

# ANIMAL CONSCIOUSNESS, COGNITION AND WELFARE

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## Abstract

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*The level of priority and resource given to the care of organisms is influenced by beliefs and understanding about their capacities for conscious awareness. Variation in attitudes to animal welfare around the world today is partly a reflection of this. Improved understanding of the range of phenomena of which animals may be conscious is likely to lead to greater global consensus about the importance of high standards of animal welfare. This is a matter of current relevance. In the global free market there is a danger that efforts in one country to raise standards for farm or laboratory animals will be compromised by competition from others which employ cheaper, less welfare-friendly systems. Scientific developments which inform us about animals' capacities for pleasant and unpleasant feelings will play an important role in the development of global agreement about animal welfare standards. Deciding which animals might have the capacity for consciousness, and thus for suffering, and of what they might be conscious, are fundamental issues which set boundaries to the ranges of species to be given basic or special forms of welfare protection. In practice, such lines have to be drawn and it is crucial that they are drawn in the right place. This is a difficult but essential task and society looks to scientists for guidance on the matter. There have been many developments in recent years in scientific approaches to the study of consciousness in animals which are pertinent to this debate.*

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**Keywords:** *animal welfare, cognition, consciousness*

## Introduction

In 1999 the European Council of Ministers adopted new legislation on the welfare of laying hens (European Council 1999). Amongst other things, this provides a timetable for the phasing out of conventional battery cages, which currently provide 450cm<sup>2</sup> per bird, and for their replacement with enriched cages providing each hen with 750cm<sup>2</sup> and access to a nest box, a perch and litter. These modest concessions to the perceived interests of the hen will inevitably lead to some increase in production costs. The industry has expressed the concern that, unless the import of eggs and egg products from outside the European Union is banned, they will not be able to compete with low cost eggs from producers in other countries that have no such welfare regulations. However, at present, World Trade Organisation (WTO) rules do not permit such import restrictions on welfare grounds (Eurogroup 1999). Time will tell what the outcome will be, but the risk that this new legislation may cause a paradoxical worsening of animal welfare by promoting the growth of less humane systems overseas will need to be watched

closely. In a global free market, there may be limits to the extent to which nations or economic communities can 'go it alone' in pushing up welfare standards.

The WTO may be persuaded of the case for permitting import bans on animal welfare grounds but there appear to be no grounds for confidence about this at present. In the long run, to avoid the risk of welfare standards of production animals being pushed down by ever-intensifying market forces, there will have to be better agreement between nations about what animal welfare is and its importance. The nations of the world have to move forward together on this. Are there signs that they are doing so? Whilst there have been some indications of a global awakening to the importance of animal welfare, there are still many regions where it is given a very low priority.

Much of the explanation for this lies in lack of resources – when human welfare is poor, one cannot expect higher standards for animals. But this is not the whole story. Variation in beliefs about the nature of animals, especially as to whether or not they are conscious and thus capable of suffering, and as to whether this is a matter of moral importance to humans, may also be a significant factor underlying variation in the priority given to, and the amount of effort put into, animal care.

Science has an impressive record for profoundly influencing beliefs. It is because of robust scientific demonstrations, that no-one has succeeded in falsifying, that few now believe the world is flat, few doubt the existence of micro-organisms, and relatively few (at least in some parts of the world) doubt that we share a common ancestry with other species. At earlier points in history, many things we take for granted now, in the light of improved understanding, would have seemed absurd. Can we expect that, in time, increasingly robust scientific evidence for consciousness in animals will facilitate development of a better consensus about the importance of animal welfare around the world?

Our laws provide some index of consensus views about the nature of animals. The UK's Animals (Scientific Procedures) Act 1986 (GB Parliament 1986) in prohibiting, except under licence, the use of vertebrates (and one invertebrate – the common octopus) in research which may harm them, whilst giving no such protection to invertebrates (other than the one exception), provides one perspective on where the boundary lies between those that have conscious feelings and those that do not. In deciding in 1997 that great apes should not be used for research (of a sort that may cause them harm) under any circumstances, the UK Government drew another line; this one between the apes and all other vertebrates. As far as we are aware, the rationale for this has not been detailed, but it appears to have been a reflection of the belief that these animals, because of their cognitive powers, may have greater capacities for suffering than all others. The newest of the world's pieces of animal welfare legislation, New Zealand's Animal Welfare Act 1999 (New Zealand Parliament 1999), the outcome of a prolonged drafting period, draws very similar lines. It gives special protection to the great apes and, but for a few exceptions (all octopus, squid, lobster and crab species), places the cut-off point for welfare protection at the vertebrate/invertebrate boundary.

Such lines have to be drawn or there is nothing to stop us dissipating all our good intentions for animal welfare on organisms that may have no more capacity to feel good, bad or indeed anything at all than the proverbial pop-up toaster, leaving us with insufficient resources to provide suitable care for the animals that do need it. Are the lines in the right place? Do we have sound criteria for placing them where we do? Society looks to scientists for guidance about this. The fundamental issues are: i) what is the taxonomic distribution of consciousness in the animal kingdom, ie what is the range of species that can be conscious of anything? and ii) what range

of phenomena, from 'simple' emotions through to second order thoughts (thoughts about thoughts) can these animals be conscious of?

The idea of the conference to which this paper was an introduction (the UFAW Symposium on Consciousness, Cognition and Animal Welfare, held at the Zoological Society of London's Meeting Rooms, 11–12 May 2000) was to present up-to-date perspectives from various fields that might yield insight into these difficult questions. There have been many developments in recent years in scientific approaches to the study of consciousness and animal cognition and it seemed timely to consider what implications these studies may have for our beliefs about the distribution of consciousness and capacity for suffering in the animal kingdom, and thus about the range of species for special moral concern and care.

Twenty years ago at the time of writing, in July 1980, UFAW held a workshop on self-awareness in domesticated animals. In a commentary, published in *Nature*, on discussions at this and at another workshop on animal minds held around that time, Professor John H Crook (1983) wrote:

Will it ever be possible to move from mere attribution of awareness to a more certain knowledge?  
... I predict that, just as ideas about hereditary factors preceded the discovery of genes, so our tentative analyses of consciousness will give rise to discoveries in the neurophysiological domain  
... If some gadgetry providing the capacity for self-reported awareness in our own species is discovered, then homologues or analogues of such mechanisms in other creatures will become powerful criteria for attributing experiences of perhaps specifiable types to them.

During the 20 years since these meetings, there has indeed been a great deal of discovery in the neurophysiological domain which perhaps constitutes significant steps to revealing the nature of the gadgetry for consciousness.

The aim of this paper was to introduce the May 2000 UFAW Symposium. First, we hazard a brief description of consciousness and a brief opinion about the link between cognitive powers and welfare. We then discuss various possible bottlenecks in the progress of developments for animal welfare, of which doubt about animal consciousness is the most fundamental. Lastly, we present a brief overview of the current diversity of scientific opinion about where in the animal kingdom the boundary between conscious and non-conscious organisms might lie.

### Consciousness

Endeavours for animal welfare rest on the belief that the animals whose welfare we are concerned about have the capacity for consciousness. We choose, here, to say that animals 'have the capacity for consciousness' rather than saying that they 'are conscious' because the latter term is often used simply to mean that animals are in an awake state, whereas our intention here is to discriminate between conscious beings – those which have at least some capacity for subjective awareness – and automata – those which do not. What consciousness is is hard to define, and we attempt no definition here, but we can say that at least part of what it allows is the subjective awareness of some sensory perceptions, emotions and thoughts. Without consciousness there is no subjective awareness and there are no feelings: pleasant, unpleasant or neutral. If we take the view, as many do, that animal welfare is largely about subjective feelings (see Dawkins [1990]), then the crucial issue is consciousness. Unless we believe it possible that an organism has consciousness of something – that it has, at the very least, the capacity for subjective awareness of pleasant or unpleasant sensory inputs – it would be as absurd to be concerned about its welfare as it would to be concerned about the welfare of a rock, a radish or a radio. There may be plenty of good reasons to tend and care for organisms (eg in

the interests of species conservation, out of respect for life or aesthetics, or to ensure normal function) and non-living things but, unless they have subjective feelings, concern for their welfare is not one of them.

Consciousness is often taken to have a wider meaning than the one we are interested in here – for example, the term may be linked in humans with aspects of creativity or comprehension. The aspect we are interested in here, that which relates to animal welfare, is ‘simply’ the capacity for the feelings of, or associated with, subjective awareness of phenomena. According to this view of consciousness, organisms either have it (albeit perhaps in a ‘simple’ form) or they do not. But there can be very great variation in the range of phenomena of which they may be conscious: from, say, the feelings from visual or tactile sensory inputs only, through to consciousness of thoughts about how life might be for an aunt next Tuesday afternoon.

Consciousness may have evolved early, providing simple animals with subjective awareness – feelings – of their sensory inputs, perhaps as a ‘stick and carrot’ system for rewarding or punishing the making of good or bad choices (Cabanac 1979). Then, as capacities evolved for an increasing range of perceptions, emotions and thoughts, it may have been commandeered by evolution to provide subjective awareness of these also. Alternatively, some have suggested (eg Kennedy [1993]; Bermond [1997]; Macphail [1998]) that it may have evolved much more recently, and perhaps through the evolution of the machinery that enables manipulation of concepts or symbols.

Research in a variety of fields may contribute to our understanding of animal consciousness. These include studies of the design, function and pathology of the brain (or other information processing organs), which may reveal the nature of the machinery or circuitry needed to support conscious states, studies of cognitive capacities aimed at discriminating conscious states, and studies in evolutionary ecology which may throw light on when and why consciousness evolved.

### **Cognition and animal welfare**

It also seemed appropriate to consider cognition (thinking) at this symposium, for two reasons. Firstly, some have argued that consciousness is a property that emerged from the evolution of advanced cognitive capacities, such as the capacity for thinking about thoughts or for semantic manipulation of symbols (eg Macphail [1998]; Rolls [1999]). Secondly, if we take as our starting assumption the idea that animals are conscious, then knowledge of their cognitive capacities – some insight into what they can think – is very important for understanding what kinds of situations may induce unpleasant feelings in them (Nicol 1996). An animal with very limited powers of cognition (perhaps none at all) may still be able to experience pain but it is unlikely to be troubled by what might happen tomorrow or to its offspring. With increasing cognitive capacities (providing these are conscious) comes a wider range of ways in which welfare can be compromised.

As with discussions about consciousness, there are pitfalls associated with variation in use of the term cognition to be aware of. Duncan and Petherick (1991) took an inclusive view:

‘Feeling’ is sensing and being aware of bodily events and ‘perceiving’ is detecting and interpreting signals that normally originate in external events. An animal is ‘aware of’ (or notices) a stimulus if it ‘feels’ it (for internal events) or ‘perceives’ it (for external events). These are the simplest cognitive processes.

This definition appears to include any conscious feeling as a form of cognitive process. Others do not include conscious awareness of pain as a cognitive process. Thus, Bekoff (1994) wrote:

An individual's ability to experience pain ... to suffer ... or to experience anxiety ... provide more compelling reasons to grant her moral status and to treat her with respect than does her ability to perform actions that demand cognitive explanations (that she has memories of past events, is aware of her surroundings, has the ability to think about things that are absent, or can have beliefs or desires and be able to make future plans).

There seems not to be a fundamental difference of stance between Duncan and Petherick and Bekoff here, but a difference in position about what type of mental processing can be described as cognitive. If one takes an inclusive view, that the generation of any conscious experience requires processing that can be termed cognitive, this leads to Duncan and Petherick's conclusion 'that welfare depends solely on the cognitive needs of the animals concerned'. If, on the other hand, one reserves the term cognitive processing for higher level information handling only (such as manipulation of concepts about time, space and self), and believes that cognitive processes are not required for conscious feelings of pain, then, by this definition, welfare is about more than just cognition.

It has often been argued that great apes, or some of them, are a special case for welfare concern because, it is ventured, like us but unlike other animals, they appear to have a 'theory of mind' – ie they act as if they know that other animals have mental states (Premack & Woodruff 1978; Byrne 1995) and may be 'creatures that can conceive of themselves' (Gallup 1998). Gallup suggested that self-conception has three components: senses of continuity, personal agency and identity, and that it allows animals to represent themselves in relation to past, present and future events and also to make inferences about comparable states of awareness in others. These capacities have obvious potential welfare implications. For example, animals that can think of themselves in particular situations in the future have the potential to suffer dread about what might happen, and animals that have a theory of mind may suffer from the knowledge that a sibling may be in pain. Gallup (1998) appeared to be making a stronger claim, however: 'it is our ability to conceive of ourselves in the first place that makes thinking and consciousness possible, not vice versa'. If this is correct, then behavioural techniques that could discriminate animals capable of 'conceiving of' themselves from others would also allow discrimination between those that are conscious and those that are not. The special case for great apes, and any other animals that may be able to conceive of themselves, is generally, however, more modest – namely that beings that have this capacity have the potential to suffer in ways not open to other animals.

Conscious feelings may be all about cognition, or cognition may be one of the types of processing, the capacity for which can affect the way animals feel. Either way, increasing knowledge of animal cognition is likely to influence our views about what to do for animal welfare.

### **How do beliefs about animal consciousness relate to standards of animal welfare?**

Standards of animal welfare can be limited by blocks at any of a series of bottlenecks. These bottlenecks (which, in reality, may be less independent and distinct than portrayed here) are outlined below.

**1. Disbelief or doubt that animals are sentient**

The UK Government has argued against whaling, not just because of concerns that whaling might threaten the viability of whale populations – this could be regulated – but because there is no humane way of killing whales. No methods have been devised that consistently render them instantly insensible until they die (Kestin 1995; Blackmore *et al* 1997). On the other hand, the use of line and hook to catch fish for sport is permitted. These two stances seem somewhat at odds with each other unless one believes that whales can suffer but fish cannot. This is indeed what some believe. For example, Michael LeChat, Snowdon Professor of Christian Ethics in Delaware, USA wrote in an essay on the defence of fishing (LeChat 1996):

Most important to my case, however, is that neurological evidence suggests that fish brains do not have structures comparable with the human neocortex ... Therefore it is unlikely that fish consciously 'experience' so-called 'pain' stimuli at all.

This introduction is in no way intended as a criticism of fishermen, fisherwomen or anyone else, but is given simply as an example of how beliefs about the capacities of animals for suffering can affect the way in which we treat them. One does not have to look far to find many other examples.

The view that we humans were divinely and separately created and were thus quite distinct from all other animals, and that only we had been created with the capacity for conscious feelings, has prevailed at various times and places through western history. The belief that other animals were non-conscious automata led to the callous use of animals and severe cruelty and neglect in earlier times (for reviews see, for example, Rollin [1989]; Ryder [2000]; Wise [2000]). Does it still? The prevailing view among the public and the scientific communities of many countries is that many 'higher' animals, at least, have the capacity to suffer, but opinions do still differ about this, and especially about exactly which taxa should be counted in, as is discussed more fully later. That disbelief or doubt that animals have the capacity for consciousness is corrosive to the concept of animal welfare has been emphasized by Carruthers (1989), who wrote of animals:

Since their experiences, including their pains, are nonconscious ones, their pains are of no immediate moral concern. Indeed, since all the mental states of brutes are nonconscious, their injuries are lacking even in indirect moral concern.

Regarding the implications of this he continued:

Much time and money is presently spent on alleviating the pain of brutes which ought properly to be directed towards human beings, and many are now campaigning to reduce the efficiency of modern farming methods because of the pain caused to the animals involved. If the arguments presented here have been sound, such activities are not only morally unsupportable but morally objectionable.

In a recent paper, Paul and Podbersec (2000) showed how beliefs about the level of sentience of dogs, cats and cows differed between veterinary students in the early years of their course and those in the final years. In the later years of their studies, the students rated these animals as having lower levels of sentience. It has been suggested that such variation in beliefs may underlie variation in approach to the use of analgesia in veterinary practice (Thornton & Main 2000).

**2. *Doubt that animal suffering is an important matter of concern for humans***

Perhaps more commonly, giving animal welfare a low priority is a reflection not of doubt or absolute conviction that animals can suffer, but of doubt that the matter is important enough to be a proper matter of concern for humans. We do not intend to discuss the point further here. However, it is worth pointing out that this stance is easier to adopt where it is believed that non-human animals have less capacity for suffering than humans and that, here again, attitudes may rest to a considerable extent on beliefs about what might be called, loosely, 'levels of sentience'. (The latter could be either variations in intensity of subjective awareness or in the range of phenomena of which there is subjective awareness).

**3. *Lack of knowledge about the needs of animals and how these can be met***

Thirdly, the standards to which animals are kept depend on the level of knowledge about their biological needs and how these can be met. The belief that animals can suffer and that they may do so intensely, albeit perhaps in a different way from humans, is crucial for animal welfare as it fosters good intentions. But good intentions are worthless unless backed up by knowledge of animals' needs and the ability to ensure that these are met, protected or restored. Neither this knowledge nor the ability to employ it effectively is a small, simple thing that is easy to come by. On the contrary, establishing the optimum requirements of animals, eg for housing and nutrition, is often difficult and time-consuming. Lack of knowledge is a common cause of poor welfare.

**4. *Lack of resources***

The next possible bottleneck is lack of resources. The needs of animals may be well understood but this does nothing for animal welfare if there are insufficient resources to provide for these needs. Resources, including time, money and expertise, are almost always limited, and conflicts with other competing demands can limit what is expended, in practice, on the care and welfare of animals whether they are kept for farming, research, conservation, companionship or other reasons.

**5. *Other factors***

For completeness, it is worth noting in passing that there are other factors which may compromise standards of animal welfare, even where the will to strive for high standards, the knowledge of how to achieve these, and the resources for success are present. These include a ragbag of problems that can arise from such human faults and frailties as forgetfulness, error and laziness.

To summarize, high standards of animal welfare depend upon the presence of a number of links in a chain of factors including knowledge of animals' needs and possession of the skill and other resources to be able to meet these. The most fundamental link in this chain is, however, the belief that animals have (or may have) the capacity for consciousness – the capacity for pleasant and/or unpleasant feelings. It is this which provides the compelling moral basis for caring for animals, with a special regard for their interests in a way that is not, for example, extended to plants, and beyond the minimum levels necessary to enable them to perform the function for which they are kept. So can science help make an increasingly robust case for consciousness in the animal kingdom?

**Diversity of opinion about animal consciousness**

The central tenet of animal welfare – that animals have conscious feelings and can suffer or feel pleasurable states – cannot be directly demonstrated. Feelings cannot be directly detected and

measured, they can only be inferred. Because of this difficulty, and notwithstanding the fact that we cannot be certain about consciousness in other humans either, opinion on the issue of whether animals can suffer, and on the importance of animal welfare, has swung this way and that through the centuries and differences remain in attitudes between nations and cultures.

The stories of the impact of the philosophy of René Descartes and, more recently, of the impact of behaviourism on belief in animal consciousness have been well told (eg Hume [1962]; Rollin [1989]; Griffin [1992]). Descartes (1596–1650), regarded by many as the founder of modern philosophy, is frequently portrayed as further bolstering the case, previously argued by various theologians and philosophers, that animals are insentient. He viewed the body as a kind of machine but took the human ability to think as evidence of our having a non-physical soul that resided in the body and controlled it in some way via, he thought, the pineal gland. Other animals, in contrast, lacking, as it seemed to him, the power of thought and thus rational souls, were simply machines (automata). It has been shown that Descartes was not as clear and dogmatic on this point as is often thought, but the view of animals as automata – insentient machines – gained considerable acceptance and this view led to a marked lack of restraint in the use of animals in research at times during subsequent centuries (Hume 1962).

The behaviourist tradition in animal behaviour has been blamed for helping to promote a mechanistic view of animals during the middle part of the last century. The only thing that can be measured, the argument ran, is the nature of responses made to particular stimuli. It was pointless therefore to speculate about what might go on in an animal's mind because it was impossible to gain any access to this. It has been suggested that, in promoting this view, there was a tendency to step beyond the position that if you cannot measure an animal's mind it is pointless speculating about it, and to conclude that there was no mind there at all. Such influences on beliefs about animal minds have received considerable attention (eg Hume [1962]; Midgley [1983]; Rollin [1989]; Singer [1990]; Griffin [1992]; Clark [1997]; Wise [2000]).

More recently, the idea that there can be no scientific approaches to the subject of consciousness has been challenged. Consciousness appears to be a real property and therefore: i) it must do something measurable (Humphrey 1987; Dawkins 1993); and ii) it must depend on some sort of neuronal machinery. From these premises a great deal of ingenuity and effort has been put into trying to find what consciousness does, what is going on in the brain when it is generating conscious states, and what organic or inorganic circuitry or machinery might be needed to support these states (eg see reviews by Dennett [1991]; Dawkins [1993]; Churchland [1996]; Baars [1997]; Weiskrantz [1997]; Macphail [1998]; Damasio [1999]; Rolls [1999]; Taylor [1999]; Edelman & Tonini [2000]).

The general consensus amongst the scientific community seems to be that the debate as to the existence of consciousness in non-human animals is largely over and the battle won. Nevertheless, a considerable spectrum of views remains about the position of the key boundary line between organisms that have consciousness and those that do not. In fact, there has been something of a resurgence in recent years of the hypothesis that consciousness is related to the capacity for language or at least to the possession of the neuronal machinery for manipulating concepts or symbols from which the capacity for language may have evolved (eg Macphail [1998]; Rolls [1999]). If correct, the range of species with the capacity for consciousness would be small. Although most of the proponents of this view have been very careful to emphasize that all animals should, in our interactions with them, be given the benefit of the doubt, the lack of agreement on the fundamental issue of the taxonomic range of animals that are conscious can have a corrosive effect on the development of measures for animal welfare. Examples of some recently advanced views on consciousness, its evolution and its likely taxonomic range, which illustrate a range of viewpoints, are given below.



The stance expressed by Smith and Boyd in their book *Lives in the Balance* (1991) is that, if it is rational to infer feelings in other human beings then 'it is no less rational to extend the generalisation to other animals'. And, as succinctly put by Rollin (1989):

Human pain machinery is virtually the same as that in other animals, and we know from experience that the ability to feel pain is essential to survival ... Feeling pain and the motivational influence of feeling are essential to the survival of the system and to suggest that the system is purely mechanical in animals but not man is therefore highly improbable.

Damasio (1999) is among those who support the view, implicit in the position taken by Smith and Boyd and by Rollin, that consciousness evolved relatively early. From his studies of the effects of various forms of brain injury in humans, he concluded that even extensive bilateral damage to the prefrontal cortex (the most recently-evolved structures) does not impair core consciousness in human patients, although extended consciousness (that which illuminates past and future, etc) is impaired. Core consciousness is that which he defines as being the simplest sort which 'provides the organism with a sense of self about one moment – now – and about one place – here' and which 'depends most critically on the activity of a restricted number of phylogenetically old brain structures, beginning in the brain stem and ending with the somatosensory and cingulate cortices'.

Among those who have taken the opposite view was the late Professor John S Kennedy who, in *The New Anthropomorphism* (1993), concluded from a review of ethological studies: 'altogether, then, it seems likely that consciousness, feelings, thoughts, purposes, etc. are unique to our species and unlikely that animals are conscious'. And: 'to sum up: although we cannot be certain that no animals are conscious, we can say that it is most unlikely that any of them are'.

From neuroanatomical and other considerations, Bermond (1997) in a chapter entitled *The Myth of Animal Suffering* reached conclusions that were almost but not quite so exclusive:

To experience suffering both a well-developed prefrontal cortex and a right neocortical hemisphere are necessary. Since the prefrontal cortex is phylogenetically the most recent structure, the analogy postulate leads to the conclusion that most animals are unable to experience suffering. On the basis of additional arguments, concerning characteristics and the fitness functions of both consciousness and emotional experience, it is concluded that emotional experiences of animals, and therefore suffering, may only be expected in anthropoid apes and possibly dolphins.

Similarly, Professor Joseph LeDoux in his book *The Emotional Brain* (1998) argued for caution in attributing consciousness to other animals. In view of the differences between the human and other brains in size and especially in cortical and prefrontal cortex development, LeDoux (1998) considered:

Clearly, the human brain is sufficiently different from the brains of other animals to give us reasons for being very cautious about attributing consciousness beyond our species. As a result, the arguments that allow us to say with some degree of confidence that other humans have conscious states do not allow us to insert consciousness into the mental life of most other animals.

More specifically, he proposed:

Consciousness is something that happened after the cortex expanded in mammals ... to the extent that other animals have the capacity to hold and manipulate information in a generalized mental

workspace, they probably also have the potential capacity to be conscious. This formulation allows the possibility that some other mammals, especially (but not exclusively) some other primates, are conscious.

There has been a great deal of interest in possible links between the evolution of language and consciousness. Macphail, in his book *The Evolution of Consciousness* (1998), presented a case for this and suggested that consciousness may have arisen as a by-product of language evolution:

The proposals that I have made in this chapter assume that consciousness is a consequence of the evolution of language – in particular, of the evolution of an ‘aboutness’ relationship that is the fundamental grammatical requirement for language. I consider, therefore, that benefits gained from the possession of consciousness were not necessarily instrumental in its evolution. The key to the evolution of consciousness lies in the evolution of language – and it is hardly necessary to point to the evolutionary advantage of being able to talk. But it is possible that one of the many advantages of language is precisely consciousness.

Macphail strongly emphasizes that his hypothesis should not alter the imperative to treat animals as if they are conscious, concluding:

I hope I have made it clear enough that – to put it mildly – doubt (strong doubt) [that consciousness exists in non-human animals] remains the only sensible attitude. Where there is doubt, the only conceivable path is to act as though an organism is conscious, and does feel. To propose that animals may not be conscious can in no way be used as justification for treating them as though they are not conscious. To do so would be irrational, not to say psychopathic.

Rolls’ (1999) theory of consciousness, which he advances with admirable caution, suggests that it may be dependent on evolutionarily newer parts of the brain, such as the language areas and parts of the prefrontal cortex and that ‘raw feels’ (conscious feelings) may arise as a consequence of having a system that can think about its own thoughts.

The explanation of emotional and motivational subjective feelings or qualia that this discussion has led towards is thus that they should be felt as conscious because they enter a specialized linguistic symbol-manipulation system that is part of a higher-order thought system that is capable of reflecting on and correcting its lower-order thoughts.

Rolls stresses that his views are preliminary and, like Macphail, he emphasizes that they should not be taken to have practical implications. In his words (Rolls 1999):

However ... one does not feel that there are straightforward criteria in this philosophical field of enquiry for knowing whether the suggested theory is correct; so it is likely that theories of consciousness will continue to undergo rapid development; and current theories should not be taken to have practical implications.

Although recently there has been, as some of the quotes above illustrate, a small crop of hypotheses that consciousness may not be very widespread in the animal kingdom, the prevalent view among scientists and society in general remains that a wide range of species have the capacity for suffering. As Baars (1997) argued:

Do animals show all the observable aspects of consciousness? The biological evidence points to a clear yes. Are they then likely to have the subjective side as well? Given the long and growing

list of similarities, the weight of evidence, it seems to me, is inexorably moving toward yes. ... Is there still controversy about animal consciousness? My sense is that the scientific community has now swung decisively in its favour.

But have we drawn the lines in the right place? The more the design of an animal's nervous system differs from that of our own, and especially if it differs in the direction of greater simplicity, the harder it is to judge whether the system is likely to support consciousness. As Breidbach (1999) wrote:

The performance of behavioural features and the internal organisation of the brain do not strictly correspond to each other: analogous behaviour can be produced by structurally extremely differently organised nervous tissues. ... A white shark and a larval dragonfly show common features of hunting behaviour; the computing tissue, however is organised in a completely different way.

Is Stevens (1997) right in suggesting that it might be preferable to use amphibians rather than higher vertebrates in pain research? Since, as he put it:

There is widespread agreement among various scientific organizations that an intact cortex is needed for the appreciation of pain. It is likely that amphibians, without either a cerebral or limbic cortex, have a vastly diminished potential for the appreciation of pain.

There is certainly room for doubt that this is a safe conclusion. It is hard to be certain that pain perception may not be handled by other parts of the brain and that it may not be just as good in amphibians as in higher animals.

The idea that a certain amount and complexity of neuronal wiring may be essential for consciousness seems plausible but how much and how complex? Eisemann *et al* (1984) considered that it might be a greater level of complexity than that found in insects. The 'relatively simple organisation' of the insect nervous system, they wrote, 'raises the question of whether any experience akin to human pain could be generated'. On the other hand, Fiorito (1986) suggested that consideration of the role of opioid peptides in regulation of nociception, analgesia and behavioural responses 'makes it possible to conclude that some pain system [and it is clear that the meaning here is pain of the subjective conscious kind] has appeared in invertebrates'.

## Conclusion

What can we conclude from the above glimpses of recent thinking on animal consciousness? First, advances are being made in a variety of fields that may illuminate our understanding of the subject. Far from being a taboo subject universally held to be beyond the realms of science, it is now receiving intense interest and study. It does not seem completely unreasonable to think that one day the kind of machinery or circuitry needed for consciousness will be understood very much more clearly than it is today. There remains a diversity of opinion about animal consciousness and because of the great relevance of this to animal welfare, there is, as argued by Crook (1983; see, *Introduction*), a need to try to identify this gadgetry.

Some take the view that it will forever be impossible to be certain about where the lines should be drawn between i) conscious and non-conscious species; and ii) species that can conceive of themselves and those that cannot, and that the exercise should not be attempted. But this is unhelpful: the lines have to be – and whether we like it or not are – drawn somewhere and

by somebody. Should the scientific community stay out of this debate and refer anyone who asks to seek an opinion from some other community instead? We think not, and consider that it is very important that scientists do what they can to provide guidance to society on these issues even if, at this stage, only to point out the great difficulties associated with these decisions, the reasons for the difficulties, and the need to give the benefit of the doubt to the widest possible circle of animals.

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