

# ANTICIPATION AND MEMORY AS CRITERIA FOR SPECIAL WELFARE CONSIDERATION

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**Abstract**

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*It is widely agreed that all animals are entitled to some degree of welfare consideration, but that some are entitled to more consideration than others. However, the basis for singling out some animals for special consideration often seems to be mostly a matter of degree of similarity to, or association with, humans. A more reasonable criterion would involve the extent of suffering caused by given events. Two variables that seem likely to be very important in the extent of suffering are the capacity to anticipate and the capacity to recall. Everyday experience tells us that human suffering can be hugely amplified by either anticipation or recall of painful or distressing events. In the past, psychologists have tended to take the view that both these processes depend on the possession of language, and were therefore irrelevant to species other than humans. But comparative psychologists are increasingly making use of concepts from human cognition, including both memory and anticipation, to explain animals' responses to both past and future events. These processes are invoked to explain the behaviour of a wide range of vertebrate species. Recent work on primate cognition indicates that more elaborate forms of representation may be possible in the great apes. Such evidence should be used as the basis for deciding whether to give special welfare consideration to certain species which have special cognitive capacities – or indeed enhanced welfare consideration to a wider range of species, if their cognitive capacities are found to be more sophisticated than is generally assumed.*

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## Introduction

He prayeth best who loveth best  
All creatures great and small;  
The *Streptococcus* is the test:  
I love him least of all.

The cynical coda to Coleridge's couplet has been variously attributed to Hilaire Belloc and Wallace Wilson, but whoever wrote the lines they make the point. Despite the logical attractions of absolutist views like that of Peter Singer (1990), all thinking about animal welfare involves some element of discrimination. If speciesism is, as Ryder (1983) defined it, treating animals in different ways just because they are of different species, then there is some point at which it kicks in for all of us. The purpose of this paper is to look at some kinds of discrimination that seem to come fairly naturally to us, as early 21st century people, and see whether we can find them on anything more solid than tradition and self-interest; in

particular, whether they are supported by the recent work on animal cognition that has completely transformed our view, and radically though not quite so completely transformed our knowledge, of animal psychology.

I am not going to be reporting new empirical research, though I shall draw on recent work done by others. Probably, I am not going to be saying anything very new, firstly because it would be hard to in this debate, and secondly because I am not a moral philosopher, and what I am exploring is at least in part a moral question. At least half of what I have to say has strong echoes of a recent paper by Byrne (1999), and the rest includes some echoes of Mendl *et al* (2001). If this paper has any claim to originality or creativity, it is in evaluating a familiar question in the light of some facts that are, perhaps, not so familiar. What I am trying to do is to put a logical framework onto a set of ideas, and provide them with the empirical substance without which they have no practical bite.

### **Making distinctions: special welfare consideration**

First, let's collect some basic propositions:

- i) To talk about animal welfare at all is to recognize that almost everyone makes a discrimination between humans and all other animals. Both law and custom recognize that: there is a huge range of privileges, and a few rights, that we accord to humans just because of their humanness, and do not accord to any other animal. To take the obvious examples: we may eat other animals, but we may not eat fellow humans; and there is a presumption that we may kill any other animal unless a specific law prohibits it (say, in the interests of conservation), whereas there is a presumption that we may not kill any other human unless a specific law permits it (say, in war).
- ii) Almost everyone makes distinctions within that very broad class of 'other animals'. Though Buddhism regards all onslaught on living beings as 'unwholesome', and from its beginning explicitly extended that thinking to insects, which were presumably the least significant animals known at the time (Harvey 1995), few other ethical systems go remotely that far (though Hume [1956] has argued that, for example, the Judaeo-Christian tradition is more demanding on animal welfare than most theologians have recognized). The development of microbiology has shown that there is much further we could go nowadays – even to the *Streptococcus* whom we started with.
- iii) The distinctions we do make are rarely rational and often anthropocentric. A famous example would be the UK Cruelty to Animals Act (GB Parliament 1876), which until relatively recently regulated experimentation on living animals in this country and, though supplemented, still does in Ireland. Famously, clause (v) states:

Notwithstanding anything in this Act contained, an experiment calculated to give pain shall not be performed without anaesthetics on a dog or cat, except on such certificate being given as in this Act mentioned, stating, in addition to the statements herein-before required to be made in such certificate, that for reasons specified in the certificate the object of the experiment will be necessarily frustrated unless it is performed on an animal similar in constitution and habits to a cat or dog, and no other animal is available for such experiment; and an experiment calculated to give pain shall not be performed on any horse, ass, or mule except on such certificate being given as in this Act mentioned that the object of the experiment will be necessarily frustrated unless it is performed on a horse, ass, or mule, and that no other animal is available for such experiment.

The special protection given to dogs, cats and equines was surely on account of their special value (emotional or practical) to humans, not on the basis of any special need of those groups of animals – even though a case could be made that there is an exceptional cruelty in harming animals who have hitherto been treated as honorary humans. The current Animals (Scientific Procedures) Act 1986 (GB Parliament 1986) still gives special protection to dogs, cats and equines, but it includes primates with them. It thus seems to be mixing value to humans with some other considerations, relating either to similarity to humans or perhaps to supposed capacity to suffer.

- iv) The questions of what is right and wrong in this field cannot be settled by pure argument, but require empirical input. Even if we took the strong Buddhist line, we would have to decide what is and is not a living being. That cannot be done by logical analysis, but requires a knowledge of the sorts of beings there are in the world. Because scientific knowledge is constantly expanding and open to correction, judgements of right and wrong are open to change.
- v) Real natural categories are fuzzy or ill defined, whereas logical abstractions tend to be well defined or, in the technical term, ‘crisp’. The mathematics of crisp sets is familiar and easy: it is the ‘set theory’ that we learned at school. But the mathematics of fuzzy sets is difficult and obscure (Zadeh *et al* 1975), and this means that the application of clear ethical principles will frequently be anything but clear. For example, we have clear legal and customary principles giving special protection to humans, but the category of humans has fuzzy boundaries: does it include foetuses, the very severely handicapped, those in a persistent vegetative state, or the very old? As these examples indicate, fuzzy boundaries allow distressing amounts of scope for self-interested argument.

Second, what kind of distinction are we interested in? It seems helpful to think about a hierarchy. Here I am not looking for what is logically or ethically defensible, but what seems plausible to a layperson.

Suppose my child is ill, or starving, and I need to find him or her food; and that there is no way of doing so without killing another living organism. Under those circumstances:

I would kill a lettuce without regret and without feeling that I should not.

I would kill a sheep without pleasure but without feeling that I should not (I am not a vegetarian), but some people would feel that they should not.

I would not kill a fox as readily as a sheep.

I would kill a cat with great regret (I like cats) but without feeling that I should not.

I might be willing to kill an unknown baby, but I would not want to and I would think that I should not.

I might be willing to kill an unknown man, but I would not want to and I would think that I should not and that it was dangerous.

I would not be willing to kill another of my children.

(If this was a moral rather than a scientific paper, I might add the question, ‘would I be willing to kill myself?’).

This series makes the point that a number of different kinds of consideration can be considered ‘special’. From the lettuce, we conclude that life is not an issue. From the difference between the lettuce and the sheep, we conclude that sentience is an issue. From the difference between the sheep and the fox, we conclude that convention is an issue. From the cat we conclude that sentiment is an issue. From the difference between the baby and the man, we conclude that danger (or, to put it positively, reciprocal altruism) is an issue. From the sibling, we conclude that relationship (kin altruism) is an issue.

### The special status of humans

So not all humans are equal, just as not all non-humans are equal. But at the level of humans, and only at that level, we find moral sentiments strongly and inevitably engaged. To different degrees, I would feel sad about killing a sheep, fox or cat, but I would not have any moral objection to doing so, if it was to save a human life. Obviously that is not to say that there are no moral obligations to animals: both the law and custom recognize that there are degrees of animal suffering we should not inflict on animals even to save human life, and certainly not for lesser human ends. But when we start to discuss humans, morality is always involved – there is no question of degree.

The difference between the baby and the man, and the stranger and the sibling, shows us that morality does not operate alone, but is coloured by and confused with self-interest, individual or genetic. But in my, non-Buddhist, view the matter of prime moral concern is whether there are animals to whom we ought, because of what we now know about them, to extend the special level of protection that we ordinarily give to humans. So to make sense of this, we need to think why it is that we do accord rights to humans that we do not accord to other animals.

One possibility is solidarity: ‘just because they are humans’. Even if such species solidarity was a natural human tendency, it clearly would not provide moral grounds for treating humans in a special way (LaFollette & Shanks 1996). But even as an explanation of our behaviour, I do not think this will do. A thought experiment suggests why not. Suppose we suddenly cracked the problem of talking to cetaceans, and found that the bottle-nosed dolphin (*Tursiops truncatus*) could indeed acquire a fluent command of the English language. With a few necessary practical changes, we could be buying our railway tickets from dolphins, sitting next to them in the train, fielding questions from them after a lecture, listening to their learned discourses on ichthyology (at which they would of course be much better than us). There are some grim possible outcomes to this scenario. Human history indicates that at some intermediate stage we would seek to enslave them, or exterminate them (maybe that is what happened to *Homo neanderthalis*) – or them us. But if these unhappy outcomes could be avoided, it is impossible to doubt that we would end up treating them as equals, just as we now treat as equals human racial groups whom our ancestors enslaved or were enslaved by, sought to exterminate or were nearly exterminated by. And we would feel we ought to. Except that we wouldn’t let them enter the swimming contests at the Olympic Games – or they would not let us.

If I am right in my thought experiment, it seems that an animal that behaves enough like a human ought to be treated like one, even if it is clearly of a different species. But what is enough? And why?

It could be that we are dealing here with a completely illogical set of beliefs. But I am going to work on the assumption that we would rather our moral principles were logically consistent, and that in fact we will only tolerate inconsistencies either because we haven’t noticed them, or because we have a strong gut feeling that both the principles are right so it must be the logic that is wrong. If that is the case, there should be a reason why an animal with language is held to deserve the same moral consideration as a human, even if it is as unambiguously non-human as a dolphin.

### How language changes the welfare agenda

Logically, then, why should humans be treated differently from animals in general? And why should an animal that is enough like a human be treated like one? And what is enough?

It is boring to say, but remains true, that what distinguishes humans from other animals is primarily language. That has two implications. It makes it impossible for an animal to tell us, 'stop that, you are hurting me' as clearly as a human can. Although such communications do not always prevent humans hurting one another, they do make it harder for us to have illusions about what we are doing. In so far as this is the difference language makes, it ought not to lead to any difference in welfare consideration between humans and other animals at all.

However, there is another difference that language might make. Although we think of language as a cognitive faculty, it is obvious that it colours all our experience, emotional and motivational as well as abstract. For example, it is obvious that all advanced animals – certainly all mammals and birds – experience both hunger and pain; we can read that fact in their behaviour, which resembles the behaviour we show when in those states. When in pain, animals, like humans, commonly cry out, struggle and withdraw. When hungry, like humans, they search, approach food and eat. But, without language, can they experience either state with the complexity and subtlety that we can?

If language makes a difference to how animals experience affective states, that could provide both a reason why we treat humans differently from other animals, and a criterion for treating a few other animals – those that can use language – like humans.

Unfortunately, in itself this does not work. We have not, and probably cannot, specify exactly how and to what extent language allows motivations and emotions to be experienced with greater complexity and subtlety. All we have to go on is our hunch. There is nothing wrong with founding important moral decisions on hunches, if a decision has to be made (and it does), and there is nothing better to go on. But there might be something better to go on.

One thing language certainly does is to change, radically, our temporal environment. If you and I share a common language, I can tell you, with considerable precision, what has happened in the past, and what will (or might) happen in the future. I can also 'tell myself'; that is, I can relive or anticipate past or present experience. Language enables us to travel in time (Suddendorf & Corballis 1997). And it is a matter of common experience that such reliving or anticipation does not just involve an abstract knowing that something has happened or will happen. Whether we hear it from someone else, or whether we imagine it for ourselves, past or future experience can come with all the feelings associated with the experience itself. The actual perceptual sensations are not (usually) there, but the feelings often are. They may be less intense – but they may not.

We do not know for sure whether this can be done without language, and I will return to this point shortly. But all I need for the moment is the fact that it can be done with language, and that is something we know for sure. And this would be sufficient consideration for giving special welfare consideration to linguistic animals, if we were sure we had found any. If I hurt a non-linguistic animal, perhaps I only hurt it for as long as the pain lasts: if I hurt a linguistic animal, I cause it to fear for as long as it can see the pain coming, I hurt it for as long as the pain lasts, and I cause it to smart with recollected pain for as long as the memory lasts. So every hurt is multiplied, as it were, by three – in fact, if we wanted to be quantitative, perhaps by much more.

This argument does several things for us. Firstly, it provides a reason why we currently give special welfare consideration to the human species. Secondly, it provides a rational ground on which we might extend special welfare consideration beyond the human species. Thirdly, it explains why in the past we generally have not done so. Finally, it deals with my hypothetical dolphin.

However, the argument also makes a point that is important at a more abstract level. It shows that the issue of special welfare consideration is irrevocably tied to the results of ongoing research. For the past 30 years, the issue of whether animals other than humans can learn and use language has been a matter of hot but empirically driven debate. This is an area where it is hard to prove a negative, but easy (in principle) to be persuaded of a positive. If a great ape was to walk in here, or a parrot to fly in, and start to take part in our debate (perhaps through the medium of sign language rather than spoken English, but why not), asking appropriate questions and responding flexibly to the answers, we would be confident that it could indeed use language. Some of those who research ape language feel that they have had this kind of experience (eg Pepperberg [1981]; Savage-Rumbaugh & Lewin [1994]; Fouts & Mills [1998]), but most of us either have not met the animals in question or feel somehow dissatisfied by the conversations we have had with them. But it is easy to conceive of an experience that would be fully convincing.

So we are confident that if an animal possesses language, any suffering that it endures will necessarily be extended – perhaps greatly extended – by anticipation and memory. (The only exception would be if the suffering arrived instantaneously and with no possible warning, and terminated the animal's life or ability to remember.) For some people (eg Fouts & Mills [1998]; Byrne [1999]), that will be a sufficient argument to put all the great apes into the 'special consideration' bracket, either because they are convinced by current research that those species really do have the capacity to learn language, or because they find the evidence, though not yet convincing, strong enough that we should accord the apes the benefit of the doubt. Others might argue that this would only apply to a very few apes who have had some very special experiences.

### **Can we have anticipation and memory without language?**

Now we can return to the point I left dangling earlier. Could animals who definitely do not possess language (or for whom we have no seriously persuasive evidence of language) possess enough anticipation and/or memory to magnify suffering in the sort of way I am talking about here? Once again, this is not something that can be settled by a priori argument; it demands a consideration of the evidence. Suddendorf and Corballis (1997) argued that mental time-travel is possible only for humans, but they accept that the evidence is so far incomplete. The relevant evidence is of course concerned with animal cognition. What do we know about animal anticipation and memory?

This is an area where our ideas have changed enormously in the past 30 years. They have changed partly because of research results. But they have changed even more because of a change in research programme. Instead of a behaviouristic approach, of trying to minimize the inferences of human-like mental processes we make in explaining animal behaviour, those of us who claim to research animal cognition are deliberately taking concepts that were worked out to explain human cognition, and trying them for size, as it were, as an explanation of the behaviour of various kinds of animals. Much more has been done with memory than with anticipation, so we will talk about that for the time being.

There is a danger in not recognizing the paradigm shift that has brought the idea of animal cognition into everyday scientific discussion. We talk much more about animal memory than we did 30 years ago, but that does not necessarily mean that we have better evidence for it, or better evidence that animals have the kind of memory that would magnify suffering. It could just mean that a cognitive vocabulary has become more acceptable. To justify taking a new approach to animal welfare, we need more than evidence that scientists are talking in new ways; we need evidence that those new ways of talking are fruitful, and are contributing to an understanding of animals.

### **The nature of animal memory**

So what we have to do is not to ask whether animals have memories, but whether we can say anything interesting about their memories if we suppose that they do have them. We need to ask what kinds of memories animals have, and how their memories work. For our present question, in particular, we need to ask whether they have the kinds of memory that would extend the duration of suffering. Because this isn't, directly, the question that has been driving animal cognition research, it is not as easy as it might be to get a clear answer.

However, we can make some progress. Following the usual animal cognition approach of applying the analysis of human memory to animal memory, we are led to make a series of overlapping dichotomies: between procedural and declarative memory; between recognition and recall; between long- and short-term memory; and between semantic and episodic memory. It turns out that some of these dichotomies have clear implications for the extension of suffering. In all cases, humans have both kinds of memory, but it does not follow that animals do, and if they do not, then certain kinds of memory-extended suffering will not be possible.

Procedural memory, the knowledge of rules of action and procedures, seems to have little to do with suffering, even if it has not yet become 'automatic' and even if it is not concerned with motor skills like riding a bicycle (or balancing along a branch). Declarative memory is memory for facts. That is why it matters, or could matter, to animal welfare whether or not domestic hens have declarative representations, to lift the title of Dr Forkman's presentation to this symposium (Forkman 2001). An animal that only had procedural memory could certainly still suffer, but it seems unlikely to suffer in memory. If we cast the distinction between procedural and declarative memory back into an older language of learning theory, it begins to look like the distinction between what is called S-R and S-S learning. Do animals only learn what to do in the presence of particular stimuli (S-R, ie stimulus-response learning), or do they learn associations between stimuli (S-S, ie stimulus-stimulus learning)? This question generated much heat in the middle years of the last century (see Hilgard [1958] especially chapters 5 & 6). Obviously it is easier to demonstrate that an animal can make the right response than that it has formed the right associations, but nonetheless the question really was answered definitively by Tolman *et al* (1946) and Mackintosh (1965), at least for rats (*Rattus norvegicus*) and hence presumably for all animals more cognitively competent. They learn both – and they learn S-S associations more quickly. It is only after repeated exposure to a stereotyped environment that we see what Mackintosh called 'transfer to proprioceptive control', the mere triggering of a learned response by a key stimulus.

The distinction between recognition and recall memory has less total, but still important, implications for the possibility of suffering. In one of the books of the pre-war naturalist G Bramwell Evens, who wrote for children under the name 'Romany', it is argued that dogs had recognition but not recall memory: if I remember rightly from my childhood (the books

have long since disappeared from libraries), Romany argued that Raq, his dog, would be reminded of the rabbit he flushed out of the hedge when he passed that way again, but could not sit by the fireside reminiscing about the pleasures of chasing it. Now, if this was true, a dog obviously could suffer by being reminded of a painful event – but if we could protect it from all stimuli that had accompanied that event, we would protect it from all such suffering.

As with procedural and declarative memory, so with recognition and recall. We can be sure that Raq recognizes the hedge, but how can we know whether he is reminiscing about the rabbit by the fireside? If he had language, of course, we could, but we are trying to do without. Our best evidence would be from spontaneous behaviour: if an animal suddenly returns to a previously abandoned problem that is not perceptually present, shouldn't we say that recall is involved? Some of Köhler's (1927) descriptions of chimpanzees (*Pan troglodytes*) solving 'insight' tasks sound a little like that, though one might argue that the problem was perceptually present rather recently. Lea and Kiley-Worthington (1996) argued that a more convincing anecdote is Jane Goodall's of the chimpanzee who had been keeping company with a young female one evening: they went to their separate nests, but when the male woke, 'he suddenly swung from his nest and, moving rapidly through the tree, leapt straight into the female's bed ... it certainly showed that the female was very much in old McGregor's mind when he woke that morning' (van Lawick-Goodall 1971 p 180).

But perhaps this is too severe a test for recall rather than mere recognition. We use the distinction at a less demanding level when we talk about problem-solving with human subjects. We can ask a person (as an old-fashioned Command-Line Interface computer operating system does), 'What is the command for deleting a file?' – that is a recall test. Or we can ask, as a Windows/Icons/Mice/Pointers operating system does, 'Is "DELETE" the command for deleting a file?' – that is a recognition test, and it is easier, which is essentially why WIMPs are better than CLIs. At this level, we have much evidence that animals have recall as well as recognition memory: when they are hungry, they set out in the right direction to find food, and when they are thirsty, they set out in the right direction to find water (eg Leeper [1935]). Could this kind of memory lead to the recollection of suffering? It might, since there is plentiful evidence that they will not set out if the reward they previously experienced has meanwhile been associated with unpleasant consequences, eg nausea; this is the well known incentive-devaluation technique (eg Holland & Straub [1979]). In the end, we do not know that even humans are capable of the purest recall. We only know that we can be led by a chain of associations from something that is currently present (even if it is only a need we sense from our own body) to think of something painful, or pleasurable, that is not at all present. It looks as if animals other than humans can follow a chain of at least some length.

This leads us naturally into another dichotomy, between short- and long-term memory. Here it is clear that from the point of view of prolonging suffering, it is long-term memory that is quantitatively more important – though of course short-term memory may be functional in laying down long-term memory traces, as was proposed in the early multi-stage models of human memory such as those of Broadbent (1957) and Atkinson and Shiffrin (1968). It is clear that animals other than humans have excellent capacities for long-term memory of the significance of stimuli, both in duration and capacity. Appropriately, one of the finest demonstrations comes from elephants: Markowitz (1975) showed that Indian elephants (*Elephas maximus*) retained a simple light/dark discrimination over a period of 8 years. The long history of domestication of elephants, and their versatility, makes this no surprise: more surprising, perhaps, is Vaughan and Greene's (1984) demonstration that an animal with a much less intellectual reputation, the ordinary pigeon (*Columba livia*), could

remember the classification of hundreds of random colour slides for a period of years. And of course animals that depend on scattered hoards of food in order to survive the winter, such as corvids or some squirrels, have now been shown to retain exquisitely accurate memories of where their numerous caches are located, for many months (eg Kamil & Balda [1990]; Macdonald [1997]). Macdonald argued that the survival strategy of the grey squirrel (*Sciurus carolinensis*) in England depends on being able to remember around 3000 separate cache locations for the duration of a winter, and her experimental data make this estimate entirely plausible.

Finally we need to look at the last dichotomy, that between episodic and semantic memory – the difference between remembering that ‘I was hurt by a knife’ (at a particular place and time) and ‘knives hurt’. It is more likely that episodic memory would be associated with relived suffering; why should I be pained to realize that knives, in the abstract, cause pain? Obviously, in the absence of linguistic instruction, semantic memories can only be formed by the integration of episodic memories, but if that integration was instant, the animal need not retain the potentially painful memory of a painful event. There is current controversy over whether animals can be said to have episodic memories, but several authors have argued that they must have: Griffiths *et al* (1999) appeal to the behaviour of food-storing birds; Gaffan and Parker (1996) to ‘scene’ or ‘object in place’ memory in rhesus macaque monkeys (*Macaca mulatta*); and Sharp (1999) to the results of experiments on hippocampal damage in rats.

What we have done now is to pick our way through quite a bit of modern research on animal memory, looking at what kind of memories we can be fairly sure we have found in animals, even animals that are far from having language. We have seen that though the types or properties of memory that are more likely to be associated with the prolongation of suffering are sometimes harder to demonstrate in animals, that is not always the case (eg long term memory is easy to show), and in some cases the demonstration, though difficult, has been done (eg declarative memory, and perhaps also episodic memory). It looks as though quite a wide range of animal species might be eligible for special welfare consideration on the grounds of their ability to remember painful or distressing events.

### Can animals anticipate?

What we would like to do next is to repeat the same kind of analysis for anticipation. But this is much harder. How, in the absence of language, can we tell whether an animal is reflecting on something that may happen in the future?

To some extent, of course, the problems of memory and anticipation are one and the same. We normally test an animal’s memory by giving it a new experience of an old situation. If it responds appropriately, presumably it both remembers what happened before, and anticipates that the same will happen in the future. Experimental techniques like incentive devaluation, referred to above, seem more likely to work on the anticipation rather than the memory of a previously valued food, but I know of no empirical evidence on that point. Nonetheless, the example shows us what we actually need. We need to find situations where an animal has good cause to anticipate an event that has never happened in the past, and see whether it shows an appropriate affective response.

The strongest evidence that animals can do this comes from studies of a range of phenomena variously referred to as imitation, vicarious reinforcement, observational learning, empathy or ‘theory of mind’: Heyes (1993) charts the difficulties of the field and summarizes many results. There are several logically and perhaps functionally distinct

phenomena involved. All, however, involve animals learning by witnessing the behaviour of another animal and its consequences. If one rat sees another press a lever and then receive food, and if the observer rat subsequently goes and presses the lever, there is a *prima facie* case that it anticipates that it too will receive food.

What can animals learn by observation of other animals' behaviour and its consequences? At least the following, it seems:

- i) That a particular place or object is associated with the production of a valued outcome. This kind of learning has long been recognized under the title of 'local enhancement' (eg Thorpe [1956]). Recent studies include, for example, Laland and Plotkin's (1992) demonstration that rats could learn to dig up carrot pieces by watching other rats do so. On the converse side, Roeder *et al* (1980) observed that rats living in a room containing a ferret (*Mustela putorius*) rapidly acquired knowledge of which were safe places, and it is likely that this was through seeing other rats attacked rather than through surviving attacks themselves.
- ii) That a particular kind of food is good and safe to eat. Transmission of food habits has long been known at least informally, and there have been extensive more formal studies in recent years. It remains a point of controversy whether food habits acquired socially are more durable than those acquired more individually (see, for example, Galef & Whiskin [1997] who used rats). The converse transmission, that a particular food is unsafe, is more controversial, though Johnston *et al* (1998) showed that domestic chicks (*Gallus gallus*) could learn to avoid bad-tasting food by seeing the rejection responses of a conspecific.
- iii) That a specific response can lead to a valued outcome. For example, Bugnyar and Huber (1997) showed that marmosets (*Callithrix jacchus*) that had observed conspecifics either pushing or pulling a pendulum door were more likely to attempt to open it by the action they had seen demonstrated – though the effect was relatively short-lived, and the animal's own experience soon outweighed it. Heyes *et al* (1992) report a similar demonstration with rats pushing a lever to the left or the right.
- iv) That a specific response to specific stimuli will make possible the completion of a cooperative task, to the benefit of both participants. Povinelli *et al* (1992a) trained chimpanzees to work with humans in a task where one could see where food was, and the other could make a response that depended on the location of food, but if performed correctly would provide a reward to both. Chimpanzees not only learned to take either role in this task: in three out of four cases, when the roles were reversed, they transferred instantly to the other role. In contrast, when rhesus macaques were tested in the same task, though they could learn either role, they showed no spontaneous transfer between them (Povinelli *et al* 1992b).

The interpretation of these data has been highly contentious, because they are seen as bearing on the difficult issue of whether animals other than humans can have a theory of 'self', an issue that has been deeply controversial (Heyes 1994; Gallup *et al* 1995). To what extent, however, does this matter from the point of view of welfare? If an animal avoids a painful situation where it has seen another animal suffer pain, does that involve anticipation of suffering only if the animal is able to conceive something corresponding to 'that could happen to me'? Byrne (1999) argues that this kind of imagination is different from the ordinary anticipation that all learning animals must show, but the issue does not seem to me to be closed.

From a welfare point of view, the issue of anticipation independent of memory has one overwhelmingly important application, as has long been recognized at least informally. There is one outcome that no animal can remember, and that is death. But can any animal anticipate

death? Of course eventual death is inevitable for all animals; but many of the ways humans interact with animals lead to premature and predictable death. It is plain that in human experience, putting someone in a situation where they can expect imminent death with certainty or high probability causes extraordinary suffering. It clearly matters greatly to the ways we feel it right to treat animals whether they have any comparable experience. That is why those concerned with farm animal welfare have often worried about the behaviour animals show at slaughterhouses; it is also why a symposium like this is always going to contain papers about various aspects of social learning, like those of Kuczaj *et al* (2001) and Tschudin (2001).

We do not yet know whether any animal can anticipate its own death. In its deepest sense, such an anticipation probably would depend on having a self-concept, and even those who argue most strongly that such self-concepts do exist in animals (eg Gallup *et al* [1995]) are inclined to limit them to the great apes on present evidence. But the evidence we have briefly listed above strongly indicates that many species of animal would be put into a state of fear by stimuli that they have seen associated with the deaths of conspecifics, though direct tests of such fear have so far yielded negative results (eg Anil *et al* [1997]).

### Special consideration based on memory and anticipation ability

So far, we have only been concerned with finding out whether animals have the power to remember and anticipate, and if so what the nature of 'animal' anticipation and memory might be. What we have learned, I think, is that we cannot assume that words like 'memory' and 'anticipation' have no content when applied to an animal that lacks language. To some extent, animals can be shown to have the sort of powers of memory and anticipation that might cause their suffering to be extended in time as ours can be. And for some people's moral purposes, that will be enough: if it is even possible that animals can suffer as much as humans do, it will seem unjustifiable to accord them lower moral status than humans.

That is a respectable position, but I think we need to do better. The *Streptococcus* is the test – not because it is dangerous, but because we cannot believe that it has the mental capacity to suffer as we do. There are lines that we need to draw. Are there grounds for believing that some species have the kinds of memory and anticipation that would extend suffering in time and, if so, what species are they?

At the moment, I see no safe grounds for drawing distinctions on the basis of memory. We looked in detail at the different kinds of memory that might be critical for extended suffering, and I find no species-specific pattern in the results. At least among the warm-blooded vertebrates (we have hardly any relevant data on anything else), memory phenomena seem to be widely distributed, and any qualitative or quantitative differences seem to be related to niche rather than to taxonomic group (I have in mind here the remarkable spatial memories of food-storers, referred to above). This implies that the fact that a painful or distressing experience is brief cannot safely be taken to guarantee that the suffering associated with it will also be brief, for any bird or mammal. This raises important general considerations for animal welfare, not special ones; if our interactions with animals unavoidably cause them pain or distress from time to time, we should try to ensure that they are not unavoidably reminded of those experiences later. And everything we have learned about animal memory suggests that the same sorts of events are likely to serve as reminders for animals as for humans.

The case of anticipation is different. As we saw, in many cases it is confounded with memory, and in these cases there seems no ground for giving some taxa special

consideration. But in those cases where anticipation is independent of memory, because the animal's information that something might happen comes from what has happened to another animal rather than itself, there does seem some ground for making a distinction. There is a whole catalogue of capacities that are beginning to look as if they are unique to great apes, at least among primates. The evidence for other candidate groups such as cetaceans, pinnipeds, canids, corvids or psittacids is much less complete, not least because it is relatively easy to take a task that an ape has successfully completed, and apply it to monkeys; if we try to do the same with dolphins or parrots, and the animal fails the task, it is harder to be sure the failure is due to the difficulty of the task for the animal, or the inappropriateness of the way we have implemented it.

As we have repeatedly noted, the way we use this evidence will depend on our general ethical position. If we say that all animals should be treated as well as humans until they have been proved to be different, then we should have to offer special consideration to quite a wide range of species. If we say that animals only deserve human-like treatment when we have good evidence that they can suffer in the same way as humans, then we would draw the boundary round a much smaller group. No doubt practical decisions will continue to be taken on a muddled, relativistic and pragmatic basis, involving some mixture of these points of view – just as the line we draw around those members of the human species who in practice get special consideration is fuzzy rather than crisp.

From his examination of the data on animal anticipation, Byrne (1999) concludes that our present state of knowledge of great ape cognition precludes invasive experimentation that we would not carry out on humans who were unable to give informed consent. The conclusion is suggestive. The present evidence on primate cognition is ambiguous: the great apes, at least, cannot yet be treated like (most) humans, since we cannot ask them to give informed consent, but on the other hand they cannot any longer be treated unlike any human – there is enough evidence that they can suffer in much the same ways as humans that we do not feel comfortable if we do not accord them the same consideration. It is a typically fuzzy situation. My own conclusion is that the fuzziness needs to be spread a little further: that although animals other than great apes almost certainly do not travel in time in the way Suddendorf and Corballis (1997) identify, they do live in an emotional world that is extended in time, and welfare practices need to take greater account of that fact.

The purpose of this paper has been twofold. Firstly, to emphasize that practical decisions about animal welfare depend on the data on animal cognition; secondly, to suggest the areas of animal cognition research that those who have to make practical decisions ought to keep under review. My own reading of the way those areas are looking at present agrees with that of Byrne (1999): we ought to be giving very special welfare consideration to the great apes. But we certainly cannot be sure that other species will not be found to require equal consideration in future, and in the meantime we should probably be treating many species with more consideration, and specifically more consideration for their cognitive abilities, than we are at present.

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