WHO NEEDS CONSCIOUSNESS?

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Thinking about animal consciousness is beset with many pitfalls, a few of which are: i) lack of clarity in words used, especially confusing 'cognition' with 'consciousness' and using words such as 'emotion' in both an objective sense (behaviour and physiology) and to imply consciousness; ii) failing to acknowledge sufficiently that different people use different versions of the argument from analogy with ourselves to infer consciousness in non-humans in animals; iii) assuming that choice and preference imply consciousness; iv) assuming that autonomic responses imply consciousness (a particular danger to those who look for physiological 'measures' of animal welfare); v) assuming that complexity of behaviour implies complexity of cognition and in turn consciousness; and vi) assuming that only cognitively complex organisms are conscious. Consciousness raises many questions of direct relevance to animal welfare that as yet have no answers, but finding possible answers may be made slightly easier if we avoid these obvious pitfalls.

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

Introduction

Consciousness is the greatest remaining mystery in biology. Other mysteries – such as how DNA molecules give rise to fully functional adult organisms – are still a puzzle, but they are beginning to yield to scientific enquiry. We may not know exactly how development occurs but we know the sorts of mechanisms that are involved and the sorts of answers that we can expect. With consciousness, however, we do not even know what kind of answer we are looking for. There is an 'explanatory gap' between what we know about and what we want to explain. Anatomical and physiological facts do not tell us what it *feels* like to be in pain (Young & Block 1998).

Almost in defiance of this, ethical concerns about the welfare of animals come from many people's deeply held conviction that many non-human animals consciously experience emotions such as fear, anxiety and boredom and that, subjectively, they experience many of the things that we do. So the study of animal welfare, by its very nature, not only touches on, but is forced to confront, the greatest remaining mystery in biology. Other scientists may get on with their scientific work and worry about consciousness in their spare time. Those of us who work on animal welfare are forced to grapple with it every day.

For this reason, a symposium on the connection between consciousness and welfare is particularly important and particularly apt at the present time when we are experiencing a complete revolution in our understanding of the way the brain works. But there are pitfalls and problems that beset anyone attempting to make the links between cognition, welfare and consciousness, and it is some of these that I would like to discuss. I do not intend this to be negative. Rather, I intend it to be like giving someone a map of a minefield so that they

know where the mines are and can avoid them, which increases their chances of a safe journey to the other side.

The title *Who needs consciousness?* is intended to convey my own starting point, which is that consciousness, mysterious though it is, is a Darwinian adaptation and evolved by natural selection (Popper 1978; Dawkins 1990; Allen & Bekoff 1997; Lindahl 1997). In other words, consciousness evolved because it gave some advantage to the organisms possessing it. For some reason, subjectively experiencing something made an animal better at surviving and reproducing than an organism that just 'went through the motions' and showed the behaviour without the accompanying subjective experiences.

Various Darwinian explanations of consciousness have been put forward, some of them quite general, such as conferring an ability to think flexibly in a wide range of novel situations (eg Griffin [1976, 1992]; Baars [1988]), others more specifically pointing to a particular feature of the environment such as the complexity of the social environment with its need to maintain reciprocal altruism and to detect cheats (Humphrey 1976; Byrne & Whiten 1988). But, as I would now like to argue, many claims to have found an adaptive explanation for consciousness fall foul of one or other of six pitfalls.

Pitfall 1: definitions and the tyranny of language

The first problem that surrounds any discussion of consciousness is, of course, that of definition. While I would be very reluctant to come up with a complete definition of consciousness, I do put in a plea to everyone to make a clear distinction between *cognition* and *consciousness*.

Cognition refers to the processes by which animals perceive, process and store information. To say that an animal has a cognitive representation implies that it has an internal representation of the world that can be used flexibly and to cope with novel situations. It is important for the sake of completeness to also say something about what would not count as 'cognitive'. Non-cognitive processes would include innate, built-in responses such as the tropic responses of plants to light or woodlice to moisture. Non-cognitive processes also include learnt habits that, once learnt, are then irreversible.

Consciousness, on the other hand, refers to a wide range of states in which there is an immediate awareness of thought, memory or sensation (Griffin 1976). The important point about these working definitions is that there is no necessary connection between cognition and consciousness. Although many people may believe that there is in practice a very intimate connection, they are logically distinct. A computer could be modelling complex cognitive processes without our concluding that it was conscious. And an organism could be feeling a violent sensation of pain without doing anything cognitive.

It is thus important to keep consciousness and cognition logically distinct in our minds and in general make it very clear at any point in the discussion whether we are using a term strictly to describe what we can observe – that is, behaviour and physiology – or whether we are using it to imply consciousness in addition.

Yet another difficult term: *animal welfare*. Here it is useful to distinguish between physical health and psychological health (Dawkins 1999) where 'psychological health' refers to positive emotions and 'suffering' refers to negative emotions such as fear, boredom, frustration, etc that are prolonged or severe (Dawkins 1990). To help us to avoid some of the confusions caused by the tyranny of our own language, I would like to introduce the concept of a river with a series of shaky bridges or stepping stones over it.

The river represents the explanatory gap. On the left hand bank, we are on firm scientific ground. The questions we ask are about the normal stuff of science: about physiological measurements of what is going on inside animal bodies and behavioural evidence of what they do. There may be arguments about evidence but these are the normal constructive arguments about scientific procedure – about whether the right controls have been done or whether the sample sizes were large enough and so on. But, to get to the right hand side, we have to use a different kind of argument and cross over by an extremely shaky bridge – expressing our belief that such and such a behaviour or physiological change entitles us to assume that the organism is conscious without being able to test it in any definitive way. We leave the firm ground of scientific fact on the left bank for the unknown territory of consciousness on the right.

This idea of a river with a bridge illustrates how the language we use can confuse the way we think. Take a word like 'emotion', which will probably crop up a great deal in our subsequent discussions. 'Emotion' can either be used in a left bank (purely scientific) sense to describe objectively observable physiological and behavioural phenomena or it can be used in its everyday sense to imply the conscious awareness that we know accompanies emotions in ourselves. The danger lies in the fact that we slip between the two sorts of meaning without realizing what we have done. Thus, we can describe the 'emotional' state of 'fear' in an animal in terms of its situation (predator attack), physiological response (rise in heart rate, adrenaline, etc) and behaviour (crouching, freezing, squawking, etc) and insist we have given it an objective scientific meaning based on what can be observed. But by then describing this syndrome as 'fear' we mislead both ourselves and others into thinking we have gained insight into the minds of the animals showing these symptoms. By using words that are commonly used to describe human conscious experiences, we jump from the strictly observable to unjustifiable inferences about the minds of other animals often without realizing we have done so (Kennedy 1992).

Pitfall 2: thinking that there is only one 'argument from analogy'

While the first pitfall is getting confused about when we are and are not talking about conscious experiences, the second is failing to realize that there is not just one way people believe they can cross the river, but many.

The idea that it is possible to infer something about an entity or a relationship that is not understood from its similarities to something else that is already understood goes back to Plato and was used frequently in the Middle Ages in Christian theology, for example, to infer the existence of God. One of most famous examples (used by R Dawkins [1986]) is that of William Paley who argued that if someone was walking across a heath and came across a watch, they would conclude that an object of such complexity must have had a maker. By analogy, they would also conclude that objects of even greater complexity such as trees and birds must also have had a maker. In the study of animal consciousness, comparable reasoning has been used extensively to infer conscious awareness in other species on the grounds that because they exhibit similarities to us in certain key respects, they must also be similar to us in ways that we cannot directly test. For example, we scream and struggle when we experience pain and we observe other animals squealing and struggling under conditions that we would find painful. By analogy, we infer that they too feel pain. Now, while the use of analogy is very important in the study of animal consciousness, it is equally important to recognize that different people place their weight on different kinds of analogies. Or, to put it a different way, there are a lot of different bridges across the river.

Some people, for example, would draw an analogy between ourselves and other people based on simple approach and avoidance or expression of preference. If humans report that something feels pleasant or unpleasant and show the same physiological and behavioural responses as other species, then, by analogy, this implies that the other species are experiencing pleasure or displeasure (eg Cabanac [1992]). Other people would put more emphasis on cognitive abilities (eg Griffin [1992]). For others, similarities of physiology or brain structure carry more weight and for yet others language is the key to consciousness (eg Rosenthal [1993]).

One of the reasons why different people cross the river at different points may be that they are talking about different kinds of consciousness. There are different ways of making distinctions, such as Edelman's (1992) distinction between primary consciousness and higher-order consciousness, but a quite widely used distinction comes from Block (1991):
Phenomenal consciousness: the experience of seeing, hearing, feeling pain, etc;
Access consciousness: the experience of being able to think about or report on a mental state either in the present or in the past (memory); and
Monitoring and self-consciousness: the experience of thinking about one's own actions and their effects and if necessary modifying them.

In animal welfare, we are very much concerned with phenomenal consciousness – ie with the extent to which animals feel pain or fear and subjectively experience immediate sensations or the impact of remembered sensations, for which no language may be necessary. Many philosophers, on the other hand, are much more concerned with higher level cognitive processes – thinking about thoughts – for which language may be essential (Rosenthal 1993). This may be one reason why there is disagreement as to which bridge is the most valid.

So, considering Pitfalls 1 and 2 together, our subsequent discussions will be clearer and more constructive if we try to avoid both of them and are clear, at any one point in the argument, both about which side of the river we claim to be on (the scientific left bank or the still mysterious right bank of consciousness) and also, if we have crossed over from one to the other, which bridge we used to get there.

I would now like to turn to three further pitfalls associated with the bridges themselves and show that many of the arguments from analogy that have been used are actually fraught with far more difficulties than may have been appreciated.

Pitfall 3: assuming that 'choice' and 'preference' imply consciousness

The standard objections to the use of choice tests in animal welfare have been discussed many times before (Duncan & Dawkins 1983; Fraser & Matthews 1997). Many of them (such as that previous experience can affect what an animal chooses, or that an animal's preference may be influenced by the exact way it is tested) also apply to almost all other measures of welfare, so what I want to discuss here is a much deeper pitfall into which I, amongst others, have certainly fallen in the past. I want then to show that there is a way of avoiding it through a recent theory of the biological basis of emotion. Michel Cabanac (1992) took the line that it was possible to draw an analogy between reported conscious experiences in humans and those that might exist in other species through similar choice and preference behaviour. For example, if both rats and humans are deprived of water, then their behaviour is quite similar – both will drink when given the opportunity and then gradually drink less, both will work for water when water deprived and so on. However, we can of course ask the humans what they are experiencing and get them to rate how pleasurable the

taste of water is. A person deprived of water will report that the taste of water is initially extremely pleasurable but becomes less so as they becomes satiated. Cabanac (1992, 1996) argued that because the behaviour of rats and humans is so similar one can argue, by analogy, that their conscious experiences are similar too. This argument is extremely persuasive and the idea that what animals will choose gives insight into what they consciously experience has been widely used (Fraser & Matthews 1997).

The problem with using choice as a bridge into consciousness is that it is not just animals that make choices. Plants do as well. And in our discussions of which animals are conscious, we may disagree about invertebrates, but I think most of us would agree that plants are not conscious and therefore we should avoid using analogical reasoning that would force us to include them. Unfortunately, plants can have some pretty complex choice and decision-making behaviour, for example, the behaviour of the parasitic plant, dodder (*Cuscuta europaea*).

Dodder is a rootless plant that cannot photosynthesize for itself. It gets its nutrition from other species, such as hawthorn (*Crataegus monogyna*) by coiling round their stems and then penetrating the host's tissue with a series of little pegs. The extraordinary thing is that the dodder plants appear to choose hosts of high nutritional value over less nutritious ones because if they encounter a host of low nutritional status, they simply reject it by growing to another plant. Kelly (1992) demonstrated this remarkable choice mechanism by tying the transplanted tips of dodder plants to hawthorn bushes that were either of high or of low nutritional status. She found that these transplanted growing tips of dodder were more likely to coil on ('accept') host plants of high nutritional status and grow away from ('reject') hosts of poor quality. This acceptance/rejection took place before any food had been taken from the host. This means that the parasite was evaluating the host's resource value and taking appropriate action before it had expended the energy of actually penetrating the host's tissues.

It is actually quite difficult to describe this behaviour of dodder without using mind-laden language such as decision-making, evaluation, choice and so on because, apart from the longer time scale, the plant's behaviour is so similar to that of a foraging bird moving on from one patch to another. This illustrates the pitfall of using choice to draw an analogy between ourselves and other species unless we are content to cross the river and find most of the vegetable kingdom demanding to be let across as well.

Fortunately, there is a way out of this, which is to modify our use of the choice analogy so that it is more discriminating and concentrates on certain mechanisms of choice. Edmund Rolls (1999) has recently made an important distinction between different mechanisms of choice behaviour in animals, some of which are, in my view, much more likely to be associated with conscious experiences than others. He distinguishes between two major categories of choice mechanisms: fixed innate responses such as the photo-tactic response in plants 'choosing' to grow towards the light on the one hand; and choices that involve learning to perform arbitrary actions in order to obtain goals on the other. He argues that because taxes are innate and can be hard-wired by natural selection, there is no need for any dimensions of pleasure or suffering to be associated with the approach or avoidance that such mechanisms can give rise to. On the other hand, natural selection cannot tell the animal that a completely arbitrary response, such as pushing a lever up or down or approaching one man-made pattern rather than another, is either good or bad for it. The animal has to learn and then it may even have to unlearn and do the opposite. All that natural selection can do is to build in a tendency to repeat certain actions because they feel 'good' (are positively reinforcing) and this feeling good or pleasure then guides the subsequent behaviour of the

organism (Rolls 1999). Rolls therefore argues that emotions (by which he means a strictly left bank or behavioural/physiological definition) only evolved when organisms evolved the capacity for reinforcement learning. He does not say that all animals that have emotions consciously experience emotions (in fact he argues that only with language can we really infer consciousness; Rolls 1999) but it seems to me that his distinction does allow us to continue to emphasize the importance of choice while still keeping the vegetable hordes at bay. To draw an analogy between ourselves and other species on the basis of shared experience of positive and negative reinforcers would seem to me to be slightly more convincing than to base it on all examples of choice regardless of mechanism.

Pitfall 4: assuming that autonomic responses imply consciousness

People who work on animal welfare are implicitly interested in the conscious states of the animals they work with. It is generally agreed amongst scientists who work on welfare that it is important to include physiological measures of welfare, but when we ask what these physiological measures are it turns out that they are almost exclusively autonomic measures: changes in heart rate, body temperature, or hormone levels. So there is an underlying assumption that it is possible to infer something about the conscious state of the animal from measuring autonomic activity.

However, lessons should be learnt from the literature on human emotion where we at least have the advantage of being able to ask people what they are feeling. In humans, three systems are recognized as underlying emotions (eg Oatley & Jenkins [1996]). These are:

i) the cognitive/verbal: people can report on what they are feeling and indeed this is one of the main ways we have of knowing what other people are feeling;
ii) the autonomic: these include changes in heart rate, temperature and hormone levels when we experience emotions; and
iii) the behavioural/expressive: different emotions give rise to different behaviour and different facial expressions.

Although of course we cannot use i) for non-human species since they cannot tell us what they are feeling, we might be tempted to use similarities in ii) and iii) to tell us, by analogy, what emotions they are experiencing. Unfortunately, there are immediate problems with this since the three emotional systems do not necessarily correlate with each other, even in humans. Sometimes, for example, strong subjective emotions occur with no obvious autonomic changes, as when someone experiences a rapid switch from excitement to fear on a roller coaster. This does not mean that the change in emotional experience has no physiological basis. It just means that it is probably due to a subtle change in brain state rather than the obvious autonomic changes that most physiological methods pick up. At other times, the emotion we experience and report corresponds to several different kinds of autonomic change, or one kind of autonomic change such as heart rate can be shown to accompany very different emotions (Oatley & Jenkins 1996).

This lack of correlation is not, in fact, very surprising. Many of the physiological changes that occur in our bodies when we feel different emotions are related to the actions we are likely to take, such as running. As running occurs when we are afraid and are running away, or excited and running towards (chasing) something we want, the same physiological preparations are appropriate for both situations and consequently for a range of emotions. What it does mean is that, in looking for physiological measures of welfare, we should be extremely cautious about what we can conclude if all we have available are these autonomic measures because these are so unreliably related to what we are really interested in. Let us

look for consciousness not in the heart or the bloodstream or the rectum but in the brain where it surely belongs.

Pitfall 5: assuming that complexity of behaviour implies cognition

One of the commonest arguments from analogy is to use examples of cognitive complexity in non-human animals and to argue that, because we consciously work out how to do things in novel situations, if non-human animals show comparable abilities, they must be conscious too. This view has been put forward by Donald Griffin (1992) who has done a great service by collecting together information about the cognitive abilities of animals and did more than anyone else to break the taboos of 'behaviorism' and make it respectable to talk about animal consciousness. However, recent developments in other fields, particularly that of robotics, suggest that we look more closely at some of the claims for cognitive complexity in animals.

The importance of robotics to animal cognition is that in trying to make a machine perform a task, we may discover that a very simple mechanism could accomplish what we had previously thought could only be done by a high degree of cognitive complexity. To illustrate this point, I am going to take one particular theory of the evolution of consciousness, one that has been widely cited in ethology and psychology as giving a Darwinian explanation of why consciousness arose, and show that it does not stand up to scrutiny in the light of recent evidence.

The theory of consciousness I want to discuss is the Social Intellect theory that is attributed to various people but is widely associated with Nick Humphrey (1976). Humphrey's idea was that the physical environment of most animals offers little in the way of intellectual challenges but that the social environment, at least of some primates, demands conscious evaluation of available options. For example, reciprocal altruism seemed to require keeping tabs on a large number of individuals, and detecting cheats seemed to demand the ability to put oneself in another's place and work out what they might do next. 'Deception' seemed to point to understanding the mind of another individual, which in turn implied that you had a mind of your own.

In this context, the work of Charlotte Hemelrijk (1997) is particularly illuminating. Hemelrijk initially worked on the behaviour of chimpanzees (*Pan troglodytes*) and then she moved into the completely different field of computer modelling. What she has done is to take a series of behavioural phenomena that people had previously assumed were due to complex cognitive processes and then modelled them and showed that similar behaviour could be produced by entities following extremely simple non-cognitive rules. As an example, I'd like to take her work on reciprocity and support.

In chimpanzees living in captive groups, de Waal and Luttrell (1988) had described what they called support. In a fight between A and B, C attacks A. The behaviour by C is interpreted as 'opposition' against A and 'support' for B. As a result of C's intervention, B wins the fight. On a later occasion – during a fight between A and C for example – B attacks A so that C wins. B is then said to be reciprocating support (de Waal & Luttrell 1988). Of course, it is very easy to describe this behaviour as evidence of complex cognition and extremely tempting to imply that B had consciously worked out that he owed C a favour and it would stand him in good stead in the future if he did respond.

Hemelrijk, however, showed that it was possible to obtain similar results by modelling very simple agents following extremely simple rules. Her models use 'virtual robots' that is, they are not real robots but precisely specified entities in a computer. She showed that

apparent reciprocation could be the result of manipulating just two variables in these virtual robots.

Imagine a series of entities or agents that are moving round fighting with one another. Each agent has a postulated variable DOM, which is its capacity to win an interaction and which increases when it wins a fight. After each fight, the DOM of each agent is adjusted and the turning angle of the path that it is following also changes. Agents that have just won a fight turn more sharply and so stay around the place where they have just won the fight. Agents that have just lost a fight straighten their paths and so are more likely to head off and leave the place where they have just had a fight. After a while, this will result in the fight winners or most dominant individuals remaining in one place and the fight losers or subordinates moving outwards to the periphery. This is, of course, a common pattern in primate groups.

Now consider what happens in the interactions between the fight winners or dominants who are all moving around in the vicinity of each other and attacking each other. By chance, they will sometimes attack an individual that is already engaged in a fight resulting in a win for its opponent. This will look like 'support' for the opponent and as this opponent is more likely to be another dominant than a subordinate, there is a high chance that the 'support' will be given to an individual that has given support in the past. Support will apparently be reciprocated as a simple result of the spatial distribution of the agents which is in turn the result of a simple rule of staying when things are going well and leaving when they are going badly. There is no complex cognition, no need even for memory of the behaviour of other individuals and certainly no need for consciously working out who to support and who not to support.

Another area of social interaction that has often been cited as needing highly developed cognitive abilities and the ability to deal with novel situations that might point to a conscious working out of what to do next is that of deception. Deception has been particularly studied in primates (Byrne & Whiten 1988).

Anecdotes widely cited in support of deliberate deception in primates include 'looking into the distance' (as if something dangerous had been spotted) by a young male baboon about to be attacked by an older male (Byrne & Whiten 1988), a female baboon hiding from a dominant male behind a rock to groom a subordinate male (Kummer 1967) and an apparent sequence of deception and counterdeception in a group of captive chimpanzees (Menzel 1974). In Menzel's study, one female, Belle, was shown where food was hidden before the rest of her group were let out into an enclosure. With most of the group there was no problem as they shared food showed them by Belle. But one particular male, Rock, persistently took food away from her. Belle then stopped taking food directly but then went to where she knew food was and sat on it rather than trying to eat it. Rock then started pushing her off and looking for the food where she had been sitting. Belle's response to this was to sit not on the food, but near it. When Rock got wise to this and searched for the food in the vicinity of where she sat down she started to move away from the place where the food was hidden. Rock initially followed her but then realized that this was not a good way to find food after all. Various people, including Dawkins (1993), have used this an example of the kind of situation in which consciousness might be useful: working out in a series of novel situations how to deceive and how to see through another's deception. In using this argument, I have definitely fallen into Pitfall 5 as a very similar experiment on sooty mangabeys (*Cercocebus torquatus torquatus*) shows only too clearly.

Coussi-Korbel (1994) had a somewhat similar set-up to Menzel's in which one subordinate individual, in this case called Rapide, was shown where food was hidden before a test and a dominant individual, known as Boss, either did or did not know. The enclosure was set up in such a way that food was always hidden in two out of a large number of different locations. When both individuals knew where food was, Rapide went directly to one and Boss to the other. But when only Rapide knew, he did not go directly to either food source (if he did, Boss followed him and immediately took the food from him so that he got nothing). Instead, he employed a variety of tactics such as walking past the place where the food was hidden, moving in the opposite direction until Boss's attention was engaged elsewhere, whereupon he immediately went to the food.

If this was all we knew about the behaviour, it would be easy to conclude that Rapide was engaged in deception, consciously working out the best tactics to employ depending on what information he thought Boss had about the situation. But Coussi-Korbel and her colleagues also provide crucial evidence on the development of Rapide's behaviour which suggests that, far from working out what to do, Rapide simply used trial and error learning based on whether or not Boss was following him. They report that the first instance of Boss being 'deceived' by Rapide's behaviour appears to have been a coincidence. On the first trial, Rapide ran away from Boss, which resulted in his accidentally leading Boss away from the food. It took him several more trials to learn that going in the opposite direction from the food when Boss was closely following behind him allowed him to eventually take the food, with some delay, but without being attacked. Rapide was clever enough to learn the connection between moving in certain directions and not getting beaten up. But a capacity for rapid trial and error learning after something has happened is not the same as consciously working out before even trying anything what to do in a novel situation. Without much more stringent controls, therefore, such examples should not even be used to infer any degree of cognitive complexity, let alone consciousness.

Pitfall 6: assuming that only cognitively complex organisms are conscious

The last pitfall I want to discuss is in many ways the opposite of the five I have so far discussed. Just as in statistics, where there are both Type I and Type II errors – falsely concluding that there is a difference when there is not and falsely concluding there is no difference when there is – so too in the study of animal consciousness there are two types of error. There are errors, some of which I have discussed, of concluding that non-human animals are conscious on the basis of evidence that does not allow such a conclusion, but there are also errors of concluding that animals are not conscious when they are. If one is concerned about animal welfare, there are dangers in being too sceptical and too much of a wet blanket about every kind of evidence that is produced.

It has always been something of a mystery to me why so many people assume that consciousness is associated with cognition. It seems to be almost axiomatic that if we want to know which animals are most likely to be conscious, we have to find out which animals have the most highly developed cognitive abilities. Many theories of the evolution of consciousness are tied to the ability to deal with novel situations, solve problems and think your way out of difficult situations. The very title of this conference might be taken to imply that through cognition we reach consciousness. But why should we make this assumption? After all, you don't need to be very clever to feel pain or hunger or fear. Negative emotions that we refer to as suffering are not particularly intellectual. Indeed, we often have difficulty trying to subdue our emotions with our more rational thoughts. Is it therefore not possible that the evolutionary origins of consciousness are far older than those of more refined

cognitive abilities? Is it possible that the capacity to solve novel problems and think your way out of a tight corner by planning ahead appeared on the Earth only quite recently and that long, long ago there was pain that hurt and fear that terrified and pleasure that was joyful?

The assumption that consciousness is only associated with a high level of cognitive ability is potentially a dangerous one because it leads people to minimize the importance of possible conscious experiences in animals that are not renowned for their intellectual abilities. I work on chickens and a frequent response by people is 'Well, they are not very clever, are they?' as if this justified not taking as much care with their welfare as with animals such as whales and dolphins that are perceived as intellectually on a higher level. But what does this mean? That less clever animals feel pain less severely? Or merely that they might feel it with the same intensity but morally it doesn't matter so much? There are, in other words, great dangers in tying conscious experiences to cognition because we may thereby ignore conscious experience of negative emotions in a whole range of other species.

In conclusion, I have not answered or even attempted to answer my own question 'Who needs consciousness?' for the simple reason that I don't think that any convincing answers have come up yet. All anyone can do is state that at some point they are prepared to make a leap of analogy and say that they believe that such and such a kind of evidence enables them to infer consciousness. If we do cross over onto the still mysterious land of consciousness, there are pitfalls every step of the way and every analogical bridge is wobbly. I have argued that we can make this transition slightly easier if we are careful about definition, careful about whether we are talking about observable scientific data or have made assumptions about conscious experiences and, above all, clear about the basis upon which we have made our crossing from the observable world of behaviour and physiology to the unobservable private world of consciousness. But I have also argued that if we do not venture across at all and do not make any assumptions about consciousness in other species because the evidence is not completely firm, we may also be in error. We may have overlooked consciousness all around us.

Animal welfare implications

Much concern for animal welfare rests on the assumption that at least some animals consciously experience pain and that they suffer through the conscious experience of negative emotions such as fear. While this is a reasonable assumption to make, and forms the basis of many people's ethical attitude to animals, it is important to be clear where observable facts about behaviour and physiology end and assumptions about subjective experiences in other species begin. However plausible the assumption that other species have conscious experiences somewhat like ours is, that assumption cannot be tested in the same way that we can test theories about behaviour, hormones or brain activity. One of the major problems for animal welfare studies has been to make this distinction and then to stick to it. Much of the language that is used (such as 'emotion', 'stress', 'well-being') is profoundly seductive in that it may have both scientific and everyday usage and, without our realizing it, we may slip from one to another with disastrous consequences for our scientific objectivity. This article is an attempt to highlight some of the main difficulties and point the way to clearer thinking about both animal welfare and animal consciousness.

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