture in our heads either. In fact we may be much more like the frog than we care to admit. Evolution has only designed us to detect selected aspects of the world around us. Just like the frog, we are quite unaware of everything else—yet we feel no gaps.

We may think that the child must be more conscious than the frog, and the frog more conscious than the fly, but why? While many authors make bold assertions about animal consciousness, it is not clear how these can be tested or what they mean. Greenfield proposes that "consciousness increases with brain size across the animal kingdom" (2000: 180). But if she is right, then sperm whales, African elephants and dusky dolphins are all more conscious than you are, and Great Danes and Labradors are more conscious than Jack Russells and Pekinese. Searle claims that "Humans and higher animals are obviously conscious, but we do not know how far down the phylogenetic scale consciousness extends" (1997: 5). But this is not "obvious" and also there is no single phylogenetic scale, or linear sequence, along which animals can be graded from "higher" to "lower." As we have seen, evolution has not produced a line but a very bushy bush.

We might try to grade animals by intelligence, but one danger is that we base our idea of intelligence on our own species-specific abilities and fail to appreciate other kinds of intelligence, like that of bees or octopuses or elephants. Even in more familiar creatures comparisons are difficult. On some scales chimpanzees are put near the very top and birds, with their "bird-brains," much lower. Yet chimpanzees can work out how to pile up boxes to reach a suspended banana, and crows can work out how to pull up a string between a beak and foot to reach a suspended nut. Is one more intelligent than the other, or more conscious?

Does one animal suffer more than another? We have empathy for other people when we see them crying or in distress, which may be reasonable on the assumption that they are similar to us. We may also feel empathy for the dog who squeals when hurt, the tiger pacing up and down in a tiny cage or the lobster screaming in boiling water. But could any, or all, of them be Cartesian automata that feel nothing? This is not an empty question because we can build a simple toy dog, wired up so that if you stand on its foot it whines, but few would believe it was capable of suffering. A few switches are not sufficient. But what is sufficient for the capacity to suffer?

Marian Stamp Dawkins (1987) suggests three sources of evidence for deciding whether an animal is suffering: its general state of health, its physiology and its behavior. She argues that the best measure of how much an animal suffers is how hard it will work to avoid the cause of that suffering. In experiments to try to find out whether battery hens were suffering because they had no litter to scratch in, she was surprised to find that although they preferred cages with litter, they would not push through a heavy curtain or jump a barrier to get to one. She suggests that we should not rely on empathy to decide whether an animal is suffering but should allow it to tell us by observing its behavior; the more complex are the ways it can use to escape from unpleasant things, the more it is capable of suffering.

Do other species experience pain as we do? Does it really *hurt*? The question may seem impossible to answer but we need not despair. In studying human consciousness we have made progress by learning about perception, memory, attention and other relevant abilities. We can do the same by looking at some of the abilities most likely to give us insight into animal consciousness.

SELF-RECOGNITION

You are not only aware of the world around you but of yourself as an observer. You have self-consciousness. Although we cannot know when young children first become self-conscious, they start referring to "me" and then "you" between 18 months and two years of age. But what about other animals? Are cats, or dogs, or dolphins aware of themselves? Do they have a sense of "I" as a conscious being observing the world? Although they cannot tell us directly, there are other ways of trying to find out. The best known is to see whether they can recognize themselves in a mirror.

Dogs and cats obviously cannot. As any pet owner will attest, kittens will rush up to a mirror, look for the other kitten inside it, and then quickly get bored. Many birds continue to treat their own image as a rival indefinitely, as do some fish. They clearly have no concept that the mirror reflects their own body. But what about our nearest relatives, the great apes?

Charles Darwin (1872) was the first to report the experiment. He put a mirror in front of two young orangutans at the zoo who, as far as he knew, had never seen one before. He reported that they gazed at their own images in surprise, often moving and changing their point of view. They then approached close and protruded their lips toward the image, as if to kiss it. Then they made all sorts of faces, pressed and rubbed the mirror, looked behind it, and finally became cross and refused to look any longer.

Sadly, we cannot tell whether these orangutans recognized themselves or not: whether they were looking at their own lips or trying to kiss another orangutan, for example. An attempt to find out more was not made until a hundred years later, when the comparative psychologist Gordon Gallup (1970) gave a mirror to a group of pre-adolescent chimpanzees. Initially they reacted as though they were seeing other chimpanzees, but after a few days they were using the mirror to look inside their mouths or to inspect other normally invisible parts of their bodies. Watching chimpanzees do this is certainly impressive. It seems obvious from the way they pick their teeth and make funny faces that they recognize themselves, but can we be sure?

To find out, Gallup anesthetized these same animals and placed on them two red marks, one on an eyebrow ridge and one above the opposite ear. When they came round from the anesthetic and looked in the mirror, they saw the marks and tried to touch them or rub them off, just as you or I would probably do. By counting the number of times the chimpanzees touched the marks compared with how many times they touched the same place on the unmarked side, Gallup could be fairly sure that they did indeed see the reflection in the mirror as that of their own body.

Subsequently many other species have been tested. Human children fail the test until they are somewhere between 18 months and two years old. Chimpanzees vary a great deal, but generally do touch the spots. Of the three other species of great ape, orangutans and bonobos have been found to behave like the chimpanzees, but gorillas do not. The only gorilla to succeed has been Koko, a highly trained gorilla who has learned to communicate with humans using American Sign Language (ASL). When asked what she saw in the mirror, she signed "Me, Koko." That Koko behaved so differently from other gorillas may seem surprising, but in fact it is well known that enculturated apes acquire many skills that their wild, or captive, conspecifics do not. Just what the relevant skills are in this case, though, we simply do not know.

In many similar tests monkeys have shown no self-recognition, even though they use mirrors in other ways. For example, they can learn to reach things seen only in reflection, and will turn around toward someone they have seen in a mirror. Yet they do not pass the spot test. From this it has been widely assumed that only great apes are self-conscious, that there is a great divide in consciousness between us and the rest. But there are several problems with this conclusion.

First, the test is not fair for many species. For example, dolphins and whales are extremely intelligent and communicative creatures, and some of them enjoy playing with mirrors, but they have no hands to touch a spot even if they wanted to. Even for creatures that do, the test requires an animal that grooms itself and would want to remove a mark if it knew it was there. Trying to give gorillas the benefit of the doubt, Gallup (1998) put marks on their wrists. They did indeed try to remove these marks but not the marks seen only in the mirror.

Another problem is that while apes sometimes interpret staring as friendly, as humans do, most monkeys find staring threatening, so the test may fail simply because the monkey will not look at itself carefully enough. American psychologist Marc Hauser (2000) got around this problem using cotton-top tamarins, small tree-living monkeys with a spectacular tuft of white hair on their heads. Once they were used to the mirror he anesthetized them and applied bright pink, blue or green hair dye to their tufts. The monkeys stared at the tuft, and most of them touched it at least once. Some moved their hands in front of the mirror as if testing the effect, and some seemed to be trying to look at their backsides using the mirror. Hauser concluded that these monkeys did have self-recognition after all, although this conclusion remains tentative.

We still do not know for sure which species can and cannot recognize themselves in a mirror, but in any case the more serious problem is that we do not know what mirror recognition would tell us about self-awareness even if we did. It does not necessarily follow that because an animal can recognize its own body in a mirror, it has either a concept of self or self-awareness. For example, an ape might work out the contingencies

between making movements and seeing effects in the mirror without concluding that the arm in the mirror is its own. Or it might conclude that the mirror shows its own body without having any concept of itself as seen by others, or as an agent or experiencer.

There is lively debate over this issue. Gallup (1998) is convinced that chimpanzees not only recognize themselves in mirrors but have a concept of self and self-awareness. He even suggests that with this self-concept comes the beginnings of autobiographical memory and awareness of a personal past and future. In Damasio's terms (1999), this would mean that chimpanzees might have extended consciousness and autobiographical selves as well as core consciousness.

Primatologist Daniel Povinelli (1998) agrees that they have a concept of self, but not that they are aware of their own internal psychological states. He suggests that "self-recognition in chimpanzees and human toddlers is based on a recognition of the self's behavior not the self's psychological states." Even more skeptical is British psychologist Cecilia Heyes (1998), who agrees only that they are capable of "mirror-guided body inspection," and argues that chimpanzees have no self-concept and no understanding of mental states.

THEORY OF MIND

One aspect of human consciousness is that we have beliefs, desires, fears and other mental states, and we attribute these same mental states to others. That is, we have a "theory of mind." According to Dennett (1987) we readily adopt what he calls "the intentional stance," understanding other people's behavior by treating them as if they have hopes, fears, desires and intentions. The intentional stance is a very powerful tool for understanding, controlling and predicting the world around us. It makes deception possible as well as empathy.

Babies are not born with these abilities. Sometime during their second year they begin to follow another person's gaze to see what they are looking at and to look at what is pointed at, rather than at the pointing finger. By the age of three they can talk about their own and others' desires and preferences. But at this age they cannot understand that someone else may not be able to see what they can see or may have a false belief. This is the age at which a child playing hide-and-seek may hide her head under a pillow and shout "come and find me." Numerous experiments have shown that between the ages of three and five the various aspects of having a theory of mind develop.

In 1978 two psychologists, David Premack and Guy Woodruff, asked, "Does the chimpanzee have a theory of mind?" The relevance of this question to us here is that if other animals do not have a theory of mind, and they cannot attribute mental states to others or to themselves, it seems impossible that they could be conscious in the human sense. Mirror self-recognition is one aspect of this. Other relevant skills include the ability to deceive others, to understand what others can see or know and the capacity for imitation.

DECEPTION

To deceive someone means to manipulate what they believe. A butterfly with a brilliant eye pattern on its wing is deceiving predators, as is a camouflaged stick insect, or a plover

that feigns a broken wing to distract a predator away from its nest. In these cases the camouflage or the behavior is genetically encoded, but human deception is rather different. You might deliberately try to convince someone that you didn't steal their chocolates or lose their book, or that you really do love them. You can only do this if you know that someone else can have a false belief.

This kind of social intelligence was largely underestimated until the 1980s when Humphrey argued that social, rather than technical or practical, intelligence was what drove the increase in brain size among primates. With its emphasis on social manipulation, deceit and cunning, this became known as the "Machiavellian Hypothesis" after Niccolo Machiavelli, the devious political adviser of sixteenth-century Italian princes (Whiten and Byrne, 1997).

Clearly humans are adept at deceit, but what about other primates? Many researchers working in the wild have reported fascinating stories of primates apparently deceiving each other (Byrne and Whiten, 1988). Monkeys and baboons will distract the attention of others in order to snatch food, or watch until others are fighting to grab an opportunity to mate with a receptive female. Rhesus monkeys may withhold their normal food calls so as to eat without sharing what they find, especially if they are very hungry or have found highly prized food. Swiss ethologist Hans Kummer watched for some 20 minutes while a female hamadryas baboon gradually moved herself about two meters, while still sitting, until she was behind a rock where she began grooming a young male, behavior that would not be tolerated by the leading male. Had she worked out what the other baboon could and could not see?

KNOWING WHAT OTHERS CAN SEE OR KNOW

Some monkeys give alarm calls to warn others of approaching danger. Calling is risky and so it would be safest to call only when it could be useful. Yet many monkeys apparently call regardless of whether others have already seen the threat, or even whether there are others around. The primatologists Dorothy Cheney and Robert Seyfarth carried out an experiment with a Japanese macaque mother. When put on the opposite side of a barrier from her infant, the mother gave the same number of alarm calls to denote an approaching predator whether or not her infant could see it. From this, and many other studies, Cheney and Seyfarth (1990) concluded that monkeys do not have a theory of mind.

What about chimpanzees? A chimpanzee will follow another's gaze, as though trying to see what the other is looking at. But this need not imply that chimpanzees have a concept of seeing. They might have an evolved tendency to look where someone else is looking. To determine whether they have a concept of what another chimpanzee can see, careful experiments are needed.

Chimpanzees beg for food from humans and from each other. In an ingenious series of experiments Povinelli and his colleagues (1998) used this behavior to find out whether chimpanzees know what someone else can see. First they tested the chimpanzees to make sure that they begged for food from an experimenter out of their reach, and did not beg for inedible items. Then two experimenters offered them food; one experimenter had a blindfold over her mouth and the other had one over her eyes. The chimpanzees came into the lab, paused, and then begged for the food. But they were just as likely to gesture

to the person who could not see them as the one who could. This was true even when one experimenter had a bucket over her head. Sometimes, when their begging failed to elicit any food, they begged again, as though puzzled at getting no response.

One test seemed to work. When one person turned her back, the chimpanzees were less likely to gesture to her. However, when both experimenters sat with their backs to the apes and one looked back over her shoulder, the chimpanzees gestured randomly to both. They seemed oblivious to the fact that there is no point begging to someone who cannot see you. This is dramatically different from the behavior of human children who can understand this before they are three years old.

IMITATION

Humans are the consummate imitative generalists, says psychologist Andrew Meltzoff. We imitate each other spontaneously and easily, and even infants can imitate sounds, body postures and actions on objects performed by adults. By 14 months of age toddlers can delay imitation for a week or more, and they seem to know when they are being imitated by adults and take pleasure in it (Meltzoff, 1996). As adults we imitate far more than we may realize. We copy the body language of people we like and mirror their facial expression when engrossed in conversation. In this way imitation underlies the capacity for empathy. It is perhaps because imitation seems so easy that we tend to think of it as a trivial skill and assume that other animals can do it as easily as we can. They cannot.

Nineteenth-century scientists like George Romanes (1848-94) and Charles Darwin assumed that dogs and cats learned by imitation, and that apes could "ape," and they told many stories of actions that looked like imitation. In 1898 the psychologist Edward Lee Thorndike (1874-1949) defined imitation as "learning to do an act from seeing it done," which captures the notion that to imitate means to learn something new by copying someone else. A century later it is clear that this ability is far from trivial. The observing animal must not only watch the model but must remember what it has seen and then convert that into actions of its own—even though these actions may look totally different from its own perspective. Computationally this is a very complex task.

It is now clear that, with the exception of some birds and cetaceans imitating songs, there are very few species that can imitate. Even some of the classic cases turn out to be explicable in other ways. For example, in the 1920s in England, small birds, blue tits and coal tits, were found to be pecking the foil tops of milk bottles left on doorsteps. Ethologists studied the way the habit started in a few places and then spread contagiously across the country. But this turned out not to require imitation at all. It seems more likely that once one bird discovered the trick by trial and error, the jagged pecked tops attracted the attention of more birds who then learned, by individual learning, that the bottles contained cream.

Even the famous Japanese macaques who learned to wash sweet potatoes may not, in fact, have learned by imitation. Young macaques follow their mothers about, and it may be that once one female learned the new skill, others followed her into the water and then, by accident, dropped their sweet potatoes and learned the trick of getting clean and salty sweet potatoes for themselves. This would fit with the fact that the whole troop only learned very slowly. Young children, with their avid delight in imitation, would learn such a skill in a few minutes rather than years.

There is clear evidence of culture in chimpanzees, in that different groups of chimpanzees use different ways of processing food, fishing for termites with sticks, or using leaves to soak up water, but there is ongoing controversy over how much these cultural skills are learned by true imitation rather than by other kinds of social learning (Heyes and Galef, 1996; Tomasello, 1999).

Some whales and dolphins have local dialects in their songs, or signatures by which they recognize other individuals, and they copy songs back after hearing them (Reiss, 1998). There is also evidence that captive dolphins can imitate the actions of their human keepers, which is particularly interesting since their bodies are so very different. If imitation implies the capacity for empathy, then it is perhaps to these cetaceans that we should look for clues. Although we do not yet know how widespread imitation is, we must conclude that it is much rarer than most people realize, and is probably confined to only a few species.

This may be important for understanding human evolution because memes are defined as "that which is imitated." This means that only a species capable of copying another's behavior can have memes and sustain a culture based on memetic evolution. One theory is that imitation—not introspection, Machiavellian intelligence or the capacity for symbolic thought—set humans on a different evolutionary path from other great apes; it was memetic evolution that gave us big brains and language (Blackmore, 1999).

Imitation may be relevant to consciousness for another reason. If the concept of self is a memeplex, then it is the ability to imitate that gives humans a sense of self and hence self-consciousness.

LANGUAGE

The greatest divide of all is that we have language and other species do not. As Dennett suggests, "Perhaps the kind of mind you get when you add language to it is so different from the kind of mind you can have without language that calling them both minds is a mistake" (Dennett, 1996b: 17).

If there is no self-concept without language, then other animals are not self-conscious. If language makes human consciousness the way it is, then the consciousness of other creatures must be quite different from ours. If human consciousness is an illusion created by language, then other creatures might be free of that illusion. Alternatively you might argue that language makes little difference, that the heart of consciousness is about visual awareness, hearing, thinking, feeling emotions, and suffering. In that case the divide between us and other creatures would not be so wide.

Using true language means being able to put arbitrary symbols together in an unlimited number of ways using grammatical rules to convey different meanings. Children in every culture pick up the language around them with extraordinary speed and agility without being specifically taught and without being corrected for their mistakes. They have what is sometimes called a "language instinct" (Pinker, 1994).

Other animals certainly have complex methods of communication. For example, bees

can communicate detailed information about the direction and distance of a food source by dancing. Peacocks communicate how strong and beautiful they are by flashing their enormous tails. Vervet monkeys make several different alarm calls for different kinds of predators. But in all these cases the meaning of the signals is fixed and new meanings cannot be made by combining them.

Many attempts have been made to teach language to other animals, in particular the other great apes. Early attempts failed because other apes do not have the vocal apparatus needed to make the right sounds. Realizing this, in the 1960s, Alien and Beatrix Gardner tried teaching American Sign Language (ASL) to a young chimpanzee, Washoe, who lived with them and was treated like a human child. Washoe certainly learned many signs, but critics argued that she did not understand what the signs meant, that the experimenters were erroneously interpreting natural chimpanzee gestures as signs and that she was not really acquiring true language (Terrace, 1987; Pinker, 1994).

Subsequently other chimpanzees also learned ASL, as did gorillas and an orangutan, Chantek. Like Washoe, Chantek was fostered by humans from a young age and learned hundreds of signs, but he did not learn them as a child would, just by watching. His hands had to be molded into the right shapes. Now nearly 30 years old he understands much spoken English and seems to understand the crucial difference between such commands as "put the stick on the blanket" or "put the blanket on the stick," suggesting some understanding of grammar. Even so his own sentences tend to be short, repetitive and are mostly demands for food. Other apes have learned to communicate using magnetized plastic chips on a board or modified computer keyboards.

Despite the real achievements of these apes, there remain glaring differences between their use of language and that of human children. While children show a great delight in naming things and telling other people about them, the apes seem mostly to use signs as a way of getting what they want (Terrace, 1987). As Pinker puts it, "fundamentally, deep down, chimps just don't 'get it'" (Pinker, 1994: 340).

Apes are not the only animals to be taught human language. Alex, an African gray parrot, has learned to answer questions about the shape, color, number and material of objects shown to him, and unlike the apes, he can speak English words easily. Bottlenosed dolphins have been given interactive under-water keyboards with which they can ask for playthings and answer questions (Reiss, 1998). They can also imitate artificial sounds made by the keyboard and then use the sounds spontaneously. It seems possible that dolphins will prove better language learners than many apes have been, and even that they have their own underwater language. This speculation aside it seems that we humans are alone in our use of language.

THE SNAKE

So what is it like to be a snake? Imagine a snake feeding on mice (Sjolander, 1995). First it has to find a mouse and strike accurately, which it does by vision (some snakes use temperature sensors rather than sight). Once the mouse is dead the snake locates it by smell, not seeming to be able to see it anymore. Once it has found the mouse it has to locate the head in order to swallow it the right way. This it does by touch only, even though, in principle, it ought to be able to see or smell the head. In this way, in catching its prey, the snake's senses seem quite unconnected with each other. The snake can have

no notion of object constancy and no concept that there is one thing, a mouse, that it is catching and eating. There are just sights, and smells, and feels, and then nice food.

Is the snake conscious? You might answer "Yes," that any creature with senses lives in its own world of experiences, however simple or primitive those might be. You might say "No," the snake lacks some critical ability without which there is no consciousness, such as sensory integration greater intelligence, a self-concept, a theory of mind, memes or language.

If you wanted to be really skeptical, you might say that human consciousness is a grand illusion and there is nothing it is like to be us. In that case there would be no sense in asking, "What is it like to be a snake?"

FOR FURTHER READING

Gallup, G.G. (1998) Can animals empathize? Yes, *Scientific American*, 9(4), 67-76. Also at http://www.zoosemiotics.helsinki.fi/Can20Animals 20EmpathizeYES.doc

Pinker, S. (1994) *The Language Instinct*. New York/ Morrow. See pages 332-49.

Povinelli, DJ. (1998) Can animals empathize? Maybe not. *Scientific American*, 9(4)/ 67-76. Also at http://www.zoosemiotics.helsinki.fi/Can20Animals 20EmpathizeMAYBE20NOT.doc

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