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Through animal eyes: What behaviour tells us☆

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Abstract

To Charles Darwin, it was obvious that animals are sentient, so why should the idea not be now universally accepted? I review the difficulties and issues with animal sentience with a view to answering some of the critics. Sentience is 'the hard problem' and it is important we acknowledge the difficulties and do not claim too much for the evidence we have. Two sorts of evidence are examined: evidence from animal cognition and evidence from animal emotion, including the ways we now have of 'asking' animals what they want, behaviour, brain imaging and parallels with our own emotions.

Despite the problems, the study of animal sentience is one of the most important areas of biology. Although conclusive evidence *that* animals are sentient may elude us, evidence of *what they want* and how they see the world is increasingly open to us and it is important that it is used. There is a danger that well-meaning people define animal welfare in terms of what they think animals want or what pleases them. But if we take animal sentience seriously, we must ensure that the animal voice is heard.

Keywords: Animal; Welfare; Sentience; Consciousness; Cognition; Emotion

For Charles Darwin, it was obvious beyond any need for argument that non-human animals are sentient "... the lower animals, like man", he wrote in *The Descent of Man and Selection in Relation to Sex* (Darwin, 1871), "manifestly feel pleasure and pain, happiness and misery" (p. 39). "The fact that the lower animals are excited by the same emotions as ourselves is so well established that it will not be necessary to weary the reader by many details". In *The Expression of the Emotions in Man and Animals* (Darwin, 1872), he catalogues the different ways in which animals express a variety of emotions such as fear, anger and affection, stressing the evolutionary

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continuity between humans and other animals and taking it for granted that they not only behaved emotionally but experienced those emotions as well.

It is therefore entirely appropriate that Darwin's name should be associated with a conference on animal sentience. What is less obvious is why, with such impeccable endorsement of the idea that animals are sentient, there should still be doubt about something that is as obvious to many people now as it was to Darwin then. So what I shall attempt to do here its to identify some of the outstanding issues and areas of controversy—the reasons that people have argued, and continue to argue, against the idea of animal sentience. I want to cast a somewhat skeptical eye over some of the evidence that has been used, not with a view to saying that animals are not sentient (I firmly believe that many of them are) but because if we want to convince the skeptics, we need to face up to their criticisms and attempt to answer them. It does not advance the cause of animal sentience in any way if we are seen as not really understanding what the problems are, not realizing that there are difficulties with the evidence or being so gullible that we accept every anecdote or story about what an animal has done as evidence of a conscious understanding of the world.

So, in the belief that identifying problems and finding ways to answer them is a way to move forwards, I shall first emphasize why sentience is still a profound problem, despite the ease with which Darwin spoke about the mental experiences of animals. Then, I shall look at what animal behaviour can and also cannot tell us and end on a more positive note by arguing for the importance of taking animal sentience very seriously.

The first question to address is ''What is sentience and is it the same as consciousness?'' The answer to that is no, 'Consciousness' usually refers to a wide range of states in which there is an immediate awareness of thought, image or sensation. Although impossible to describe definitively, we use the term to cover a range of phenomena from the basic sensations of touch to worries about the future of the planet and our place in it. Even Darwin did not imagine newts worrying about whether their ponds were going to dry up in a few months time. He was much more concerned with immediate sensations and experiences. Block (1991) makes a useful distinction between *phenomenal* consciousness and *access* consciousness (Davies and Humphreys, 1993). By phenomenal consciousness is meant the basic experiences of seeing, hearing, feeling pain, etc., sometimes called qualia or 'raw feels'. Qualia are the basic units of experience—the hurt of a pain or the seeing of redness. Sentience is the ability to have these experiences, and it is the belief that animals possess at least this basic kind of consciousness that gives rise to out concerns for their welfare. Access consciousness, on the other hand, refers to more complex experiences of being able to think about or report on a mental state either in the present or in the past (memory). I shall take it that sentience is about phenomenal consciousness or qualia.

But why is even sentience – the most basic sort of consciousness – such a problem? Why does not everyone accept that animals are sentient when for Darwin it was so obvious that animals do experience not only touch and pain but emotions as well? T.H. Huxley–Darwin's bulldog, the same Huxley who defended Darwin's theory of Natural selection against the criticisms of Bishop Wilberforce put it as well as anyone: ''How it is that anything so remarkable as a state of consciousness comes about as a result of irritating nervous tissue is just as unaccountable as the appearance of Djin when Aladdin rubbed his lamp'' (1866). He was pointing out that the obvious fact that although we all know consciousness has got 'something' to do the brain, it remains a profound mystery how a grayish lump of nervous tissue can give rise to the rich world of our subjective experiences. It is so mysterious that it is almost like magic. We now know a great deal more about the brain that Huxley did but despite our knowledge of synapses and neural

connections, we are still mystified about where consciousness – even basic sentience – comes from. Understanding how to bridge this aspect of consciousness; the gap between brain and sentience has been called 'the hard problem' by Chalmers (1995) to distinguish it from (relatively) easy problems such as the difference between sleep and wakefulness. With consciousness, we have absolutely no idea how nerve cells give rise to subjective experiences. It is not just a hard problem. It is the hardest problem in the whole of biology. The difficulty it raises for us is that because we do not know how sentience arises from brain cells or how, if at all, brains with sentience work differently from brains without it, we have no real idea what to look for in other species in our search for animal sentience.

There are two sorts of evidence that people have proposed: evidence from animal cognition and evidence from the study of animal emotions.

1. Evidence from animal cognition

Many people believe that if we find out what cognitive abilities animals have – that is, what they can learn, what they can understand, what feats of reasoning and logic they are capable of – then we can find evidence of sentience. The argument here is that animals that show high intellectual achievements like us must in some sense be conscious like us. We now have a great deal of impressive evidence of the cognitive abilities of various species of animals (Byrne, 1995; Hauser, 2000; Griffin and Speck, 2004; Emery and Clayton, 2004) ranging from using tools (Weir et al., 2002) to recognizing themselves in mirrors (Gallup, 1970; Povinelli et al., 1997). The problem with using this as evidence for animal sentience is that we do not know which cognitive abilities point to sentience, particularly as many apparently 'clever' tasks can be accomplished by following relatively simple rules that could be easily programmed into a computer.

A very simple example to illustrate this is that of a rat trained to choose the odd one out from a row of three doors painted with either vertical or horizontal stripes. Two of the three doors are always locked, while one of them is unlocked and has a piece of food hidden behind it. The unlocked door can be in any position – on the left, on the right or in the middle – and it can have either vertical or horizontal stripes on it. The only way the rat can reliably find food is to look at all three doors and choose the one that is different from the other two. Many animals can easily learn to solve such oddity problems and it is tempting to assume that they have developed an abstract concept of 'odd-one-out', an apparently clever thing to be able to do. However, unless further tests are carried out to see whether they can also deal with other sorts of 'odd-one-out' tasks, it is entirely possible that all the rat does is to learn a series of simple rules about what to do in each of the six possible combinations of three vertically and horizontally striped doors (e.g. with V–V–H, choose right hand door; with H–V–V, choose middle door and so on). It would be very simple to make a computer do this as it would just have to remember a short list of what to do. But which cases would imply sentience? The ability to learn the task at all? The ability to solve it by memorizing rules? The ability to transfer to a variety of other oddity questions? The situation is made even more confusing by the fact that we ourselves might solve the problem one way (consciously realizing we had always to choose the one that was different) but that other animals might solve the same problem by memorizing rules.

So while the study of animal cognition is extremely important in telling us about what animals are capable of intellectually and is very influential in helping people decide how to treat them, it carries no guarantee of sentience. The 'hard problem' raises its head: because we do not know what to look for and we do not know what sentience does, we do not know which abilities are associated with being sentient and which are not. However, there are a growing number of

philosophers who are claiming that there is one kind of cognitive ability that *does* indicate consciousness, namely the ability to have Higher Order Thoughts or thoughts about thoughts (Rosenthal, 1993; Genarro, 2004). The claim here is that consciousness only arises when a thought is thought *about*, for example when we reflect on the fact that we have a thought about what we might do. Some philosophers have gone so far as to claim that since HOTs require language, organisms without language (which include human babies as well as non-human animals) are not conscious (Carruthers, 1992; but see Genarro, 2004). Dennett (1996) also argues that organisms capable of language use have minds that are quite different from those that are not, using language as the distinguishing feature.

Of course, HOT theorists also have to confront the same hard problem as the rest of us: they have no real evidence that consciousness only occurs in organisms that have language or only springs into existence when a thought is thought about. In any case, there is an even more compelling reason for not relying too heavily on particular cognitive abilities as indicators of sentience. This is that the states in animals that arouse the greatest ethical concern are those such as pain and fear seem to have very little to do with cognition. You do not need to be clever to feel pain or experience hunger. Perhaps the most compelling evidence for animal sentience will come from looking at animal emotions directly.

2. Evidence from the study of animal emotions

In ourselves, emotions can be positive (e.g. pleasure, contentment, relief) or negative (e.g. fear, pain, boredom, discomfort, anger) and are accompanied by a variety of behavioural and physiological signs such as increased heart rate and facial expressions. Darwin documented many of these in many species of animals including humans but the question that is still raised is whether other animals *experience* emotions or simply behave in an emotional fashion. The intuition that they feel as we do is immensely powerful because the similarities to ourselves seem so close but how close are they really?

We now have a variety of ways of 'asking' animals what they want and also what they want to avoid or get away from. We can offer them choices between different options, we can train them to press levers, peck keys or push doors to gain rewards of various sorts and so find out the conditions they like or dislike (Fraser and Matthews, 1997; Dawkins, 1998) by what they tell us they find rewarding or punishing. We can even find out *how much* they want to obtain or avoid something by weighting the doors so that they have to push heavier and heavier weights to get what they want or peck a key many times in a row to get a single reward (Dawkins, 1990; Mason et al., 2002). But is this evidence of sentience? Does it mean that they are feeling unpleasant emotions when they work to escape from something or avoid it in the future? Are they feeling pleasure when they show us they 'want' a piece of food or access to their companions? Choice itself is no guarantee of sentience since plants 'choose' to grow towards light and bacteria use gravity or magnetic fields to orient themselves. What sorts of choices do imply sentience?

Two kinds of studies have been influential in convincing many people that the emotional responses of other animals are sufficiently like ours that they too experience emotions. The first kind of study is the response of injured animals to pain-relieving or anxiety-relieving drugs. For example, Danbury et al. (2000) used this approach to ask whether broiler chickens that were lame and had difficulty walking actually feel pain. They offered chickens a choice of distinctively coloured foods, one of which contained Carprofen, a non-steroidal anti-inflammatory pain-killer, very similar to ones we might use when we are in pain. Chickens that were behaviourally lame learnt to choose the food containing the Carprofen, whereas healthy chickens that walked

normally did not. Furthermore, the lame birds starting walking much moré freely after they had eaten the drug. So lame broiler chickens choose to ingest a pain-killing drug very similar to one we choose to take when we are in pain. It is sufficiently important to them that they can actually learn which food gives them pain relief and the effect on their behaviour (better movement) is very similar to the effects on ourselves. For many people, this is sufficient evidence that broilers feel pain like us and do not just go through the motions, but it has to be pointed out that even this conclusion is not watertight. The real skeptic, such as the HOT theorist, could still argue that all that was happening was that pain fibres were being activated and the animal was programmed to find ways of reducing this activation.

The other very important line of research is comparing brain activity in humans and non-humans using the non-invasive brain measuring techniques such PET (positron emission tomography) scans. Denton et al. (1999) took PET scans of the brains of people they had deliberately made thirsty (with saline) or very unthirsty (by making them drink to satiation). They then asked everyone to rate their thirst verbally from a score of 0 = no thirst to 10 = the worst ever experienced. They found a very good correlation between how thirsty people said they were and the amount of activity that showed up in the brain scans. The activity was particularly noticeable in the parts of the brain known as the posterior cingulated area, the parahippocampus, thalamus and the amygdala. Moreover, these same structures are also found in reptiles, amphibia, birds and mammals. This looks like good evidence that these animals feel thirst like us, but again, there is an alternative explanation. This is that although non-human animals have many of the same brain structures that we do, they lack the crucial ones that give rise to the experience of thirst. We share with them the evolutionarily older parts of the brain, the parts concerned with detecting and correcting water deficits but, so this skeptical view goes, they lack the additional circuitry that brings thirst into consciousness. The conscious awareness of thirst is thus seen as a relatively late evolutionary development, reinforcing the basic unconscious mechanisms for dealing with water deficits that have existed for hundreds of millions of years and still persist in us.

This idea—of conscious and unconscious routes to the same end ('dual routes to action') is one that we do need to take seriously in the context of animal sentience because I suspect it is going to going to be discussed increasingly as we learn more about the human brain. We already know that many of the things we ourselves do can be done either consciously or unconsciously (Rolls, 1999). For example, we can either concentrate on our breathing, consciously deciding when to breathe in and when to breathe out, or do it all unconsciously and automatically. Many skills, such as playing the piano or driving a car, are acquired consciously at first but then become automatic and unconscious when we become good at them. Many of our emotional responses such as increased heart rate, are controlled by the autonomic nervous system without our being aware of them and even our judgements can be affected by stimuli of which we are not aware. Murphy and Zajonc (1993) asked non-Chinese speakers to say whether they though certain Chinese ideographs indicated a positive or a negative concept. Unknown to the subjects, they flashed an extremely brief (4 ms) picture in front of them and found that if the picture was of a happy face the subjects interpreted the ideogram as showing a positive concept but if the flashed picture was of an angry face, they interpreted the ideogram as negative. The extraordinary thing was that the people had no conscious awareness of having seen any faces at all even though their behaviour was clearly being influenced. The idea of 'unconscious emotions' (Rolls, 1999; Berridge and Winkielman, 2003) is of course an old one and goes back to Freud. We are many-layered beings and despite many similarities, it is not clear which of those layers we share with other species.

3. Taking animal sentience seriously

Sentience – whether in ourselves or in other species – is and remains the 'hard problem'—harder than any other problem in biology and harder than some of us perhaps would like to admit. It is hard because we do not know what it is, where it comes from, what it does or where to find it in other species. My aim has been to argue that the way forward is to acknowledge these problems and attempt to answer our critics. We should not pretend there are no problems or that we have all the answers. We should also accept that we have to make decisions about animal sentience that are not completely watertight and can be challenged. But seeing sentience as the 'hard problem' ensures that everyone else's views on animal sentience are equally leaky and equally open to challenge.

Each of us needs to make some sort of pragmatic decision about animal sentience—which animals we see as sentient and by virtue of what abilities or attributes. Some people will want to have criteria that exclude plants, bacteria and computers. Others will not be concerned about insects but will be about molluscs such as octopuses. Some will look for scientific evidence and believe it is at last beginning to reveal some important glimmerings of truth. Others will become impatient with the difficulties that I have outlined here and opt for a more intuitive approach.

My final point is addressed to anyone who takes animal sentience seriously and it is about two kinds of scientific evidence that can be brought to bear on the way we treat animals. As I have argued, the evidence *that* they are sentient is compelling but not conclusive. The 'hard problem' has seen to that. But if we believe that other species are sentient and have the ability to express what they want and need through their choices and behaviour, there is a much more pragmatic kind of scientific evidence we can employ. We now have a wide range of methods for 'asking' animals what they want and we should have the humility to use this evidence these and ask the animals rather than automatically assuming that we know from our human standpoint. Animals are not little furry or feathered humans looking at the world through human eyes and science can help us to understand what it is like to look through those different eyes. Real respect for animals will come when we see them as sentient beings in their own right, with their own views and opinions, their own likes and dislikes. The animal voice should be heard.

Uncited references

Carruthers (2000) and Rosenthal (2004).

References

Berridge, K.C., Winkielman, P., 2003. What is an unconscious emotion? (The case for unconscious "liking"). Cognition Emotion 17, 181–211.
Block, N., 1991. Evidence against epiphenomenalism. Behav. Brain Sci. 14, 670–672.
Byrne, R., 1995. The Thinking Ape. Oxford University Press.
Carruthers, P., 1992. The Animals Issue. CUP.
Carruthers, P., 2000. Phenomenal Consciousness. CUP.
Chalmers, D.J., 1995. The puzzle of conscious experience. Sci. Am. 62–68.
Danbury, T.C., Weeks, C.A., Chambers, J.P., et al., 2000. Self-selection of the analgesic drug carprofen by lame broiler chickens. Vet. Rec. 146 (11), 307.
Darwin, C., 1871. The Descent of Man and Selection in Relation to Sex. Princeton University Press (Reprinted 1981).
Darwin, C., 1872. The Expression of the Emotions in Animals and Man. Chicago University Press (Reprinted 1965).
Davies, M., Humphreys, G.W. (Eds.), 1993. Consciousness. Basil Blackwell, Oxford.
Dawkins, M.S., 1990. From an animal's point of view: motivation, fitness and animal welfare. Behav. Brain Sci. 13, 1–61.

Dawkins, M.S., 1998. Evolution and animal welfare. Q. Rev. Biol. 73, 305–328.
Dennett, D.C., 1996. Kinds of Minds: Towards an Understanding of Consciousness. Weidenfeld & Nicolson, London.
Denton, D., Shade, R., Zamarippa, F., Egan, G., Blair-West, J., McKinley, M., Lancaster, J., Fox, P., 1999. Neuroimaging of genesis and satiation of thirst and an interoceptor-driven theory of origins of primary thirst. PNAS 96, 5304–5309.
Emery, N.J., Clayton, N.S., 2004. The mentality of crows; convergent evolution of intelligence in corvids and apes. Science 306, 5703.
Fraser, D., Matthews, L.R., 1997. Preference and motivation testing. In: Appleby, M.C., Hughes, B.O. (Eds.), Animal Welfare. CAB International, Wallingford, pp. 159–173.
Gallup, G.G., 1970. Chimpanzees: self recognition. Science 167, 86–87.
Genarro, R.J., 2004. Higher-order thoughts, animal consciousness and misrepresentations: a reply to Carruthers and Levine. In: Gennaro, R.J. (Ed.), Higher-Order Theories of Consciousness. An Anthology. John Benjamins, Amsterdam and Philadelphia, pp. 45–66.
Griffin, D.R., Speck, G.B., 2004. New evidence of animal consciousness. Anim. Cognition 7, 5–18.
Hauser, M., 2000. Wild Minds. Penguin Press.
Mason, G.J., Cooper, J.J., Clareborough, C., 2002. Frustrations of fur-farmed mink. Nature 410, 35–36.
Murphy, S., Zajonc, R., 1993. Affect, cognition and awareness—affective priming with optimal and suboptimal stimulus exposures. J. Pers. Soc. Psychol. 64, 723–739.
Povinelli, D.J., Gallup Jr., G.G., Eddy, T.J., Bierschwale, D.T., Engstrom, M.C., Perilloux, H.K., Toxopeus, I.B., 1997. Chimpanzees recognize themselves in mirrors. Anim. Behav. 53, 1083–1088.
Rolls, E.T., 1999. The Brain and Emotion. Oxford University Press.
Rosenthal, D.M., 1993. In: Davies, Humphrey (Eds.), Thinking that One Thinks. pp. 197–223.
Rosenthal, D.M., 2004. Varieties of higher order thoughts. In: Gennaro, R.J. (Ed.), Higher-Order Theories of Consciousness. An Anthology. John Benjamins, Amsterdam and Philadelphia, pp. 17–44.
Weir, A.S., Chappell, J., Kacelnik, A., 2002. Shaping of hooks in New Caledonian crows. Science 297, 297–981.