

From an animal's point of view: Motivation, fitness, and animal welfare

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Abstract: To study animal welfare empirically we need an objective basis for deciding when an animal is suffering. Suffering includes a wide range of unpleasant emotional states such as fear, boredom, pain, and hunger. Suffering has evolved as a mechanism for avoiding sources of danger and threats to fitness. Captive animals often suffer in situations in which they are prevented from doing something that they are highly motivated to do. The "price" an animal is prepared to pay to attain or to escape a situation is an index of how the animal "feels" about that situation. Withholding conditions or commodities for which an animal shows "inelastic demand" (i.e., for which it continues to work despite increasing costs) is very likely to cause suffering. In designing environments for animals in zoos, farms, and laboratories, priority should be given to features for which animals show inelastic demand. The care of animals can thereby be based on an objective, animal-centered assessment of their needs.

Keywords: animal care; animal welfare; behavioural ecology; consumer demand theory; emotion; ethics; experimental analysis of behaviour; mental states; motivation; operant conditioning

1. Introduction

Let us not mince words: Animal welfare involves the subjective feelings of animals. The growing concern for animals in laboratories, farms, and zoos is not just concern about their physical health, important though that is. Nor is it just to ensure that animals function properly, like well-maintained machines, desirable though that may be. Rather, it is a concern that some of the ways in which humans treat other animals cause mental suffering and that these animals may experience "pain," "boredom," "frustration," "hunger," and other unpleasant states perhaps not totally unlike those we experience.

This would appear to put scientists in a dilemma. If we insist that such subjective language has no place in science and that the mental states of nonhuman animals cannot be studied empirically, then we opt out of all debates about animal welfare, leaving the formulation of laws and regulations concerning the treatment of animals to those (often nonscientists) who may have no such scruples. On the other hand, if we feel that laws and regulations should be based on scientific knowledge about the animals (Dawkins 1980), we may feel we have a duty to step into these muddy waters and say what we can, even if we then risk being called unscientific. The purpose of this target article is to argue that we do not, in fact, have to choose between scientific respectability and practical considerations. A middle way is possible. We can acknowledge the genuine difficulty of ascertaining what a nonhuman animal feels and yet attempt to attain a scientific understanding of its feelings. Indeed, we should do so not only because we will thus promote the welfare of

animals but because the study of subjective feelings is properly part of biology.

Some of this ground has already been broken by Griffin (1981). It has recently become permissible to talk about animals having "thoughts" or forming concepts (Terrace 1987; Walker 1983). What we need now is to come to grips with the wide range of unpleasant emotional states we call "suffering" (fear, loneliness, thirst) and the more pleasant ones we call contentment or well-being. The reason is that almost all arguments about the treatment of animals focus on the issue of suffering and the experience of pain. [See also Rachlin: "Pain and Behavior" *BBS* 811, 1985.] Singer (1976; see accompanying Precommentary), for example, argues that the capacity to suffer and to feel pain is central to the question of what is moral and what is not. He believes that this capacity is shared by humans and nonhuman animals and that consequently "speciesism" (discrimination against other species, Ryder 1975) is as reprehensible as sexism or racism. The idea that animals are morally the equals of humans and have "rights" comparable to those of humans is based on a belief in an equal capacity to suffer as well as on a belief that both have other similar attributes that influence subjective experience (Rollin 1981). Regan (1984, 1985) advocates the total abolition of the use of animals in research, commercial agriculture, and hunting for sport (see further discussions by Clark 1977; M. W. Fox 1986; Frey 1980; Midgley 1983).

Even those whose views are less extreme and who see humans as more important than nonhuman animals nevertheless think that animals deserve care and consideration. It is not essential to believe that animals have

rights comparable to those of humans to conclude that animals should not suffer unnecessarily (Cohen 1986; M. A. Fox 1986). Countries in many parts of the world have established, or are currently revising, legislation relating to the way animals should be treated in farms, zoos, and research institutions. Academic bodies have published guidelines for the use of animals in research (e.g., Animal Behavior Society/Association for the Study of Animal Behaviour 1986) and ethical issues regarding the use of animals have been openly debated in academic journals (Bowd 1980; Burghardt & Herzog 1980; Gallup & Suarez 1980; Huntingford 1984). Experiments on animals have recently been defended (Miller 1985; Paton 1984) and attacked (Sharpe 1987) with renewed vehemence. The moral basis of experimenting on animals is now being questioned and analysed (Bateson 1986) and where possible, alternatives to the use of animals are being sought (Gallup & Suarez 1985).

None of this would be happening if many people did not believe that animals are in an important way different from inanimate objects such as national monuments or religious relics, entities that also receive protection. They are different because of their assumed capacity to feel, to experience subjectively. Many now agree that when an animal "suffers," it *experiences* unpleasant states and that they matter to it (Baxter 1983a; 1983b; Dawkins 1987; van Rooijen 1984; Zayan & Duncan 1987).

The growing interest in the ethical issues surrounding animal welfare thus forces us to consider the subjective feelings of animals and how we might best study them. Many attempts have already been made to define the signs of well-being and suffering in animals (Banks 1982; Barnett et al. 1985; Broom 1986; Brown 1981; Craig & Adams 1984; Dantzer et al. 1983; Duncan 1974; Ewbank 1985; Hill 1983; Kilgour 1985; McBride & Craig 1985; Morton & Griffiths 1985; Smidt 1983; van Putten 1981; Tschanz 1982), using the criteria of the animal's physical health or changes in its physiology and behaviour. In this article I will concentrate on behavioural measures of ensuring welfare and will draw together work from applied ethology, psychology, and behavioural ecology. The aim throughout will be to attempt to understand how much of what happens to animals actually matters to the animals themselves. The animals' point of view cannot be considered in isolation from long-term health interests (any more than a child's view about going to the dentist can be). However, I shall argue that the animals' viewpoint should be an essential ingredient in all animal welfare studies because it provides the only plausible bridge between observable events such as physiological and behavioural changes, which are the basic data at our disposal, and the subjective experiences of animals, which it is the ultimate goal of animal welfare studies to understand.

2. "Suffering" and natural selection

In the rest of this paper "animal" will be assumed to mean nonhuman animals and "suffering" will refer to a wide range of unpleasant subjective states (e.g., boredom, frustration, thirst) that appear to have evolved by natural selection as means of avoiding danger or restoring physiological deficits resulting from animal's natural environ-

ment (Archer 1979; Broom 1986; Cabanac 1979). Only when they are prolonged or acute should these states be termed "suffering." A mild itch may be unpleasant, but it can hardly be said to cause suffering; itching so severe that it prevents someone from sleeping or working amounts to suffering.

Why coping mechanisms are accompanied by subjective feelings (in other words, why pain hurts, why hunger is unpleasant) is not understood (Humphrey 1983; Wall 1974). Nor is it clear whether subjective feelings play a causal role in these mechanisms or are epiphenomenal (see discussions by Churchland 1986; Libet 1985). However, subjective feelings can be assumed to have evolved because they help animals (or are inseparably linked to something that helps animals) to avoid death or failure to reproduce.

This means that both captive and wild animals can suffer (Dawkins 1980). Shortages of food and water occur even in the wild, with the result that normal foraging behaviour fails to yield enough to eat or drink. Some animals are captured by predators despite their efforts to escape and they probably suffer in the process. But in captivity, which is a restricted environment, there is more likelihood that the animal will be prevented from taking the usual steps to remove itself from danger or correct other aversive conditions.

Suffering occurs when unpleasant subjective feelings are acute or continue for a long time *because the animal is unable to carry out the actions that would normally reduce risks to life and reproduction in those circumstances*.

McNamara and Houston (1986) (see also Houston & McNamara 1988; Mangel & Clark 1986) put forward a framework relating an animal's behaviour to risks to its fitness. They argue that, at any given time, an animal should perform that behaviour which, if not performed, would lead to the greatest risk to survival and reproduction, behaviour they refer to as having the highest "canonical cost." They argue that animals are sensitive to the canonical costs of different courses of action and choose the one that most minimizes cost.

The assumption that suffering occurs when animals are prevented from performing behaviour with high canonical costs might lead to the conclusion that canonical costs (risks to fitness) are directly related to suffering. In one respect this conclusion is correct. A clear sign that an animal's fitness is threatened is that its physical or psychological health or its ability to reproduce are diminished. Ill health or injury are also major indicators of suffering. In this regard, the biologist's and the veterinarian's definitions of "fitness" have much in common. It should also be stressed, however, that an animal could be in good health yet still suffer (Dawkins 1980) when prevented from performing behaviour with even very low canonical costs. The reason is the following.

As used here, "cost" means a decrease in the chances of surviving and reproducing as the result of not pursuing a particular course of action (Maynard Smith, 1982; McNamara & Houston 1986). Yet this may not be the same cost felt by the animal that is prevented from performing a behaviour or deprived of some commodity, particularly if the animal is being kept in an environment very different from the one that shaped the behaviour of its species in the course of evolution (Dawkins 1983;

Houston 1987). For example, if a bird of a species that normally migrates in autumn is kept in a cage, it may be well cared for and its chances of surviving the winter may be considerably greater than those of its wild conspecifics that are free to migrate. But the caged bird's behaviour has not evolved to meet this contingency. The bird is highly motivated to fly (as judged by its repeated attempts to escape): it is unable to do so, and may be "suffering" from its confinement. Wild birds of the same species may have little chance of surviving if they do not migrate, so the caged one is behaving "as if" death through failure to migrate were very likely. In other words, the canonical costs of not migrating may be very small, but the animal may suffer nevertheless.

The reason for this logical separation between canonical costs and suffering is that "canonical cost" refers to the ultimate or evolutionary effects of not performing a behaviour, whereas "suffering" is associated with the proximate or causal mechanisms underlying a behaviour. When animals are in their natural environments, proximate or causal mechanisms lead them to behave in ways that maximize fitness. But in unnatural environments, those same proximate or causal mechanisms may be activated irrespective of the consequences for fitness. If an animal's assessment of a given situation is that it is in great danger if it cannot perform certain behaviours, then it will suffer even if it is not actually in danger.

In assessing whether an animal is suffering, therefore, we must take into account not just the canonical costs of preserving its fitness but the "perceived costs" – the costs as perceived by the animal (Dawkins 1988; cf. the "objective function" of McFarland & Houston 1981). Perceived costs are the proximate or causal counterparts of canonical costs. High perceived costs may or may not involve unpleasant subjective feelings. When they do have a subjective component, we call that state "suffering." We must accordingly consider both the physical and psychological health of animals in assessing animal suffering and well-being.

Physical health requires that, at the very least, an animal be free from injury and disease, that is, that there be no obvious threats to its survival and reproduction. Physical health may also include the absence of less obvious physiological disturbances (Dantzer et al. 1983), and positive signs such as bright eyes and the ability to reproduce.

Psychological health is more difficult to identify but just as important (Dawkins 1980; Duncan 1974; Broom 1986; Kilgour 1985). As has just been suggested, an animal that is apparently in good health may experience suffering if the perceived costs of its confinement are high. Psychological health implies that perceived costs are low. In the next section I will consider how perceived costs can be measured and how they may be related to suffering.

3. Perceived costs and motivation

Thorpe (1965) and Martin (1975) argued that animals suffer when they are unable to perform the full repertoire of behaviours performed by members of the same species in nature. The reasoning is that an animal's inability to perform any behaviour in its "natural" repertoire may

entail a high perceived cost. This view has recently been endorsed by the U.K.'s Farm Animal Welfare Council (1986). Such a view is open to question, however. First, there may be major genetic or environmental differences between captive animals and the wild ones with which they are compared (Beilharz & Zeeb 1981; Price 1984; Wood-Gush 1973). Even feral animals (here meaning domesticated stock that have been allowed to run wild) may show genetic differences from the parent stock because selection can result in genetic changes in behaviour within a very small number of generations (Cade 1981; Majerus et al. 1982). Second, animals may acclimatise or adjust to their captive environments in their own lifetimes. An obvious example is the tameness of many zoo animals towards their keepers (Hediger 1964); this may be strikingly different from the behaviour of wild animals of the same species towards humans. The third and most important reason an animal may not suffer in captivity, even though its behaviour may be very different from that of a wild animal concerns the variety of control mechanisms underlying animal behavior. Domestic or zoo animals may not perform much antipredator behaviour if the critical stimuli are not present (see Ewert 1987). Out of sight may mean out of mind for captive animals, so the absence of a behaviour does not necessarily imply that they are suffering (Hughes 1980). Another possibility is that the environment in captivity may provide such good substitutes for its needs that the animal lacks the motivation to perform the behaviour normally found in the wild. Baxter and Robertson (submitted) studied the nest-building behaviour of pregnant sows and found that, if provided with straw, they would build nests like those built by wild or feral pigs and would perform an operant response to obtain straw. They also found, however, that if the sows were provided with large water beds, they displayed very little nest-building behaviour and did not perform the operant response, instead settling on the water beds to give birth. In this case, the end result of the natural behaviour of nest building (a comfortable nest seemed to be more important than the performance of the behaviour itself. Hence, sows may not suffer from being unable to build a nest as long as they have a comfortable place to farrow.

Herrnstein (1977) argues that it is not always the end result that matters; the actual performance of the behaviour may also be important (see also Hughes et al. 1989). Breland and Breland (1961) cite a number of cases where hungry animals decreased the rate at which they obtained food because they spent time performing "natural" behaviour that would be appropriate to obtaining food in the wild (e.g., "rooting" and digging by pigs). Inglis and Ferguson (1986) showed that starlings prefer to search for food rather than eat identical freely available food (also Carder & Berkowitz 1970; Neuringer 1969). Vestergaard (1980) has argued that the time course of dust bathing by hens is consistent with Lorenz's model (1950; 1978) of accumulated motivational energy and that hens suffer if deprived of the opportunity to carry out this behaviour (Samraus 1982; Wennrich & Strauss 1977; but see Halliday 1983; Hinde 1970; Hughes 1980; Toates 1986; 1987).

What all this means is that whether an animal is highly motivated to perform a particular behaviour and whether it suffers as a result of not being able to do so are *empirical*

questions. In the absence of any other evidence, we cannot assume that just because an animal has not performed a behaviour for a long time or cannot perform it within the physical confines of a small cage the perceived cost of not performing it is high. The likelihood of suffering from not performing a behaviour may differ among behaviours (Nicol 1987).

Studies of the behaviour of wild or feral animals (Duncan et al. 1978; McBride et al. 1969) are a starting point for the assessment of the welfare of captive animals because they provide a baseline against which behaviour in captivity can be compared (Dawkins 1989). For the reasons just given, however, we cannot assume that all differences between the behaviours of wild and captive animals are necessarily indicative of suffering. We need empirical evidence.

Two quite distinct problems arise in this kind of investigation. The first is to determine whether a relationship exists between strong motivation to perform a behaviour whose performance is prevented and the subjective feelings of the animal concerned. The second problem is the basic practical one of how to measure an animal's motivation, particularly its motivation to do something it is prevented from doing. These two problems will be dealt with in turn in sections 4 and 5.

4. Motivation and subjective experiences

I have suggested that suffering may occur when captive animals are unable to do something they are highly motivated to do because it would normally reduce a risk to their fitness. But no clear relationship exists between motivation and subjective feelings of suffering.

Since subjective experiences are known only to the individual experiencing them, the only way we can infer their existence in any other being, human or nonhuman, is by analogy. Following J. S. Mill and what has become known as the "argument from analogy," we know we have subjective feelings; we see we are very similar to another person; therefore, by analogy, we infer that the other person has subjective feelings similar to our own. Without such a leap, without this argument from analogy, we are locked within our own skins (Skinner 1963), condemned to a solipsistic view of the world, with ourselves as the only experiencers of anything subjective. Most of us unhesitatingly make such a leap with respect to other individuals. We have more doubts with regard to non-human animals because they are not similar to us, either in anatomy or in behaviour, and we may be uncertain whether the analogy is still valid. We need evidence that the similarity is sufficient to justify the analogy.

Cabanac (1979) has argued that the behaviour and physiological responses of humans and nonhuman animals to conditions such as water deprivation, cold, and fatigue are so similar that we are justified in making such an analogy. For example, both humans and rats show similar reductions in preference for sweet foods after food intake (Booth et al. 1972). Human subjects report that sweet tastes become less pleasant after a meal and then pleasant again as satiety fades (Duclaux et al. 1973). By analogy, Cabanac infers that rats experience pleasure or displeasure under similar circumstances. He notes that in both humans and animals, unpleasant subjective feelings

(which in their extreme form we would call suffering) evolved as warning signs, signalling potential harm to the organism.

It is important to point out that in assuming that humans and animals are similar in their capacity to experience suffering we make only minimal use of the argument from analogy. We do not need to assume that animals experience things *exactly* the way humans do or that they suffer in the same situations. But if we had prior evidence that an animal had strong motivation to escape from or to obtain something and was prevented from doing so we could assume that this condition was accompanied by an unpleasant experience, as it would be in the case of a human being. Animals may be completely different from us in their likes, their dislikes, and in what they attempt to escape from (Nagel 1974). But if we assume that they are like us in just one important respect (namely, that they too have unpleasant subjective experiences when they are prevented from doing things they are strongly motivated to do), we have a bridge between our subjective world and theirs. We can then leave it to empirical investigation to determine what animals will strive to obtain or to avoid and thereby derive an animal-based view of when they suffer. What we need are reliable methods of measuring animal motivation.

5. Indicators of high motivation

Ethologists and psychologists have adopted a variety of approaches to the problem of how to measure an animal's motivation to perform a behaviour. One line of argument among applied ethologists has been that the tendency to perform behaviour in the absence of suitable stimuli is an indication of strong motivation (Black & Hughes 1974; van Putten & Dammers 1976). For example, hens in battery cages go through all the motions of dust bathing on bare wire floors even though there is no dust or litter. Ethologists have interpreted such "vacuum activities" as indicators of high levels of motivation (Vestergaard 1980), a view that owes much to Lorenz's (1950; 1978) psychohydraulic model. [See also Ewert: "Neuroethology in Toads" *BBS* 10(3) 1987] One of the complications in interpreting these activities as signs of suffering is that their performance may itself reduce the motivation to perform the behaviour (Heiligenberg 1965).

A related finding is that animals prevented from performing certain kinds of behaviour may show a greatly increased tendency to perform that behaviour when eventually given the chance: the "rebound effect" (Nicol 1987; Sembraus 1982; Vestergaard 1980; Wennrich and Strauss 1977). One possible explanation for such an effect is that the animals are merely responding to the novelty of the opportunity presented to them; however, the high levels of response, in some cases, do indeed seem to result from rising motivation during the period of deprivation (Metz 1985; Nicol 1987; Vestergaard 1980).

A third and very important motivational finding is the display of novel or "abnormal" behaviour, a large and miscellaneous category including displacement activities and stereotypies (fixed behavioural sequences performed repetitively and with no obvious function). For example, an animal that is prevented from reaching its food or does not find water where it has learned to expect it may

exhibit a range of behaviours apparently unrelated to feeding or drinking such as pacing, aggression, or grooming (Roper 1984). Such “displacement activities” of animals on intensive farms or in zoos have been used as evidence of strong motivation to do something that cannot normally be done in those environments (Duncan 1970). The same interpretation has been made of stereotypies (Broom 1983; Wiepkema et al. 1983). The causal basis of stereotypies is still unclear (Broom 1983; Dantzer 1986), although they are often associated with food deprivation (Appleby & Lawrence 1987; Rushen 1985) and may also be part of an animal’s means of coping with a restricted environment through the release of endorphins (Dantzer & Mormede 1983).

Psychologists too have long tried to measure the strength of an animal’s motivation. Warden et al. (1935) list a number of possible measures, including how quickly an animal learns a task or how much electric shock it will tolerate to obtain a reward. Warden himself was aware of the problems with these methods – for example, that speed of learning will confound learning ability with motivation and that the shock method is very unreliable. (His rats often refused to do anything if shocked.) Other measures of motivation include the rate of consumption (e.g., the rate of ingesting water as an indicator of drinking motivation; Stellar & Hill 1952), speed of running down an alley towards a reward (Cabanac & Johnson 1983), and the amount of time spent consuming food or water (Lester 1984; Sibly & McFarland 1976). As Miller (1956) pointed out, however, these different ways of measuring motivation may yield different results. Moreover, the observed behaviour may be the net result of the contribution of a number of different subsystems affected in different ways (Teitelbaum 1982). Feeding behaviour, for example, is affected by the dietary content of the food, the presence or absence of predators (Milinski & Heller 1978), the presence of conspecifics, and many other factors.

Cabanac (1985) used a modified version of Warden’s (1931) obstruction method to measure motivation. In Warden’s experiments, a rat could reach a reward (food, water, a female for a male, her pups for a female) only by walking over an electrified grid, but the rat was removed as soon as it touched the reward. Cabanac, using the food reward in a more natural setup, made his rats leave their warm nest and forage at 15°C but allowed them to eat once they reached the food. Their motivation for feeding was thus measured by the extent to which they were prepared to overcome the obstacle of cold following different durations of food deprivation. Cabanac found that the rate of eating and meal durations were not influenced by food deprivation, whereas the amount of food consumed, the number of meals eaten, and the speed of running to the feeder were.

Of the various methods of measuring animal motivation, those used by ethologists tend to focus on the animal’s response when there is no opportunity to carry out a particular behaviour (e.g., vacuum activities, displacement activities, and stereotypies). Unfortunately, there is still much we do not understand about why animals make these responses and the effects of performing them. Some investigators have asserted (without supplying evidence) that if animals perform stereotypies for long periods (e.g., more than 10% of their waking

lives), then they are suffering (Broom 1983; McBride & Craig 1985; Wiepkema et al. 1983). The shortcoming of the ethological methods is that no one has established how much the deprivation that gives rise to the abnormal behaviour matters to the animals themselves. We do not know *how much* vacuum activity or stereotyped behaviour indicates motivation strong enough to warrant being called suffering.

The methods used by psychologists have tended to concentrate on the behaviour that occurs after the deprivation period is over or on the animal’s attempts to obtain a commodity (food, water) by paying a price such as having to press a bar or to tolerate cold or an electric shock. An animal’s willingness to pay a price suggests that we can make a link between what an animal does and what it is feeling. As Cabanac (1985) puts it, “What is measured is not a motor response but rather the decision made by the subject to overcome a resistance to obtain a reward.”

Recently, measurements of the price animals are willing to pay have been interpreted in terms of an economic framework that seems particularly useful for the study of animal welfare.

6. The economics of choice

Both biologists (McFarland & Houston 1981; Rapport & Turner 1977; Stephens & Krebs 1986) and psychologists (Lea 1978; Rachlin et al. 1981; Staddon 1980) have applied economic concepts to the study of animal behaviour. In this section it will be argued that, on the basis of data on what animals do when allowed to make a choice, we can infer perceived costs with the help of such economic concepts. (For a full description of the analogy between economics and ethology, see McFarland & Houston 1981.)

An animal’s preferences (for certain foods and temperatures, numbers of social companions) give a first indication of its view of the world. Preferences can be measured either directly by providing an animal with an array of options and seeing which one(s) it chooses (the choice test), or indirectly by requiring the animal to make some response such as pressing a lever or pecking a key to produce or to avoid certain consequences (operant conditioning). Both methods have now been used extensively to study the responses of farm animals to different sorts of flooring (Hughes 1976; Hughes & Black 1973; Irps 1983; Pontaux et al. 1983; van Rooijen 1985), different-size cages (Dawkins 1981; Faure 1986; Lagadic & Faure 1987; Nicol 1986), the vibration and noise of a transport vehicle (Bailey et al. 1983), different temperatures and light levels (Baldwin & Start 1985; Curtis 1983; Morrison & McMillan 1985; Richards 1976), and many other factors (Beilharz & Zeeb 1981; Kilgour 1976; Matthews & Temple 1979; Temple & Foster 1980).

Once the preferences and operant rewards have been established, it is possible to determine how much value the animal places on them by making it pay a (perceived) price, for example, having to peck a key or press a lever many times to obtain the same reward.

If an animal’s preference is still apparent when it has to work harder (e.g., when it must perform a larger number of bar presses for the same amount of reward), the animal is said to exhibit “compensation” (Hogan & Roper 1978)

or “resilience” (McFarland & Houston 1981). To use the terminology that psychologists have borrowed from economics, the animal’s behavior reflects “inelastic demand” (Hursh 1984; Lea 1978; Staddon 1980). In economics, price elasticity is the ratio of the percentage change in consumption to the percentage change in price. It is calculated by holding everything else – income and prices of other commodities – constant, and varying the price of the commodity in question. Commodities for which a given percentage increase in price results in a decrease in the quantity demanded are said to have an *elastic demand* and are sometimes called luxuries; those for which a given percentage increase in price results in little change in the quantity demanded are said to have an *inelastic demand* and may be called necessities. There is clearly a continuum between elastic and inelastic demand, but economists use a slope of -1 as the boundary. (An alternative is to measure income elasticity: the percentage change in demand in response to a given change in “income,” or the total time available to the animal for performing its entire behavioural repertoire.) Elasticity of demand is a key concept for the study of animal welfare (Dawkins 1983) because it shows how important different environments or commodities are to the animals themselves.

When food is the reward, animals usually appear to be prepared to work harder for the same amount of reward (Collier et al. 1972; 1986; Hogan et al. 1970; Hursh 1984; Marwine & Collier 1979); in other words, their behavior indicates an inelastic demand. With other rewards, or with activities other than eating, demand is often elastic: The animal’s preference is apparent when the cost of obtaining the reward is low but not when the animal must work hard for it. Elastic demand has been reflected in behaviors performed to gain access to a rival (Hogan et al. 1970; Thompson 1964) and to obtain light (Findley 1959).

Demand functions have been used to assess the relative value of a range of stimuli to farm animals. For example, Matthews and Ladewig (1987) used an operant procedure to present pigs with food, social contact with a familiar pig, or an empty chamber. Price increases for each reinforcer were stimulated by increasing the fixed ratio of reinforcement in sequence 1, 2, 5, 10, 15, 20, 30). The demand for social companions was found to be more elastic than that for food. Other methods that have been used to increase price include (1) increasing the weight of a door that a cockerel must push to obtain access to a female or to another cock (Duncan & Hughes 1988) and (2) increasing the wind speed that hens must tolerate to obtain litter (Lagadic & Faure, in preparation). Laying hens push heavy weights to gain access to nest boxes and continue to do so when the weights are increased, thus indicating inelastic demand (Duncan & Kite 1987).

There are certain problems in interpreting demand curves, however, particularly when operant conditioning is used. It may be difficult to train animals to make operant responses to obtain certain kinds of rewards (Dawkins & Beardsley 1986; Hogan & Roper 1978; Roper 1983; Sevenster 1973; Shettleworth 1973). This may seriously confuse the comparison of demand curves corresponding to different behaviours, since a steeply sloping demand curve, suggesting elasticity of demand, may in fact reflect incompatibility of response and reinforcer and not necessarily low motivation. Animals may also be more

prepared to work for a reward if they can see it (Dawkins & Beardsley 1986; Duncan & Hughes 1988).

A second difficulty is that short-term choices made in response to an immediate need may not reflect the animal’s long-term preference. Hens that are about to lay have such a strong preference for nests that they will enter trapnests even when the consequence is that they will have no food or water for the next 24 hours (Duncan 1978). If tested just before laying, they choose the nest; if tested just after laying, they choose food and water. Animals generally have a preference for immediate rather than long-term rewards (Timberlake 1984). [See also Logue: “Research on Self-Control” *BBS* 11(4) 1988.]

The first problem – the possible incompatibility between response and reinforcer – can be overcome by measuring demand curves based on data from several tests other than bar pressing and key pecking and by attempting to elicit responses that are more closely related to the kind of behaviour the animal might perform in the wild. The second problem – the time scale over which preferences are measured – can be overcome by giving an animal the opportunity to change its behaviour continuously over long periods. For example, instead of being given a brief opportunity once a day to perform an operant response, the animal can remain for long periods in a cage in which pressing different levers gives it access to food, water, and exercise (Collier et al. 1972). A joint consideration of these two problems suggests that a particularly fruitful research strategy might be to examine the way animals allocate their time over long periods and to stimulate the price they would have to pay if in their natural environments.

Survival and reproduction depend on whether an animal allocates the right amount of time to different behaviours and performs the behaviours at appropriate times of day, as determined by such factors as food reserves (Metcalf & Furness 1984), risk of predation (Barnard 1980; Caraco et al. 1980), available time, and results of behaviour earlier in the day (Houston & McNamara 1982; 1985; Katz 1974; Mangel & Clark 1986). Even the fact that many wild animals spend a large proportion of the active part of the day resting and apparently doing nothing (Herbers 1981; Sutherland & Moss 1985) can be regarded as an adaptive strategy, since periods of inactivity may be essential for digestion (Belovsky 1981; Diamond et al. 1986), energy conservation (Anderson & Harwood 1985), or avoiding predators.

Animals adjust their time budgets according to the costs of the various activities. Müller-Schwarze et al. (1982) experimentally reduced the milk supply of white-tailed deer fawns and found that they increased their grazing by 62% and achieved a virtually total energy compensation, even though they had to curtail their other activities to do so. Johnson and Cabanac (1982a) studied rats in an environment that included a warm nest box and food in a cold area some distance away. They increased the cost of obtaining food by altering the air temperature (25°C, 5°C, or -15°C). The rats were able to maintain a near-normal balance of food intake and body temperature by reallocating the time spent feeding and sheltering and by changing their eating speed. When Johnson and Cabanac (1982b) kept the temperature of the feeding area constant at -15°C and varied the cost of obtaining food by varying the distance from food to the refuge (1, 2, 4, 8, or

16m), the rats maintained the same rate of eating and their total feeding time remained constant but their skin and core temperatures dropped. The demand for food remained the same despite the real cost in terms of body temperature.

Hill et al. (1986) used a time budget manipulation with growing chicks, but instead of changing the cost of one commodity, they altered the total light period and therefore the length of time available for any activity normally performed in the light (the equivalent of income; McFarland & Houston 1981). When light periods were short, a given amount of time spent feeding was costlier in terms of the time left over for other activities than when light periods were longer. Nevertheless, the chicks continued to eat the same amount, changing their rate of feeding rather than eliminating other activities. Dunbar and Dunbar (1988) studied the time budget changes that are made naturally by gelada baboons as the infants grow older. The time the mothers spent feeding increased, but the time devoted to social activities seemed to reflect inelastic demand. Baboons found time to socialise, even when they had to spend a great deal of time feeding, by taking time away from resting.

Laying hens show a preference for being with social companions even when the cost is increased by placing physical barriers in their way, thus reflecting elastic demand (Bubier, in preparation). Under the same conditions, the behavior of hens reveals an inelastic demand for food, and also for the opportunity to peck and to scratch in litter (Dawkins, in preparation; Lagadic & Faure, in preparation). Even when food is freely available elsewhere, hens will pay a price to be able to carry out the "natural" feeding behaviour (Dawkins 1989).

7. Demand curves and suffering

By experimentally manipulating costs we can obtain a rank order of the importance of different commodities or activities based on the relative slopes of the demand curves. Suffering is most likely to occur if animals are prevented from performing the activities or deprived of the commodities whose demand curves have the flattest slopes (inelastic demand). Note that this measure is not the same as the absolute frequency with which the animal performs the behaviour under natural conditions, the parameter that Thorpe (1967) suggested as the indicator of what is essential to the animal. The demand curve for behaviour that occurs rarely but is still performed when costs are imposed would have a flat slope (inelastic demand); the curve for commonly occurring behaviour that disappears in the presence of imposed costs has a steep slope (elastic demand).

How inelastic must demand be to indicate suffering? Since food is essential to survival, and prolonged deprivation leads to clinical symptoms of ill health, a comparison between the slopes of the demand curves for feeding and for other activities can be used as a welfare yardstick. Commodities with demand curves similar to that of food can be regarded as essential to welfare. From the animal's point of view, they are as important as food and should have top priority in the design of animal housing.

Several different sorts of evidence (physiology, health, and the animals' willingness to work) all point to the

conclusion that hens suffer in the restricted space of many cages. Demand curves (indicating the animal's point of view, or perceived costs) often confirm evidence from other measures of suffering. Caged laying hens will peck a key to obtain more space than they are generally given in battery cages (Lagadic & Faure 1988). (The most recent European Economic Community recommendation is 450 sq cm per bird and many birds in Europe and elsewhere are given even less space than that.) There is also evidence that plasma-corticosteroid levels are highest at highest bird densities (Cunningham et al. 1987) and that brittle bones, leading to a high risk of breakage, are characteristic of birds kept in crowded conditions (Wabeck & Merkle 1974). As argued earlier, perceived costs are particularly important in welfare studies, for they are as close as we are likely to come to an accurate estimate of the animal's own subjective view of the situation. They may also indicate the existence of other conditions that cause suffering but that may not be revealed by other methods; for example, the importance of nesting materials, substrates to forage in, objects to manipulate. There may be situations in which physiological or health criteria have not yet been determined, are difficult to interpret, or become evident only after a long time.

8. Aversion

Thus far, we have considered the subjective feelings that animals may have when deprived of conditions they will work hard to obtain if given the opportunity (deprivation). It is also important to consider the possible suffering caused to animals kept in conditions that they will work hard to escape from (aversion).

The indexes of acute pain have been considered by, for example, Chapman et al. (1985), Kitchell and Erickson (1983), Melzack and Wall (1983), Morton and Griffiths (1985), and Sanford et al. (1986). Following Russell and Burch (1959), Rushen (1986a) has recently reviewed the ways in which aversion learning can be used to establish whether handling procedures, veterinary treatments, and transport cause suffering to the animals subjected to them. He makes the assumption that electrical shocks cause suffering (pain) to nonhuman animals just as they do to humans and that shocks of high intensity or long duration are more painful (make the animal feel worse) than shocks of low intensity or short duration. He then argues that an animal's response to electrical shock can be "titrated" against the animal's response to some other variable such as the way it is handled.

Rushen (1986b) reports an experiment titrating electro-immobilisation against physical restraint for sheep running through a shearing area. In Australia, an electric current is sometimes passed through sheep's bodies to keep them from moving while they are being sheared. Sheep that have been immobilised in this way are more reluctant to run over the same ground on subsequent occasions than sheep that have been physically restrained in a sheep-handling machine, suggesting that electro-immobilisation is more aversive (is more of a punishment) than physical restraint. The "conditioned suppression" of a previously learned response such as bar pressing can also be used to test unpleasantness. An animal first learns that pressing a bar delivers food; then it learns that when a

light comes on it will get an electric shock if it presses the bar (Blackman, 1977). The extent to which bar pressing is suppressed when the light appears indicates how unpleasant an experience the shock is for the animal (Baldwin & Stephens 1973; Dantzer & Baldwin 1974). Animals appear to be sensitive to the cost of such a suppression, since the degree of suppression that occurs in a given experiment is reduced by periods of food deprivation, when food is worth more to the animal; suppression is increased by partial satiation (Millenson & de Villiers 1972). Individual animals may vary in how aversive they find a given level of shock, so the degree of shock can be varied to give the same degree of punishment using individually calibrated degrees of response suppression (Rawlins et al. 1980). The degree to which the punishing effects of shock are alleviated has been used as a practical indicator of the intensification of unpleasant emotional states by certain drugs (Gray 1977). This is a clear example of reliance on the presumed relationship between punishment and suffering.

As in the case of deprivation we need a yardstick to relate the cost the animal is prepared to bear to avoid x to the suffering caused by being forced to remain in the presence of x . Titration against different degrees of food deprivation may be one solution. An animal that is prepared to forego a given amount of food (deprivation of which is known to cause weight loss and deterioration of physical condition) to avoid a particular treatment would most likely suffer if it were forced to undergo that treatment. This assumption can be used to answer some of the most important questions concerning animal welfare, such as whether preslaughter stunning is painful (Leach et al. 1980), and how much animals suffer from the various experimental procedures they are subjected to in laboratories.

9. Problems with the aversion learning approach

Although data on the price an animal is prepared to pay to gain access to or escape from something are the most direct measures we have of what that animal may be experiencing, there are several problems with this approach that must be confronted if the results are to be interpreted correctly.

1. The nature of the price paid may affect the slope of demand curves (section 6). In particular, incompatibility of reinforcer and response may give a false impression of low motivation. The solution to this problem is to plot and compare the demand curves and to increase the price in several different ways to make sure the apparent elasticity (or inelasticity) of demand is real.

2. The suppression of operant responses by stimuli that predict shock may vary depending on whether the paradigm used is a "conditioned emotional response" (shock delivered regardless of the animal's behavior) or a "discriminated punishment" (shock delivered only if an operant response is made; Rawlins et al. 1980). This variation must be investigated so the most appropriate procedure can be chosen (Rushen 1986a; also section 8).

3. The price an animal is prepared to pay may depend on the availability of substitutes. The price that rats are prepared to pay for food depends on whether sucrose is present (Lea & Roper 1977). Availability of substitutes is a

factor, but not a major problem in welfare work. If an animal is demonstrably not willing to work hard for something because acceptable substitutes are available, it is probably not suffering according to the criteria developed in this paper.

4. The slopes of demand curves may depend on whether the experiment is set up as an "open economy" or a "closed economy" (Houston & McNamara 1989; Hursh 1984). If the animal is put into the experimental situation for just a short period each day and gets most of its food and exercise outside the experimental environment (open economy), its motivation to perform one behaviour rather than another may be quite different from its motivation when it lives in the experimental environment (closed economy) and has complete control over what it does throughout the day. For various reasons (Houston & McNamara, unpublished), long-term, closed economy experiments are more likely to produce valid results.

5. The animal may not be able to plan far enough ahead to make the right decisions for the whole day (Duncan 1978; Kagel et al. 1986; Timberlake 1984), possibly because of the unnaturalness of some experimental situations. As in (4), long-term experiments in which the animal is observed for long periods are most likely to yield valid results.

6. The price an animal is prepared to pay for something may depend on the predictability of the environment. A perceived risk that food may not be available in the future may render the present food source more attractive (Caraco et al. 1980b; Stephens 1981). Again, this is not a serious problem. It simply means that the effect of predictability (or the lack of it) should be investigated.

7. What the animal chooses to pay for may not be beneficial to its physical health in the long run, as pointed out by Duncan (1978) and van Rooijen (1984). As emphasized in section 5, the solution is to take into account more than one measure of welfare (Dawkins 1980; Duncan 1974; Kilgour 1985).

8. There may be some states of suffering in which an animal cannot be said to be motivated to do anything at all. For example, it might have a tumour that causes it to be inactive. Animals' physical and psychological health must always be the first criterion of their welfare demand curve analysis should recognize its effect on motivation.

9. Demand curves may be nonlinear. An animal's behavior may seem to indicate elastic demand for some commodity when the cost is first increased, or the animal may drastically reduce the time it allocates to a particular behaviour, when the total time available is reduced. As the price is increased still further, however, the animal may still "insist" on paying the price to perform the behaviour for a short time each day. The only solution is to make sure that the range of price changes is sufficient to determine the true slope of the demand curve.

None of these problems is insoluble; all should be carefully considered in the design of any experiment. They do not detract from the usefulness of demand curve analysis or aversion learning as methods that describe as accurately as possible the animal's subjective experiences.

10. Conclusions

1. A central problem in the study of animal welfare is to define situations in which animals “suffer” (experience a range of unpleasant subjective states, such as hunger, fear, and pain).

2. Suffering occurs when otherwise healthy animals are kept either in situations that they will pay a high price to escape from (aversion) or in situations that, because they are being deprived of certain stimuli or behavioural possibilities, they will pay a high price to obtain (deprivation).

3. High cost is shown graphically by a demand curve with a flat slope (inelastic demand), which indicates that the commodity in question is important to the animal. If the slope of a commodity’s demand curve is similar to that

of the demand curve for food, we can conclude that being deprived of that commodity matters to the animal as much as does food deprivation.

4. Demand curves can be constructed to show (a) changes in “income,” and (b) changes in the cost of performing individual behaviours. The latter demand curve can be most conveniently plotted by altering the schedules of reinforcement in an operant conditioning experiment; but because of the potential problems raised by using this approach for some kinds of behaviour, time budget manipulations in more natural environments may yield better results.

5. In designing environments for animals in zoos, farms, and laboratories, priority should be given to providing commodities and behavioural opportunities for which the animals’ behavior reflects inelastic demand.

Precommentary

The significance of animal suffering

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Nonhuman animals can suffer. To deny this, one must now refute not just the common sense of dog owners but the increasing body of empirical evidence, both physiological and behavioral (Dawkins 1980; Rollin 1989). My inquiry in this precommentary takes the existence of animal suffering for granted. The question is: Does the suffering of nonhuman animals matter? If so, how much does it matter? When it comes to a choice between human welfare and the suffering of nonhuman animals, how should we choose?

Many people accept the following moral principles:

1. All humans are equal in moral status.

2. All humans are of superior moral status to nonhuman animals.

On the basis of these principles, it is commonly held that we should put human welfare ahead of the suffering of nonhuman animals; this assumption is reflected in our treatment of animals in many areas, including farming, hunting, experimentation, and entertainment. I shall argue the contrary: that the combination of the two principles cannot be defended within the terms of any convincing nonreligious approach to ethics. As a result, there is no rational ethical justification for always putting human suffering ahead of that of nonhuman animals.

Before I defend this claim, a word about religious ethics. It is of course no accident that the principle of human equality and the principle of animal inferiority are widely held in Western society. They reflect a Judeo-Christian view of the human-animal relationship. Genesis tells us that God gave human beings dominion over the beasts. This has generally been interpreted to mean that we human beings have divine warrant for always giving priority to human interests. A clear example can be seen in the work of William Paley, a progressive moral theologian of the late eighteenth century. He wrote that the

practice of killing animals to eat them caused them pain and death for our pleasure and convenience; moreover, eating meat was unnecessary, since we could live on fruits and vegetables, as the Hindus do. We are therefore “beholden for it to the permission recorded in Scripture . . .” (Paley 1785). It is true that some Christians have argued for a very different interpretation of the Christian tradition, one much more favorable to nonhuman animals (Attfield 1983; Linzey 1987). But I am putting aside such theological questions, partly because there is no rational foundation for the premises on which they are based, and also because if we are considering public policy in a pluralistic society, we should not take a particular religious outlook as the basis for our laws.

Let us examine the two principles just stated. If they are to be held in combination, we can expect that there is some characteristic possessed by all human beings, but not possessed by any nonhuman animals, by virtue of which all human beings are equal, and nonhuman animals are less than equal to humans. But what might that characteristic be?

One possible answer to this question is that the characteristic is simply that of being human. But this merely invites a further question: Why does “being human” matter morally? Here we can go in either of two directions, depending on how we understand the term “human.” On the one hand, the term can be used in a strict biological sense, so that it refers to members of the species *Homo sapiens*; on the other, it may refer to a being with those qualities which are distinctive of our species – in particular, the superior mental capacities that are characteristic of our species. Problems arise with both lines of response.

If the claim is that mere membership in the species *Homo sapiens* is enough to entitle a being to special moral consideration, we can reasonably ask why this should be so. Imagine that, as happens so often in science fiction, a good friend suddenly reveals that she is an alien who was stranded on earth when her spaceship crashed. Although she has been deceiving us all these years about her origins and her species, there was no deception in her visible delight in fresh spring mornings, her sorrow when she felt unloved, her concern for her friends, her dread of the dentist – all these feelings are real. Does our discovery

about her species really make any difference as to how she should be treated? To say that it does is to make the mistake made by racists who think that blacks should be treated as inferiors, even though they acknowledge that blacks have the same interest as whites in being treated well. It is significant that there really are few such racists nowadays, and there were very few even when racism was defended more often in public. That is because this type of racism depends so obviously on an arbitrary distinction. Yet a similar type of "speciesism" is still often encountered, either in its naked form, or thinly disguised under the claim that all human beings and only human beings possess some "intrinsic worth" or "dignity" not to be found in members of any other species (Bedau 1967; Frankena 1962). Generally no reasons are given for this claim, which resembles a religious incantation more than an argument. It is, in fact, a slightly secularized descendant of the Judeo-Christian belief that humans, and only humans, are made in the image of God; or the Christian view that only humans have immortal souls.

The term "speciesism" refers to the view that species membership is, *in itself*, a reason for giving more weight to the interests of one being than to those of another. This position, properly understood, is virtually never defended. Some who have claimed to be defending speciesism have in fact been defending a very different position: that there are morally relevant differences between species – such as differences in mental capacities – and that they entitle us to give more weight to the interests of members of the species with superior mental capacities (Cohen 1986). If this argument were successful, it would not justify speciesism, because the claim would not be that species membership *in itself* is a reason for giving more weight to the interests of one being than to those of another. The justification would be the difference in mental capacities, which happens to coincide with the difference in species. (The example of our friend the alien shows the difference; to a genuine speciesist, her mental capacities would be irrelevant; to a defender of the view we are now considering, they would be crucial.) The claim that there are morally relevant differences between all humans and other animals is the second way of understanding what it is to be "human": not the biological sense of membership in a species, but the sense in which to be human is to possess certain characteristics distinctive of our species, such as the capacities for self-awareness, for rationality, and for developing a moral sense.

It is easy to see why such characteristics should be morally relevant to how we treat a being. It is not arbitrary to say that beings with these capacities live fuller lives than beings without them, and that these beings therefore deserve a higher degree of consideration. (Note that I am not saying that this view is necessarily correct, but merely that – unlike the preference for members of a particular species merely on the grounds that they belong to that species – it is not arbitrary.)

There is, however, an obvious problem with any attempt to defend the principle of human equality by reference to superior mental capacities: They are not possessed by *all* humans. Newborn humans, for example, are not rational, appear not to be self-aware, cannot use language, do not share in culture or civilization, and have no sense of morality or justice. No doubt they have the

potential to develop these characteristics, but arguing from potential is fraught with difficulties (Singer & Kuhse 1986; Singer & Dawson 1988). Moreover, if infants are to be brought within the scope of the principle of human equality by virtue of their potential, it would seem that human embryos and fetuses must also be included. This would require a significant revision of our attitudes to abortion and embryo research, although that in itself is not a reason for rejecting the appeal to potential. The real difficulty with the attempt to defend the principle of human equality on the grounds of superior mental capacities lies in the fact that even if we include those human beings with the potential to develop the requisite mental capacities, some humans will still be outside the scope of the principle of equality – those with profound and irreversible intellectual disabilities.

How are permanently, profoundly, intellectually disabled human beings to be included under the protection of the principle of human equality? One way would be to reduce the level of mental capacity required for inclusion. For example, if we were to require simply a capacity to feel pleasure or pain, to suffer or to enjoy life, almost all of the intellectually disabled could be included; those few who were excluded because they lack even this minimal capacity would be incapable of suffering by their exclusion. But whereas this would be acceptable as far as the principle of human equality is concerned, it would come into direct conflict with the principle of animal inferiority, because so many nonhuman animals would also satisfy the new standard.

No fine tuning of a standard based on mental capacities will eliminate the conflict between the two principles. Because there is an overlap between the capacities of human and nonhuman animals, there is no way of drawing a line that will leave *all* human beings above the line, and *all* nonhumans below it.

At this point some observers make a different claim: that the issue should not be put in terms of whether all human beings individually possess mental capacities that dogs lack, but rather whether the essential nature of humanity is different from the essential nature of, say, dogs. Thus rationality, or the capacity for making a moral judgment, or whatever else the capacity might be, is said to be an "essential feature" of humanity, but not of dogs; so even the most profoundly retarded human beings is entitled to the respect and moral consideration that we properly deny to the most intelligent dog (Benn 1967; Cohen 1986).

What should we say about this shift of focus from the individual to the species? It is quite unclear what is meant by "essential feature" in this context; the term is redolent of an Aristotelian biology. We should not lose sight of the fact that whatever may be true of the "normal" adult human, there is nothing at all "rational" about the mental processes of some humans with congenital brain defects. It is therefore puzzling why we are supposed to treat them in ways appropriate to rational beings such as "normal" humans, rather than in ways appropriate to nonrational beings, such as some nonhuman animals.

Even if we were given a satisfactory explanation to end our puzzlement here, there is a good deal that should make us suspicious of the suggestion that we ignore individual characteristics and instead judge individuals by the general characteristics of their species. Just over a

century ago a similar assertion was made by those who were against proposals to admit women to occupations such as law and medicine, and to the higher education that would qualify them for such professions. It was claimed that women, by their essential nature, lack the capacity for success in these areas. Against this claim, advocates of the feminist cause, John Stuart Mill among them, argued strongly that if the opponents of equality were successfully to make their case, they would have to maintain that "the most eminent women are inferior in mental faculties to the most mediocre of the men on whom those functions at present devolve" (Mill 1970, p. 182). Surely Mill's claim is right; but note that it presupposes that the focus is on the individual rather than on the group. If Mill's opponents were entitled to argue in terms of what is "normal" for men and women, or what is an "essential feature" of the sexes, Mill would have needed a different argument. He would have had to maintain that there are no differences in the essential nature of the sexes that affect the abilities required to succeed in the professions from which women were being excluded. Given the basic presuppositions of Mill's time (and perhaps even of our own), this would have been a much more difficult argument to sustain, and one that goes well beyond what is required for a successful attack on sexual discrimination in employment and education.

An important thrust of movements against discrimination has been the insistence that we consider individuals as such, and not as members of a group. It is curious that some writers want to reverse this in respect of humans and nonhuman animals, especially as they offer no clear reason why, in this particular case, we should focus on the species or kind, rather than on the individual: Indeed, the claim is simply asserted; no argument is presented in its defense. In the absence of any convincing reason for this claim, it should be rejected.

We are now in a position to see why it is so difficult to defend both the principle of human equality and that of animal inferiority. The key to the difficulty is that the combination of principles draws a sharp moral line, whereas evolution and natural variation have left an overlap between human beings and other animals. The solution is to abandon the attempt to draw such a sharp line. Instead, we should be sensitive to both the differences and the similarities between beings. Differences in such qualities as intelligence, self-awareness, and the capacity to make a moral judgment will certainly be relevant in some contexts; in others, similarities will be more important.

Up to this point my argument has had the limited aim of showing that we cannot justify applying sharply different standards to humans and nonhuman animals; but I have, strictly speaking, said nothing about my main subject, the significance of animal suffering. The statement that we should not apply different standards to humans and animals tells us nothing about what standard we should apply to both human and nonhuman animals. Someone might say, as scientists frequently do, that pain and suffering are part of nature, that they have evolved because they have survival value, and that there is no reason why we should be especially concerned with their reduction or elimination. I shall argue that, on the contrary, we should give to the elimination of the suffering of others – humans and nonhumans – the same degree of effort that we give to the

elimination of similar suffering when it is our own. This is a demanding standard indeed, and it is only fair to say that although I regard the argument of this precommentary up to this point as one which has proceeded quite rigorously, what follows is more controversial. It is a view that I hold in common with a number of other philosophers, but also one with which many philosophers disagree. Nevertheless, here are my reasons for holding it.

If we make a moral judgment, we must go beyond our own interests and preferences and base it on something more universal: a standard that we are prepared to accept as justifiable even if it should turn out that we lose by doing so. This conception of ethics is at the root of all of the most ancient ethical traditions, but it has been given more precise expression in the work of contemporary philosophers (Hare 1963; 1981; Singer 1979; 1981). Although I may consider my own interests when I first make an ethical judgment, I cannot give them greater weight (simply because they are my own) than I give the interests of those affected by my judgment. If I do not condone robbery when I would lose because of it, then I cannot justify robbing someone if my victim would lose as a result of the robbery – unless there is some morally relevant difference between us that can be expressed in universal terms (that is, without specifying the identity of the individual involved).

This method of ethical reasoning takes as its starting point my own interests. The avoidance of suffering, therefore, receives the same high priority as ethics as it does in all our lives, when it is our own suffering. Other things being equal, it cannot be in my interests to suffer. If I am suffering, I must be in a state that, insofar as its *intrinsic* properties are concerned, I would rather not be in. (I specify intrinsic properties to take account of the objection that I may choose to suffer in order to gain something else that I value; but if I could get that gain without suffering, I would do so – or else it would not really be *suffering* that I was choosing.) Conversely, to be happy is to be in a state that, other things being equal, one would choose in preference to other states. There may, of course, be other things that we value, or disvalue, besides happiness and suffering. The point is that once we understand this method of ethical reasoning, the significance of suffering and happiness is indisputable.

It is consistent both with the method of ethical reasoning just outlined and with the argument presented in the first part of this precommentary that the weight we give to the interests of others should not depend on their race, sex, or species. Suppose that I have suddenly conceived a foolproof method of dramatically improving the lives of profoundly retarded children languishing in state institutions, but to implement it I must evict some poverty-stricken black families from a building I own. To decide whether I ought to do this, I must imagine myself as living the lives of all those affected to any degree by my decision, and ask which *total set of lives* I would prefer – those lives as they will be lived if I do it, or those lives as they will be lived if I do not. Thus, I must imagine myself as a profoundly retarded child, as well as an evicted black parent, and as all the others who will, to a greater or lesser degree, be affected by my decision. Race is not totally irrelevant here. When I imagine myself in the position of the evicted blacks, I must consider what this experience would be like for a black person, whose attitudes have

been shaped by a history of slavery and oppression. But having done my best to understand what the experience would be like for them, I do not then give their interests a different weight because they are the interests of black people. Similarly, in putting myself in the place of the profoundly retarded children, I cannot ignore the fact that their mental capacities are different from those of normal children, because this will affect the difference that my scheme will make to their lives. But after considering what experiencing this difference would be like, I do not then discount it because it is a difference made to the life of an intellectually disabled, rather than an intellectually able, person.

We should include animals in our moral reasoning in just the same way. To defend a proposal for improving the housing of battery hens, at the cost of making it more difficult for some families to afford eggs, I would have to put myself into the positions of both the hens and the families. In trying to imagine what is it like to be a hen in a battery cage, compared with being a free-ranging hen, I would have to do my best to grasp what it is like to be a hen, take into account everything we know about how a hen experiences confinement in a battery cage. But having done so (to the best of my ability), I would not then discount the interests of the hen, on the grounds that hens are not human. The only acceptable limit to our moral concern is the point at which there is no awareness of pain or pleasure, no conscious preference, and hence no capacity to experience suffering or happiness. That is why we need to consider the interests of hens, but not those of lettuces. Hens can suffer, but lettuces cannot. (To the question as to where precisely the limit is to be drawn, I can only plead agnosticism. I presume that fish can feel pain, but I do not know whether shrimps and insects can.)

To resolve such difficult questions as where to draw the boundaries of the capacity to suffer, or what individual animals of different species we need all the assistance we can get. That is why the pioneering work done by scientists such as Marian Stamp Dawkins (1980; 1989) is so important. There are many methods of trying to assess what an experience is like for a being who cannot describe it to us. Before any empirical attempts at such assessment were made, we could rely on the knowledge of those who knew the animals well and had observed them over long periods. They were often able to understand empathetically what the animals were feeling. But such reports were subjective, based on signs that the observer was perhaps unable to describe. When methods of farm production worth billions of dollars annually were challenged by people concerned about animal welfare, these reports from people with lifetimes of experience were often rejected as “subjective” and “unscientific.” But what else could humans do to put themselves in the animals’ positions? They could measure productivity, observe instances of abnormal behavior, examine the animals’ physical health, or test the levels of hormones in their blood; yet these were all very indirect ways of understanding what the animals themselves felt about different situations. Dawkins’s approach has its own methodological problems, as she acknowledges; but it gives us new and valuable information that, perhaps more directly than any other “objective” method, enables us to form some idea of what an experience is really like for the animal at the center of it. And this, as we have just seen, is at the core of ethical reasoning about our treatment of animals. It is because suffering, whether human or non-human, is ethically significant that we must welcome new insights into the existence, and degree, of that suffering.

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Ethological motivational theory as a basis for assessing animal suffering

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Marian Dawkins’ target article provides a valuable synthesis of cognitive ethology, the economic and functional approaches to behavior, and animal welfare studies. It is important, as Singer recognizes in his precommentary, because it is an attempt to remove the issue of animal suffering from the realm of nonscientific speculation. Singer’s own position is one of rejecting animal experimentation on moral grounds (Singer 1976). He argues that the same criteria should be applied to both human and animal suffering. There is a problem, however, in reconciling this moral stance with a recognition of the value of empirical studies: To determine precisely which species are capable of suffering, and which scientific procedures entail suffering, it is necessary to use procedures that may involve suffering.

Dawkins is right to argue against some of the alternative behaviorally based criteria for assessing suffering – for example, that an animal must be suffering if it is unable to perform behavior in its natural repertoire. In addition to the arguments she puts forward, applying this criterion to the human case highlights the difficulties it entails. Activities such as hunting, or attacking and killing people, are likely to have been part of the “natural” repertoire of human ancestors, yet few would advocate the view that humans in modern industrial societies suffer because there are constraints on these activities. Perhaps this particular criterion is based on an implicit Lorenzian view that behavioral problems exist when unnatural conditions (or breeding) distort an animal’s or a person’s natural repertoire (e.g., Lorenz 1973).

A related aspect of Lorenz’s theorizing – the psychohydraulic model of motivation – has been surprisingly influential despite the absence of evidence to support it (cf. Hinde 1967; Toates & Archer 1978). The preethological papers on animal motivation by Craig (1918; 1928), which provide a much sounder basis for considering different types of motivation, are more applicable to the issue of animal suffering. Craig distinguished between appetites and aversions; if an animal is deprived of the former, it will be motivated to seek out stimuli associated with performing the relevant action. Such behavior may be closely tied to activities that have to be performed to stay alive, such as feeding and drinking (Toates 1980; Toates & Archer 1978), temperature regulation (Toates 1980), and breathing (in newts, Halliday & Sweatman 1976). This category also includes behavior whose deprivation may not be life threatening, but that is essential for

long-term fitness in any environment, such as dustbathing in hens (Vestergaard 1980; see target article), mammalian male sexual behavior (Toates & Archer 1978), parental behavior, and attachment to a social companion [See Lamb: Security of infantile attachment as assessed in the "Strange Situation" BBS 7(1)1984.] Craig contrasted such activities with aversions, which are responses to the continued presence of a potentially noxious stimulus. These include fear and escape behavior (Archer 1979b), interspecific aggression (Archer 1988), and antipredator behavior (Huntingford 1976). Grooming might also be placed in this category in the sense that it is a response to an irritant.

Compared with the Lorenzian view, Craig's motivational scheme leads to a more realistic assessment of the consequences of depriving animals of the opportunity to perform various activities. Deprivation of behavior associated with an "appetite" and the continued presence of stimuli associated with aversive behavior both produce unpleasant experiences. Motivational schemes that are not associated with deprivation effects or with responses to aversive stimuli belong to neither of Craig's categories and represent behavior that is a low priority in the animal's repertoire (as Martin & Caro 1985 argued for play) or may be a low priority depending on circumstances (as in the case of exploration, or predation when food is freely available).

Applying the economic approach (Lea 1978) to animal suffering extends rather than replaces Craig's scheme. Dawkins states that suffering occurs when "otherwise healthy animals are kept in situations that they will pay a high price to get away from (aversion) or situations that lack stimuli or behavioral possibilities they will pay a high price to obtain (deprivation)." This is Craig's distinction, with the addition of the notion of relative price.

In her assessment of animal suffering, Dawkins applies concepts (such as economic choice) derived from functional motivational theory, thereby providing an important, empirically based behavioral alternative to assessments of suffering based on its effect on health or stress level. Her application of the findings of theoretically driven research from a variety of areas in the solution of a specific practical problem establishes a model for applied research in general, for it highlights the importance of a sound theoretical basis and contrasts with the atheoretical problem-solving type of applied research.

Incidentally, Gallup and Suarez (1985), referred to in the target article, argued the feasibility of alternatives to the use of animals in behavioral research. Other researchers, however, have outlined possible alternatives to procedures involving suffering in behavioral research (e.g., Huntingford 1984; Lea 1979).

The significance of seeking the animal's perspective

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Since 1984, I have been conducting a sociological field study of the "culture" of animal experimentation. My goal has been to understand the point of view of people who conduct research on animals or assist in the process (Arluke 1987; 1988; 1989a; 1989b). Based on extended observations in more than a dozen biomedical laboratories and interviews with more than 120 principal investigators, postdoctoral fellows, research technicians, and animal caretakers, I have concluded that there are two views of animals used for experimentation.

The more predictable and prevalent view is that these animals are objects devoid of unique personality or even animate nature. They are considered tools, models, data, material, or supplies. They are batched, numbered, used, and dispatched in a dis-

assembly process reminiscent of the mechanical and routine work of factory mass production. Far less commonly, laboratory animals are viewed as pets, often set aside from experimentation and sacrifice to become mascots or household adoptees. Viewing laboratory animals as pets morally elevates their status compared with that of their depersonalized peers. The pet will be treated as a living entity rather than as a collection of tissues; it will be perceived to have a unique identity and a will; and it will be a source of human pleasure.

There are several reasons why some laboratory animals become morally elevated. Animals that are seen only briefly and dealt with only in terms of experimental tasks are unlikely to be morally elevated. An animal is more likely to be morally elevated when people can "get to know it" over time and can be with it in a caretaking or socializing capacity. Of course, moral elevation is also likely to occur when people are interested in and curious about animals as everyday living things rather than as sources of scientific data. This curiosity may be aroused by a former pet that bears some resemblance to the experimental animal. Sometimes such an interest is also triggered by characteristics of the animal that make it stand out from the others. They include unique physical characteristics, as in the case of a single brown spotted rabbit among hundreds of uniformly white rabbits, and endearing (as well as sometimes difficult) behavioral traits, as in the case of an unusually solicitous dog or an exceptionally intelligent and affectionate primate.

More relevant to Dawkins's argument is the possibility that perceived physical discomfort and suffering in laboratory animals may also result in moral elevation. For example, a few rabbits in one animal facility developed skin abscesses that caused them to jump when the sores were touched and to favor certain positions that prevented contact with the sores. Staff members became concerned about the welfare of these rabbits and spent extra time nursing them. Their interest led to the attribution of thinking, albeit rudimentary, to these rabbits, the identification of individual rabbit personalities, and the development of a sense of reciprocity – these rabbits made it possible for staff members to reduce rather than create suffering and to experience a special relationship, if not companionship, as a result of their nursing. It is interesting that similar situations have been found to foster and sustain relationships between nondisabled people and severely retarded "subhumans" (Bogdan & Taylor 1989).

Attempts to understand suffering from the animals' perspective may serve as a catalyst and nutrient for their moral elevation because the very process of trying to fathom, objectively or subjectively, the inner experience of another may entail projection, taking the role of the other, identification, empathy, and sympathy, and often stirs more profound feelings and thoughts about the "other." This process is familiar to therapists who experience countertransference and anthropologists who "go native."

Improving the ability to gauge suffering in laboratory animals has obvious value for the animals themselves. Presumably, experiments can be redesigned to reduce or eliminate such suffering when it occurs. More objective efforts to understand the perspective of laboratory animals may convince those who are skeptical of this aim that such knowledge can and should be obtained. New methods along the lines proposed by Dawkins may validate the efforts and sharpen the skills of scientists and technicians who have already tried, in highly idiosyncratic and private ways, to understand the experience of laboratory animals.

Since moral elevation would probably result from the use of such methods, its far-reaching implications should be considered. For instance, moral elevation allows emotionally safe and enduring attachments to animals when they are not sacrificed and remain in the laboratory. Moral elevation also makes it somewhat easier for scientists and technicians to see themselves as humane and caring with regard to their animals. Those who

have established long-term and emotional relationships with animals that are sacrificed may experience substantial stress and feelings of loss and grief. Treating laboratory animals as pets may influence experimental results, since the morally elevated ones are likely to receive more attention and special treatment from investigators and technicians.

Clearly, the scientific community must attempt to understand the inner experience of laboratory animals. Dawkins' work will certainly move us closer to this goal. But it would seem reasonable and prudent for those who seek such special knowledge to be aware of and sensitive to the social and psychological implications of understanding the "other."

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The importance of measures of poor welfare

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Marian Dawkins makes the important statement that scientists should be involved in the assessment of animal welfare. She emphasises in particular the assessment of animals' preferences and the evaluation of the importance of such preferences to the animals through procedures that force the animals to balance any preference against a cost that must be incurred when demonstrating it. Such studies provide information that can be used in designing better conditions and management methods for animals and hence can be of great value in attempts to improve animal welfare. Dawkins places too little value on direct measures of animal welfare, however. Singer also adopts this position, referring in general terms to such measures as being merely "very indirect ways of understanding what the animals themselves felt about different situations." Thus, both authors ignore or belittle the majority of the essential information concerning animal welfare.

The term "welfare" should refer to a characteristic of an individual at the time under consideration, that is, to its state rather than to anything which is given to that individual. When conditions are favourable, animals regulate their interactions with their environment without difficulty. Under hostile conditions, animals use various methods to try to counteract the adverse effects of those conditions. These attempts to cope can themselves be measured and, if they fail, adverse effects on the animal can be measured. The welfare of an individual is the state resulting from its attempts to cope with its environment (Broom 1986a). Hence welfare varies along a continuum from very good to very poor and can be measured (Broom 1988b). If an individual fails to cope with its environment so that there are substantial adverse effects on its life, then it is under stress and its welfare is poor. Stress is an environmental effect on an individual that overtakes its control systems and reduces its fitness (Broom 1988a; Fraser & Broom 1990). If the individual succeeds in coping but has great difficulty in doing so, its welfare is again poor.

At present, most of the useful direct measures are of poor welfare, but in the future there may be possibilities for measuring good welfare directly; sophisticated preference tests, like those of Dawkins, are valuable indirect measures. Some measures of poor welfare, such as failure to grow, injuries, signs of severe disease, or high levels of adrenal products, have been used for a long time. Others – such as high frequencies of stereotypies, severely reduced responsiveness, misdirected behaviours, impaired immune system function, or evidence of self-narcotisation using brain opioids – are now being quantified more accurately. Individual variation in the coping methods

used means that although any one indicator can show that welfare is poor, the absence of an indicator (e.g., reduced growth rate) does not mean that welfare is good. A range of indicators must be used in order to identify and quantify poor welfare (Broom 1988b).

The methods for investigating welfare advocated by Dawkins are more suitable for some situations than for others. When welfare problems are short-term (for example, when animals are being handled, transported, or operated on), welfare can be investigated using learning experiments; the first effects of the procedure cannot be measured, however, and some procedures are so unpleasant that the repeated exposure to them in the learning situation that would be needed to assess preferences would be most inhumane. In these circumstances, the actual effects on the animals should be measured. If clear signs of poor welfare are present, the treatment can be criticized on welfare grounds whether or not preferences against it are shown.

Preference studies may sometimes provide incorrect information about either the real preference or the welfare of the animal. An animal that is suffering may not try to avoid the stimuli or situations that are hurting it. There may be other circumstances in which an animal gets its preferences wrong in that it actually chooses something that harms it. As Dawkins mentions, with reference to Timberlake (1984) and Logue (1988), animals sometimes show preferences for immediate apparent gain rather than long-term benefit. The animals' "perceived costs" may be erroneous. This situation does not mean that information from preference studies should not be used but that it should be interpreted with care and considered together with direct measures of animal welfare. Dawkins explains some of the problems associated with her approach and rightly emphasises its advantages when designing both conditions for animals. After designing better systems for the housing and management of animals using preference studies, however, it is still essential to use direct measures of welfare to compare the new systems with the alternatives.

There is a place for measures of animal preferences and for direct measures of welfare in our attempts to understand the responses of animals to their environment and to improve animal welfare. Welfare cannot be assessed by preference studies alone, however; veterinary surgeons' vast knowledge concerning the recognition of signs of injury or ill health and the rapidly increasing number of other indicators of poor welfare must be used, too.

Animal suffering, critical anthropomorphism, and reproductive rights

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Dawkins cites many papers and raises several critical issues, but what is relatively new and important is her use of demand characteristics (elastic and inelastic) as a way of gaining improved animal welfare data as well as providing a window on animal subjective states. Her basic approach is the old one of subjective analogical inference (Burghardt 1985), which Romanes (1882) insightfully used in the study of animals. Indeed, Romanes even discussed choosing among alternatives as an objective means of assaying behavioral "ambassadors" of the mind. Thus, Dawkins is advocating a formal, much more experimentally based, classical comparative psychology, and this historical continuity should be recognized.

Both Dawkins and Singer advocate *critical anthropomorphism* (Burghardt 1985; 1988), the explicit use of our own experiences and feelings, along with our knowledge of human and nonhuman animals, empirical data, and the natural history of the species in question, in approximating what other species

experience and in generating predictions. Ultimately, as Singer affirms, public, objective information is needed; testimonials from experienced individuals with anecdotal insights will not convince people with vested economic and ideological interests, nor, I might add, will it persuade much of the scientific community.

This being the case, it is unclear why Dawkins did not use human data to support the applicability of the elastic-inelastic dichotomy, aversion, and deprivation to suffering. Human data showing the detrimental effects of social isolation or stress are not sufficient; data parallel to those being collected with animals are needed. The omission is ironic, because economics and psychology are the social sciences being conceptually parasitized here.

Dawkins lists several problems with her approach but seems confident that they are surmountable, although the gathering of sufficient data for more than a few domestic breeds seems far in the future, and extrapolation may involve some of the unwarranted generalizations she warns against.

That the ultimate currency of evolution is fitness via reproduction is acknowledged repeatedly by Dawkins. But reproduction itself can be detrimental to the individual's welfare and can cause psychological suffering, as any parent of a teenager knows. Yet the subject of reproductive behavior is largely ignored by both Dawkins and Singer. Much evidence exists that in nonhuman and human animals lack of sexual opportunities as well as atypical rearing may, especially in males, lead to all kinds of maladaptive behavior and, at least in humans, cause suffering. The problems faced by obligatory celibate clergy and sexually segregated prisoners are prime examples. Romantic/sexual pairing, rather than the search for a good meal or a soft bed, seems to be the major preoccupation in literature, drama, music, and even politics. Are we being less than candid about human motivation? By using as the measure of well-being the absence of starvation or malnutrition, we may be setting our sights much lower than we would for our own species. (Parental behavior is also highly motivated in animals and as well as in people. The removal of offspring from a mother can cause psychological and physical distress in humans.) But perhaps addressing these issues will arouse the animal welfare constituencies as well as the farm lobbies. Will we see calls for "reproductive rights" for animals? The relationship between ultimate and proximate causes is more profound than Dawkins seems to acknowledge.

Thus feeding as a convenient touchstone for assessing suffering may be overemphasized and insufficiently critically anthropomorphic. Iguanas I have studied in Panama and Venezuela go for weeks eating little if at all during the breeding season; this is true of males during courtship and territory holding, and of females during the weeks before their eggs are laid. Edible green iguanas, by the way, are being bred, reared, and ranched in captivity at a rapidly increasing rate. Perhaps eating is generally the most motivated behavior of domestic species in which rapid growth, weight gain, and selected traits are desired. But grief-stricken people and those in physical pain still eat; dare one say this reflects at all on extent of their suffering?

The issue of species differences having been raised, a central but largely ignored ethical question presents itself: Should we condone the genetic selection of traits that lead to reduced physical and mental well-being regardless of environmental and maintenance schedules? Is it ethical to develop animals that have lessened demand for certain behavioral characteristics? Is it ethical to select animals with traits that can't help but lead to distress, such as obesity, lack of fur, certain facial conformations in dogs, disease susceptibility (even for animals used in cancer research), abnormal gait and limb structure in horses? If all these choices are equally unacceptable, then the stakes are much higher than what is under consideration.

Ironically, the human preoccupation with sex and children may prove my point in a most unhappy way, for I fear that the

fate of animals lies less with more accurate assessment of suffering than with human overpopulation. Singer dismisses religious arguments, but other entrenched ideologies also keep us from facing reality. This is especially true of those who oppose birth control and abortion for whatever reason but feel no push to formulate realistic alternatives. A growing human population will inevitably lead to increasing environmental degradation, suffering and extinction of many species in the wild and in captivity, and a lower mean quality of life for both humans and animals. Human life will become devalued and full of suffering, as it already is in many countries. Will political, scientific, and moral sentiments prove effective when whole populations are faced with imminent crises and limited resources? The question of animal welfare raises more questions about our own species' future than we seem willing to recognize.

Ultimately the focus has to shift from all narrow speciesist concerns to the welfare, and viability, not of species, not of individuals, but of the earth's ecosystem. Thus the individualistic approach favored by Singer, in which organisms are *not* considered with reference to which "group" they belong to, does not help us at all when we must decide what is best for, say, domestic cattle, ranches, loggers, and the denizens of a rain forest (including humans) about to be destroyed for use as grassland. A crass utilitarianism based on what is best for the greatest number is untenable. The issues are complex; their discussion is complicated by numerous conflicts of interest (as in all controversies over human moral issues – see Alexander 1987). Unfortunately I see no possibility of an ethical system for our treatment of animals that is not inevitably inconsistent with the various values each of us currently holds dear (Burghardt & Herzog 1980).

Having the imagination to suffer, and to prevent suffering

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For too long, those who care little about animals' welfare have been able to argue cleverly that since we cannot know what they feel, or indeed whether they feel anything, there is no scientific justification for bothering to understand. The premise is false. Psychophysicists have for years put questions to animals about their phenomenological experiences, using the techniques of operant conditioning – to find out whether, for instance, a pigeon perceives two colours as being the same, or whether it finds one is a novel hue, more like orange or red.

Now, Dawkins writes as an advocate of applying just such a commonsense technique to the study of animals' suffering. With beautifully simple logic, she argues that if we want to find out whether an animal dislikes some circumstance, we should give it the choice of paying to avoid it. Since economists already understand consumer demand quite well, we can then use their techniques to quantify the strength of the impulse that causes the animal's behaviour. This procedure is so eminently sensible and transparently valid that using it must be the right way to proceed if we are to treat captive animals more humanely.

Doing so will not be smooth sailing, however. Consider three potential problems, in increasing order of seriousness. We are all well aware that we don't always pay for what is best for us – even when we *know* what that is. Chamove et al. (1982) showed that housing various species of primates with woodchip as floor litter leads to greater activity but reduces fighting in the groups. Most keepers of animals would consider this a welfare improvement, yet it does not seem likely that the animals themselves would have worked hard for the opportunity of making their

food far more difficult to obtain! It seems possible then, that what an animal chooses to pay for is sometimes not best for its mental health, as Dawkins acknowledges is the case for physical welfare. As in that case, taking other measures of "welfare" into account should be sufficient to avoid such a problem.

A second problem is the possibility that what is good for an animal one day may not be good for it the next. The opportunity for regular social activity is likely to emerge as a priority for social primates; Dawkins refers to work that shows an inelastic demand for social behaviour in gelada baboons. In the aggressive competition for resources and rank among many social primates, however, there will be occasions when *avoiding* social activity becomes a major need for some individuals. In the wild, of course, these individuals would simply become peripheral to the group; they could sensitively adjust their distance from potential harassment according to their current needs. Investigators of the consumer demands of captive animals will therefore need to be ingenious when offering choices of living situations to complex social species. I can see no reason why this problem should be insurmountable, once it is recognized.

The third and most serious problem is again one of having the imagination to ask animals the right questions. Consider recent results on the mentality of the common chimpanzee. Chimpanzees are the only species of nonhumans that give reasonably convincing evidence of being able to understand the possibility of another individual's deceiving them (Byrne & Whiten, in press; Premack & Woodruff 1978). [See also Whiten & Byrne: "Tactical Deception in Primates BBS 11(2)1988.] The implication of this, that chimpanzees have a "theory of mind," is consistent with their known skill as social manipulators (de Waal 1982; Nishida 1983), their ability to recognize their own reflections in a mirror (Gallup 1970; Mitchell, in preparation) their ability to achieve complex levels of imitation (Mitchell 1987); and their apparent understanding of pretence (Hayes & Hayes 1952).

Given that chimpanzees have a vastly greater capacity for imagination than do other species (on the basis of evidence obtained thus far), scientists interested in animal welfare will have to study chimpanzee "consumer choices" among options very different from those that are sensible for most species. The suffering that might result from dreading what someone else might be planning, even when nothing unpleasant has yet been experienced, and the alleviation of suffering that might result from believing that someone else cares, are not obvious variables to incorporate into the framework of consumer demand theory. But they must be taken into account if we are not to inflict *greater* torture on our closest relatives than on any other animal.

On the neurobiological basis of suffering

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No responsible scientist would argue for the inhumane treatment of animals, but many are confused by ethical arguments rooted in ambiguous moral principles of uncertain origin. Dawkins's attempt to define suffering in a scientific framework is a step in the right direction. If we are to deal effectively with the issue of animal suffering, we must specify precisely what we mean. I argue here that our definition should link human and animal experience as well as permit us to build our knowledge of suffering in a rigorous scientific manner.

Questions of definition. Dawkins seeks a basis for deciding when animals suffer. She identifies suffering as a wide range of unpleasant emotional states that occur when an animal is

blocked from carrying out actions that are biologically mandated, that normally reduce harm or risk to life, or that concern reproduction. I submit that before accepting her purely behavioral definition we need to evaluate it against neuropsychological theory and data on affect. Similarly, before accepting an animal-specific definition of suffering, we ought to examine alternative definitions that can link animal experience with human experience. The following literature helps guide us.

Cassell (1982; 1985) defined suffering as any perceived threat to the integrity of the individual. This definition narrows the field of negative emotions; suffering is akin to fear and anxiety, areas in which we have a rich knowledge base concerning both animals and humans. The literature on affective disorders offers animal models for depression. The most suggestive of these relates negative affect to helplessness in the presence of aversive events (Seligman 1975). Such work conforms to a complex rapidly growing literature on neuropeptide regulation of brain activity (Frenk et al. 1986); it can account for both animal behavior and the suffering of severely ill human patients. Still another definition relates (but does not limit) suffering to separation from others, since relationship with others is a biologic imperative of the mammalian limbic brain (MacLean 1985).

This brings us to the important subject of suffering and central nervous system neuroanatomy. Dawkins's model of suffering imputes emotion to both pigs and hens. Neuroanatomical structure refutes this.

The neuropsychology of suffering. Nowhere is the nature of affect better characterized than in MacLean's work (MacLean 1973; 1985). He describes the brain of advanced mammals as consisting of three basic phylogenetic formations: reptilian, paleomammalian, and neomammalian. These formations differ anatomically and biochemically; each corresponds to a qualitatively different type of consciousness and a corresponding set of psychological phenomena.

The reptilian brain, as found in birds, for example, is commonly equated with the basal ganglia. These structures, which are heavily dopaminergic, direct specific behaviors such as foraging, submissive displays, territoriality, ritualistic displays, flocking, imitation, migration, displacement behaviors, and trophic behaviors. This brain is incapable of emotion, empathy, or compassion. We have as yet no neuropsychological basis for postulating the existence of suffering in birds or reptiles when their biologically mandated behaviors are blocked.

The paleomammalian or limbic brain surrounds the brain stem in mammals and is a common denominator among mammalian species (MacLean 1973; 1985). Nurturance, audiovocal communication, and play all depend on the limbic structures. Affect and feelings of meaningfulness originate in the limbic brain and such experiences are its "intelligence." Limbic awareness gives us the capability of empathy and emotional bonding with pets; it is essential for our sense of compassionate moral responsibility toward fellow animals.

We know a great deal about the limbic neuropsychology of affect. A noradrenergic system subserves anxiety and emotional arousal (Redmond 1979; Van Dongen 1981). This system includes the locus coeruleus (LC), the dorsal noradrenergic bundle (DNB), and the septo-hippocampal structures. The DNB ascends from the LC to limbic areas and to the cingulate cortex. Noxious stimulation increases firing rates at the LC (Segal 1978; Stone 1975). Direct stimulation of the LC induces an anxietylike behavioral state in the monkey (Redmond et al. 1976). Various anxiolytic drugs decrease the firing rates of LC cell bodies, particularly during stress (Gray 1982). In rats, stress depletes norepinephrine in the LC and leads to helpless behaviors (Weis et al. 1982). Endogenous opioid substances play complex modulatory and regulatory roles in the experience of affect (Rogers & Cooper 1988). Thus, affect is fundamentally limbic, noradrenergic, related to stress, and endogenously modulated.

The neomammalian formation, or neocortex, expands progressively in higher mammals. In humans it permits language

and speech, abstract reasoning, and other higher processes. The neocortex in humans is less the seat of suffering than the interface, which allows us to express suffering abstractly. Human suffering probably differs more in complexity than in quality from that of lower mammals.

Is consumer demand theory a viable model? Given Dawkins's assumptions, this is an elegant and resourceful approach. I argue that suffering is specific to mammals and more complex than the phenomena she identifies, however. Dawkins's model is at root an approach-avoidance paradigm and is therefore concerned with fundamental trophism. As Wise and Bozarth (1987) have described, the psychomotor response of forward locomotion depends on the dopaminergic circuitry of mesolimbic neuronal systems. These are biologically primitive and essentially reptilian. Dawkins's economics model ultimately reduces to this reptilian mechanism, which is more primitive than affect. Her approach can work, but only if the behaviors studied truly reflect affect. She needs a more specific definition of suffering.

Moral reasoning. My argument falls on the side of "speciesism" as defined by Singer. I contend that mammals require greater moral concern than other species because they "feel" more; animals are, quite simply, unequal in their capability to suffer. I endorse a criterion of affective rather than intellectual capability.

Singer's reasoning ignores brain structure and is based on assumptions that can, and should, be evaluated biologically. We can no longer afford to approach pressing ethical problems as nineteenth-century armchair philosophers would. It is time to integrate ethics with biology.

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Animal suffering: The practical way forward

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The traditional attitude of scientists toward ethical and philosophical issues such as animal suffering is either not to care, or to cloud the issue by using their reputation to give weight to their personal opinions. In view of Peter Singer's plea for treating animal suffering seriously, Marian Dawkins's sincere desire to apply her expertise as an animal behaviourist to the assessment of animal suffering is to be lauded.

In her writings and lectures over the last decade, Marian Dawkins has worked toward a pragmatic and scientific approach to the assessment of animal suffering. In her target article, she summarizes her own approach to the subject, which mainly consists of using preference tests and quantitative motivational measures. Because I fully agree with the principle underlying this approach, I will not discuss the importance of treating animals as cognitive creatures capable not only of having mental states but also of reacting to the external world according to these mental states. This is a subject that has been neglected for too long in the field of stress research (Dantzer & Mormède 1983b); the theme is also central to the point Dawkins is making. What I would like to do is to (1) make clearer and more correct a few points mentioned by the author, and (2) point out some of the theoretical and practical difficulties in the approach she is advocating.

When Dawkins mentions the use of abnormal behaviour (e.g., stereotypes) to assess indirectly a high level of frustrated motivation (section 5), she is correctly pointing out the descrip-

tive nature of this approach and the decision problems it creates. (For example, what level of abnormal behaviour implies suffering? Like many other colleagues in the field, however, she is mistaking symptoms for causes. As I have already argued elsewhere (Dantzer 1986), stereotyped behaviour is unlikely to be accompanied by suffering since the neural system that processes the load of information that is engendered during the execution of stereotyped activities has little or no opportunity to elaborate such mental states as suffering. In addition, an animal does not stereotype to release endorphins, since blocking endogenous opioid systems does not interfere with performing fully developed stereotypes. So the question of whether or not a stereotyping animal is suffering is the same as the question of whether or not a schizophrenic patient is suffering from his disease, but with the important difference that there is no excuse for a production system from which such a disease originates.

Dawkins is not aware perhaps of the fact that the best example thus far of the use of titration techniques for assessing motivation is not found in the field of welfare but in behavioural pharmacology, in relation to the rewarding properties of self-administered drugs (e.g., Griffiths et al. 1978). Monkeys fitted with an intravenous catheter have been trained to self-inject various drugs of abuse intravenously by pressing a lever. Test sessions are run using a progressive ratio schedule to assess the breaking point (i.e., the ratio at which the animal ceases to respond). The rank order of the values obtained for different drugs corresponds well to the abuse potential of these drugs in practice.

The use of operant conditioning techniques for measuring motivation, although it would seem intuitively to be sound, is plagued with a number of problems that are well known to experimental psychologists and should not be underestimated by zealous "applied ethologists." One of the main problems common both to basic reinforcement schedules and to conditioned suppression techniques is the nature of the relation between the range of responses normally elicited by the reinforcer and the operant response selected in the experiment. This is best illustrated by the phenomenon of autoshaping in pigeons (Brown & Jenkins 1968; Hearst & Franklin 1977). Animals do not simply use operant keys as tools to gain access to the reinforcer but redirect toward them elements of the behavioural repertoire normally elicited by the reinforcer. Pigeons do not peck an operant key in the same way when it provides access to water as when it provides access to food. Moreover, pigeons learn with great difficulty to peck a key in order to avoid electric shocks simply because the normal response to such a stimulus is not a peck but some form of escape. This of course, does not mean that they are unable to experience the pain associated with electric shock. The problem may seem trivial, but bearing it in mind, how are we to interpret the data from experiments in which hens are required to peck a key in order to increase the space allocated to them or to gain access to conspecifics?

Another very important point concerns the generality and meaning of the results obtained in motivation tests. Simply because they sound intuitively appealing does not mean that they are correct. An important problem when it comes to assessing a need is how to avoid creating the very need that the experimenter wants to test. "Out of sight, out of mind," writes Dawkins. A laying hen that has never experienced dustbathing may be less frustrated at not being able to do so than a bird that already has some experience with it. Therefore, to assess the intensity of her motivation for dustbathing, a laying hen must be allowed to have a minimum experience of it. (If I have to make do with a black and white television set, I will be very happy as long as I do not know that I can watch the same programs in color.) Another important problem is that the results obtained are very situation-specific and cannot easily be generalized. A good illustration of this point is provided by an experiment by Baldwin (1979) on thermoregulation in pigs. Pigs put in a cold room work hard to turn on heating lamps and they do it in a very

precise way; for example, they double their number of operant responses if the heat power is divided by two. When they are tested outside in winter, however, with the operant system set up in a hut in the middle of a field, they spend their time rooting outside the hut and do not care about turning on the heating lamps.

Although the approach advocated by Dawkins is by no means easy, the important message is that there are objective ways of assessing animal suffering. As pointed out by Singer, this is a field to which we cannot remain indifferent; it should attract innovative and bright young scientists instead of only being the object of discursive arguments.

On Singer: More argument, less prescriptivism

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Singer's precommentary is an excellent discussion of the significance of animal suffering, and I agree with him that there is no characteristic of, or fact about, all humans in virtue of which their interests – including the preference not to suffer – deserve greater moral consideration than the identical interests of animals. I think his article has several shortcomings that are worth examining, however.

Singer's argument against granting humans superior moral status in comparison with animals is fine as far as it goes, but it does not go far enough. First, it ignores the following possible appeal to a putatively relevant difference between humans and animals: Only humans are members of the human community and have special moral relationships to one another because of their social bondedness. Perhaps discrimination on the basis of group membership or social bondedness is not always unjust. Midgley writes:

The special interests which parents feel in their own children is not a prejudice, nor is the tendency which most of us would show to rescue, in a fire or other emergency, those closest to us. . . . The question is, does the species barrier also give some ground for such a preference or not? (Midgley 1983, p. 102)

This question, and arguments by analogy to an affirmative answer, merit careful consideration. I suspect that the human community argument ultimately fails. It seems true that we may, and should, act preferentially with regard to the welfare of family members, but this seems explicable by the greater long-term efficiency of such partiality. Furthermore, even if discrimination in favor of one's family were justified in terms of social bondedness and not efficiency, to complete the argument one would need to show that favoring human interests over those of animals is relevantly similar to such discrimination, but relevantly different from racism and sexism, where appeals to groups or social bondedness might also be made — and this is a tall order. But the human community approach should not be overlooked.

Singer might also take more seriously what I call the "*sui generis* view," according to which membership in our species *per se* grants superior moral status. He contends that because no argumentation is offered to demonstrate the relevance of being human, this appeal is arbitrary and therefore unworthy of consideration. But all moral positions ultimately assume that some characteristic is morally relevant — for example, sentience, self-awareness, or, more generally (as Singer and I both hold), the possession of interests — and the *sui generis* view assumes that this characteristic is being human, arbitrary as that may sound.

Moreover, there is at least one good reason to think that this characteristic is morally relevant: Almost all of us, thinking as carefully as we can, feel at least very uncomfortable with the idea that some humans may be used involuntarily in harmful,

nontherapeutic research, no matter what capacities they lack. Yet few of us doubt that we may be justified in causing a few rats to suffer if necessary to test a highly promising possible cure for AIDS. Hence the problem of marginal cases, with which all philosophers who take animal welfare seriously struggle: We either (1) justify some use of animals, grounding moral protections in a characteristic they lack, thereby lassoing similarly lacking humans; (2) preclude all use of animals; or (3) identify a morally relevant characteristic of, or fact about, all humans that excludes animals from the protections granted to humans. The *sui generis* view may be a bit mysterious, but it would solve the problem of marginal cases by directing us to possibility (3). Although I consider this view arbitrary, in its favor it may be said that no one has yet dealt very satisfyingly with this problem.

In addressing the problem of marginal cases, Singer focuses too much, I believe, on capacities of individuals. Other facts about individuals might be relevant, though I shall mention only one. If it is in principle permissible to use for research humans (and animals) lacking certain characteristics, this does not prevent us from exempting the humans gratuitously. My giving *A* a gift does not mean that I must give *B* a gift. In addition to protections (e.g., from being harmed needlessly) that are due "naturally" (i.e., in virtue of natural characteristics), there may be protections that are given not as a matter of strict justice, but simply because we care about those affected.

My final objections concern Singer's suggested method for resolving moral problems. After rightly stating that in ethics we must transcend our own interests and adopt a more universal viewpoint, he commences a slide from a description of what ethics is to a very specific moral theory:

This conception of ethics is at the root of all the most ancient ethical traditions. . . . So, although when I first think about what to do, I may consult my own interests, when I attempt to make an ethical judgment, I cannot give greater weight to my own interests (simply because they are my own) than I give to the interests of others affected by my decision. (ibid)

According to the view he ends up with, the right action is that which, given one's own preferences (the focus of prescriptivism), one could accept if one were somehow to "stand in the shoes" of all of those affected (utilitarianism). If this position is, as Singer suggests, strongly recommended by an understanding of what ethics is, then few moral philosophers truly understand the subject of their profession, for utilitarian prescriptivists are a minority (and were nonexistent before this century). By begging significant questions in passing from a characterization morality to a discussion of his own moral theory, Singer has, for one thing, ruled out rights views, according to which protections of individuals should be so strong that we may never harm some to benefit others.

In addition, Singer's prescriptivism retains an overly subjective element in moral decision making. He states that "[t]his method of ethical reasoning takes as its starting point my own interests." In considering whether to do something, "I must imagine myself as living the lives of all those affected by my decision, and ask which total set of lives I prefer, those that will be lived if I do it, or those that will be lived if I do not do it." But suppose I am extraordinarily tough and have relatively little concern about pain, nondebilitating injuries, and actions that would humiliate most people. I might then prefer some actions or policies that others would consider too severe. Things would be even worse if I were a sadomasochist! But why should others be subjected to the peculiarities of my own preferences and values?

Epistemology, ethics, and evolution

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Marian Stamp Dawkins, in her concern for animal suffering, combines an evolutionary, ethological, and ecological perspec-

tive on animal life with an empiricist's epistemology and pragmatic ethics. The latter has pre-Darwinian roots, and it is uncertain whether the two approaches are compatible.

Dawkins wants to gain access to the inner subjective experiences of animals so as to understand and mitigate animal suffering, but she is blocked by severe epistemological obstacles. According to the modern philosophical tradition, all subjective experience is necessarily private. Dawkins asserts that to overcome solipsism and the inaccessibility of the experiencing other (human or animal), we must rely on problematic and uncertain analogical arguments. We must rely on our own subjective experiences to interpret external, sensory signals about the inner experiences of the animate others. The problem arises with our differences despite organic similarities, with the disanalogies to their black-box, inaccessible inner life. This epistemological skepticism is behind Dawkins's call for indirect and objective tests of animals' "high motivations," "perceived costs" of various frustrations or aversions, and subjective sufferings. It also underlies her "economic" measures of inelastic demand as the assumed objective correlate of a suffering that is beyond our experiential ken.

Dawkins's skepticism is healthy but, I think, misplaced. Once one seriously takes an evolutionary, Darwinian perspective, "purely private subjective experience" – the old Cartesian *res cogitans* or Lockean, Humean subject – becomes highly suspect. Natural organisms, human and animal, are alive. They are worldly actors and sufferers fundamentally characterized by metabolic existence, which means an essential dependence upon, and interaction with, the world, including animate others. There is no essentially private and isolated being or experience. Organisms are by necessity expressive creatures. They have to be in order to be. Thus subjective experiences are both private and public. I see the delight of our nine-month old Tegan, evidenced by her smile and the active response of her body. I feel her pain or unhappiness when I hear her cry and see her struggling arms. Her inner life and experience shines through such bodily expressions. The same is true of our Labrador, Nasti. Radical skepticism about the existence and lively experience of other subjects is misplaced. ("Other minds" is a problem studied by philosophers – a crisis of modern philosophy, not of natural organic existence.) In virtue of being natural organisms ourselves, suffering the throes of metabolic existence, we are natively and epistemically equipped to recognize and understand the animate, animal other. Without this capacity we could not deal with the world, practically or theoretically.

Nevertheless, a modified or moderate skepticism is well founded. With respect to both human and animal others, there are real differences despite profound organic similarities. We may fail to recognize or to interpret adequately the particular expressions of inner experience. We may fail to grasp the terror behind the grin of a monkey or the immobility of a small rabbit. Yet this is a failure to comprehend not basic subjective experiences but how they are concretely felt and expressed. In spite of our native powers of knowing, we are incurably ignorant and fallible. Thus Dawkins' call for the indirect and "objective" tests of animals' experiences and sufferings is important as a practical, if not a theoretical matter. But the gulf between human and animal experience is not as unbridgeable as she claims.

Inadequate metaphysics, epistemologies, and ethical theories dog all our heels. Note Dawkins's and modern science's quandary over what to make of the relation of "causal, mechanistic coping mechanisms" and subjective feelings – of determining whether the animal (and human) subject is an efficacious agent in the world or merely an epiphenomenal bystander. Such inadequacies, particularly glaring from an organic and evolutionary perspective, also plague Peter Singer.

Singer is interested in animal and human individuals; in the private pleasure, pain, and preferences of all sentient creatures; and in the ethical ideals of justice and equal consideration of the interests of those with no "morally relevant differences" of

character. Out of a sense of moral scandal, he would make radical changes in our present use of animals.

Singer's individuals are pre-Darwinian, utilitarian abstractions, however. They are essentially independent of and isolated from one another – the aforementioned subjects of the private pleasures, pain, or preferences. They may coexist in social collectivities, but not as interconnected individuals in genuine and concrete communities. Singer's moral judgments and interests exclusively concern individuals as individuals.

From an evolutionary and ecological perspective, individuals are not isolated or radically independent but decidedly interdependent. They make up a bewildering variety of concrete "webs of life," for they matter to each other's very lives and selves. Patterns of community life, engendered within these webs of interconnected individuals, gain an ethical significance of their own, as is requisite for the continuation well-being of such communities and individuals. Thus there are social, communal, and ecological concerns that do not refer to any *particular* individuals. Can Singer's utilitarianism handle these issues, or does it miss the point? Notice his crucial argument from "marginal cases," aimed at breaking down overweening speciesist or anthropocentric concerns. There will always be some animals that will outdistance some human beings in some honored mental or subjective capacity. We refuse on ethical grounds to mistreat human beings; therefore, we should not mistreat their "equals." We should reduce to aboriginal sentence our standard of inclusion in the community of equal consideration of interests. It is only fair to the individuals concerned.

But this "one on one" ethics won't do. If pressed to make a "Sophie's choice" between a competent chimp and an incapacitated human being, we will always go with the human being, not from a rating of individual capacities, but because the human belongs to our community and is one of us. (To belong to a community of interconnected individuals is not the same as to belong severally to the same species.) We have community norms, interests, and mores to uphold. We ought to avoid being forced to make "Sophie's choice" between animals and ourselves, we must recognize the existence of the transhuman communities of animal and organic life to which we belong. Given the goodness of life and organisms's inherent and varying capacities, this emphatically does concern us morally. But these concerns go considerably beyond the private pleasure, pain, and preferences of individuals (human or animal). Moreover, an ethic of organic life that gave due weight to ecological and communal, as well as individual, concerns might be significantly different from that proposed by Singer.

The philosophical foundations of animal welfare

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The importance of the topic addressed by Dawkins and Singer is just now becoming widely appreciated. Both authors have, of course, made major contributions to the intellectual movement for animal welfare. Although I am in total sympathy with their aims, I think there are crucial points at which the shaky philosophical underpinnings of both of their presentations need to be shored up.

I generally agree that the work Dawkins describes provides just the right direction for the development of a more sophisticated understanding of what is important to the welfare of other animals. My only serious objection is that Dawkins rests the whole project on what I take to be a philosophical bed of sand. In section 4 of her target article she bases the belief in animal suffering on the argument from analogy. This argument, however, is not "much criticized" but rather overwhelmingly re-

futed, not only for the case of other species but even for application to our conspecifics. The rejection of this argument does not mean that we are “locked within our own skins,” but is grounded in the realization that the solipsistic perspective, the starting point for the argument from analogy, is totally incoherent. Following Wittgenstein, we can now see that it makes no sense to suppose that we learn the meaning of mental language – of terms such as “pain” – simply by awareness and the naming of our private experiences. Rather, the general connection of experiences with characteristic behavioral expression is a precondition of a meaningful language of sensations. Sensation language, or mental language generally, cannot be separated conceptually from the criteria for its application. This perspective on the issue suggests that the attribution of mental attributes to either human or nonhuman animals is philosophically not problematic (though of course attributing the *right* attributes to nonhumans may be very difficult – which is the point of Dawkins’s project). In summary, we do not need an “inference,” based on a worthless inductive argument, relating similarities of behaviors to similarities of experience; we need some knowledge (uncontaminated by flawed philosophy) of what such attributions of experience *mean*. (The general thesis of this paragraph is elaborated in much more detail in Dupré, in press.)

My difficulties with Singer’s presentation can best be introduced by considering the sympathetic imagining that he takes to be the ground of our concern for other beings. I suspect that many readers will share my inability to imagine what it is like to be a chicken. Certainly if this is what is involved in determining the moral status of a being we will all have to remain, with Singer, agnostic with regard to the experiences of shrimps and insects. And although I think Dawkins does tell us something about what animals prefer, and what causes them to suffer, I do not think she gives us much help in imagining what it is like to be a rat. Much of this discussion derives from Thomas Nagel’s (1974) classic article, “What Is It Like to Be a Bat?” But unless Nagel is providing merely a misleading way of saying that bats are subjects of experience, I want to deny that there *is* anything it is like to be a bat. Indeed, although a very large number of things can truly be said about me as a subject of experience, I do not think there is any further ineffable thing it is like to be me. At least, I hope that others will consider me a proper object of moral consideration, not because they can imagine what it is like to be me (possibly an impossible project) but because they can recognize me as an obvious subject of experiences and possessor of mental attributes.

I think these imaginative feats are another vestige of the Cartesianism that lies at the heart of the argument from analogy, and of which defenders of animal welfare have no need. Someone who thinks in terms of the primacy of the private experience may be inclined to think that the crucial question is whether animals have experiences like *this* – mentally contemplating one’s own painful experience. To the extent that they do, we can imagine what it is like to be like them. One problem is that none of us, I suppose, knows the experience of having one’s desire to peck and scratch in litter frustrated. But more generally, the issue of animal suffering just does not turn on impossible comparisons between my own experience and that of a chicken. What is crucial is merely that chickens can quite sufficiently realize the criteria that are conceptually connected with suffering. Thus I suggest that a more promising approach is less problematic: Learn what suffering means, and it is easy enough to observe that a great many animals frequently exhibit it. It then becomes possible to interpret the work of Dawkins and others quite unproblematically as providing a more accurate prediction of exactly when particular kinds of beings are most likely to suffer.

Finally, giving serious philosophical weight to imagining what it is like to be a chicken or a bat seems to me a minimization of the *differences* between humans and other species, of which

defenders of animal welfare also have no need. What is surely right about Nagel’s (1974) article is the assertion that the experiences of, say, bats are very different from ours – demonstrably different in that bats experience features of the world that we do not. It is unclear whether our language of experience has any application at all to animals that are very different from us, such as insects and shrimps. This reflects the fact that in applying our language of, say, suffering to animals, we are inevitably being somewhat anthropocentric. This language is grounded in our own form of life, and as the differences between humans and other species increase, so does the applicability of our language of experience. But, to use a very suggestive metaphor of Singer (1981), the fact that we are the center of the “expanding circle” implies nothing about how far we may increase its radius. Only a perceived need for – and the subsequent rejection of – an inductive inference (the argument from analogy) could provide a motive for limiting the circle so parochially to our own species.

Taking the animal’s viewpoint seriously

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Marian Stamp Dawkins deserves the highest praise for having created, practically single-handedly, the science of animal welfare. She not is the only investigator in the field or even the first; she is, however, the first to have attempted to provide a methodology and to analyze and codify its results to date. Having said this, I wish to indicate some philosophical problems raised by her approach; this critique might suggest that an even bolder vision is called for.

In her target article, Dawkins presents a dilemma for scientists: If they deny that it is meaningful to attribute to animals subjective experiences that are similar to our own, researchers will exclude themselves from participating in the framing of animal welfare regulations. But to accept the premise that animals do have such experiences (specifically that they, like humans, can suffer) entails a commitment to take these experiences seriously and to investigate them fully, and this stance may clash with deeply held methodological presuppositions. It is important to realize that this is also an *ideological* commitment – to a misguided quasi-Cartesianism and, in addition, to a kind of extreme instrumentalism that permits humans to exploit nonhumans for their own ends, free from any worries about their putative mental states. Therefore, I think Dawkins should acknowledge that what scientists are confronted with is not just the pragmatic dilemma she presents but, more important, a *moral* dilemma.

This dilemma, articulated in the context of animal experimentation by Singer (1975) and now commonly discussed in the philosophical literature, can be described as follows. The more biological knowledge we have about nonhuman animals, the more inclined we are to find new ways to make them serve our needs. But this knowledge reveals ever more sharply the natural kinship we have with nonhuman animals and thus provides more reasons for showing them equal consideration in our ethical deliberations. Here we encounter the crucial challenge faced today by scientists studying animal behavior. Dawkins has carefully avoided assuming that animals’ attractions and aversions are in general the same as or similar to those of humans – or that they even need to be, for the problem of suffering to be paramount. Although we should guard against excessive anthropomorphizing of animals’ behavior and experiences, scientists must accept that their basic dilemma is a moral one; it is not solely a problem of compromising cherished methodological principles.

A second philosophical problem arises from Dawkins’s sug-

gestion that in such empirical studies of animal welfare as she proposes, "the animals' viewpoint should be an essential ingredient." She has in mind here the consideration that what matters to the animals being studied (1) can be established by observation, and (2) counts for something in our ethical deliberations. But a more far-reaching view would be that what matters to the animals counts for at least as much as, and probably more than, what matters to the experimenters and those whom they seek to benefit, namely, the rest of us. This is most evident when basic interests of animals (life, well-being) are sacrificed to promote nonbasic or short-term human interests. If we take seriously the idea that some nonhumans are subjects of a life that they can experience going well or ill for them (Regan 1983), and that all organisms have a good specific to their kind that they seek to realize barring outside interference (Taylor 1986), we might come to realize that in these very fundamental, morally relevant respects they are closely similar to us. We might then arrive at the conclusion that very few of the ways in which animals are made to serve humans are morally justifiable (Fox 1987; Sapontzis 1987). Thus, the radical aspect of Dawkins's principle of taking the animals' viewpoint might be a shift away from anthropocentrism to biocentrism, to respect for and living in cooperation with animals (and the biosphere as a whole). This would entail an affirmation of animals' intrinsic value and a complete rethinking of our relationship to them.

Dawkins is not prepared to go this far, understandably. Few of us are, and indeed it may well be impossible to overleap our speciesism to this degree. But it is also clear that some of our most ingrained behaviors with respect to animals must be reexamined and questioned probingly once we allow that there is such a thing as "the animals' viewpoint." For this criterion of evaluation cuts more deeply than either Dawkins or Singer suggests, because it raises issues about the quality of life that are broader than those centering on welfare defined in terms of pleasant and unpleasant experiences.

Third, Dawkins' outlook is shaped by her adherence to the argument from analogy concerning other minds and others' subjective states. This time-honored position – that we can know of the existence and states of other minds only by inference from their accompanying behavior – should not, however, be accepted as problematic for a science of animal welfare. It is understandable that Dawkins and other scientists wish to avoid relying merely on empathetic and anecdotal accounts of animal motivation. Singer points out plainly enough that too great a reliance on such accounts has helped undermine the animal welfare advocates' agenda for change. But it does not follow that we should move to the opposite extreme, feigning a fear of collapsing into solipsism unless we make this inferential or analogical "leap." It has been argued (Strawson 1959) that we cannot meaningfully attribute mental states to ourselves except by contrast with the attributing of such states to others. Existential phenomenologists have portrayed the world of human experience convincingly as a "life-world" or a "with-world" – we attribute a social-perceptual construct occasioned by mutual recognition of each other's subjecthood (Heidegger 1967; Merleau-Ponty 1962; Sartre 1956). These positions do not of course refute the argument from analogy decisively, but they do place it and the related epistemological tradition in doubt. Dawkins assumes that an inference is needed as a bridge between empirical evidence of animals' motivation and attributions to them of feeling states somehow comparable to our own. I submit, however, that we should not let skepticism overwhelm us and that we should respect our natural empathetic reactions when they are supported by the kind of evidence of motivation Dawkins seeks. We would, then, find ourselves justified in having the compassionate feelings we have by nature, rather than as Dawkins has it, being merely, "justified in applying such an analogy."

Dawkins's most important contribution to animal welfare lies not in justifying a minimal application of analogical inference to

ascertain the nature of animals' experiences. Rather, it lies in confirming and perhaps extending the intuitions of sensitive, compassionate, and humane beings. What the outcome of her effort will be, no one can predict. But a development in the evolution of our species' moral consciousness seems not unlikely.

Concepts of suffering in veterinary science

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To have a realistic perspective, no study of animal suffering should neglect the fact that this is the central focus of clinical veterinary medicine. In its common use, the term "suffering" covers the overtly manifested features that coexist with all clinical states that are substantial (Fraser 1984). Suffering can be regarded as the affective component of any significant disturbance of or insult to the subject's physiology and sentience.

Most signs of suffering occur in behavioral syndromes that have long been recognized in veterinary medicine (Fraser 1988b; 1989). Many involve pain, which often generates suffering. Pain is sometimes revealed in negative behavioral reactions, for example, when the "seat of pain" can be palpated. Fear, as an additional factor in the syndrome, may either subdue or exaggerate any expression of pain in animals. Shock can also mask pain. Behaviors that are well-recognized signs of pain include flinching, restlessness, flailing or rigid limbs, writhing, or self-directed bites, and abnormal vocalization. Other signs of painful suffering include panic biting, suddenly altered appetite, inactivity, "tucked-up" posture or postural changes, and modified motion (Fraser & Quine 1989). Suffering is assumed to exist in all these cases if the animal's conduct is altered.

Recognizing and interpreting animal suffering clearly requires appropriate experience and medical knowledge of livestock behavior and health. Surgical intervention is often aimed at alleviating suffering, either directly or indirectly, and this emphasizes the need for the veterinary appraisal of suffering with a realistic perspective. In clinical veterinary work, levels of suffering are implicitly understood. The eight chief clinico-behavioral manifestations, in an order that approximates the diminishing degrees of disturbance to the affected subject, are: collapse, arresting pain, agitation, depression, anorexia, inactivity, self-disuse, behavioral anomalies.

Suffering is also a component of more ambiguous conditions such as stress or distress. Distressful circumstances of husbandry are those that clearly disturb the animal beyond its ability to adapt to or become accustomed to them (Ekesbo 1978; Van Putten 1988). Suffering can therefore result from psychogenic insults, independently of physical cause. Certain acute behavioral signs such as intensive vocalizations, struggling, and trembling are clear evidence of a reactive variety of suffering. In addition, chronic forms such as passively depressed behavior and agitated, stereotyped behavior can occur as states of suffering that are also physico-pathologically independent. The latter varieties of suffering can therefore be classified as substantive or psychological. Noxious forms of stereotyped behavior are widely assumed to indicate such suffering (Fraser 1988a; 1985; Sambras 1981).

Affective suffering and psychological well-being are opposite behavioral states, either tolerated or enjoyed by the organism's constitution. It is a valid clinico-behavioral rule that the development of either state displaces the other. The imbalance between these two states demands the recognition of both states as behavioral manifestations. It is also necessary to recognize that welfare is exogenous to the animal, whereas both well-being and suffering are endogenous states. Perceptions in ani-

mal welfare need some of the discipline of veterinary-based ethology – a rapidly emerging subject of importance.

Animals, science, and morality

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Marian Dawkins is certainly right in thinking that the growing interest “in the ethical issues surrounding animal welfare forces us to look at the subjective feelings of animals and how we might best study them,” and she herself, both in earlier work and in the present target article, has significantly contributed to this study. This study matters in no small measure because, as Peter Singer makes clear in his precommentary and as Dawkins gives every evidence of accepting, subjective feelings, especially those related to suffering, are factored into moral arguments about our treatment of animals. So we need some way of approaching those feelings. I agree that suffering is, as Singer stresses, ethically significant. My problem is with what follows from this – with *how* subjective feelings of suffering are factored into arguments about our treatment of animals.

The claim that animal suffering must be taken into account morally is, I think, beyond dispute; but that that suffering cannot be justified by an increase in some other value is very much in dispute. There are all kinds of examples (conscriptation, taxation, eminent domain) of our imposition of burdens on one group of humans to benefit another, often without the consent of the first group. In the case of scientific research, for example, we typically impose burdens on animals to benefit (primarily) humans, and we think, as with the human examples, that the benefits justify the imposition of the burdens, as they would for humans. This argument from benefit, in which we make some humans and animals pay a price in terms of burdens or harms, seems a fundamental part of contemporary morals and social life, and we need some direct assessment of it. If one is a utilitarian as I am (as, indeed, Singer is too), one will typically accept this argument, though quarrels will persist about whether something is a benefit, about how much of an increase in one value will justify how big a decrease in another, and so on. If one does not accept the argument, then it is unclear exactly how one will deal with the obvious trade-off situations that are facts of life.

To tell scientific and medical researchers that animal suffering is ethically significant and that it must be taken into account is, I think, preaching to the converted. I agree that more has to be done to enable us to study animal welfare empirically; but what is crucial to the moral validity of much scientific and medical research is that animal suffering (in the widest sense) be consistent with the argument from benefit. If this argument could be rendered suspect (e.g., by showing that suffering is what philosophers call an incommensurable value), then I do not have a very clear idea of what would then justify the imposition of animal suffering for our benefit.

Will empirical studies of animal welfare affect the argument from benefit? Yes and no. They will, because they will give us a better understanding of when and to what extent an animal is suffering, which is part of the argument; but such information will not show that animal suffering cannot be offset by an increase (appropriately labeled, to an appropriate degree) in human (and, possibly, though usually not primarily, animal) benefit. Of course, such studies might indicate that some very considerable benefit was required to offset *this* degree of suffering; but the general point of the argument would not be affected.

Reduction in animal suffering seems an obvious good, and Dawkins' remarks about designing suitable environments for animals are clearly to the point. Nothing about the argument from benefit, however, denies that such reduction would be a

good thing, something to be carried out by scientific and medical researchers for its own sake.

I see nothing wrong with talking about animals' mental states, emotional states, and how they “feel” about something – so long as these are given behavioral correlates. But it is all too easy, as I think Dawkins' target article shows, to shift from the position that discussion of, say, mental states is really about behavior to the position that behavior *is* evidence for private, interior mental states, which, collectively, are then construed as how the animal “feels” about or “sees” a situation. The aim is to capture part of the animal's “viewpoint” about its experiences and what is done to it that produces those experiences. Dawkins writes as if the main problem with this kind of shift is the viability of the argument from analogy. But this is only part of the problem. For example, to see experiences as my experiences – as, say, my experiences of a particular situation – must I be self-conscious? Must I have a concept of self? If so, then what is required to have such a concept? Language? Or something less demanding? Dawkins' claim that all we need for such a shift is that animals should be like us in having unpleasant subjective experiences strikes me as far too simple. If I am to make sense of how an animal “feels” about a situation (and Dawkins should say more about what is packed into this term), I must understand how *it* sees itself as being affected in that situation. If I simply identify how it sees itself affected in a situation with its behavior, then perhaps I can avoid explaining what “seeing itself” means; otherwise, I cannot.

In defence of speciesism

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The target article by Dawkins offers a method for developing an empirical calculus of animal suffering; the precommentary by Singer proposes how we should use this calculus to make ethical decisions regarding the human use of animals.

I find Dawkins' arguments entirely acceptable. They provide about as good a way as is presently available to assess suffering from the animal's point of view, and this is the point of view that Dawkins, Singer, and I all agree is the important one. Dawkins' calculus is neutral with respect to species, as such a calculus must be. This approach to the measurement of suffering could be applied even to the shrimps and insects about whose experiences Singer unnecessarily pleads “agnosticism.” Thus, in principle, Dawkins' calculus is of universal applicability (opening the way, incidentally, to an eventual and long needed extension of animal welfare laws to invertebrates).

Singer's ethical proposals similarly aim at universality, and thus follow a prestigious philosophical tradition. Singer's universality has two aspects.

First, he supposes that, by using *inter alia* methods of the kind advocated by Dawkins (but using also, e.g., the knowledge of people who “know the animals well”), suffering can be assessed from an individual animal's point of view. Moreover, this assessment can and should be carried out in a manner by which the magnitude of such suffering can be compared with that of the suffering, similarly assessed, experienced by another individual animal, even if the two animals belong to different species. Note that this claim – that one can make rational comparisons between the magnitudes of suffering experienced by animals of different species – goes well beyond what Dawkins' suggested methods of assessment might achieve. The latter are based on getting the animal to choose between possible states of his world, so that the experimenter can then infer, for example, that state Y is superior to state X but inferior to state Z for animals of this kind. Thus they cannot even in principle be used to compare the degree of suffering imposed by different states of the world on animals of different kinds (in Singer's example, to

compare the suffering of hens caused by battery housing with the suffering of people caused by the unavailability of eggs).

But it is principally on the second aspect of Singer's universality that I wish to focus. He states that, though it is right to take into account special features of the particular species to which an individual belongs (and also special features characteristic of the particular individual concerned) in assessing the degree of suffering it experiences under given circumstances, it is morally wrong to give any weight to such features in choosing between the suffering that might be experienced by different individuals. Singer states that "in trying to imagine what it is like being a hen in a battery cage, as compared with being a free-ranging hen, I would have to do my best to grasp what it is like to be a hen, taking into account everything we know about how a hen experiences confinement in a battery cage; but having done this (to the best of my ability) I would not then discount the interests of the hen, on the grounds that they are not human." To discount an animal's interests on the grounds that the animal is not human is to be guilty of "speciesism" – "the view that species is, *in itself*, a reason for giving more weight to the interests of one being than another." According to Singer, "this position, properly understood, is virtually never defended." If this is so, it is unfortunate, since (philosophers and extremist members of animal rights movements apart) I would guess that the view that human beings matter to other human beings more than animals do is, to say the least, widespread. At any rate, I wish to defend speciesism here.

Let me begin by distinguishing between ethical principles and moral choices. I do not wish to question the view that ethical principles should not be qualified by species. If it is wrong to inflict pain unnecessarily, it is equally wrong whether the pain is inflicted upon a human being, a rat, or a spider. But the situation is quite different when it comes to moral choices between suffering experienced by human beings and that experienced by members of other species; indeed, the situation is already quite different when it comes to choosing between the suffering of two different individuals even if both belong to the human species.

Consider an extreme version of the latter case, in which the degree of suffering can be considered identical for the two individuals concerned. A mother is faced with the choice of saving one of two small children from a fire, knowing that the other will die. Suppose that one of the children is her own and that, as is most likely, this is the one she saves. Few would find this choice morally reprehensible; the alternative choice would likely be seen as a failure in the mother's primary duty to her own child. Suppose that we now relax the condition of identical suffering for the two children: The mother has to choose between a burn of lesser severity inflicted upon her own child and one of greater severity inflicted on the other. Or suppose that the two children in some sense have different qualities of life: The mother's own child is crippled, mentally handicapped, or shows dangerous psychotic tendencies, whereas the other is healthy and normal. No doubt, a point would come at which the imbalance between the two children or their degrees of suffering would outweigh the initial bias in favour of the mother's own child; but few would find it morally unacceptable if the required degree of imbalance turned out to be rather large, as I imagine it would in most real cases.

We may be reasonably certain that the origin of both the mother's most likely choice and our most likely reaction to this choice, is biological; the forces of natural selection have shaped the ways in which we interact with one another to maximize survival of the genes we carry. One reaction to such an understanding of the biological origin of the mother's choice might be to remove it entirely from the sphere of moral action. We do not, after all, regard the murder of a sexual rival as morally acceptable on the grounds that it stems from the same biological origin. But this reaction would, I believe, be a mistake. Most of the behaviour that is normally regarded as morally desirable was part of our biological heritage before it was codified and transformed by moral philosophers. If the discovery of a biological

origin for such behaviour is sufficient to remove it from the moral sphere, there may in the end be little left of morality. Much of the concern we feel for the welfare of people unrelated to ourselves is very likely to be an extension of the genetically based concerns that we feel for kin; a further extension of the same type of concern may well contribute to the animal welfare movement. (Consider how much easier it is to arouse sympathy for mammals that resemble us than for fish, which do not.)

The mother's choice in the example just given is not as different as it may at first seem from the choices that have to be made with regard to the proper human use of animals. If we are guided simply by an ethical principle of universal applicability – for example, that it is wrong to inflict pain, without regard to species – then experiments that would not be permitted with human subjects ought not to be carried out with animals. But there are also moral choices that have to be made. In many cases the decision not to carry out certain experiments with animals (even if they would inflict pain or suffering) is likely to have the consequence that some people will undergo pain or suffering that might otherwise be avoided. Suppose that we could measure the degrees of suffering inflicted upon the animals and people concerned, and that we came to the conclusion that these were exactly equal. The "speciesist" claim is that under such circumstances the calculus of suffering should give more weight to one side of the equation *just because* it pertains to human beings. This claim, I believe, can be coherently defended on the grounds that, just as a mother owes a special duty to her child (and for the same kind of biologically based reasons), so we owe a special duty to members of our own species. It would therefore, in the example given, be morally right to carry out the experiments concerned.

As in the case of the mother, we may now relax the condition of equality of suffering for animals and for human beings. Equality of suffering would result if the severity of the experiments with animals were increased, or if the likely benefit of such experiments to human beings were reduced. A complication is that the benefit to human beings may not be the direct alleviation of suffering (thus compounding still further the problems of comparison that arise even if the equation for both species is couched in terms of suffering alone). Even if the aim of an experiment is, in the long run, the alleviation of human suffering, it is usually only after the extensive development of knowledge and scientific understanding in a particular field that medical advance becomes possible; in the interim, the advancement of scientific understanding may be the only specific objective that the experiment can readily attain. (A case can also be made that an understanding of the biological world to which we belong is itself an aim of sufficient moral worth to justify the imposition of suffering; but that case is peripheral to the arguments pursued here.) However complex the calculus, there will at some point be a degree of imbalance at which the suffering inflicted upon animals is too great to be worth the avoidance of lesser suffering (or provision of other benefit) by people. Exactly how great that imbalance has to be (after every possible step has been taken to minimise unnecessary suffering) is at the core of the often very difficult decisions that have to be made by scientists and by the ethical committees that (thanks in large measure to the proper concerns of people like Singer) now increasingly watch over their activities. Dawkins's suggestions for the measurement of suffering will facilitate the construction of a more rational framework within which to make such decisions.

Experimental investigation of animal suffering

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Animal welfare concerns issues of extraordinary complexity on the interface between science and philosophy. It raises at least four separate but related questions: (1) Do animals suffer? (2) If they suffer does it matter? (3) If it does matter can we measure suffering? (4) If suffering can be measured what do we do about it?

In their articles, Dawkins and Singer discuss the first three of these questions. The first is not a scientific question, but its answer can be verified by scientific findings. It rests on neo-Darwinian analogy and, as Dawkins maintains, many if not most of us now accept that the evolutionary continuity between man and his progenitors is as valid for mental attributes such as pain, fear, and frustration as it is for morphology.

The second question is more purely philosophical. Singer accepts the premise that animals can suffer, presumably again on the basis of analogy with human beings. He also implies that it is a general ethical priority that suffering should be avoided whenever possible and then argues that there is a moral overlap between humans and animals, that it matters if humans suffer so it matters if animals do. His conclusion, which could have been more explicit, appears to be that the sum total of suffering, both human and animal, should be considered as an entity and that decisions are morally defensible only if they have the effect of minimizing this total. As he emphasises, the scientist's role here is to provide information to allow us to put the correct values into the equation.

There are clearer examples that Singer might have utilised to illustrate both the moral overlap between humans and animals and the importance we place on reducing suffering. In the same way that we justify killing a severely injured animal, many of us consider it right to kill congenitally malformed human embryos or even neonates, and, by withdrawal of life support systems, to allow irreparably brain-damaged individuals to die. We may also regard as acceptable the euthanasia of terminally ill people. The common factor in all three examples is that killing eliminates suffering or the potential to suffer. Like Singer, we believe that suffering, whether human or animal, matters. We also believe that he could have made a better case for that assertion.

Most of Dawkins's target article concerns question three. She makes a strong case that the study of animals' subjective feelings is valid on both biological and utilitarian grounds and is central to any discussion of animal welfare. Her stated aim is to examine how much of what happens to animals actually matters to the animals themselves. Section 2, on suffering and natural selection, deals with the biological value of performing behaviour and its relationship to suffering. We found this the least satisfactory section of the article, partly because McNamara and Houston (1986) define the "canonical cost" of behaviour in negative terms: It is the cost of behaviour that, if not performed, will cause damage to inclusive fitness. Dawkins' somewhat tortuous attempt to extend this notion to "perceived cost" is less than convincing. It is surely sufficient to argue that unpleasant subjective feelings probably evolved to motivate animals to perform behaviours that increase fitness and to avoid behaviour that reduces fitness. The next stage, ably presented by Dawkins, is to demonstrate that one cannot generalise directly from the behaviour seen in wild animals under natural conditions to domestic animals kept in an intensive situation; every aspect of possible behavioural deprivation or noxious stimulation requires empirical investigation.

Dawkins development in sections 6 and 7 of her thesis that demand curves provide a rational basis for assessing perceived cost is clear and convincing. The conclusion that demand curves often confirm evidence from other measures is sound. We can add two further pieces of evidence to the example cited regarding the space requirements of laying hens. Subjecting hens to severe stress is known to depress egg production and there is a positive correlation between the amount of cage space provided per bird and its egg output (Hughes 1975a). Hens given a choice select the larger of two cages, even when the smaller alternative provides more space than that of a typical cage (Hughes 1975b).

Thus, production and simple preference criteria provide further convergent evidence that hens crowded in cages suffer.

In section 8, Dawkins discusses aversion responses as possible indices of suffering. This approach raises its own ethical problems: Considerable suffering may be undergone before reliable relationships can be determined. Animals do not respond to major suffering by showing neat, linear changes in performance but may suddenly flip from one behavioural response to another; for example, the response to pain may change from struggling to passivity (learned helplessness), whereas an increase in fear may be reflected by a sudden change from escape behaviour to freezing. The complexity of responses thus makes interpretation difficult; the only way of obtaining scientifically valid results may be to use a wide range of treatments and large numbers of experimental animals. The ethical dilemma here is that an attempt to improve the long-term welfare of animals by increasing the understanding of suffering may put short-term welfare at severe risk. The solution may be to accept the realisation that progress in this area must be slow and to ensure that research workers initially seek models that, although appropriate, do not involve severe suffering. An example of such suffering is the fear induced in hens by cage cleaning using a feather duster, which may simulate an overhead predator (Rutter & Duncan 1989).

Although Dawkins rightly rejects the notion that suffering necessarily occurs if animals are unable to perform the full repertoire of activities observed in nature, it is interesting that she eventually arrives at the conclusion that true priorities can be determined only by housing and manipulating animals in a "closed economy" (or a controlled but relatively complex environment) and observing their responses over an extended period. The problem of measuring animal welfare will be solved only by a synthesis of the clarity of philosophy, the precision of experimental psychology, and the breadth of ethology.

Singer's intermediate conclusion

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Singer's intermediate, and most confidently reached, conclusion is "that we cannot justify applying sharply different standards to humans and nonhuman animals." What exactly does this tell us about how we should treat nonhuman animals? One thing it tells us is that we should not inflict gratuitous suffering on them. But this is, I trust, something we already believed (which is not to say that we should not be forcibly reminded of the point). What about important and controversial questions such as whether it is justifiable to test possibly dangerous drugs on nonhuman animals to protect other animals, both human and nonhuman, and whether it is justifiable for humans to eat nonhuman animals? Although there is no doubting the importance of Singer's conclusion, by itself I think it tells us surprisingly little about how to answer such questions. Let me illustrate this point with the issue of vegetarianism.

The live issue is not whether factory farming is justified. (If animals suffer as much as they appear to – and here work such as Dawkins's is central – factory farming is not justified.) The live issue is whether it is justifiable to eat nonhuman animals that have lived relatively happy lives and have been killed relatively painlessly. We can approach this question by asking, What exactly is bad about the *painless* death of a human? In certain cases the answer is nothing. That is what motivates the debate over euthanasia and mercy killing. Moreover, in those cases where we regard a painless death as a tragedy, we tend to talk about the effect of the death on friends, relatives, and in general

on those whose lives will be badly affected, and about the way the death cuts off a life before its time, that is, in terms of the concept of a worthwhile future, a life plan, which premature death terminates.

No doubt much more needs to be said. But for our purposes here, the important point is that if these considerations are at all pertinent, Singer's intermediate conclusion does not help us with the hard question of vegetarianism. Suppose, for instance, that having an articulated life plan is what gives value to continuing one's life and that nonhuman animals do not have articulated life plans, consequently, there is nothing wrong with eating nonhuman animals, provided they are killed painlessly and are not maltreated during their lives. This result will in no way conflict with Singer's intermediate conclusion. The standard being applied to human and nonhuman animals is the same: The answer to the question turns on the very same consideration in *both* cases – whether the creature has a life plan and the associated concept of a worthwhile future.

Our point is not that the moral case for vegetarianism fails – that is as may be: We endeavor only to show how little the (important) line of thought encapsulated in the term “speciesism” and its association with racism and sexism does to establish the moral case for vegetarianism. It shows that we should care about the kinds of lives the nonhuman animals we eat live, but it does not in itself show that we should not eat them.

A similar situation obtains, it seems to us, regarding the question of using nonhuman animals to test drugs. This is a special case of disadvantaging one group of beings in order to advantage another group – something that happens all the time in human society. Every time a freeway is built, the tax laws are changed, a vaccination program is initiated, zoning regulations are changed, or tenure is granted, some people are advantaged at the cost of others being disadvantaged; for example, those who use the freeway are favoured over those who live next to it, and the person who gets tenure is favoured over those who are seeking employment in the department. It is accordingly important to inquire when advantaging one group at the expense of another is morally permissible. It seems to us that the answer to this question as it applies to humans (rather than Singer's intermediate conclusion) will also provide the answer to the question about experimenting on nonhuman animals. The intermediate conclusion does tell us to take into account the same considerations in both cases, but it does not tell us *which* considerations are the key ones.

Science and subjective feelings

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In the past decade, Marion Dawkins has produced an important and usable body of work. To make informed decisions about animal welfare we must be able to make comparisons between the desirability of different states from the point of view of the animal. This she has helped us to do.

There are difficulties with her methods, as she acknowledges. There are problems in applying consumer demand theory to humans, so it is not surprising that its application to animals is problematic. Dawkins appreciates this, though she is more sanguine than I about our ability to finesse these problems through experimental design.

In their articles, Dawkins and Singer claim, without much argument, that animals can suffer – an assertion that will provoke resistance. Some scientists will insist that the evidence for this view is not compelling; when we say that animals suffer we are speculating, or engaging in unacceptable anthropomor-

phizing. I agree with Dawkins and Singer that the evidence for the subjective feelings of many animals is overwhelming (see Clark, in press; Crisp, in press; and Dupré, in press). (Although I do not like the terminology, I will follow Dawkins in referring to animals' “subjective feelings.”) I would say that we have access to the subjective feelings of many animals in the same way that we do those of other humans: by looking and listening. Only someone in the grip of a philosophical theory (e.g., behaviorism) would deny this. But such a person would not be freed from the theory's grip by the sort of evidence produced by Dawkins.

In this commentary, I will not try to convince die-hard behaviorists that their views are incorrect. Instead, I shall try to convince them that even they should take Dawkins' results seriously, and perhaps even be moved by Singer's arguments. Rhetoric about anthropomorphism, and arguments for the subjective feelings of animals are matters of speculation, should not be allowed to close the debate.

Consider the following claims: (1) Scientific evidence supports the view that animals do not have subjective feelings. (2) Questions about the existence of subjective feelings are not in the domain of science. The first claim is absurd. If scientific evidence were somehow construed as supporting the view that animals do not have subjective feelings, then the case for denying subjective feelings to humans other than oneself would have to be regarded as quite strong (one's self may be regarded as an exception). The only evidence we have for the subjective feelings of other humans that we do not have for animals is a slightly fallacious version of the argument from analogy, and (perhaps) verbal expression (see Dupré, in press). Some philosophers (as opposed to scientists) might hold that humans do not have subjective feelings. But if this is a thesis rather than a pathology it concerns the tenability of the concept of subjective feelings, not the existence of a certain kind of experience. The second claim is I think, the one that is most widely held by scientists. I suggest that even people who hold such a view may want to regard preference satisfaction as important.

The simplest way to see this is to return to consumer demand theory: Much of this theory was developed during the heyday of behaviorism. Economists such as Samuelson (1947) regarded talk about subjective feelings as unscientific. They showed that utility functions could be constructed solely on the basis of choice behavior. But it would be a mistake for economists to infer, from the methodological view that questions about subjective feelings are not in the domain of science, the substantive conclusion that people do not have subjective feelings. A similar inference with respect to animals would be just as fallacious.

Historically, welfare economics grew out of revealed preference theory (Sen 1973). Many economists whose methodological commitments prevented them from discussing subjective feelings were nevertheless interested in questions about the maximization of preference satisfaction. Some of this interest stemmed from the fact that they believed people to be generally rendered better off by having their preferences satisfied. Similarly, even if one holds that subjective feelings are not in the domain of science, one can still believe that animals are generally made better off by having their preferences satisfied. This belief may be grounded in the view that preferences are expressions of subjective feelings, or in the view that preferences should be satisfied simply because they are preferences. Regarding the latter view the value of preference satisfaction is brute, and the belief needs no further grounding.

The upshot of these considerations is that we should not mistake a methodological view for a substantive view. Thus Dawkins's work, and perhaps even Singer's, should have force even for those who believe that subjective feelings are not in the domain of science. I do not endorse such methodological views, for I do not believe that science and philosophy (or indeed science and everything else) can be kept so distinct. But even if one holds such a view, one can (and in my view should) believe that it is generally good to give creatures what they want. So

even unreconstructed behaviorists should welcome Dawkins' work, and perhaps even join in her efforts to improve animal welfare. They may not be comrades in theory but there is no reason why they cannot be comrades in practice.

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Hidden adaptationism

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We will argue that (1) Dawkins's arguments do not establish precisely the degree of nonhuman animals' experience of suffering, unless one assumes an adaptationist framework; and (2) even if Dawkins's analysis is correct, it is insufficient for the purposes of Singer's moral theory.

Dawkins suggests that animal suffering can be quantified through an examination of the demand curves that show animals' demand for various commodities and activities. When these curves are more flat (demand is relatively inelastic), being deprived of the given commodity or activity will cause more acute animal suffering. Although this argument offers a mathematically precise way of determining the suffering of an animal (in terms of the slope of the demand curve for a given situation), the deduction depends on the assumption that suffering correlates very closely with these demand curves.

This assumption appears unwarranted, because one may distinguish between an animal's *desire* to engage in an activity (which can be defined in terms of the demand curve) and the *suffering* that results when an animal fails to engage in the given activity. Thus, a bird in a cage may have a desire to fly that is comparable to its desire to eat food, but it seems at least conceivable that the bird's subjective experience of suffering will be greater when the bird is deprived of food than when it is deprived of the possibility of flight. Unless desires are actually *determined* by the acuteness of suffering, no necessary correlation exists between suffering and desire.

Indeed, there are a number of instances where a close link between demand curve and suffering actually runs counter to our intuitions. In situations involving humans (the only cases in which we have access to the subjective experience of suffering), desires (or demand curves) and degree of suffering may be decoupled. One may have a much greater desire to eat a piece of chocolate cake than to eat a piece of fruit yet one may suffer only minimally if one is deprived of either activity. On the other hand, one may have comparably strong desires for basic necessities such as food and water, yet one may experience far more unpleasant sensations if one is deprived of the latter than if one is deprived of the former. Again, demand curves do not correlate precisely with the degree of suffering.

A precise correlation can be obtained if one assumes an adaptationist framework for the evolutionary development of desire and suffering. In such a framework, the functions describing our lives (demand curves for commodities and activities) are precisely in line with the degree of suffering we experience when we are deprived of these commodities and activities. There are well-known problems with an adaptationist approach (see Gould & Lewontin 1978; Kitcher 1987; and Lewontin 1978). In a nonadaptationist framework, on the other hand, the link between desire and suffering is far more crude. There might, of course, still be a *general* correlation between demand curves and suffering, and one might still generally suffer somewhat more when deprived of a "necessity" than when deprived of a "luxury."

Because of the crude nature of this link, the additional data we obtain from the quantitative assessment of demand curves will not prove very informative in quantifying suffering. A rough assessment of the existence and degree of suffering may be obtainable through direct observation of someone's (or something's) physical condition, coupled with some of our basic intuitions. Thus, we can conclude that humans and nonhumans suffer when deprived of food or sleep. But in a nonadaptationist framework, this assessment is qualitative, and the precise quantification of suffering promised by the demand curve analysis remains elusive. Insofar as such a quantification is essential for a utilitarian analysis, Dawkins's approach does not offer the necessary precision of detail.

But even if Dawkins's analysis were correct and the comparison of demand curves yielded a way to devise an empirical method for determining when an animal is suffering, this would still be insufficient to support Singer's argument. According to Singer's theory, moral decision making involves taking the point of view of all morally relevant individuals and considering the "total set of lives" that different choices of action present. This kind of theory faces obvious philosophical problems with regard to making sense of taking another's point of view, since we presumably do not have access to the subjective experiences of others. As Dawkins points out, this problem is often overcome by appeal to the argument from analogy. The difficulty with this argument is that the requisite similarity is not as apparent for nonhuman animals as it is for our fellow humans.

Dawkins's work is supposed to solve this problem for Singer. Her work is characterized as an empirical method for determining what suffering is from the animals' point of view. Hence, it should yield an objective method for determining the subjective character of nonhuman animals' experience. Unfortunately, Dawkins's demand curve analysis is insufficient for the purposes of Singer's moral theory. It may be possible to compare a hen's experience of being in an enclosed space with its experience of food deprivation. Therefore, a notion of hen suffering may be possible. But there is no way to *compare* the suffering of any aspect of a hen's experience with the suffering of any aspect of the experience of a member of a different species. How do we compare any of the experiences of a hen with the experiences of a turtle? Without a means of *interspecies* comparison of experience, no purely *intraspecies* analysis of experience will be adequate for moral reasoning. We will be unable to put ourselves in a hen's position, successfully to imagine experiencing things as a hen does. Without this capability, Dawkins's work enables us to make judgments only about the trade-offs in welfare among members of the same species.

Obtaining and applying objective criteria in animal welfare

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Like other important debates of our time, the issue of human-induced animal suffering has exercised the minds of people in a wide variety of disciplines and walks of life. In many cases attitudes to animal suffering are primarily emotional. This is not necessarily a bad thing since, for example, scientists or farmers who empathize with the animals they are working with do not require legislation or formal guidelines in order to minimize suffering. Yet human emotions cannot be relied upon. The main challenge must therefore be to find objective criteria on which decisions about animal welfare can be based. Singer and Dawkins offer different but complementary approaches to this quest. Both should be congratulated for their stimulating writing.

Singer's philosophical exploration of the concept of "speciesism" is elegant but not as straightforward as it initially appears. His argument is weakened by his admission that he is unsure about where to set the boundary of concern. He is quite clear, for instance, that plants do not feel pain and thus need not be considered in the ethical debate about suffering. With regard to the vertebrate/invertebrate dichotomy the picture becomes blurred. All organisms in this continuum are of course equally valid species, a product of natural selection. Biological information is required to categorise them according to those that can and cannot "suffer." There is no simple way of doing this, especially if we adopt Dawkins' definition of suffering as a variety of unpleasant states, including hunger, fear, and pain. My own research on fish has shown that these animals display fear responses when they encounter predators (Magurran & Pitcher 1987) and that members of gregarious species suffer (behaviourally measurable) distress if kept in solitary conditions (Magurran 1984). The effect of hunger on the reactions of fish (including decreased ability to react adequately to predator attack) has also been documented (Godin & Smith 1988; Milinski & Heller 1978). Investigators of cephalopod biology report similar sophisticated behavioral responses to adverse stimuli (Messenger 1988). Humbler creatures, such as mosquito larvae (*Culex pipiens* and *Aedes aegypti*; Sih 1984; 1986), have the ability to shift habitat when under the threat of predation.

Dawkins' work is so exciting because it offers a new perspective on an animal's view of suffering. As she admits, there are difficulties with the approach. In addition to the methodological problems she lists there are a number of more pragmatic concerns. It is extremely expensive, in terms of both time and resources, to compile measures of consumer demand for individual species. In circumstances where there is considerable variation in the behaviour of different populations or genetic strains within a single species, the problem is compounded. It is necessary to ask the correct questions. Tests of elastic and inelastic demand must be grounded in a sound knowledge of the natural behavior and ecology of the species in question.

It therefore seems that only a multiplicity of disciplines can provide an adequate approach to the issue of animal welfare. The philosophical viewpoint promotes reasoned thinking but can function properly only with additional biological information. The psychological techniques and economic background required in tests of consumer demand theory need to be matched by an understanding of behavioral ecology. Behavioural research has come under criticism from antivivisection groups that, in some cases, are keen to have it banned. In reality, this kind of research makes an important contribution to the understanding of animal suffering and has a vital role to play in welfare decisions (Bateson 1986; Driscoll & Bateson 1988).

One final comment: Once it is established that certain groups of animals suffer under certain (human-induced) conditions it is important to make sure that the same welfare standards are applied to the different contexts in which the animals are exploited. Thus, in the United Kingdom, the current legislation ensures that tests of antipredator behavior in fish must be conducted in a way that minimises distress. For example, model predators are used to replace live predators in experiments. Anglers, however, are free to employ live baiting, a practice that entails more cruelty than any laboratory procedure.

"there are clearly some problems surrounding the putative relationship between motivation and the subjective feelings of suffering." Dawkins advocates argument from analogy, normally used to infer that other people have subjective feelings similar to our own. She realises that there are problems "with nonhuman animals because they are not so similar to us, either in anatomy or behaviour and we may be uncertain whether the analogy is still valid. We need evidence that the similarity is sufficient to justify the analogy."

It seems to me difficult to argue that suffering in animals is, by analogy with humans, associated with inelastic demand, when we do not know much about this relationship in people. Dawkins' argument would be more convincing if she could show that suffering in people is associated with inelastic demand. But even if this could be demonstrated, a number of problems remain.

1. Demand functions result from microeconomic laws that depend upon a small number of premises. These laws can be demonstrated in humans, animals, and even machines. Are we to conclude that there is a link between inelastic demand and suffering in any animal (or machine) whose behaviour indicates inelastic demand? If the answer to this question is negative, then Dawkins must modify her thesis to the effect that suffering is most likely to occur if some animals are "deprived of the activities or commodities with the flattest demand curves." The question is, which animals?

2. In considering the evolutionary significance of suffering, it is difficult to see why animals should have been designed to suffer from particular stimuli or situations, rather than simply avoiding them, or learning to avoid them, in an automatonlike manner. Since I have recently discussed this problem elsewhere (McFarland 1989), I will not elaborate on it here, except to note that I would be happier with Dawkins' thesis if it were worded something like this: In those species in which the relevant decisions are not purely procedural, suffering is most likely to occur when an animal is "deprived of the activities or commodities with the flattest demand curves."

3. Strictly speaking, it is not "the activities or commodities" to which the demand functions relate, but the consequences of performing the activity of obtaining the commodity (McFarland & Houston 1981). In other words, it is changes in motivational state that are important to the animal.

The effect of such changes on the animal's behaviour is not always the same but may be altered by acclimatization and other forms of environmental adaptation. Consider the case of the female Burmese red jungle fowl (*Gallus gallus spadiceus*), which spends 99% of her time on the nest during incubation, devotes little time to feeding, and progressively loses weight (Sherry et al. 1980). Does this animal suffer during incubation? Presumably Dawkins would say that it does, even though the anorexia is "voluntary," because the behaviour of laying hens shows inelastic demand for food. If, on the other hand, demand for food becomes more elastic during incubation, then we face another problem – that elasticity of demand can change with motivational circumstances (see Houston & McFarland 1980 for a discussion). This problem is of general importance in animal welfare because of the possibility that farm animals acclimatize to their maintenance conditions. If so, it could be argued that the animals become accustomed to their life style and therefore do not suffer. To handle this kind of complication requires a more sophisticated theoretical approach than that advocated by Dawkins.

Suffering by analogy

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Dawkins' main argument is that "suffering is most likely to occur if animals are deprived of the activities or commodities with the flattest demand curves (inelastic demand)." She recognises that

Consumer demand theory and social behavior: All chickens are not equal

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Although there is widespread agreement as to the need to ensure the welfare of laboratory, farm, and zoo animals, there is considerable disagreement as to what constitutes welfare and how it should be measured. As Dawkins states, some scientists consider well-being to be subjective, and therefore not amenable to empirical investigation. Scientists may also avoid this issue because resolving controversies about animal welfare is ultimately an ethical and a philosophical exercise rather than a purely scientific process, as Singer's precommentary emphasizes. Nevertheless, although defining the obligations of humans to animals is challenging, we believe that this is an area of increasing interest and one of the most important topics facing contemporary society; as such, it is worthy of investigation and discussion by scientists.

Ethologists in particular need to play a significant role in developing measures to assess animal pain, distress, and well-being. Recently, however, ethologists' interest in the study of the mechanisms of proximate causation so central to an understanding of animal welfare and of the behaviour of domesticated animals has languished. In consequence, the comparatively new discipline of applied ethology (the study of the behavior of domesticated and captive animals) has not developed an adequate theoretical foundation but has instead relied largely on a descriptive approach. Dawkins is to be congratulated on her attempts to develop a research methodology for assessing welfare that has predictive value.

We believe, however, that Dawkins' approach has some shortcomings because it tends to exclude the effects of social factors. All farm animals are members of social species, and they are typically housed in groups. Under these circumstances, the behavioral options available to an individual animal at any given moment are not only a function of that individual's motivational state and the physical environment, but are also influenced by the choices made by other members of the social group. Typically, operant conditioning involves testing individual animals under conditions where all factors are held constant except those under consideration. These test situations differ significantly from conditions found in an agricultural production setting.

In social groups, both the ability and the motivation of individual animals to acquire particular resources are likely to vary depending on social context. An individual's social status is a particularly important determining factor with respect to resource utilization (Syme & Syme 1979; Stricklin & Mench 1987). The degree of physiological stress experienced also varies among individuals as a result of social factors (Kaplan 1986).

It is consequently possible that the preferences expressed by animals tested singly will differ from those they would express if they were tested in groups. Conversely, results obtained from operant testing of group-housed animals might be misleading. Lagadic and Faure (1987) studied cage space preferences among hens housed four per cage by allowing them to peck keys to effect movement of a cage partition. These investigators reported that the hens chose to spend approximately 50% of their time in cages with a surface area greater than that required by the European Economic Community animal welfare regulations (450cm²/hen). Individual differences in key-pecking frequencies, however, apparently were not recorded. Since spacing preferences may differ as a function of dominance status (Stricklin 1983), it is conceivable that the results of Lagadic and Faure's study could have been influenced significantly by the preferences of only a single hen. It is therefore important that social factors be taken into account when operant conditioning tests are designed and interpreted as an index of motivation.

Gathering objective, repeatable, and quantitative data on animal welfare is essential in order to design appropriate animal housing and management systems. To date, neither the traditional methodologies of physiology nor those of ethology have been completely successful in providing data that meet these criteria. Our concerns about the extension of operant testing methodology to social groups aside, we believe that Dawkins' consumer demand theory can be an extremely valuable tool because it allows us to evaluate well-being under various conditions from the animal's viewpoint, and this information should result in an improved human understanding of animal welfare.

Developmental experience and the potential for suffering: Does "out of experience" mean "out of mind"?

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In her target article, Dawkins shows how techniques and concepts from psychology and economics can be used to construct a method for quantifying the price an animal is prepared to pay to gain access to, or to escape from, some stimulus or resource. The approach is a valuable addition to the tools used to study animal welfare, but it does have problems, some of which are discussed by Dawkins. One problem that is largely ignored, and that generally receives little attention in the animal welfare literature, is the effect of developmental experiences on an animal's perception of its environment. Dawkins herself (1977; 1980) noted that hens that had lived in battery cages for some time preferred these cages to an outside run on grass when given the choice. She suggested that what an animal is used to may have a strong effect on what it perceives as a desirable environment. Clearly, such effects could influence how hard an animal will work to gain access to or avoid a stimulus or environment. Hemsworth et al. (1986; 1987) have shown that brief periods of unpleasant treatment of young pigs by humans can give rise to clear behavioral differences in the pigs' responses to humans compared with responses of animals that have not been badly treated. This kind of early experience could have strong effects on tests of the pigs' motivation to avoid procedures involving contact with humans, such as handling and transport.

Lack of motivation to do anything at all, a problem that Dawkins mentions, may conceivably arise not just as a result of disease, but also as a result of experiencing an environment in which the animal is unable to control what happens to it. This state of so-called learned helplessness (e.g., Overmier et al. 1980) may be part of the cause of the "apathetic" and unresponsive behavior seen in some stall-housed sows (Broom 1986b; 1987). It is itself a cause for concern and, where it occurs, is likely to influence the results of demand curve experiments.

The effects of experience during development are thus likely to affect the rate of learning to work for a particular stimulus or resource, the use of the resource in time budget experiments, and the elasticity of demand. Animals that have had little experience with the resource may be slower to learn to use it and, once they have learned to use it, their demand for it may be more elastic than that of experienced animals. Clearly, these issues are open to, and should receive, empirical investigation, particularly since many laboratory and farm animals are reared in barren environments, thus raising the important question of whether an animal that has never experienced something can suffer from a continuing lack of it. "Out of sight" may be "out of mind" for some stimuli, but does that mean that "out of experience" is also "out of mind?"

Developmental experiments may allow us to subdivide stimuli or resources into at least three categories: (1) those for which all animals, irrespective of experience, show rapid learning and have an inelastic demand (e.g., a rooting substrate for pigs); (2) those for which experienced animals have an inelastic demand but inexperienced animals may have a more elastic demand and show less rapid learning (e.g., nest boxes for hens); and (3) those for which all animals, irrespective of experience, have an elastic demand.

If we accept the argument from analogy that animals, like humans, "have unpleasant subjective experiences when they are prevented from doing things they are strongly motivated to do," then we can suggest that denying access to a category (1) resource or stimulus is likely to cause suffering in all individuals, denying access to a category (2) resource or stimulus is likely to cause considerable suffering only in individuals that have a certain amount of experience of the resource or stimulus (the amount of experience necessary can be empirically determined), and denying access to a category (3) resource or stimulus is likely to cause the least suffering. The impact of developmental experience on an individual's perception of the environment and potential for suffering could thus be evaluated using Dawkins' approach.

In his precommentary, Singer argues convincingly that we cannot justify applying sharply different standards to human and nonhuman animals. He suggests that we need to consider the mental capabilities of animals and to base our decisions about whether and how much they can suffer on our knowledge of these capabilities. I am not sure, however, whether Dawkins' approach will help us differentiate between those species that are likely to have the ability to suffer and those species that are not. Singer seems to be suggesting that it will when he says that Dawkins' approach, "perhaps more directly than any other 'objective' method, enables us to form some idea of what an experience is really like for the animal at the centre of it."

Classical and operant conditioning are procedures that contribute greatly to an individual's ability to survive and cope with changes in the environment. Both have been observed in a wide variety of animals ranging from platyhelminthes to mammals (Hodos 1982). It seems likely that, if the appropriate test apparatus can be devised, the same range of animals may be shown to be capable of demonstrating high motivation and to have an inelastic demand for particular resources or stimuli. For example, virtually all animals would be expected to have an inelastic demand for basic resources such as food, which are needed to survive. Does this mean that a food-deprived housefly will suffer the way a starved dog or a hungry human does? I think not. Evidence accumulating from studies of the cognitive abilities of animals, the complexity and flexibility of their behavior, and the behavioral, physiological, and neurological similarities between man and other species (Dawkins 1980; Griffin 1984) may provide the best guidelines for suggesting which species are likely to experience suffering in a way that is similar to our own. Dawkins' approach can then be used to examine which activities are most important to these species. Being prevented from performing these activities is what is likely to cause suffering in such species.

Consumer demand: Can we deal with differing priorities?

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I won't mince words either. I believe that the suffering of nonhuman animals does matter, and I applaud the way in which

Dawkins and Singer face up to the scientific and ethical problems involved in animal welfare issues. The authors have discussed in detail such questions as, how do we measure suffering, and how much suffering will we condone as a means to a particular end? The main issue I would like to comment on is the extent to which we can use Dawkins' proposed yardstick of the demand curve for food to assess likely causes of suffering in animals whose sensory experience, priorities, and cognitive abilities are radically different from our own.

Like the capacity to avoid environmental dangers, self-awareness is likely to have adaptive significance. In humans it probably evolved as a mechanism to allow forward, strategic planning by a cooperating group of individuals; it may have been favoured in many other species, as well. It forms the basis of most of our subjective feelings and has certainly given us the capacity to imagine how other people, and to some extent other mammals, experience a particular situation. But what about other kinds of animals? Can cephalopods *feel* pain as we do? Can insects feel frustration? Singer declares himself agnostic on this issue, and it is one with which Dawkins does not deal. That natural selection has favoured the capacity to respond appropriately to noxious stimuli does not mean that all animals suffer on encountering such stimuli, however. Mental experience may be linked in functional terms to associative learning abilities. Although one might still argue that there is a difference between "learning" and "knowing," contemporary animal learning theory has largely moved from a behaviourist to a cognitive standpoint in which the concept of mental experience is no longer anathema (Dickinson 1980). Science may have little to contribute to the development of morality, but can it perhaps tell us whether a certain kind of hardware – say, a particular type of brain – is necessary for subjective feelings? And if so, does that mean we can disregard the welfare of all animals without such hardware? I think not, for if the capacity to suffer were all that mattered in animal welfare, then we might think it acceptable to do anything to an animal provided we first render it unconscious.

But if we could identify what kinds of animals have at least the capacity to suffer, we would still need to recognise suffering and understand what causes it. Dawkins poses the question of whether we can study subjective feelings scientifically in other animals, since we cannot ask them directly how they feel. She then goes on to demonstrate that by developing the right methodology we can find out an animal's views concerning a particular situation. Comparing elastic and inelastic demands could help us recognise what matters to the animal. The concept of elastic demand is similar to cost-benefit analysis in behavioural ecology, in that it is based on the idea that the animal will trade off costs against benefits; when the cost outweighs the benefit, the animal will give up. [See Houston & McNamara: "A framework for the functional analysis of behavior" *BBS* 11(1)1988.] In inelastic demand, however, such a trade-off does not occur. There are many reasons this might be so. For example, the longer an animal goes without food, the greater the benefit of obtaining it. In addition, increasing the time or energy costs of obtaining food may actually increase the demand. As a deficit accumulates, the animal may have to bear considerable costs if it is to survive at all. The demand for food will therefore decrease little with increasing costs. Dawkins suggests that we use comparisons with the demand curve for food to find out what really matters to an animal on the assumption that maintaining food intake is always an important priority. But whereas this may be true for mammals and birds, it is not true for many other kinds of animals. The priorities of fish, for example, are very different from our own; in many cases fish will not bear high costs in order to obtain food. Individual intake rates can vary as much as eightfold (Elliot 1982), and when food is difficult to obtain fish may opt to do with very little and cease growth. The demand curve for food will therefore have a very steep slope. Fish have an inelastic demand for other resources (e.g., a

particular water temperature), but we need to be able to identify them to apply Dawkins' methodology. When we study animals even further removed from ourselves, this is more difficult.

In addition to identifying variation in the causes of suffering between species, we should consider the extent to which we can generalise between individuals of the same species. In humans, what are obviously very traumatic injuries sometimes cause no pain or suffering, as is the case with some soldiers in battle (Bond 1979). Clearly, we must take a conservative approach. Once we have identified the factors that can cause suffering in animals, we must avoid putting animals in a situation where suffering is likely. Dawkins' methodology gives us a basic tool that we can try to modify for use with different species. We must not shrink from the difficulties of making the subjective objective.

The case for and difficulties in using "demand areas" to measure changes in well-being

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I strongly support the main thrusts of both Dawkins' and Singer's articles, and wish to make or reinforce the following points:

1. It is far better to be roughly right than to be precise but wrong or irrelevant.
2. Suffering and enjoyment by all sentients, human and nonhuman, count ethically.
3. It is better to use the area bounded by the demand curve rather than the slope or the elasticity of demand.
4. The use of demand "areas" to judge changes in well-being involves well-known difficulties but can be justified in view of point (1).
5. It is desirable to supplement Dawkins' measure with measures of levels of marginal preferences to achieve intersentient comparisons.

Natural scientists, accustomed to the high level of precision required in their subject areas, are apt to dismiss less precise measures (such as those of enjoyment and suffering) as unscientific. This is a big methodological blunder. To be scientific, one should try to be as precise as possible (subject to constraints). This does not mean, however, that anything that cannot be measured precisely should not be studied scientifically.

I myself regard enjoyment and suffering (defined more broadly to include milder pain and discomfort) as not only the most important, but *ultimately* the only important things. Freedom, knowledge, and so on are all important but only because they ultimately promote net welfare (enjoyment minus suffering). Even if they do not completely agree with this strong view regarding enjoyment and suffering, most people will accept that enjoyment and suffering are the most important considerations. Given their importance, the amount of scientific research devoted to them is dismally inadequate. The neglect is partly due to the methodological blunder, which prevents the publication of important results on things that are difficult to measure precisely.

I fully agree with Singer that the welfare of all sentient beings should rank equally. We cannot expect each individual to behave perfectly in accordance with ideal ethics, however. Individuals naturally put their self-interests ahead of those of others. But only completely unethical persons totally neglect the welfare of others. Similarly, at the level of nations, the Australian government cares mainly about the welfare of Australians but should also have some concern for the welfare of people in other nations. We have governments, treaties, and even the United Nations to coordinate relations between individuals and nations. But there are no similar institutions to

coordinate relations between different species. This makes our ethical concern for animal welfare all the more important. Even if we, as a species, are not prepared to be fully ethical in putting the welfare of animals on a par with that of our own, we should at least have *some* concern. If animal welfare can be increased significantly at the cost of a small loss to our welfare, we should be prepared to accept the cost (e.g., higher meat prices as a result of more adequate animal welfare regulations).

Can we make interspecies comparisons of welfare? If we require precision comparable to that of measurement in the natural sciences, we cannot even make interpersonal or intrapersonal comparisons of welfare in most cases. Yet this does not prevent us from condemning something that causes extreme suffering and provides only a small gain to others. It is true that the welfare measures based on demand elasticities are not designed for intersentient (including interpersonal and interspecies) comparisons of welfare. There are measures designed for intersentient comparisons of welfare, however, such as the concept of a "just perceivable increment" of welfare (Edgeworth 1881; Ng 1975). It would be interesting to see the results of empirical animal studies using such measures so that interspecies comparisons could have a more objective basis.

It should be pointed out that changes in well-being are measured by the areas bounded by demand curves (subject to some minor difficulties, to be mentioned later) rather than by the slopes or elasticities of demand. This is illustrated in Figure 1; the horizontal axis measures the per-unit cost (or price) a sentient (person or animal) has to pay in undertaking a certain activity. (Economists usually put this amount on the vertical axis following Alfred Marshall, who viewed it as the dependent variable.) It is true that if we start from the same point (say, A), all three measures give the same qualitative (but not quantitative) result. Demand curve AB is steeper than demand curve AC, demand shown by AB is also more elastic, and when quantity is halved, the demand curve bounds an area ABDE that is smaller than ACDE. If the initial points are different (e.g., F

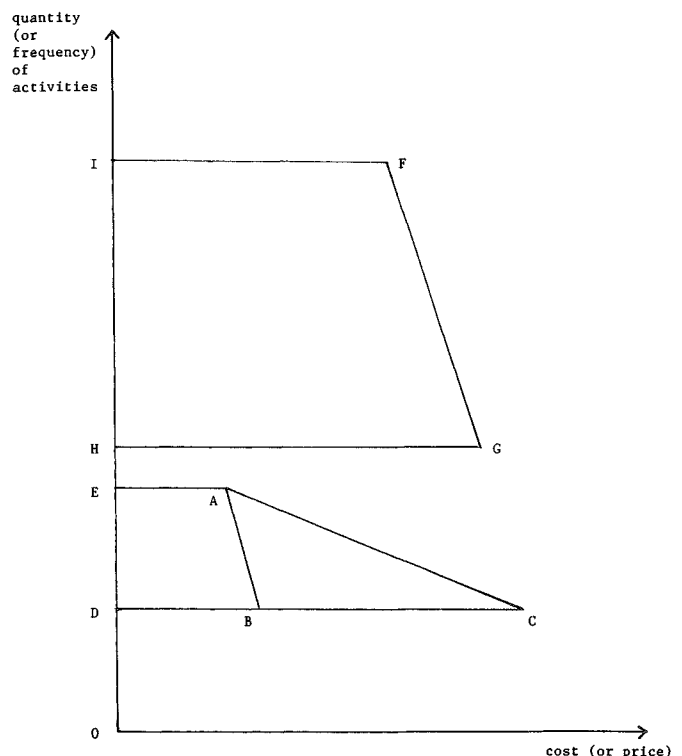


Figure 1(Ng). Areas bounded by demand curves as measures of changes in well-being.

and A), however, neither the slopes nor the elasticities give the right qualitative answer. For example, a sentient undertaking an activity at *F* will suffer a welfare loss (when the quantity is halved) measured by the area *FGHI*, which is larger than the area *ACDE* even though demand curve *FG* is much steeper and demand more elastic than that shown by *AC*. This is because *F*'s location northeast of *A* indicates that the sentient at *F* views the activity as more important (than the sentient at *A*), for it undertakes it more often and is paying a higher price (sustaining a higher cost) to undertake it.

In economics, the use of areas bounded by demand curves to measure welfare changes is known to have the following familiar difficulties:

1. The measure may differ depending on what is used as a measure of cost or price. (Economists usually use money.)
2. Since the marginal welfare of money (or whatever is used as price) may itself change along the demand curve, the measure is open to the objection that a changing measuring rod is being used.
3. The measure is "path-dependent" – its value depends on the exact path of integration. This is especially relevant when more than one variable has changed.

These difficulties, as well as the history and rationale of using the area bounded by the demand curve, are discussed in Ng (1983, Chapter 4), where it is also argued that the difficulties are usually quantitatively insignificant and an alternative measure (marginal dollar equivalent) is proposed when the divergence is significant.

Seeking the sources of simian suffering

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Do nonhuman primates suffer under conditions of captivity? Despite some strongly held opinions, this is not a frivolous question with an obvious answer. In captivity, primates live longer, have reduced infant mortality, are healthier by virtue of lowered exposure to and treatment for disease, and are assured of adequate nutrition in comparison with wild animals. In this sense, monkeys and apes are not only free from suffering, they clearly benefit from captivity. Captive primates may also experience varying degrees of sensory, social, cognitive, or spatial restriction, however. At issue is whether these kinds of restrictions produce suffering in any or all primate species.

Several procedures are available for determining the effects of different captive environments on primate well-being. One method is to compare animals in different environments with respect to outcome measures such as health, behavioral repertoire, level of distress, and coping responses (Novak & Suomi 1988). Although ostensibly based on the animal's reactions, this method requires that we make some judgments about the desirability of outcomes produced in each setting. Another procedure emphasizes the animal's preferences for different environments in a forced-choice test. Such tests may reflect only short-term needs, particularly if animals do not fully comprehend the choices, and preference for a particular environment cannot be construed as evidence that the alternative choice is unsuitable.

Dawkins' approach assesses the suffering of confined animals by measuring the elasticity of demand for specified commodities or environmental conditions. Desire for a commodity is titrated against the cost to the animal, with the assumption that commodities or conditions that yield relatively inelastic curves (*i.e.*, demand that is relatively independent of cost) should be given the highest priority in the design of animal housing. This

method is superior to the simpler forced-choice test in that it evaluates *how important* the choice is to the animal. Although Dawkins' method may help to identify circumstances that influence suffering in captive animals, several issues merit discussion. We will discuss these issues in the context of two environmental conditions thought to play a role in the well-being of captive primates, namely, cage size and social companionship.

In Dawkins' presentation, elasticity of demand is assumed to vary mainly between commodities; however, there may also be variation within a commodity. Because commodities or environmental conditions frequently exist in a continuum, a curve showing either an elastic or an inelastic demand might be obtained depending on the region of the continuum being studied. For example, the opportunity to move from a small cage to a moderately sized cage might be of considerably higher value to many primates than the move from a middle-sized to a large cage. Thus, sufficient sampling of the continuum may be necessary for sound conclusions to be drawn.

Demand curves may also vary with subject and species characteristics and the previous history of the animal. Thus, rhesus monkeys maintained in social groups might pay a higher price for continued access to their cage mates than an individually housed monkey would pay to obtain a social companion. Do different rules apply to animals with diverse backgrounds?

Other pragmatic and theoretical concerns may limit the utility of Dawkins' approach. In some cases, the actual conditions under which demand curves are generated may be difficult to construct. How does one adequately measure demand curves for migration in migratory birds? In other cases, the meaning of such demand curves could be difficult to decipher. How does one determine the cage size reactions of primates living in a group? Although group members can be tested individually for their reactions to changes in cage size, the group demand curve will not necessarily be the average of the individual response functions.

Finally, Dawkins' main thesis is that commodities or conditions for which there is inelastic demand are so important to the animal that their absence produces suffering. Although this assumption has value in certain instances, its general validity needs to be tested. If being deprived of a commodity produces suffering, we should be able to recognize and quantify that response by monitoring the physical health, behavioral repertoire, stress, and coping responses of the animal. Some might argue that outcome measures such as these are more useful than demand curves in identifying sources of suffering.

All primatologists have an ethical and legal obligation to provide captive primates with an environment that promotes their well-being. Dawkins has given us another interesting tool that, if used in conjunction with other methods such as outcome measures, will help us design and construct better environments for captive primates.

The precommentary by Singer is valuable in that it raises the issue of the morality of animal use. Regardless of the practical benefits that may accrue, advocates of animal use in research and agriculture must ultimately confront the moral implications of their actions. Whereas we agree with Singer on this point, we strongly disagree with his particular philosophical position. He argues that animals have moral status equivalent to that of humans because of their capacity to suffer and as a result cannot be used to further human goals. Elsewhere, he maintains that although humans must respect these rights, other animals themselves are not similarly obligated because "nonhuman animals are not capable of considering the alternatives, or of reflecting on the rights or wrongs of killing for food" (Singer 1977, p. 237). Because of his insistence that the capacity for suffering is the sole criterion for moral consideration, Singer fails to see the contradiction inherent in his viewpoint and finds himself in the awkward position of trying to imagine "what it is like being a hen in a battery cage." We certainly believe that

animals should be treated with dignity and respect and that their suffering should be minimized. As eloquently stated by Cohen (1986, p. 866), however, "only in a community of beings capable of self-restricting moral judgments can the concept of a right be correctly invoked."

Suffering as a behaviorist views it

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Singer and Dawkins assume that suffering is an intrinsically private internal "state," directly accessible through introspection, and that behavior is only a messenger or ambassador of that state. Singer and Dawkins both imply that we first perceive suffering in ourselves and know about the suffering of others only by analogy.

I have pointed out several serious empirical and logical problems with this conception in *BBS* (Rachlin 1985) and argued for a behavioral view – that we first perceive suffering in others (the same way that we perceive other abstract qualities in the environment). Only then do we (1) label as suffering the perceptible qualities of our own overt reflexive behaviors, and (2) acquire overt instrumental responses (especially verbal ones) that serve the same social function as do our innate reflexive responses – to enlist the aid and forbearance of other people.

The behavioral view implies, for instance, that the suffering of wild dogs differs from that of domesticated dogs because the instrumental component of wild dogs' suffering is perceived and reinforced by conspecifics whereas that of domesticated dogs' suffering is perceived and reinforced by human beings. This conception implies that it is possible to suffer without realizing that you are suffering, that it is not possible to suffer without exhibiting the pattern of *overt* behavior typically perceived as constituting suffering, and that it is not possible to pretend to suffer, pretend so widely and consistently as to convince all audiences (family, friends, business associates), and not really suffer. What implications does this view of suffering have for ethical treatment of animals?

Two relevant questions about the suffering of wild animals are: (1) When an individual animal's normal functioning is impaired, to what extent are the responses of conspecifics altered so as to aid in the recovery of that functioning? (2) What sort of behavior of the impaired animal sets the occasion for these responses in conspecifics? The answer to question 2 tells us the quality (not just a sign) of the animal's suffering; the answer to question 1 gives us an idea of the degree of suffering.

If an injured animal is typically ignored and abandoned in the wild by its conspecifics, suffering has no meaning for that animal (in the wild). The question, What could conspecifics do about it even if they wanted to? implies only that they in fact do nothing. Because both Singer and Dawkins agree that suffering is a direct product of biological evolution (not a by-product or accident), it must have a purpose. What value could suffering (however interpreted) have for normal efficient solitary foraging, hunting, avoidance, or escape in the wild? On the other hand, there is clear value in suffering for enlisting other animals' aid when functioning is impaired. Note that these considerations exempt (as Singer and Dawkins would probably agree they should) both "playing possum" to deceive predators and giving alarm signals (e.g., a beaver slapping its tail). [See also Whiten & Byrne: "Tactical deception in primates" *BBS* 11(2)1988.]

I agree with both Singer and Dawkins that in domestication, farming, experimentation, and other interactions between humans and other animals, important ethical considerations arise. We ought to reduce animal suffering for the same reasons that conspecifics naturally do. In using the animal for our own

purposes we make ourselves to some extent that animal's society. Since we assume that the animal's normal society benefits when the suffering of its members is minimized, it might be a good idea to assume that we will also benefit (even if we do not presently see how). So we should be careful not to elicit any responses that indicate suffering in the wild, and if we do elicit such responses, we ought to act so as to reduce them.

With regard to domesticated and farm animals, the ethical issue is more complicated. Our ancestors, by saving the lives of animals whose suffering superficially resembled that of humans and allowing to perish those whose suffering differed from that of humans, must have enlarged whatever overlap there might originally have been between their suffering and ours. For these animals, behavior that arouses our pity is probably a genuine signal of injury. We ought to minimize such behavior, as well as nonhumanlike suffering. In doing this, we put ourselves more fully in the place not of the suffering animal (where we cannot be) but of its conspecifics (where we already to some extent are).

With regard to Dawkins' economic model, much as I endorse and participate in this kind of research [see Rachlin et al.: "Maximization theory in behavioral psychology, *BBS* 4(3) 1981.], I fail to see its relevance to the ethical issue. Price and elasticity are absolutes only in a money economy. In a barter economy (which is a better model of animal behavior), price and elasticity are both (as Dawkins recognizes) relative concepts, depending on what is being traded. The economic constraints on an animal's behavior are essentially compounds of the conflicting purposes of other animals. When we create artificial constraints in the laboratory, they stand not for monetary prices but for those purposes. The "problems with this approach" listed by Dawkins are therefore probably unresolvable. A still more serious problem is that the large number of experiments required to discover the really inelastic demand for goods needed by a given species would have to involve a great deal of animal suffering *provided suffering is truly as Singer and Dawkins define it* (but not if it is truly as I define it). Because I believe that these kinds of experiments have an intrinsic scientific and practical value for both animals and humans, I hope Singer and Dawkins are wrong and I am right.

Science and value

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The Dawkins target article and Singer's precommentary not only bespeak the growing concern with the moral status of animals in society but, equally interesting, they mark fundamental changes in the very nature of science occasioned in part by that concern. Throughout much of the twentieth century, the purview of scientific inquiry has been defined by a set of assumptions taken as axiomatic in scientific practice and training and typically unexamined and uncriticized. So dominant have these ideas been that I have elsewhere characterized them as constituting the ideology or common sense of science (Rollin 1989).

Fundamental to this ideology is the understandable desire of science to demarcate itself clearly from speculative metaphysics, theology, and other debatable knowledge claims. Science has thus historically stressed its allegiance to empiricism. In the early twentieth century, this historical tendency peaked in positivism and its psychological cousin, behaviorism, both of which specifically articulated methodological (and ultimately metaphysical) commitments to countenancing only the verifiable in the scientific inventory of the universe. As an inevitable consequence of such a reductivistic sweep, certain concerns were definitively barred from the domain of scientific attention.

In the first place, science was unequivocally defined as "value free," having no truck with value judgments in general and moral judgments in particular. If science dealt only with the verifiable and testable, and judgments about right and wrong and good and bad could not be tested in the laboratory and confirmed or disconfirmed by gathering data, they were dismissed by scientific ideology as subjective matters of opinion and taste, which might affect the social and political uses to which science was put, but had no place in science itself. Thus, authors of scientific textbooks disavowed (and still disavow) a role for ethics in science (Keeton & Gould 1986; Mader 1987), and scientific journals and conference speeches typically included no explanation of ethical questions relevant to their particular fields.

The second concern that was barred by scientific ideology, and that is directly relevant to the articles by Dawkins and Singer, was animal consciousness. [See *BBS* special issue on Cognition and Consciousness in Nonhuman Species" *BBS* 1(4) 1978.] In the nineteenth century, such major biologists and psychologists as Darwin (Darwin 1871; 1872) and C. Lloyd Morgan (1894) considered the study of animal thought and feelings to be an essential part of science, for it seemed plain to them that if morphological and physiological traits were phylogenetically continuous and studiable, so too were psychological ones. It is ironic that Morgan is perennially portrayed by scientific ideology as a pioneer in excising consciousness from scientific study by his famous canon, when in fact he specifically asserted that all of nature had to be suffused with consciousness, and directed his canon only at too liberal an attribution of rationality to animals. Throughout the twentieth century, however, scientific ideology has excluded the study of animal consciousness on the grounds that claims about animal thought and feeling are unverifiable. Indeed, one of the few commonalities of Anglo-American behaviorism and most European ethology from the 1920s to the 1950s was the exclusion of animal mentation from science (Schiller 1957).

Elimination of subjects from scientific ideology had unfortunate conceptual, moral, and practical consequences. The belief that science has no truck with morality led scientists to ignore moral questions and assumptions in great need of clarification, the result being muddled morality. Plainly, for example, as soon as one has decided to use an animal invasively to advance scientific knowledge, one has made a moral decision, namely, that the knowledge gained is of greater value than the animal's life or suffering. If, as many scientists argue, invasive animal use is essential to science, then a debatable moral judgment stands at the foundation of biological, psychological, and biomedical science. The agnosticism about the morality of animal use that followed from the ideology of science was further buttressed by ideological denial of the scientific legitimacy of attributing pain, fear, and other modalities of suffering to animals. If animal pain and suffering were scientifically unreal, they did not need to be studied or dealt with, especially if animal use and treatment were not seen as raising moral questions by a science that considered itself value free.

As long as society was basically unconcerned about the moral status of animals, the concerns of scientific ideology we have discussed were ignored. Although ordinary common sense dictated that animals were conscious and that their mental states were knowable, there was no generalized moral concern for animals; scientists focused instead on isolated instances of cruelty or on the welfare of favored animals. They could therefore dismiss scientific ideological denial of animal mentation as yet another incomprehensible but irrelevant scientific oddity, like the twin paradox in relativity.

In the last two decades, however, in significant part as a result of the sorts of argument presented by Singer in his precommentary and other writings (Singer 1975), as well as in the work of other philosophers (Regan 1984; Rollin 1981; Sapontzis 1987), society has grown increasingly conscious of the fact that animal

treatment is a significant and genuine moral issue. This moral concern grew exponentially as society became ever more aware of the magnitude of animal suffering in areas like research and confinement agriculture. The public demanded to know the extent of animal suffering in such areas and demanded of science both assistance in effecting such a determination and accountability in its own use of animals; the latter demand ultimately resulted in legislation in the United States and Britain mandating the control of animal pain and suffering in research.

In the face of such public concern, scientific ideology inevitably began to crumble. Dawkins's work in the past decade is one of the best examples of how science can return to the Darwinian vision and make animal mentation a major subject of study. In her first book, Dawkins (1980) provided a conceptual framework for the scientific study of animal suffering in general that meshed beautifully with the sorts of general moral concerns being presented by Singer and others. A decade later, with animal welfare a major established social concern, the issue is less one of overturning the scientific ideological denial of value questions and the legitimacy of talking about animal consciousness (though significant pockets of ideological resistance to both of these areas still exist in the scientific community), and more one of providing specific analyses and recommendations for improvement in problem areas. It is now clear, for example, that the conditions under which laboratory animals, food animals, and zoo animals are kept can lead to various forms of suffering – such as loneliness, boredom, and frustration – and that we are morally bound to ameliorate or eliminate them. It is thus important to decide what matters most to the animals, and what changes will be most efficacious to ameliorate suffering and promote happiness (Rollin 1989). This in turn requires that we have some method for assessing not only what matters to animals, but how much it matters. This is the question that is addressed in Dawkins' current model. Such a model is a natural outgrowth of attempts to reform practices now recognized as morally problematic.

Nonetheless, as I have argued elsewhere (Rollin 1989), this new approach has its own potential for abuse, in that Dawkins's mechanisms for determining how much something matters to an animal may engender significant suffering in the experimental animal, even though their purpose is to benefit a class of animals. (The same problem arises in analgesia research aimed at alleviating animal pain.) Given the sort of argument developed by Singer, it is clear that we must guard against causing significant harm to individuals to help the group in the same way that we feel obliged to guard against such harm in our research on human subjects. The new moral concern that has led science again to study animal consciousness and suffering should also temper that science in such a way as to treat each experimental animal subject as an object of moral concern.

To suffer, or not to suffer? That is the question

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Dawkins and Singer discuss a number of issues that relate to the moral status of animals and how we might gather empirical data that will help us determine what that status should be. Suffering is an important element in the writings of both Dawkins and Singer but neither author focuses on the meaning of the term. Singer takes it for granted that animals suffer whereas Dawkins equates suffering with certain physiological or behavioral conditions. However; neither is now adequate, we need to examine the comparative biology and metaphysics of suffering much more carefully. In this commentary, I have attempted to issue a

challenge to those, such as Singer and Dawkins, who have the philosophical, behavioral, and neurological training both to define the wider range of questions I believe we should pursue when examining the moral status of animals, and to consider how we might generate satisfactory answers to those questions.

Although the term "suffering" is commonly used in discussions of animal well-being, we have only a commonsense understanding of what it might mean (e.g., Rollin 1989). Cassell (1982) has tried to define human suffering, concluding that people suffer when they perceive a threat to their personhood. "Personhood" is a complex concept; in this context, it is more than just an individual's body or mind. According to Cassell's definition, animals would suffer only to the extent that they had the mental qualities that constitute human personhood. But it is not clear to what extent animals possess those qualities (Sapontzis 1987), or how personhood varies among humans. Gray (1982b) has noted that people with prefrontal lobotomies apparently do not experience the full range of verbally mediated anxieties and thus, it can be argued, do not suffer as much as people in whom these capacities are intact.

Presumably, animals who lack language ability would also be unable to experience such anxiety. In Cassell's more recent discussion of suffering in animals (Cassell 1989), he notes that an animal's capacity to suffer is related to its sense of the past, whether it can apply meaning to events, and whether it has some notion of self as including past, present, and future meanings. In this description, an animal need not engage in self-reflection to have the capacity to suffer; it need only have a self.

Several investigators (Eisemann et al. 1984; Fiorito 1986; Wigglesworth 1980), have argued that insects are unlikely to feel pain. They base their conclusions on neurophysiological and behavioral evidence. They do not claim that insects are oblivious to noxious and aversive stimuli, however. Clearly, insects have the usual nociceptive pathways that serve to protect them from many of the dangerous stimuli present in their environment. The distinction here between nociception and pain can be highlighted by an intriguing human example. A human paraplegic with an injury to the upper spine but intact lower spinal reflexes will withdraw a foot from a hot iron but will feel no pain. The nociceptive reflex arc is sufficient to protect the foot from tissue damage.

Thus, it could be argued that pain sensations are not necessary to confer an evolutionary advantage to an organism; simple nociceptive reflex arcs appear to be eminently satisfactory given the evolutionary success of the insects. What, we might ask, is the additional advantage conferred by the pain experience (as opposed to nociception) – or is pain merely an unfortunate byproduct of an expanding awareness during the process of evolution?

I would argue that much more attention should be given to human and animal anxiety as causes of suffering. The study of anxiolytic and anxiogenic substances provides a wealth of data relevant to animal suffering (Gray 1982a; Rowan 1988). Most of the legislative control of animal research and animal abuse focuses on the control of and reduction of pain; but frustration, helplessness, anxiety, and fear (Rowan 1988) probably cause more suffering than pain does. Clearly, voluntary and legislative approaches to the control of animal suffering must take into account more than just pain if they are to achieve the commonsense goal of reducing and possibly eliminating pain and suffering.

In the last two decades, the philosophical debates have been dominated by those arguing for raising the moral status of animals. By and large, the arguments have been based on one characteristic that is deemed to be the morally significant feature. Singer (1975) talks of animal suffering and pleasure (sentience). Regan (1983) mentions the criterion of being a subject of a life, a feature that is very dependent on the capacity to have beliefs and desires. Nozick (1983), however, in his review of Regan's (1983) book, argues that no comprehensive

and satisfactory moral theory can be based on any single characteristic since there are several morally relevant qualities that must be taken into account. Tannenbaum and I (1985) have suggested what some of those characteristics might be – namely, sentience (including pain, distress, and suffering), intentionality and/or purposiveness, self-awareness, and kinship (including both genetic relationship and social attachment). The possession of life also would seem to raise some moral concern although not of the same order as sentience.

These comments are very brief and superficial but I hope they have raised some additional issues that must be considered in any analysis of animal well-being, suffering, and consequent moral status. There is a clear need for a sophisticated discussion combining both empirical data and philosophical argument.

Emotion, empathy, and suffering

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What is the relation between emotion and suffering and how do we recognise them in animals? I have previously (Salzen 1979; 1981) outlined a theory in which unpleasant emotions are defined as the responses to the thwarting of or conflict between aroused motivations and pleasant emotions are the changes that occur at the cessation of thwarting or conflict. The specific emotion depends on the particular motivation and consummatory actions aroused. This definition of emotion parallels Dawkins' definition of suffering, apart from her reference to subjective feelings. If subjective feelings are essential, then we must determine to what extent they occur, both in animals and in humans incapable of using language.

I understand subjective feelings to mean a self-awareness of affect so that there is a perception and cognition by the individuals of their own emotions (both internal and external bodily actions) that is comparable but not identical with their perception and cognition of affective displays by other individuals. If an individual responds to the affective displays of its social partners, it is inevitable, if the individual is able to perceive its own affective displays *in virtually the same way* as it perceives those of others, that it will come to respond to its own affective displays *as if they were those of others*. This makes possible self-control of states of thwarting and conflict, that is, of emotions. It also permits the formation of neuronal assemblies representing the individual (the self or the "me") comparable with assemblies that represent other individuals and with which the rest of the brain system (the "I") can interact. This interaction constitutes the self-awareness of subjective feeling. Such a view is totally in agreement with the theory of self-awareness and the social self argued in beautiful detail by Mead (1934).

Thus, suffering is the state aroused in us by the self-awareness of thwarting states and displays. In humans it develops in infancy, with the awareness of emotional states emerging later than the awareness of bodily appearance and actions (Lewis & Brooks-Gunn 1979). It occurs in animals to the extent that they have such self-awareness. There is evidence of bodily self-awareness in some apes (Gallup 1982) and vocal self-awareness in a songbird (McArthur 1986). But the determination of the degree of self-awareness of affective states in animals is too difficult to be a useful requirement for establishing the presence of suffering.

The behavioural procedures described by Dawkins determine the nature and degree of motivations that are thwarted, which should be related to affective displays. My theory of emotion uses the analysis of thwarting responses made by Morris (1956), who divides them into primary responses, con-

sisting largely of intention movements and accompanying visceral changes; and secondary responses, which occur when the primary responses fail to end thwarting, that is, when there is chronic or repeated thwarting. Secondary responses include displacement, redirection, regression, and "neurotic" inactivity. To these I have added aggression, and would now add stereotypies. Secondary somatic responses are evident in humans with neurotic complaints; secondary visceral responses are present in cases of psychosomatic disease. Thus secondary thwarting responses can be taken as objective signs of suffering. Dawkins includes some of these as "indicators of high motivation." In the absence of evidence of subjective feelings they are the best affective display indicators of suffering that we have.

The use of affective displays to assess suffering, however, depends on some commonality of affect display in the perceiver and the emitter. Unfortunately, this may not exist. Many mammals use olfactory displays; and affective signalling may be less developed in solitary species. So there is good reason to resort to measures of the strength of motivations underlying thwarting rather than to rely on the resultant social signalling. This is done effectively by the various methods so clearly reviewed by Dawkins.

A continuum of conation, cognition, affect, and self-awareness in vertebrate animals is evident from comparative psychobiology. This enables us to respond to other species with differing degrees of empathy and sympathy. A developmental continuum from zygote to adult suggests a gradation of responses within species too. It is through empathic responding to affective displays that individuals come to comprehend the suffering of others. Social learning capitalizes on this process.

Elsewhere (Salzen 1989) I have identified three developmental stages of affective response to others: reflexive in the neonate, empathic in the infant, and sympathetic in children. Both empathy and sympathy are acquired through interaction with the immediate caregivers and are later generalized to neighbourhood, region, nation, and beyond. The same generalization may or may not occur in all developmental stages, mental conditions, creeds, races, and species. Presumably there is survival value and genetic advantage for empathy and sympathy both within and beyond the family. But both would seem to decrease at each level of generalization to ever-widening circles of contacts (the "expanding circle" of Singer 1981). Thus, empathy and sympathy must be adjusted ultimately to the maximum benefit of the perceiver as a genotype.

This conclusion seems to support callous disregard of suffering in others whose welfare is in conflict with one's own inclusive fitness. The analysis of altruistic behaviour (Barash 1982), however, shows how seemingly unselfish behaviour can evolve and the mechanisms by which a balance of selective advantages is struck.

One possible mechanism favouring unwarranted or disadvantageous extension of empathy and sympathy is that callousness itself might generalize to yield an ever-decreasing circle of individuals and things that can evoke compassion – a process known, somewhat unfortunately, as "brutalization." Although both types of generalization may occur, there is no simple relation between callousness and compassion in animals and humans, either in individuals or in societies. In neither can we rely on the similarities of affective displays, for the reasons already given. Singer also seems to be aware of this. Therefore, the measurement of motivational needs described by Dawkins promises solutions that may satisfy both psychobiological and philosophical concerns about animal suffering.

The meaning of speciesism and the forms of animal suffering

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In his precommentary, Singer defines "speciesism" as "the view that species is, *in itself*, a reason for giving more weight to the interests of one being than another." Singer has argued at length for an analogy between speciesism and racism and sexism, contending that speciesism should be considered to be as morally deplorable as those two prejudices (Singer 1975). Given the above definition, however, speciesism is also analogous to "familyism," "friendism," "neighborism," and any number of other morally unobjectionable preferences "giving more weight to the interests of one being than another." These preferences are unobjectionable because morality includes special obligations to limited groups as well as obligations owed equally to all. Consequently, to understand what is morally deplorable about speciesism, we cannot rest content with Singer's definition of it.

The modern era in moral philosophy is marked by the gradual but determined substitution of a presumption in favor of equality for a hierarchical world view, inherited from ancient Greece, Palestine, and feudal society, according to which a "better class" is intended by nature to be served by its inferiors. As a result, a commitment to equality is now definitive of the moral point of view (Kant 1959; Hare 1965). Singer's arguments for animal liberation have been criticized for taking this emphasis on equality even further by attempting to base morality solely on a principle of equal consideration for all (Francis & Norman 1978; Diamond 1978). The logic of this criticism is as follows.

1. In addition to egalitarian obligations, moral practice includes special obligations to limited groups based on special relations we have to those groups. Some of these relations are biological (e.g., "blood relations").
2. There is no credible moral argument for condemning all of these special obligations. Such an argument would condemn individuals for feeling more obligated to feed one's children than to feed strangers, which is incredible.
3. Consequently, moral theories based solely on a principle of equal consideration for all are either gross oversimplifications or unjustified critiques of moral practice.

Integral to our relationships with family, friends, neighbors, etc. are moral obligations of commitment, loyalty, trust, etc., so that we can be counted on to assist them in ways we do not owe strangers. (Family members have been sagely identified as those who have to take you in when you're down and out.) These special relations are an important part of what makes life worth living for most people; therefore, to condemn them as immoral would be to propose a morality that has lost touch with psychological reality.

It follows that if our current treatment of animals is morally deplorable and if "speciesism" is to be the label for the morally deplorable view that underlies that treatment, then an interpretation of speciesism must be formulated that takes into account the variety of our moral obligations. Elsewhere, I have offered the following characterization of speciesism: "A speciesist doctrine is one which gives such great moral importance to what typically distinguishes one species from others that it leads to disregarding the interests of those others in favor of satisfying the interests of members of the favored species" (Sapontzis 1988, p. 99). Although far from adequate, this characterization focuses on what is morally deplorable about speciesism: We not only "give more weight" to human interests than to animal interests; we routinely *disregard* the interests of animals (in life, liberty, and the pursuit of happiness) in the attempt to satisfy human interests.

A preference for family or species (or whatever) becomes morally deplorable when it is used (1) to excuse us from trying to balance our special obligations (and self-interest) with

egalitarian obligations so that no one is treated unfairly or left without the wherewithal to lead a reasonably satisfying life – and (2) to justify our treating those to whom we feel no special obligation merely as resources for satisfying our special obligations (and self-interest). For example, it would be morally deplorable for a father to steal from other children, leaving them destitute and starving, in order to provide a comfortable life for his own children. Imprisonment and otherwise destroying the lives of animals as a means to achieve human welfare similarly go beyond the limits of morally acceptable preference.

Since the avoidance of suffering is something in which many animals have an interest, Dawkins' formulation of techniques to discern animal suffering which will impress scientists, and thus a society impressed by science, is important (Dawkins 1980). Although her definition of suffering as "a wide range of unpleasant subjective states (e.g., boredom, frustration, thirst, etc.) that are acute or continue to a long time" is commendable because it acknowledges that we must talk about a wide range of subjective states, it omits a common component of the meaning of "suffering" – the idea of suffering a loss. This omission is particularly objectionable with regard to the morality of our treatment of animals.

The idea of suffering a loss depends on "suffering" as defined by Dawkins, since whether losing something is considered "a loss" depends on its relation to (un)pleasant subjective states (e.g., a person does not suffer a loss in being cured of the measles). One can suffer a loss even though one does not experience any unpleasant subjective states in the process or as a consequence. For example, many motorists have left the car motor on while they slept through a snowstorm and died peacefully of carbon monoxide poisoning. It would be arbitrary to hold that these deaths (losses of lives presumably worth living) are not morally significant, whereas those of people who died painfully in other accidents are, just because these sleepers did not experience any unpleasant subjective states.

When the remainder of one's life might have included enough pleasant subjective states to make it worth living, suffering the loss of that life is a morally significant loss. Consequently, such suffering must be taken into account when determining how we ought to interact with others. Animal welfare advocates have traditionally disregarded this suffering when contemplating how we ought to treat animals, and although Dawkins' work marks a sensitive, important step forward in animal welfare (Rollin 1989), she still considers the treatment of animals as resources that can, without moral loss, be made to suffer the loss of the rest of their lives in the pursuit of satisfying human interests. It is to be hoped that the moral progress we have been making for the past several centuries will soon lead to fairness playing a fundamental role in our interaction with animals, not only at the level of suffering unpleasant subjective states but also at the level of suffering loss (Sapontzis 1987).

Animal well-being: There are many paths to enlightenment

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Re Dawkins. Dawkins' methodological recommendations for assessing animal well-being and suffering in terms of consumer demand theory are wise, shrewd, and practical. I only wish she hadn't risked losing the case for behavioral assessment before she'd even stated it by basing the utility of choice and preference methods on the doubtful grounds of mentalism. That argument must fail with scientists whose outlook is monist and materialistic rather than dualist.

What is wrong with basing the assessment of animal well-

being and suffering on the biobehavioral principles of reinforcement and punishment, or, what amounts to the same thing, appetite and aversion? It makes eminently good sense to suppose that species that have survived the rigors of natural selection would be bound to seek contact with things that are in the main good for them and to shun contact with things that are in the main bad for them.

Animals do in fact learn to act in ways that result in reinforcing consequences (access to appetitive stimuli, escape from aversive stimuli) and learn not to act in ways that result in punishing consequences (contact with aversive stimuli, loss of appetitive stimuli). It is surely reasonable to suppose that, by and large, events that function as reinforcing consequences (= "good" = "promote well-being" = "enhance fitness") and to suppose that, by and large, events that function as punishing consequences (= "bad" = "promote suffering" = "threaten fitness"). (I mean the equals sign to be taken literally; that is to say, I regard these as synonymous expressions.)

Isn't that enough to justify concern for animal well-being and suffering, and to warrant the serious search for methods to assess it? Why muddy the waters with talk of subjective feelings, mental suffering, mental states, and so on? I don't want aversive stimulation (I act to keep aversive stimuli away from me); I do want appetitive stimulation (I act to put myself in contact with appetitive stimuli). I assume that other species with nervous systems have the same fundamental biobehavioral motivational and emotional mechanisms, for I think contacting appetitive stimuli and avoiding noxious stimuli is a chief function of the nervous system – it's what evolution gave use a nervous system for.

Two other points struck me. First, there is a cost in terms of animal suffering of carrying out well-controlled experimental assays of animal suffering. Studies (and models) of the exemplary kind Dawkins recommends are very much needed, but at a certain point we must be prepared to call a halt, and from then on extrapolate, on the basis of data in hand, to the likely outcomes of assays too costly in terms of animal suffering to be justifiable.

Second, in a recent book on the psychological well-being of captive primates (Segal 1989), almost every author stressed the importance to well-being of variety in the lives of laboratory and zoo primates. No doubt animals place high priority on food, but the same damn food day after day, although it meets nutritional needs, fails to meet the need for variety. Is variety, then, a luxury or a necessity? (Neither my laboratory macaques nor my standard poodle will eat the same thing day after day. They just won't eat.) Research with closed economies, in which nonlinear demand curves have a chance to show themselves, will doubtless reveal the real *necessity* of "luxuries" like variety of diet, activities, living space, and companions.

Re Singer. There are two routes to ethical convictions, through the head and through the heart. I say *convictions* rather than *principles* because ethics is a product of human psychology. Ethical precepts do not come from on high but from the mouths and pens and daily conduct of humans. They are not absolute, but change and evolve as human cultures change and evolve. We might wish it otherwise, but it is not otherwise.

Since human psychology is an aspect of evolutionary biology, self-interest must underlie ethical convictions, as it underlies all biological functions. Starting from individual self-interest we can, by the route of reason, derive an ethical interest in the collective welfare of our group, for we depend on the cooperation and integrity of the group for our own well-being. So we come to the Golden Rule and the ethical concepts of fairness and equity. Collectively we negotiate a social contract: If you will have a care for my interests, I will have a care for yours, equity will result, and we will all have a chance to prosper.

Self-interest works through the human head to arrive at equity, but it works through the human heart as well, to arrive at affection. Proximity to those on whom we depend, and acts such

as looking out for their interests strictly so that they will look out for ours, exchanging goods and services with them, taking care not to cause them pain or suffering strictly so that they will not have reason to cause us pain or suffering all lead, through dimly understood processes of human psychology, to affection for others, and to sympathy and empathy. Sympathy means that we imagine they suffer or rejoice as we do; empathy means that we feel their suffering or rejoicing as our own. Then it becomes a matter of our self-interest not to let those we love suffer, for we suffer when they do; and it becomes a matter of our self-interest to promote their happiness, for we are happy when they are.

Equity and affection, I believe, are the bases of our ethical convictions and commitments toward our fellow humans. But what is the basis of our ethical commitments toward other species? Self-interest aided by reason dictates that we should treat them well enough to serve our purposes. Thus, if our purpose is to study physiological or behavioral processes, we need animal subjects whose health is not compromised, either physically or psychologically. If our purpose is to raise livestock for human consumption, we want them healthy, lean (nowadays), free of chemical contaminants, and yielding both a financial and an energy net profit. If our purpose is to produce pelts for fur coats, then we treat our mink in a way that yields high-quality pelts. These are matters of self-interest, clearly, but hardly matters of moral commitment.

I believe it is affection that dictates ethical convictions toward nonhuman species. My guess is that many of us know that but fear to confess it in forums of this kind lest we be dubbed anthropomorphic, bleeding hearts, softheaded, childish, irrational, mystical – as though affectionate regard for animals other than our own kind were shameful and not to be mentioned in serious adult discussions. But as Saint Exupéry (1943) reminded us in *The Little Prince*, we can hardly help eventually coming to love what we care for, unless we have been deliberately brutalized out of that natural inclination.

The gradual shift in my ethical attitudes toward nonhuman animals – especially my fellow primates – was not willed. It came about as a result of working in a research lab for 12 years side by side with a Barbary macaque and observing firsthand, often to my astonishment, the similarity of his intellectual actions and emotional reactions to my own. I felt daily a closer kinship to him, and finally love.

My concern for his welfare is of the same kind (though not of the same degree) as my concern for humans I care for; it is both sympathetic and empathic. When he is faced with a predicament suggestive of one that would embarrass me, the macaque behaves as I do when I am embarrassed. I imagine, therefore, that his psychological state is something like my embarrassment, and since for me embarrassment is aversive (I escape from and try to avoid embarrassing situations), I assume sympathetically that his resembling state is aversive to him, and because I love him, and because his suffering causes me empathic suffering, I try hard (self-interestedly) to spare him embarrassing situations.

I don't know how far to go with this line of thinking. I know whether recognizing myself in a Barbary macaque has led, by extrapolation, to recognizing myself, to a greater or lesser degree, in other nonhuman primates. Or whether love for a single Barbary macaque has led, by extrapolation, to a moral concern with the well-being of all primates. Nowadays I have an easier time recognizing myself in nonprimate species as well, and I feel a concomitant ethical concern for their welfare. I insist that my ethical concern is at bottom self-interested, just as my ethical concern for my fellow humans is.

Have I contradicted myself? Have I come around to the position of Dawkins and other mentalists, that suffering and well-being are mental states, and appetitive and aversive behavior are merely their physical symptoms? No, I'm content to rest with biological self-interest and the behavioral processes of reinforcement and punishment, appetite, and aversion. I view

my own psychology as I view that of other animals. And although I come to it by a somewhat different route, I share Dawkins' and Singer's concern for the well-being of other species; I greatly admire Dawkins' sensible proposals for a scientific assessment of animal suffering and well-being.

From one subjectivity to another

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It is not clear what is added to the causal explanation of behavior by claiming that animals experience suffering or its opposite when trying to escape from danger or when trying to attain a goal such as food or a mate. It is possible to understand what external and internal factors cause a hen to eat or to scratch in litter and even to speculate about why control by these factors evolved without referring to the hen's pleasure in eating and scratching or her suffering when hungry or deprived of litter. Most courses and textbooks on animal behavior of which we are aware do not include the topic of animals' subjective experiences. Nevertheless, Dawkins is right in saying that an implicit belief in the capacity of animals to suffer is the basis of many attempts to improve animal welfare. We therefore welcome her attempt to study issues of animal suffering with objective methods. As Dawkins herself no doubt realizes, however, the use of these methods to guide decisions about how animals should be treated still presents considerable problems.

One of them is Dawkins' suggestion (e.g., conclusion 3) that the demand for food can be taken as a standard of inelastic demand. To some extent calibrating the undesirability of a situation in terms of the duration or the amount of hunger is equivalent to going from one subjectivity to another. Suppose a situation is found to be aversive to the extent that the animal will tolerate 24 hours without food to avoid it, but not 36 hours. What does that mean? To a person the unpleasantness of that situation may depend greatly on hopes about finding or fears about going without food for the next 24 hours. The perception of the situation may modify its affective content. Such factors may be less potent or even absent with many animals.

Another problem here concerns how hungry the animal should be when its demand for food is assessed. Responding to food varies as a function of prior deprivation and quality of the food, among other factors. For example, for a shrew 24 hours without food may be a matter of life or death, but for an elephant it may be like forgoing a minor snack. One could try to refine the hunger measure by factoring in metabolic mass. But even that cannot be done in a simple way. There is probably a whole family of demand curves for each species. Some species of similar size are adapted to undergo considerable periods of anorexia and indeed may spontaneously eat very little at some stages of their life cycles (Mrosovsky & Sherry 1980), whereas others might seldom do this. If we wish to compare a hen's demand for litter or a large space with her demand for food, how hungry should the hen be? In what reproductive state? If she is incubating eggs, her demand for all of these commodities may be rather low and different from what it is when she is not incubating.

Solving problems like these, along with all the others that Dawkins points out in section 9, presents a serious obstacle to those wanting to put their ideas into practice. And if it is so difficult to compare motivations (as indexes of assumed subjective feelings) within a single species, how much more difficult it is to do so across species, as Singer suggests we must do to arrive at rational decisions about animal welfare! It is hard to imagine Dawkins's recommendations being put in practice on a large

scale in the near future. Desirable as a more rational approach may be, we doubt that it will readily replace the compassionate and generally informed, but ultimately subjective, assessment of what treatment of animals is permissible.

The attribution of suffering

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A fundamental problem with Dawkins's target article (and Singer's precommentary) is the lack of an adequate definition of suffering. Though a central aim of the animal welfare movement is to reduce or eliminate suffering in animals, these authors have given us only the most tentative grounds for discovering and analyzing it. Animal suffering has become so emotionally charged a term that attempts to analyze it critically have been rejected in favor of immediate action to stop it. But if animal welfare advocates aspire to be more than a lay-oriented animal rights group whose members are scientists, they must determine when and how much animals suffer.

The definition and determinants of suffering. A major contention of animal rights groups is that suffering in animals is easily inferred from simple criteria and that all animal research involves animal suffering. Most scientists have difficulty taking these claims seriously. There is no definition or analysis of suffering, and rarely do such groups present the convergent evidence required for attributing suffering in humans. Most of us have learned from experience not to infer too readily that people who have artificial body parts, or live more than two to a room, or eat fewer than three meals a day are suffering. But if an animal has on a head cap, is restricted in its access to food, or is in a cage, it is presumed to suffer. The animal rights approach also completely ignores the scientific context of experimentation, including potential uses of the results; the scientist's aversion to causing needless pain and wasting time and resources on experiments with animals that are not healthy and well cared for; and the limitations on experimentation imposed by the institutional review of experiments according to the Public Health Service guidelines. But scientists have underestimated the impact of the sheer repetition of activists' claims on a willing press. Because there is no agreement on a formal definition of suffering, there has been little coherent disputation of the claim that all animal experimentation produces suffering and must therefore be immediately stopped.

Unfortunately, attempts by lawmakers and animal welfare advocates to define suffering have usually been unidimensional and biased on the side of sensitivity. For example, rules recently proposed by the United States Department of Agriculture governing the transportation of all nonhuman primates require, among other things, that animals never be exposed to temperatures over 85 °F, that they be exposed to temperatures over 75 °F for a maximum of four hours a day and only if efforts are made to lower the temperature, and that they never be in visual contact with any nonhuman mammal. The United Kingdom's Farm Animal Welfare Council has endorsed the view that animals suffer when they are unable to perform the full repertoire of behavior shown by members of their species "in nature."

Though these rules and assumptions arise from the best of motives, consider that: (1) at least half of the humans on this planet are regularly exposed to these circumstances without reported large-scale suffering; (2) the great majority of pets have been exposed to these circumstances, yet most of their owners do not consider that their pets have suffered; (3) these circumstances regularly exist for many natural populations, again without any supposition that we should do something about

them. What is even more remarkable is that in most cases there is almost no evidence indicating that the prescribed rules are effective in reducing suffering, or even which circumstances are preferred by the animals involved.

These rules and assumptions come closest to what highly protective parents might desire for their children, but would not see enacted into law because of the cost and lack of agreement as to what was best for children. Somehow, self-appointed parents of research animals have convinced lawmakers that they know best, and as the head of policy-making at the USDA remarked, cost is not a concern. As a result, many standards of animal care are higher than those for workplaces, day-care centers, schools, nursing homes, and, in some respects, even hospitals. It could be argued that in the best of all possible worlds we should all be treated with equal extreme care. In a complex world in which children die of hunger and many people are poisoned by pollutants, however, it seems that, at the least, we have gotten our priorities in the wrong order.

Singer's claims. Singer, like other animal rights advocates, is not concerned with the definition of suffering. Rather, his concern is that animal suffering exists and that we should treat it the same as our own suffering. At first glance, failing to distinguish between the suffering of humans and the suffering of ticks, tapeworms, and maggots does not seem like a plausible position. There are hints that Singer intends ultimately to measure the intensity of suffering to make difficult decisions about relative suffering. But this is not included in the form of his main arguments, and it is certainly not the way his arguments have been used by animal rights advocates.

Singer begins with the assumption that animal suffering is rampant because of our Judeo-Christian heritage, which gives humans "dominion" over animals. According to Singer, in this tradition "human beings have a divine warrant for always giving priority to human interests." I am neither a biblical scholar nor a historian, but as I remember it, the meaning of dominion here implies responsibility as well as authority. Certainly farmers who espouse the Judeo-Christian ethic have risked their lives for their animals, and provided them at times with equal or even privileged access to scarce resources of food and shelter. I believe that the concern of many ecologists about disappearing species comes partly from a sense of the responsibility of human dominion over the planet. The animal rights movement itself appears to have roots in the Judeo-Christian beliefs of the unique responsibility of humans for animals and the obligation to deny impulses to gain advantage over those who are less powerful than ourselves.

Singer attacks the Judeo-Christian ethic for producing two highly influential but contradictory moral principles: (1) All humans are equal in moral status; (2) all humans are superior in moral status to nonhuman animals. According to Singer, these assumptions are incompatible because their joint truth requires the existence of some common quality that is possessed by humans, making them equal, and is not possessed by animals. Singer then argues that because there is no such quality, we must give the same effort to the elimination of suffering in animals as we do to the elimination of suffering in humans.

There are many problems with this approach. First, I'm not clear these are common assumptions. I do not believe that people commonly assume that all humans are equal in moral status or even that all humans are better than all animals. Equality of moral status is something we aspire to in specific circumstances; we have tried to formalize those circumstances in legal systems, but a few moments of conversation with the average person should convince one that this is not a common belief. Children do not have the moral status of adults, the mentally ill are not judged by the same standards as the mentally competent, illegal immigrants do not have the moral status of citizens, nonresident poor do not have the moral status of resident poor, strangers do not have the moral status of friends, someone who has stolen from us does not have the moral status

of someone who has befriended us. A fairer summary of what we commonly believe is that only within certain boundaries and in certain dimensions are humans assumed to be similar in moral status, and usually only in the absence of further information.

I believe we commonly place nonhuman animals in the same framework. For example, both people and animals that are judged nobler or more intelligent are often accorded higher moral status. In a not inconsequential number of cases, some animals may be viewed as nobler than some or even most humans. When we add to this an overall bias toward viewing beings that are more similar to or related to ourselves as nobler or more intelligent than beings that are distantly removed from us, we have a complex set of assumptions influencing the judgments of differences in the moral status of both human and nonhuman animals. There is no necessary discontinuity between our moral evaluations of animals and humans and, thus, no logical problem. Both human and nonhuman animals may be ranked differently and with overlap in moral status depending on the dimensions and circumstances.

The second problem with Singer's approach is that there is a common quality that unites humans and separates them from animals, namely, the unique aspects of DNA found in human cells. Singer might well argue here that we cannot specify perfectly the nature of the human gene pool, and that even if we could, it would simply be a species identification and not a logical reason for making judgments of the relative value of suffering. As far as I can see, however, the existence of even modestly distinct pools of DNA must be based on pressures toward reproduction within that restricted set of genes. At least some of this pressure will take the form of choices that effectively value the suffering and survival of gene pool representatives more than the suffering, survival, and reproduction of some other set of animals having an alternative gene pool. If this is not so, either the amount of resources in the world is infinite, or the particular gene pool in question will not long be with us.

I am not arguing that all acts necessarily have immediate or even long-term benefits to a particular gene pool. Social species, perhaps especially humans, make choices that benefit the survival and reproduction of genetically dissimilar animals. But the variables controlling these acts of altruism more often than not do produce results of long-term benefit to the human gene pool. Thus, though all acts of individual animals may not contribute to the reproduction of their own genes, if we consider all acts controlled by similar variables across all individuals from a gene pool, that is the expected direction.

Singer might well acknowledge that this is the status of the world, yet argue that it should be different. The moral status and suffering of an animal should count the same as those of humans to every human evaluator. Appealing though it may be, this view is neither logically consistent nor viable. Consider the incompatibility of the following beliefs: (1) All animals (including humans) are equal in moral status; (2) all animals except humans can promote the survival of their own kind at the expense of the suffering and restricted access to resources of other species. First, it follows from statement (1) that humans have the same rights as predators to express their predatory tendencies. But it follows from statement (2) that they must not express these tendencies. Therefore, the moral status of humans is either higher or lower than that of other animals, but definitely different.

A second argument is similar. On the grounds of evolution, the rule that all animals are equal in moral status is literally not viable. Every animal on the planet is competing for resources with other animals. Even the most devout human vegetarian living alone with minimal shelter, few clothes, and great respect for life is denying resources critical to the survival and reproduction of a surprisingly large number of animals by his simple presence in the ecosystem. If he has a dog or a cat as a pet, so much the worse for other animals.

In short, the logic of our Judeo-Christian heritage is certainly

no more flawed than that of the animal rights approach (which in part represents an extension of pieces of that heritage). Both animal rights advocates and scientists want to reduce the suffering of others, but this cannot be done in any reasonable way until we agree on its nature, extent, and relative value.

Dawkins's contribution. Into this area of strong opinions and fuzzy definitions steps Dawkins with her welcome proposal to relate issues of animal suffering to experimental science. As much as any researcher, Dawkins has taken the definition of suffering seriously and has attempted to link it to particular measurable behaviors. The beginning of her target article left me awash in the long historical wake of the problem raised by attributing mental states to another organism, however. Her claims that subjective experience (having feelings) is the critical difference between living and nonliving entities, that suffering consists of acute or persistent bad feelings, and that the end point of research on animals is to understand their subjective feelings, represent little improvement on what has passed for analysis to date. Points are still made by assertion and example. Suffering is defined in terms of feelings, and feelings are defined by our seldom analyzed tendency to project our experiences on other organisms.

But after this shaky start Dawkins makes some excellent points. Dawkins makes clear that there is no simple connection between suffering and lack of access to a particular behavior. She asserts that suffering is caused by circumstances in which the animal is unable to carry out the actions that would normally reduce risks to life and reproduction. In other words, suffering is produced by the prevention of normal species-typical behavior *in the presence of circumstances that normally elicit it*. Dawkins argues that the intensity of such suffering can be measured by establishing the elasticity of demand (the slope of the curve relating instrumental responding and price) for the prevented behavior.

A welcome strength of this approach is that it can be related to models of animals as complex sets of interrelated regulatory systems. The disruption of regulation in one or more of these systems presumably leads to changes in behavior that are likely to promote resumption of regulation. The exact responses that occur should depend on stimulus circumstances, the evolutionary history of the species, and the development of the individual. This approach helps clarify some arguments frequently made about an animal's welfare. For example, the argument that animals in cages necessarily suffer because they are not free to express behaviors from their natural repertoire ignores changes in the eliciting circumstances, including genetic shifts in the laboratory gene pool, changes in developmental processes, and the absence of typical eliciting stimuli. Moreover, as far as I can see, there is no evidence that a rat that is reared in a laboratory environment with food adequate for growth and that is not allowed to reproduce suffers, either in absolute terms or in comparison with a wild rat. Attributing suffering here is almost surely based only on our own theories, assumptions, knowledge of means and ends, and feelings. In other words, in attributing suffering to a rat in such circumstances, we have not taken its view but rather have imposed our view of the world on the rat. This is certainly specism with a vengeance.

Dawkins's approach raises two questions: (1) Whether suffering should be attributed to all conditions of when responses are both instigated and prevented, and (2) whether elasticity of demand for a particular stimulus provides a reasonable measure of the intensity of suffering. With respect to the attribution of suffering, I believe that anyone who defines suffering as including boredom, pain, hunger, frustration, and thirst must take great care not to cheapen suffering beyond its connection with our own experience and thus its ability to arouse our empathy. To accurately infer suffering we must consider how response prevention interacts with the stimulus circumstances and evolutionary history of the species.

From an evolutionary perspective, one would expect a suffer-

ing-related motivational state to occur when it might facilitate, arrest, or sustain responses increasing the likelihood of survival and reproduction. Because of the disruptive or immobilizing effects of suffering states, one would not expect them to occur under conditions of immediate external danger to the operation of the animals' essential motivational systems, or under conditions where controlled active behavior is the best response. For example, rats denied access to free food exhibit naturally occurring search behaviors rather than apparent suffering. This seems quite reasonable given the natural ecology of the rat. Intermittent food is the rule rather than the exception, and if it produced a suffering state it might well decrease a rat's chances of finding food.

Suffering-related states should be more likely to occur when the resultant reduced activity or social communication contributes to survival and reproduction. Thus, animals from social species should suffer the most, particularly in cases in which the interruption of ongoing sequences is not immediately dangerous and may serve useful communication or healing functions. Its important social communication aspects could explain why suffering is so powerful a goad in our own species. We are responding with increased probability of aid to a signal that has improved our own survival (or at least the survival of our genes) in evolutionary time. The releasing signal provided by presumed suffering in animals is more powerful to the extent that we view animals as helpless, undeceitful, dependent on us, and related to us. It is less powerful to the extent that the animal appears dangerous, deceitful, not dependent, and unrelated to us.

As to the second question, I don't think elasticity of demand is related to suffering in any simple way. From an evolutionary perspective, elasticity measures should reveal the extent to which an animal has been selected to produce persistent responses of a particular form as the solution to the reduction in access to a desired commodity or state and to the forced access to an undesired commodity or state. Thus, elasticity of demand will vary with whether increases in effort increase the likelihood of obtaining the desired commodity in the wild, with the relation of the instrumental response specified to natural instrumental sequences, and with the stimulus support for such sequences. For example, a predator of large prey that is exposed to recurring prey cues may well show an inelastic demand for food. But in the absence of specific prey cues, demand may be very elastic over a wide range of feeding deficits. Do specific prey cues cause more suffering? Wouldn't the predator choose the specific prey cues, given the opportunity?

As a second example, rats in a 24-hour environment appear to defend their nest time under conditions of food challenge, even at the cost of maintaining their food intake. If the rats are asked to pay a direct price of bar-presses for access to the nest, however, their demand for the nest is more elastic. Does this mean that the rats suffer less when asked to bar-press for access to the nest than when they must take time from feeding? I doubt it.

If a rat is asked to groom for access to food, its demand is more elastic than than if the rat is asked to lever-press for food. Similarly, if pigeons are asked to peck keys for access to grain, their demand is more elastic when the amounts of food are large than when they are small. These differences in elasticity also seem unrelated to suffering. In short, elasticity of demand may be a meaningful index of directed motivation to obtain a particular commodity by making a particular response, but it does not provide a sufficiently general or compelling index of demand to measure suffering. Issues of evolution, stimulus support, response sequence, and experience must be considered, too.

In summary, Dawkins has provided both the beginnings of a science of animal welfare and an important impetus to research that will increase our understanding of how animals function. In my opinion, the resolution of welfare issues is inextricably bound to basic research on how animals function. We often forget that the information that is the basis for increasingly sophisticated statements about animals and their potential emo-

tional states should come from research, not from a sudden increase in our ability to read minds. In our research we must guard against making unfounded projections. It would not be surprising to learn that English hens suffer from cramped cages, cold drafts, and constant work without breaks, whereas American hens suffer from alienation, the absence of opportunity for advancement in the peck order, and not being able to fly away on weekends. But such diversity of opinion is not a laughing matter. Enormous resources are being poured into preventing the possibility of suffering in laboratory and farm animals, resources that could be used to alleviate present and future suffering in humans, clarify and control the determinants of suffering in animals, and increase understanding of our planet and its inhabitants before many of us are gone.

Broadening the welfare index

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The question of whether animals suffer must remain unresolved. It is of course safest to assume that they do, and I congratulate Dawkins and Singer on the clarity of their arguments. (Cartesian dualism can also find some support in behavioural biology, however; Harrison 1989.) For a while, I feared that ethology was lost as a result of an obsession for sociobiology, mathematics, and optimal foraging theory. Some distinguished texts made no mention of emotion, stress, welfare, or suffering (see Toates 1988). It is therefore gratifying to see Dawkins, an ethologist, wage a campaign to bring animal suffering and welfare to the centre of ethological discourse.

Dawkins raises the question of whether subjective feelings are epiphenomena. Determination of the relationship between subjective feelings and neural events (in terms of epiphenomena or identity theory) presents a fascinating philosophical challenge. Various attempts have been made to explain how, in terms of giving an adaptive advantage, subjective states of pleasure and displeasure have emerged in evolution (e.g., McFarland 1989). Each particular subjective state (such as x_1 , x_2 , . . .), however, is usually assumed to be associated with a unique physicochemical state of the central nervous system (X_1 , X_2 , . . .). This being so, it is always possible to argue that the CNS state is, in itself, sufficient to explain behaviour (see also Harrison 1989). But, as Dawkins implicitly recognizes, this philosophical discussion need not matter to our concern with suffering. Even as a "mere" epiphenomenon, a subjective state of suffering is no less painful. I therefore disagree with the conclusion of McFarland (1989, p. 36): "The concept of suffering has value for ethologists only if it can be shown to be necessarily instrumental in the causation of behaviour." Not only is the subject of suffering a worthy one in its own right, but it has the bonus that it raises fundamental general issues whose resolution demands a breakdown of traditional boundaries between the theories of motivation (that of Lorenz 1981 and others), emotion, stress, and learning, I would like to explore some of these general issues.

Dawkins' "animal's own point of view" approach is one viable starting point for devising an index of welfare. There are other compatible approaches. One could focus on the stress hormones (adrenal-medullary and pituitary-adrenocortical) and monitor the animal's capacity for keeping their levels within certain bounds. One could start an analysis with the central assumption that welfare is synonymous with being able to predict and control the external and internal environments (Wiepkema 1987). I would have welcomed greater integration of Dawkins' approach with these other potential starting points. How might such a synthesis be achieved?

Behaviour is essentially goal-directed, towards certain incentives and away from others. Movement towards a goal and realization of an anticipated goal-object appears to be associated with positive emotion, whereas movement away from a goal or failure to realize a goal is accompanied by negative emotion (see Gray 1988; Toates 1987; 1988). Goals are set by a combination of internal states and external incentives, among other things. When an animal is in a certain motivation state, performing species-typical behaviour per se can have an intrinsic hedonic (reinforcement) value. Such an approach places more weight on incentives than does that of Dawkins, though she acknowledges their importance. An animal that is prepared to work hard for food or water rewards will work much less hard, if at all, for an intravenous or intragastric reward. It will work hard for intravenous morphine (reviewed by Toates 1981; 1986). This suggests that the suffering of food deprivation is in large part (at least in the initial stages) mediated via thwarting of incentive access. As indexed by stress hormone levels, the degree to which food deprivation is aversive depends upon whether cues previously associated with feeding are present (Mason 1971). Dawkins argues that "incompatibility of response and reward may give a false impression of low motivation." I suggest that it might give a *true* impression of low motivation but a *false* impression of low need.

I can see why Dawkins uses the term (metaphor?) "perceived cost." I fear, however, that this runs the risk of compounding the confusion between functional and causal levels of explanation that is common in ethology, at least at the undergraduate level. I cannot envisage an animal measuring the cost of, say, not mating, but I can envisage it being under the influence of a stronger or weaker tendency to pursue a goal and being thwarted in the attempt (e.g., to reach a mate).

I share Dawkins' interest in Herrnstein's (1977) argument, though its relevance to animal welfare requires more development. An explanation of how it dovetails with the Lorenz (1981) model of motivation is crucial. Suppose that behaviour per se can serve as a positive reinforcer. One imagines that obtaining such positive reinforcement is, in some sense, synonymous with well-being. Indeed, satiety seems to be a complex function of the detection of ingested nutrients and the motor act of chewing (reviewed by Toates 1987). Uncoupling nutrient gain from species-typical access behaviours can have harmful effects on welfare (Toates 1987). Does this support Lorenz's model, concerning the buildup of action-specific energy that is dissipated in behaviour? Dustbathing (see target article), like feeding and drinking, seems to fit this model (Hughes 1980). We must be careful not to confuse two issues here by generalizing across motivational systems. The opportunity for attack can serve as a positive reinforcer (Azrin et al. 1965). Even though the attack might have no external consequences for the animal, it can lower stress levels, as indexed by hormones (Conner et al. 1971) and gastric ulceration (Weiss et al. 1976). This "positive reinforcement" value is for an animal already *aversively motivated* by electric shock, however. Thus the results for aggression lend no support to the Lorenz model. This is what we might expect, based on evolutionary considerations (see also Hughes 1980). It would be maladaptive for aggression to be tied to a fluctuating intrinsic source of motivation, but intrinsic modulation would be appropriate for a behaviour such as dustbathing, the causal basis of which would have little or no external frame of reference.

Dawkins discusses active avoidance. Both Dawkins and I need to acknowledge that passive avoidance is also an often-used strategy. In some cases, this is associated with "giving up" and seems analogous to human depression (Henry 1982; Von Holst 1986). In other cases, it seems to be a switch of strategy when active coping has failed. Using Dawkins' terms ("paying a price"), how might one assess the suffering of such an animal?

Pain, suffering, and distress

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I question the extent to which the behavioral measures of animal preferences or, if you like, animal values, described by Dawkins can be taken as indicators of animal suffering. My point is not that there is any weakness in these measures but that the notion of suffering is vague and therefore unsuitable as the key concept in the ethics of animal management.

The notion of suffering is clearest in connection with pain, which has both a sensational aspect, with variation in intensity, and a conative aspect, with variation in degree of aversiveness. Degree of aversiveness correlates with intensity typically, but not necessarily. Pains of equal intensity may differ in aversiveness, and a regime of pain management – including certain drugs or psychological techniques – may lessen one without affecting the other (see Rachlin 1985). The distress that tends to be caused by intense or prolonged pain should be distinguished from both of these aspects. I take distress to be an emotional disturbance with disruptive effects on behavior. Distress may vary independently of its cause. Comforting and certain techniques for coping with pain may reduce distress without reducing either the intensity or the aversiveness of pain. What is bad about pain, what gives it its moral dimension, is, I suggest, its aversive aspect combined with its tendency to cause distress. If we were to concentrate on the pain paradigm, we might sharpen the notion of suffering by defining it as an aversive state likely to cause distress.

The aversive aspect of pain, and its tendency to cause distress, are found in states that are not painful, such as hunger, cold, fear, and grief. Therefore, our definition of suffering may be extended to include these conditions. In all such cases suffering requires a subjective state with an aversive aspect. This is how Dawkins defines the notion of suffering early in her target article. But in much of the article (for me the most interesting part), she concentrates on measures of the importance to animals of conditions that they will work, or pay a cost, to obtain. Of interest here is the possibility of an objective assessment of an animal's "point of view" or values – what matters to the animal. What seems to me suspect is the assumption that animals suffer when they are deprived of things that matter to them. This assumption seems to require the supposition that being deprived of such conditions will cause a *further* subjective state, one with with the aversive qualities associated with suffering. Dawkins states that "suffering is most likely to occur if animals are deprived of the activities or commodities with the flattest demand curves." This may be so. But it is far from clear that the intensity of this further state is proportional to the intensity of the frustrated desires; hence it is likewise unclear that behavioral measures of motivation also measure the intensity of the further states that constitute suffering in cases of deprivation. An animal might be highly motivated to perform some behavior, yet it may experience relatively mild feelings when the motivation is frustrated.

What the evidence seems to show is that there are conditions that *matter to the animal as much as* the avoidance of states with an aversive character of the sort associated with suffering. These are things an animal has an interest in obtaining. We might, then, define a broader notion of suffering that will encompass frustration of animal interests generally, whether or not any further subjective state is caused thereby, and will measure suffering directly by the importance to the animal of the relevant interest. Dawkins (1987) in fact proposed such a definition in an earlier paper. Suffering will, by this definition, be present when animals "are kept in situations that they will either pay a high price to get away from (aversion) or situations that lack stimuli or behavioral possibilities they will pay a high price to obtain." But this extended definition of suffering is very different from the

one discussed earlier, and our use of both will confuse the discussion of ethical issues.

The importance of the notion of suffering for considerations of animal welfare was stressed by Bentham. Subjective states of pleasure and pain had a key position in his particularly crude form of utilitarian doctrine. Moral philosophy has, for the most part, moved away from this form of utilitarianism. What matters morally are the interests of individual; their weight is measured by the importance they have in an individual's preference rankings irrespective of their tendency to cause states of pleasure or pain. Work of the sort Dawkins reports shows that we can apply similar considerations to the ethics of animal treatment, in which case it is clearer to stress the animal's point of view, or preference rankings, rather than to extend a definition of suffering that belongs in a moral outlook that we have generally abandoned. The continued emphasis on the notion of suffering in ethical discussions of animals is itself a form of speciesism, a refusal to take animal interests seriously. I do not accuse Dawkins of this failing; but I do think that the stress she places on suffering obscures the importance of her work for the discussion of animal rights.

Paradoxical experimental outcomes and animal suffering

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Issues pertaining to the termination of human life have been debated but are not yet resolved; enumerating the "rights" of humans to escape from the more subtle sources of suffering such as inadequate space, income, and autonomy remains a historic challenge. Identifying similar rights of nonhuman animals is doubly challenging. Dawkins' target article is a laudable attempt to operationalize the complex and contradictory findings on animal stress and suffering, but its reliance on economic models may be unduly optimistic in view of the ontogenetic complexities posed by individual animals' past histories of learning, and the phylogenetic complexities of species differences in response to stress and suffering.

Dawkins makes the correct assumption that such issues can and should be resolved through research. The data base at hand, however, offers no clear conclusions regarding the many variables that seem likely to cause suffering according to our intuitions. This commentary will focus mainly on studies conducted with nonhuman primates; these animals have recently been the subjects of amended welfare regulations proposed in the United States (Animal Welfare Act of 1985).

Studies of the effects of suffering and stress on nonhuman primates have produced various and inconsistent results. The mean arterial blood pressure of rhesus monkeys that were continuously exposed to a typical sequence of daily construction noise increased 23–28% within a month (Peterson et al. 198). When baboons were exposed to the identical noise under identical procedures, their blood pressure, heart rate, and plasma catecholamines decreased (Turkkan et al. 1984). Although environmentally produced blood pressure elevations and hypertension have been used as objective measures of psychological stress (panel report 1982), this pair of studies illustrates some of the difficulties in measuring stress effects objectively (Turkkan et al. 1982; Turkkan & Brady 1984). These and other studies suggest that even in closely related species such as baboons and rhesus monkeys, different responses to stress are apparent (Woolverton et al. 1989).

Research on alleviating stress is also equivocal. Traditional anthropomorphic proposals for reducing stress in laboratory

primates by measures such as increasing environmental enrichment, cage size, and social contacts have often been found to be ineffective or to produce undesired effects according to a recent review of studies (Woolverton et al. 1989). For example, a study that systematically manipulated cage size found *increased* aggression in group-housed rhesus monkeys when their cage size was doubled; aggression returned to baseline with a return to the original cage size (Novak & Drewson 1989). Another example of differing responses to environmental manipulations among closely related species is that neither patas nor African green monkeys reduced their frequency of abnormal self-directed behaviors such as self-biting during exposure to toys as psychological enrichment, whereas chimpanzees, rhesus monkeys, and cynomolgus monkeys did (Weld et al. 1989). In systematic studies of social interactions, titi monkeys preferred a cagemate to an empty cage, and a familiar cagemate to an unfamiliar one, but squirrel monkeys showed no preference (Mason 1975). These species differences and those that Dawkins cites, in which seasonal and circadian factors also modulated responses to enrichment or stress, cast doubt on the effectiveness of global legislation or theoretical models. One envisions scarce research dollars being expended on producing a multitude of demand curves for each of 200 nonhuman primate species at particular times of day, for both genders, for each season, and so on.

If studies on alleviating stress in nonhuman primates and other species are to be productively pursued, better measures of stress and suffering are needed. Dawkins suggests that withholding conditions or commodities for which the animal can be shown to have inelastic demand (i.e., willingness to work despite increasing costs) produces suffering. A counterintuitive degree of demand for some commodities can be produced in the laboratory with nonhuman primates, however. Kelleher and Morse (1968) observed paradoxical behavior in squirrel monkeys after an operant training history that included response-contingent food as well as electric shock. Lever pulling increased to high rates toward the end of fixed intervals (with shock as the reinforcer), extinguished when shocks were terminated, and reappeared when shocks were reinstated. To an external observer, it appeared as if the animals were working "for" shock by pulling the lever and ceasing to work when shock was no longer available (see a brief review of similar studies in Morse & Kelleher 1977). Although the "elasticity" of this well-documented and easily conditioned behavioral outcome has not been studied systematically, Dawkins may be reluctant to conclude that electric shock is a commodity that should be provided to animals with certain histories of reinforcement and punishment.

Given a learning history in which pain comes to signal otherwise absent reinforcing events, potentially inelastic demands can be produced in the laboratory for a wide range of commodities that would seem unsalutary for any organism. In a widely cited operant study, pigeons pecked faster and thereby hastened the receipt of electric shock when shock was paired with food delivery, but food was otherwise unavailable (Holz & Azrin 1961). That such counterconditioning may be operating in the "natural" human environment is suggested by the unwillingness of some spouses to leave physically abusive relationships, and by the self-abuse of some institutionalized persons. In such cases, it can often be observed that attention, care, and concern tend to occur after abuse – care and attention that are otherwise absent (cf. also Catania 1984, p. 92; see Turkkan 1989 for a discussion of counterconditioning in respondent studies). To complicate matters further, animal studies have shown that some *food* reinforcement schedules seem to be aversive. Animals will work to turn off stimuli associated particularly with high fixed-ratio schedules of reinforcement even when, in so doing, they repeatedly remove themselves from the opportunity to earn food (e.g., Azrin 1961). Such studies have been reported in the literature for a long time and have demonstrated that reinforcement and punishment (with their associ-

ated incorrect interpretations as involving well-being and suffering) are not inherently positive or negative, but are relative events that are complexly related to the ontogenetic conditioning history of the organism.

Is the inelastic demand criterion for measuring suffering applicable to humans? After all, inelastic demand for unexpected commodities can be seen during lottery weeks with a high jackpot, or during particular holidays when there is a "must" toy. In such cases, responding (persistent attempts to purchase) is maintained in the face of increased costs (waiting longer in lines). Would the withholding of these commodities produce suffering as defined by Dawkins? Finally, it is interesting to note that animals' demand for pharmacological agents that are forbidden for human consumption has been inelastic. Baboons trained to pull on a lever for intravenous cocaine infusions will continue to pull despite increasing response costs, with ratios progressively increasing to 3,600 pulls per infusion (Griffiths et al. 1978; 1979). According to Dawkins's reasoning, it would seem that cocaine should be made available to laboratory animals.

The data described earlier suggest that in the attempt to alleviate animal suffering, investigators make anthropomorphic and subjective assumptions about psychological well-being that are often not supported by the experimental literature. The inelastic demand criterion has a great deal of operational appeal and may be a first step, but it leaves unresolved the complexities of species differences and the relativity of aversive and rewarding events. Animal researchers continue to make improvements in the laboratory (Turkkan, in press; Turkkan et al. 1989). Economic models do not provide a persuasive new direction.

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Natural and unnatural justice in animal care

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It is not necessary to concur with Singer's advocacy of drawing no line whatever between the moral status of humans and that of other species in order to welcome Dawkins' carefully considered suggestions for devising behavioural measurements of preference, on the assumption that these can be helpful in minimizing the nonpreferred emotional states experienced by captive animals. Although I have argued for certain kinds of continuity in the psychological processes of humans and other species (Walker 1983), there is ample evidence of significant discontinuities; these undercut the assumption that there is a simple dimension of suffering that can be put into cross-species utilitarian equations of the kind Singer appears to propose. For instance, the traditional assumption that language is a special determinant of human cognition has resisted all efforts to disprove it (Chomsky 1980; Premack 1985). Moreover, the equally venerable view that distinctive aspects of human mentality are culturally determined (or "socially constructed") is still vigorously promoted (e.g., Harre 1986).

Therefore, although scientists should be (and are legally) obliged to accept the commonsense view that animals can suffer, Singer's argument that we should consider nonhuman suffering as essentially similar to our own defends, as he points out, a much stronger position. It is worth noting that the commonsense view seems to recognize differences in the moral status of animals – many pet owners neuter their charges when they are young and vigorous, and "put them down" when they are old and feeble. Philosophical and empirical analyses may support this distinction. It might be claimed that fear of being castrated

(or resentment at having been so treated) is both socially constructed and linguistically mediated; or, following Dawkins, it might be possible to show that an animal's fear of going to the veterinarian (or fear of a standard signalling stimulus) is no greater after a painless neutering experience than after a control condition involving no loss of natural function.

Dawkins' target article is both moderate and practical, and under "Problems with this approach" she seems to have considered most of the difficulties that might arise from too stringent an application of her main recommendation of assessing preference according to the principle of inelastic demand. In now emphasizing some of the problems, I do not wish to detract from the advantages of her behavioural approach.

A theoretical problem that may be minor in practice is that inelasticity may indicate automaticity of behaviour rather than high emotional value in some species, or in special cases. Suppose, for example, that the response effort of a cockroach (Horridge 1962) or a decerebrate embryo (Heaton et al. 1981) in avoiding aversive stimuli indicated inelasticity of demand, or that a decorticate mammal showed less than normal sensitivity to response cost in food-rewarded behaviour (e.g., Oakley 1979). Should we assume greater suffering, or the operation of a more mechanical motivational system? A greater difficulty is that very elastic demand might instead indicate more cognitive representations of goals or "declarative" emotional states (McFarland 1989). Pigs might have a more elastic demand for social companions relative to food because of a relatively blind drive for food, and because they make a more considered evaluation of the social benefits available in a particular experiment. Dawkins solves this sort of potential problem for practical purposes by using several measures of welfare (e.g., the general condition of socially isolated though well-fed pigs), but a greater distinction may need to be made between the intensity of motivational effects on behaviour and the type of cognitive representation involved in a given motivational effect (Dickinson 1985; Walker 1987).

A more general reservation that applies both to parts of the target article and to the precommentary concerns the relation between suffering and natural behaviours. Dawkins' conclusion is that the question of whether the lack of opportunity to perform a natural activity such as migration leads to suffering is an empirical one, but she tends to assume that only the prevention of motivated acts, and not the natural performance of such acts, can be associated with unpleasant emotional states. On the other hand, Singer seems to suggest that we have a duty to reduce pain and suffering that may arise under animals' natural conditions. There is surely something to be said for the point that natural life itself may involve high levels of stress – for instance, hard winters for nonmigrators, and disease, drought, and famine for all, both predators and prey.

Thus, although I support Dawkins' idea that negative motivational states resulting from the prevention of natural behaviours in captive animals should be empirically assessed, and that steps should be taken to minimize them, I am not convinced of the validity of the implied corollary that animals free to engage in natural behaviours always suffer less. Since the main issue is the care of captive animals, this is not directly relevant, but it would have serious implications if one accepted Singer's position that the welfare of wild animals is as deserving of concern (e.g., the lowering of infant mortality rates) as the welfare of our own species.

Who suffers?

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In their apparently inclusive analysis of animal welfare, Dawkins and Singer miss one giant wood among their species-

specific trees, and that is ecology. By positive action, we humans have tilted successful reproduction in favour of the grasses such as rice, wheat, and corn, and we create those miles of dull pine trees. We have achieved this by waging a blitzkrieg on viruses, bacteria, fungi, insects, birds, and vermin. It is true that there has been a minor discussion of consequences, but only when they threaten some arbitrarily favoured species such as man or manatees or mangabeys. We need to examine our moral and ethical justification for killing or domesticating any species in addition to examining the precise method by which we kill or domesticate. The moral issue of chopping down one tree or killing one rat or one man merges with the practical consequence of killing a million.

Beyond ecology, Singer and Dawkins do not face the fact of killing. I have had the grim experience of examining slaughterhouses in order to report on various religious customs. It was an unnerving experience even for a dedicated carnivore, which I am. "Led like a lamb to the slaughter" is one of those biblical phrases that implies innocence of the future, which Dawkins and Singer attribute to animals. The animals stand about in the pens outside the slaughterhouse with space in which to move and with plenty of water and food. Yet they are bizarre. They make no sounds, and you can approach and touch them. Are they unaware of their fate, or are they like those children who, after operations, are now recognised by doctors and nurses as being frozen in terror rather than as being the "brave little soldiers" who accept all the goodwill around them?

In our fanatical human obsession with breeding, selection, and farming, have we not produced rice and rats that are obedient to our aims and have a high threshold before "demand curves and suffering" are expressed? In our selection of pet dogs and humans, have we not produced varieties of Micawbers who are convinced that it will be all right in the end because the pack leader knows best, no matter how preposterously the pack leader behaves? Of course Dawkins and Singer are right that we need to consider pain and suffering if we are unwise enough to try to misuse some poor beast not selected for our purposes. Beyond that is the deeper moral question of whether we may (or perhaps must) misuse species for our purposes.

"Perceived cost" may reveal frustration, but not boredom

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Marian Dawkins' commonsense, empirical approach to animal suffering appeals to me. She avoids a lengthy philosophical debate about the tenability of the concept of subjectivity in the natural sciences. Instead, she applies this concept in its broadest sense in order to generate animal-centered experiments aimed at finding practical answers to concrete animal welfare problems. Needless to say, I also wholeheartedly agree with Peter Singer's eloquent justification of such an approach.

I see some problems with the concept of "perceived cost," however, in that it may adequately reveal some forms of suffering, such as frustration, but not others, such as boredom. Suffering from frustration relates to the fulfillment of *specific* needs, such as having an adequate nest or being able to root in the ground. The perceived costs of such specific needs can be measured. Suffering from boredom, however, relates to the *general* need to be alert, to have "something" to do, to have meaningful goals in general (Wemelsfelder, in press). Such a need cannot be assessed by measuring preference for, or avoidance of, a specific situation. Boredom, and its counterpart,

alertness (or liveliness), are states that are always affected by the *totality* of the animal's situation, including the operant activity of the animal. Thus, an animal's performance of normal operant activity in an experimental situation *presupposes* a "normal" level of alertness (and goal-oriented behaviour). This leads to problems concerning (1) the measurement and (2) the interpretation of "perceived costs." Each will be discussed in turn.

The environmental history of test animals might have important methodological implications for measuring perceived cost. If a test animal is extremely bored, and its level of alertness is abnormally low because it was housed in a barren environment before testing, then its operant behaviour might be quite different from the behaviour of a nondeprived animal. Because it lacks the power of concentration needed to perform goal-directed, manipulative behaviour with regard to specific stimuli, it might aim its attentional efforts at generally exploring and investigating the experimental environment.

Rats raised in impoverished conditions do not manipulate test objects to the same extent as conspecifics raised in enriched environments; they just walk around and sniff at the objects (Renner & Rosenzweig 1986). Likewise, battery hens might work for food or for more space, but they might not be able to muster the concentration to work for needs that are less basic, such as social interaction, but that nonetheless are a necessary condition for well-being. Nor can tethered sows – who in their apathy no longer respond to buckets of water being emptied on their heads (Broom 1986b) – be expected to perform normal operant behaviour. It would therefore be valuable to perform the same operant test with animals exposed to both enriched and deprived environments, in order to estimate the impact of environmental background on operant behaviour.

The second problem concerns the connection between elasticity of demand and animal welfare or, more specifically, the contention that behaviour indicating inelastic demand is essential, and that behaviour indicating elastic demand is only of secondary importance for animal welfare. Such a contention is incomplete in a crucial respect: The determination of inelastic demand presupposes "normal" alertness, which I mentioned earlier. Demand that appears elastic in a "normal" situation, such as demand for exploration and play (Baldwin & Baldwin 1976), might turn out to be a need to maintain normal alertness and well-being in a boring, barren environment, where time is not limited. As Hughes and Duncan (1988) point out, "If animals are kept in barren environments, . . . it is crucial that some of the behaviour they can perform is elastic, that is, it can expand to fill the available time. . . . It may be that animals have a strong tendency to perform certain activities when much time is available in order to maintain, say, an optimal level of arousal." The conceptual framework proposed by Dawkins would thus be well suited for the understanding and satisfaction of needs for which the demand is inelastic. For the understanding and satisfaction of needs for which the demand appears to be elastic, however, more conceptual and experimental work is needed. I have developed several ideas as to how such work might proceed (Wemelsfelder, in press).

The notion of animal boredom as I see it does not presuppose a concept of animal subjectivity different from the one Dawkins has outlined. The idea that well-being is essentially related to the animal's point of view (cf. Nagel 1974), and that such a point of view reveals itself primarily in the performance of anticipatory, goal-directed behaviour, seems crucial to me. The problem of boredom concerns the question of whether animals suffer from a *lack* of opportunity to express their views. The fact that such a question cannot be investigated by actually giving the animal the opportunity to express its preferences does not diminish the fundamental value of Dawkins's proposals for becoming acquainted with the subjective world of animals.

Consumer demand theory and animal welfare: Value and limitations

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Marian Dawkins' development of consumer demand theory for use in the study of animal suffering is a valuable contribution. Her discussion is thorough and thought-provoking; she points out the problems as well as the benefits in the methodology and interpretation of this approach. Measures of motivation can provide answers to some of the outstanding questions about the "ethological needs" of farm animals and the "psychological well-being" of laboratory animals (Hughes & Duncan 1988). Although Dawkins' theoretical arguments are sound and her approach lends objectivity to an area often loaded with emotion and opinion, they may not be the answer to all of our questions concerning animal well-being.

The purpose of animal welfare science is to provide objective answers to questions about animal well-being so that sound and timely decisions can be made regarding recommendations and regulations for the housing of farm, zoo, and laboratory animals (Dawkins 1980). The assessment of welfare should take into account all the available information on health, productivity, physiology, and behavior (Broom 1988b; Curtis 1987; Duncan 1987). Both Singer, in his precommentary, and Dawkins suggest that the use of demand curves provides *the most direct* evidence of what an animal is experiencing or feeling about a particular aspect of its environment. Although this may be true for many specific behavior patterns or environmental conditions, other measures of behavior or physiology can also provide an accurate estimate of how an animal is feeling. For example, Duncan's approach, using behavioral indicators of frustration or fear, provides rather direct evidence of suffering (Duncan 1974; 1981; 1987). Also, considering the methodological problems that Dawkins discusses, the use of demand curves could consume call upon a great deal of time and resources before answers are found.

Dawkins criticizes the use of ethological measures that rely on the identification of abnormal behavior, such as stereotypies or vacuum activities, as indicators of welfare because they assume high levels of motivation but do not provide accurate estimates of motivation or suffering (section 5). Some evidence linking stereotypies to opiate peptides or lower brain structures, however, might suggest that the performance of this type of behavior results in analgesia or relief from suffering (see Dantzer 1986; Broom 1988b). From an ethical standpoint, is a measure of suffering necessary to determine that a husbandry system that

causes an animal to develop a functional pathology as a coping mechanism is unacceptable?

Consumer demand curves may not be applicable to all animal welfare questions. Dawkins and Beardsley (1986) illustrated the problems of using operant conditioning techniques to measure motivation when the operant tasks or stimuli are incompatible with the behavioral system studied; Dawkins discusses similar problems with the consumer demand approach and how these might be overcome. For some behavioral systems the fitting of demand curves may be practically impossible, however. One example of such a system may be the period of parturition nest building in the sow. This behavior occurs spontaneously on the day of farrowing (Widowski & Curtis 1988); it can be stimulated by injection with prostaglandin F_{2a} in peripartum sows (Widowski & Curtis, in press) and is highly correlated with the parturition release of prolactin (Widowski et al., 1988), suggesting that the behavior is initiated by parturition endocrine changes. Thus, a very brief and physiologically specific time window (one that occurs only two days a year for most sows) is available for the study of nest building behavior in the sow.

Another issue raised by Dawkins concerns the need to determine whether it is the environmental end product achieved by the behavior or the performance of the behavior itself that is important to the animal. The results from Baxter and Robertson (as interpreted by Dawkins) suggest that the end result (the tactile feedback provided by the nest) of nest building in the sow is more important than the performance of the behavior itself. Conversely, Widowski and Curtis (1988) found that parturition sows demonstrated certain motor patterns characteristic of nest building regardless of the nature or amount of nesting material provided and whether or not it resulted in nest construction, suggesting that the performance of the behavior is, in itself, important to the sow (for a similar example in the hen, see Hughes et al. 1989). Also, sows directed behavior toward a suspended cloth tassel in the absence of straw but preferred to manipulate straw when both were available. Whether providing substitute nesting material, like the cloth tassel, that allows the animal to perform material-directed behavior but not to construct the nest can in some way satisfy the sow needs to be determined. It is unclear how consumer demand theory can resolve this problem, especially in light of the short period in which the sow is motivated to engage in this behavior.

In summary, Dawkins should be congratulated on applying consumer demand theory to provide "animal-centered" answers to questions of animal welfare. The information provided by demand curves or other measures of aversion could substantially improve our relatively weak understanding of how animals perceive and respond to their world. Although this approach may not be the answer to all of our problems in the area of animal welfare science, it certainly may help solve many of them.

Postcommentary

Ethics and animals

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My attempt to state my position clearly has proven insufficient to forestall false or misleading interpretations of it, so I shall begin with some corrections.

Misrepresentations. First, contrary to what Chapman suggests, there is nothing speciesist about believing that mammals require greater moral concern than members of

other species because they have a greater capacity for suffering. To repeat what I said in the precommentary, speciesism is the view that species membership is, *in itself*, a reason for giving more weight to the interests of one being than to those of another. It is therefore quite false to say that my reasoning "ignores brain structure" or is "armchair philosophy" that ignores biology. In the precommentary I even went on to say: "Some who have claimed to be defending speciesism have in fact been defending a very different position: that there are morally relevant differences between species – such as differences in mental capacities – and that they entitle us to give more weight to the interests of members of the species with superior moral capacities." I then added that it is easy to see why these mental capacities should be

morally relevant, whereas species alone is not. Thus I agree with Chapman that when capacities for suffering are greater, we need to have greater general concern for the beings with the greater capacities for suffering. The statement that when one heads into the desert, big water bottles are generally more useful than small ones is quite compatible with the statement that a liter of water in a large, half-empty bottle is no more valuable than a litre of water in a small, full bottle. Similarly, what Chapman says in no way contradicts my main claim, that we should give equal consideration to similar amounts of suffering, irrespective of the species (or order) of the beings who suffer.

Walker and Timberlake reveal similar misconceptions when the former suggests that differences in the extent to which animals and humans react to castration could show that they are of different moral status, and the latter asserts that I don't distinguish between the suffering of a child and that of a tick. (These respondents could benefit from reading Gray's commentary, which shows a better understanding of what speciesism is; but I shall come to my disagreements with Gray shortly.)

Another gross misrepresentation is found in the commentaries of Novak & Meyer and Timberlake: that I hold a "rights" view, according to which animals "cannot be used to further human goals" (Novak & Meyer) and that I and other "rightists" adopt an approach that "completely ignores the scientific context of experimentation, including potential uses of the results" (Timberlake). These commentators appear to have read my precommentary through lenses obscured by fixed ideas gathered from the popular press. There is no talk of "rights" in the precommentary. Elsewhere I have clearly distinguished my own position from the "rights" approach (Singer 1980; 1985). In any case, anyone who understood the first thing about the consequentialist ethical position I do adopt would know that the claims made by these commentators are false (Singer 1979)¹. I certainly would never deny that we are justified in using animals for human goals, because as a consequentialist I must also hold that in the appropriate circumstances we are justified in using humans to achieve human goals (or the goal of assisting animals). I am not the kind of moral absolutist who holds that the end can never justify the means. Nor have I said that *no* animal experimentation is ever of use to humans (though I do think that much of it is of minimal or zero value) or that *all* animal experimentation involves suffering. (If I seem testy here, it is because such oversimplifications are bad enough when they come from the popular press; when they come from people who teach at distinguished universities, they may well cause even highly sophisticated folk to wonder about the worthwhileness of a college education).

Comparisons between species. Though the existence of different capacities in different species is no threat to the justifiability of the moral principle of equal consideration of interests, it does pose a problem for the application of that principle. Magnus & Thiel claim that Dawkins' work "enables us to make judgments only about the trade-offs in welfare among members of the same species." Here I prefer Ng's view that if we require precision, we cannot make interpersonal or even intrapersonal comparisons of welfare in most cases. On the other hand, it scarcely requires precision to decide that the suffering of hens

crowded four or five to a small cage and unable to fulfill many of their basic desires is greater than the suffering that we would experience if we were unable to eat eggs produced in that manner.

Interspecies comparisons become more problematic when we move beyond vertebrates. A question that has exercised the minds of many commentators, including Gray, Mendl, Monaghan, and Rowan, is: Can insects suffer? Gray thinks that my retreat into agnosticism here is unnecessary, because Dawkins' method is in principle of universal applicability. I'm not convinced that Dawkins' method can cut through our doubts about insect suffering, as Gray seems to think. It would not be difficult to build a machine that kept moving through areas of varying temperature until it found a place where the temperature was close to 40 °C and then stopped. We could even make the speed with which it moved directly proportional to the extent to which the temperature was above or below the machine's "preferred" temperature. We could program many other aspects of the machine's behavior; for instance, we could design the machine so that it would travel to a refueling station whenever its fuel supply dropped below a certain level, *unless* it had to pass through a region where the temperature was below 20 °C to reach the refueling station. On the basis of this and other aspects of behavior, a naive observer, familiar with animals but unused to sophisticated machines, might conclude that the machine preferred a warm environment, and in particular that it suffered from being kept at temperatures below 20 °C. I take it that such a conclusion would be wrong, and that once we are given an explanation of the simple computer program that makes the machine behave in this way, we will no longer be tempted to think of it as having conscious preferences. On the other hand, we know that humans do have preferences in the required sense, and we are justified in assuming that the same is probably true of other creatures that behave in important respects as we do, have similar mechanisms for the sensing of pain and distress, and have a common evolutionary heritage. The question is whether insects are in this respect sufficiently like us, or whether they might be like some kind of computer in their ability to respond to conditions without having conscious experiences. Here I agree with Mendl, Monaghan, and Rowan that Dawkins' method cannot of itself give us an answer.

Rachlin bases his view of suffering on evolutionary arguments, stretched to a ludicrous extreme. He asks what help suffering could be for solitary animals who are foraging, hunting, or escaping in the wild. The obvious answer is that it could be a way of learning about dangers; however, the question betrays a simplistic view of evolution. The theory of evolution may lead us to assert that animals have evolved a capacity to suffer because this capacity enhances their reproductive fitness, but it does not necessarily support the view that suffering occurs only in circumstances in which it enhances reproductive fitness. There may be limits to the extent to which evolution can "fine-tune" the capacity to suffer. (Would Rachlin also deny the existence of the human appendix?)

Before leaving the topic of the nature of suffering, I should note my agreement with Townsend's important point that we need not think of suffering only as a *further* subjective state that occurs when humans or animals are deprived of things that matter to them; rather, the term

should be used in a broader sense, to refer to the frustration of interests in general. In using the term "suffering" in my precommentary, I intended to convey this broader sense; hence my reference to "interests" and "conscious preferences."

Speciesism and evolutionary ethics. The single overriding aim of my precommentary was to advance and defend a substantive ethical claim: that the interests of non-human animals should receive consideration equal to that given to the similar interests of humans. To object to speciesism, as it is properly understood, is simply to endorse that claim. I was pleased to see how many commentators did endorse it, for I do not evade the fact that it is radically at odds with our Western tradition of ethical thought. As expected, there were also several who took issue with the claim. I turn now to this central issue.

One approach to ethics was predictably popular among commentators. **Donnelley, Salzen, and Segal** all suggest in different ways that a Darwinian understanding of our place in nature is required for a sound appreciation of the ethics of our relations with nonhuman animals. Donnelley claims that the animal and human individuals that are the subjects of my moral concern are "pre-Darwinian, utilitarian abstractions," whereas from an evolutionary perspective we see individuals as interdependent. I am at a loss to understand, however, why Donnelley thinks that I deny the interdependence of individuals, or any other aspect of a Darwinian perspective. Implicit in what Donnelley is suggesting is a crossing over from the factual assertion that Darwinism is roughly true as an account of our origins, to the ethical judgment that preference for one's own species is justifiable. By what means Donnelley hopes to cross the well-known gap between facts and values, however, remains entirely unclear. (Granted, some philosophers do think the gap bridgeable; but they at least see the need to indicate the design of the bridge.)

Salzen and Segal are both interested in how creatures who have evolved on the basis of reproductive fitness ("self-interest" if you like, though to say that a creature acts to enhance reproductive fitness tells us nothing about that creature's motivation) could come to embrace an ethical view that gives weight to the interests of other species. Salzen is troubled by the problem of decreasing survival value and genetic advantage of empathy and sympathy as the circle of contact widens. As Segal suggests, and I have proposed elsewhere (Singer 1981) we can start from our affections, which have genetic advantage; but since we are reasoning creatures, we can generalize to the golden rule, or as I prefer to put it, to the universalizability of ethical judgments.

This universalizability, incidentally, must not be understood in the way that **DeGrazia** suggests. The claim that the preferences of a sadomasochist are a threat to universalizability has been refuted many times (e.g., Hare 1963). The reason is, of course, that universalizability requires me to put myself in the place of others, taking on their preferences. A sadomasochist, in deciding whether it is possible to accept as universalizable the judgment that sadists may inflict pain on non-masochists, must consider what it is like for a person who is highly averse to pain, as nonmasochists are, to experience that pain.

Speciesism and the ethics of community. A more promising line of thought explored by some commentators is the possibility of defending an approximation of the traditional view by an appeal to some form of community-based ethics. Thus **Donnelley's** Darwinian remarks are followed by his statement that if pressed to make a choice between a competent chimp and an incapacitated human being, "we will always go with the human being, not from a rating of individual capacities, but because the human belongs to our community and is one of us." I am not sure that this statement is in fact true for everyone, but suppose it is. Does Donnelley want to suggest that this justifies our preference for our own species? Could this be how Donnelley proposes to cross the fact-value gap? Surely not; I have no doubt that if pressed to make a choice between a white person and a black person, most white people in South Africa would always go with the white, not from a rating of individual capacities, but because the white belongs to our community, and is one of us. Moral argument should be beyond unthinking acceptance of prejudice.

Sapontzis and Gray take the debate further. Sapontzis points out that "speciesism" is analogous not only to "racism" but also to "familyism"; hence we need a deeper understanding of precisely what is deplorable about speciesism. Gray's drawing of a parallel between the biologically based preference a mother will give to her own child and the preference he claims we may legitimately and for similar biological reasons give to members of our own species is another way of making essentially the same point. (On the purported biological justification for this preference, see my earlier response to **Segal**, and the reference given there.)

To the question of what precisely is deplorable about speciesism, **Sapontzis** offers an attractive answer: that we recognize the acceptability of preferences for "one's own" (whether family, species, or whatever) but insist that this legitimate premise is limited by the requirement that we treat others fairly and allow them to lead a reasonably satisfying life. Gray, too, would accept a limit to the degree of preference that may be given to our own species, for he thinks that at some point the degree of suffering inflicted upon animals will be too great to be justified by the avoidance of lesser suffering for humans.

These views are plausible, but a little ad hoc. A suggestion by **DeGrazia** provides a means of incorporating, in a more systematic understanding of ethics, something like what **Sapontzis** and **Gray** advocate. De Grazia thinks the idea that discrimination on the basis of group membership or social bondedness may not be unjust, but then notes that the acceptability of partiality toward family members, for example, can be explained by "the greater long-term efficiency of such partiality." This seems right. From a detached, impartial perspective, the welfare of my own children is no more important than the welfare of the children who live next door. How then can I justify buying my child a bicycle for her birthday, when the children next door need bicycles just as much? The answer is that children will in general be better looked after if parents give first priority to the interests of their own children. By accepting this premise for everyday ethics, we take advantage of the innate love we have for our children, and channel it into a current leading to the good of all. But (and this is why there must, even in this

case, be limits, as Sapontzis and Gray suggest) this justification of family partiality does not extend to extreme cases; the money I spend on the bike could save a stranger's child from starvation (Singer 1972; 1979). Therefore, Sapontzis is right to say that this argument does not justify disregarding the interests of animals to the extent of denying them the means to a reasonably satisfying life.

I would go even further, though, and say that no such "long-term efficiency" argument can justify preference for the interests of human strangers over the interests of (at least) animals that are totally under our control, as animals are in factory farms and laboratories. Such an argument may, on the other hand, provide a response to an issue raised by Walker: We need not strive to eliminate the sufferings of wild animals, because our track record suggests that human intervention, even when well-intentioned, is very likely to turn out badly. Ecological systems have a way of producing unpredictable consequences when we tamper with them.

Beyond speciesism. It is significant that a philosopher like Jackson (who has not been identified with the animal liberation viewpoint) does not regard speciesism in itself as "the live issue," and claims that factory farming is clearly unjustifiable if it causes the suffering that it appears to cause. Instead, he finds real philosophical interest in the question of whether it is justifiable to eat nonhuman animals who have lived relatively happy lives and have been killed relatively painlessly (and in related trade-offs between the death of an animal and a benefit to humans). He is quite right to point out that the avoidance of speciesism alone cannot give us an answer to this question. As philosophers, we need to reflect on what it is that makes killing wrong. I have elsewhere argued that at least part of what makes it wrong to kill normal human beings is the interference with a life plan (Singer 1987). Hence, killing a normal human being is not equivalent to killing a nonhuman animal; but this still does not tell us how seriously we should regard killing a normal human being, or when we can justifiably harm one being to benefit others. Thus I can only agree with Jackson's pinpointing of the key questions that still need philosophical attention. Yet I am troubled by the thought that in reading Jackson's commentary, we could easily forget that our society scarcely questions the practice of making nonhuman animals lead miserable lives so that they can be eaten at less cost than they would if allowed to live relatively happy lives. Focusing on the live philosophical issues can divert attention from the practical importance of rejecting speciesism. I am sure it was not Jackson's intention to divert our attention in this way; but there is a danger, both for society as a whole and for the practice of philosophy, if philosophers leave the rest of society trailing too far behind.

Burghardt draws our attention to other possible causes of suffering inflicted on farm animals: the lack of sexual opportunities afforded them, and the removal of offspring from a mother. He hints that addressing these issues would alienate animal welfare constituencies. But the separation of dairy cows from their calves certainly is something to which I, like many others, have already objected in strong terms (Singer 1975; in press). Whether the lack of sexual opportunities causes suffering is more

difficult to establish. Human experience suggests that sexual desire can be very strong when its object is present, either in reality or in the imagination, but fades in the absence of stimulation. In this respect it may not be like, for example, the needs of a hen for freedom to walk, stretch wings, or find a sheltered spot in which to lay an egg.

On the whole, I share Burghardt's belief that extending our concern to animals raises a myriad of new issues, including the breeding of animals with characteristics that make them inherently more likely to suffer. Certainly we also need to control the growth of the human population and to preserve our remaining wilderness, and not only for animal-regarding reasons. What I do not understand is his statement that an "individualistic" approach or a "crass utilitarianism" cannot help us here. Burghardt might have said why it cannot, and what alternative approach is likely to be more helpful; it is difficult to respond to vague and unsupported assertions. It is probably true that, as Burghardt concludes, an ethical system for our treatment of animals will be inconsistent with various values that each of us holds dear. As I have already indicated in my response to Donnelley, however, that is no argument against adopting an ethical system for our treatment of animals. Those other values just have to go, or at least yield on some occasions to conflicting values. People brought up in racist cultures who abandon racism have to make similar difficult choices.

Preaching to the converted? Finally, some commentaries reflect too rosy a view of the attitudes of scientists in regard to animal welfare. Chapman writes that "no responsible scientist would argue for the inhumane treatment of animals" and Frey says that I am "preaching to the converted" when I tell scientific and medical researchers that animal suffering is ethically significant and must be taken into account. I wish these statements were true, but I fear they are not. David Baltimore, the Nobel laureate from M.I.T. is presumably a "responsible scientist," and since he speaks publicly on behalf of the American Association for the Advancement of Science on the animal experimentation issue, his statements cannot be too far removed from the opinions of his colleagues. He has said, on television, that he does not think experimenting on animals raises a moral issue at all (WNET/Channel 13 1974). In fact, despite all the recent protests by scientists about new regulations regarding animal experimentation, the legal situation presently existing in the United States is that neither institutional animal care and use committees, nor anyone else, can insist that a scientist change the design of the experimentation to protect animals, nor can they say that the experiment is simply not worth doing because its objectives are not sufficiently important to outweigh the suffering it causes. In this respect the United States lags far behind other countries, like Australia, Sweden, and Britain, where the issue of whether the goal of the experiment is worth the suffering is at least considered by a relatively independent review panel (Singer, in press). Until scientists in the United States overwhelmingly call for the creation of such a system, I shall not believe that it is preaching to the converted to seek to persuade scientists that animal suffering is ethically significant.

NOTE

1. Consequentialists hold that an act is right if and only if its consequences are better than, or at least as good as, the consequences of any alternative act open to the agent.

Author's Response

Other minds and other species

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I will deal with most of the points raised in the accompanying commentaries under six headings.

1. Relative weight given to measures of welfare other than demand curves. I have concentrated too much on preference and demand curves in the assessment of animal welfare and have neglected or belittled other essential information, argue **Broom**, **Fraser**, and **Widowski**. In fact, I have repeatedly emphasised (Dawkins 1980; Dawkins 1983; and sections 1 and 2 of the target article) the importance of taking into account as many different measures as possible and the dangers of relying on just one. I have referred to a very large body of literature on other measures of welfare and have repeatedly stated the importance of physical health as a criterion of welfare. What concerns me is that although other measures are available, their interpretation is often confused. We need look no further than the commentaries themselves to see this: **Broom** and **Fraser** write that stereotyped behaviour is indicative of suffering, whereas **Dantzer** states categorically that stereotyped behaviour is unlikely to be associated with suffering!

With such diametrically opposed interpretations (not to mention the difficulty of arriving at a universally accepted definition of stereotypy), it is clear that the use of stereotypes as indicators of poor welfare is a far from simple matter. What I tried to argue in the target article is that whereas many different measures of welfare (e.g., hormones, impaired immune system, stereotypes) are important, they are often difficult to relate to suffering and all of them eventually come back to the same question: Does what is happening to the animal matter to the animal itself? We need the animal's own viewpoint to make sense of the other methods, not as a substitute for them.

Broom argues that we should define welfare as an animal's attempt to cope with its environment; **Widowski** talks about functional pathologies as a coping mechanism; **Fraser** mentions "etho-anomalies." I find such terms and definitions difficult to understand and have argued that we should instead go straight to the heart of the matter. This means acknowledging that what we are really concerned about in animal welfare studies is the subjective feelings of animals and that consequently they should form a central part of our definition as well as of the practical experiments that are done. I restate the position I have held for a long time: In assessing animal welfare,

we need to take into account many different measures, of which the animal's own viewpoint is only one, but an essential ingredient. **Turkkan's** statement that I should advocate giving cocaine to laboratory animals can, in the light of this, be seen to be quite incorrect. Only someone who took animal preferences as the sole measure of welfare and ignored other considerations such as health would be foolish enough to advocate such a thing.

2. Attributing the capacity to suffer to nonhuman species.

A number of commentators object to the extent to which I attribute consciousness and subjective feelings to non-human animals but their reasons for objecting are very variable. Some believe I have gone too far, others that I haven't gone far enough, and still others that there is really no problem about "other minds," so there was no need to consider it.

Arluke advocates much more empathy and use of projection in understanding animals than I have proposed. **Fox** and **Donnelley** believe that the compassionate feelings we have by nature are the best guide and are more valuable than any attempt to be scientific. Although I sympathise in some ways with their view of animals, I feel that it is important to attempt to put the study of animal welfare on a scientific footing. Not only is this more likely to carry weight with those who do not share such empathetic feelings with animals, but too much projection of ourselves onto other animals carries dangers of its own. Seeing other species as being exactly like us without taking into account the peculiarities of their biology and behaviour may lead us to act in ways that are contrary to their welfare (Dawkins 1980).

Arluke believes that there is no such thing as a private subjective experience (I must confess to being under the strong impression that I have them!) and that feelings of both other people and other species are open to public inspection. **Rachlin** also argues for a behaviourist point of view – that we first perceive suffering in others, not in ourselves. **Dupré** goes so far as to suggest that attributing mental states to other animals is philosophically unproblematic. Problems do remain, however, in determining exactly which states to attribute to other species. To **Rachlin** and **Dupré** these problems may be no more formidable philosophically than sequencing an animal's genes (or measuring anything else that is not directly visible), but they deserve empirical investigation nevertheless. For me, attempting to study the subjective feelings of other animals poses additional difficulties having to do with the very nature of subjective feelings, but this is a personal view and it is not important to the formulation of a practical research programme whether a public or a private view of feelings is adopted.

Running through many of the commentaries is the belief that suffering is primarily found in social animals. **Donnelley** stresses the fact that suffering is communicated to other beings and **Salzen** believes that some of the best indicators of suffering are social displays. **Rachlin** sees no evolutionary significance for suffering except in soliciting help from other animals; **Timberlake** argues that social species should suffer the most.

I have argued elsewhere (Dawkins 1987) that suffering is most likely to arise in organisms that have the capacity to take some sort of action to remove themselves from danger or obtain something that is important to their

survival and reproduction. Soliciting the aid of other individuals is one – but only one – course of action that such an organism might take. It might also learn not to return to a dangerous place, anticipate the movements of its prey or predator, or remove itself from distasteful or venomous food, and so on, none of which need involve interactions with other members of its species. **Rachlin's** assertion that suffering can be of no help to a solitary animal in hunting or escape seems unconvincing.

Without further evidence, we should not assume that solitary animals do not suffer when they are injured, deprived of food or water, or chased by a predator. **Rowan** also questions the functional significance of the experience of suffering. He points out that paraplegic humans with intact spinal reflexes can remove their foot from a hot iron but will feel no pain. He therefore argues that pain sensations have no evolutionary significance, an argument that neglects other possible advantages (e.g., learning) that are unconnected with the avoidance of immediate tissue damage.

Frey, Jamieson, and McFarland rightly point out the difficulties of attributing subjective feelings to other species and I accept much of their skepticism. What I do not accept is **Chapman's** statement that suffering is specific to mammals. He argues that birds do not suffer because they do not have the appropriate brain structures. By the same argument, birds should not be able to learn as well as mammals because they have a poorly developed cortex. This is refuted, however, by behavioural evidence that birds have a highly developed ability to learn and even to form concepts (e.g., Terrace 1987; Herrnstein et al. 1976), equalling and sometimes surpassing those of mammals. [See Macphail; "The comparative psychology of intelligence" *BBS* 10(4) 1987.] In birds, other parts of the brain such as the hyperstriatum have become large and have assumed many of the functions that the cortex performs in mammals (Webster 1973). To say that birds do not suffer because their brains are different from those of mammals is like stating that a jet airplane cannot fly because it has no propellers. Different anatomical structures can serve the same function and we should not close our minds to the possibility that animals with anatomies and physiologies very different from ours nevertheless share capacities similar to ours. My emphasis on demand curves was in fact an attempt to provide a hardware-independent measure, one that would be equally applicable to birds, mammals, octopuses, and insects.

3. The value of demand curves as indicators of suffering.

A number of commentators are unconvinced that measuring demand curves really contributes anything to the assessment of welfare and suffering in animals. **Segal** agrees that natural selection would lead to the evolution of animals that approached things that were good for them and avoided things that were detrimental, but sees no reason to go any further. Positive and negative reinforcement could give indications of well-being and suffering without the need for demand curves, a view also expressed by **Hughes & Petherick**. The point of using demand curves is that it provides a way of comparing the strengths of different motivations (Hursh 1984) and measuring how important different behaviours (or commodities) are to an animal even when the behaviours

being compared occur at different frequencies, or in different circumstances.

By getting the animal to trade one behaviour for another (because time spent on one is spent at the expense of another), we get the animal to rank its own behavioural priorities directly. The finding that a commodity (access to nest material, say) is a positive reinforcer for a particular species of animal could be an important piece of information about conditions that are likely to lead to good or bad welfare, but it does not indicate how much gaining access to nest material matters to the animal. On the other hand, if it can be shown that the animal's demand for nest material is extremely inelastic and that the animal will insist on gaining access to such material even though it has to do without other things, such as mechanical obstruction, exposure to cold, lack of food, then we have considerably more information about how much nest material means to that animal. To show that something is a positive reinforcer for an animal is, indeed, to show that the animal will pay a price (e.g., bar-press) for that commodity. To plot a demand curve is to show the same thing in a much more extensive way that allows direct comparisons to be made with the animal's demand for other commodities.

Novak & Meyer suggest that demand curves are less useful than other measures of suffering such as physical health and "coping responses." I have already emphasised (in section 1 of this Response) that other measures of welfare, particularly health, are important and should always be collected. Because domestic or captive animals may be healthy, yet still exhibit suffering (Dawkins 1980; target article, sections 1, 2), the other measures suggested by Novak & Meyer should be supplements to, not substitutes for, demand curve analysis.

Hughes & Petherick object to use of the idea of canonical cost in connection with demand curves, apparently because it is negative and defined in terms of behaviour that, if not performed, will cause damage to fitness. My response to this is that suffering is also negative and is also related to the effects of not performing behaviour. By analysing the effects of animals' failure to perform very diverse behaviour in terms of a single common currency (effects on fitness), Houston and McNamara (1988) provide exactly the evolutionary framework that is needed.

Hughes & Petherick also object to the term "perceived cost," and **Toates** believes it will confuse undergraduates. I am quite prepared to acknowledge that the words "perceived cost" may not have been the best ones to choose, but whatever words are used, the concept is essential. I have argued elsewhere (Dawkins 1986, chap. 2) that an extraordinary amount of confusion exists in the behavioural ecology literature (and certainly in the minds of many undergraduates) as a result of the failure to distinguish between long-term evolutionary costs (costs to fitness) and short-term proximate costs (e.g., loss of food). Some distinction between these two is essential if we are to avoid falling into the trap of concluding that animals will always choose what is best for them or that demand curves are a direct reflection of threats to fitness (Dawkins 1983).

Monaghan argues that with inelastic demand, a trade-off between cost and benefit does not occur. This is

incorrect. The slope of a demand curve reflects the trade-off an animal makes between different courses of action under different circumstances. By using the common currency of fitness to analyse how the animal trades off, one for another, the consequences of not performing different types of behaviour, we can see how choice of behaviour has been shaped by natural selection. By applying the concept of perceived costs, we can study the proximate, rules-of-thumb the animal is using. When it perceives these costs as being high, the animal suffers.

Magnus & Thiel offer to me what they obviously consider a hard choice: I have to admit either to being an adaptationist or to being vague. A naive Panglossian adaptationist (*sensu* Gould & Lewontin 1979) I am not (Dawkins 1986, chap. 1). I am too aware of the evolutionary constraints on animals (R. Dawkins 1982) to believe that animals are perfect. I therefore do not believe that there is a perfect correlation between the desire for something (as revealed by demand curves) and suffering. All I have argued for is a reasonably close correlation between the two, and there is no reason to suppose that the connection is any looser than that between other pairs of biological traits. If we find that an animal's demand for commodity *A* is more inelastic than that for commodity *B*, it is conceivable that the animal would suffer more from being deprived of *B* than from being deprived of *A*. There is no necessary connection between the animal's desire for *B* and its suffering in *B*'s absence, but it seems more plausible to predict a positive rather than a negative correlation as a result of natural selection. If this is what being an adaptationist means, then I am pleased to be called one. Consequently, demand curve analysis seems to me to be informative rather than uninformative as **Magnus & Thiel** claim.

For the same reason, I am not convinced by **Townsend**'s skepticism about the idea that animals suffer when they are deprived of things that matter to them. He argues that there is no necessary connection between suffering and the intensity of frustrated desires. I agree that an animal might be highly motivated to perform some behaviour yet suffer relatively mild feelings when that motivation is frustrated. It is also, of course, possible that an animal will run towards rather than away from its predator. But in the real world, where natural selection weeds out logically possible animals that cannot survive, we would expect contingent if imperfect connections between fitness, motivation, and suffering.

McFarland is quite right to point out that we need more information on the connection between human suffering and demand curves. As **Timberlake** maintains, such a connection will not be simple to determine for any animal. He argues, for example, that the elasticity of demand will be related to the likelihood of obtaining a particular commodity but that the presence or absence of the cues signifying that commodity may affect apparent elasticity of demand without affecting suffering. The framework put forward by **Houston & McNamara** (1988) allows us to incorporate the likelihood of obtaining a commodity into the animal's decision-making mechanisms (see also **McFarland & Houston** 1981) and consequently, I would argue, into a notion of how much it suffers if the commodity is withheld. This point is discussed further in the next section.

Timberlake argues that rats or other animals adapted to an intermittent rather than a constant food supply would be at a disadvantage if they suffered. This would only be true however if suffering somehow interfered with normal searching behaviour. If the argument I have advanced is correct, suffering as a result of a food deficit should make the animal more likely to perform behaviour associated with reducing a food deficit – for example, searching.

McFarland is skeptical about the relationship between demand curves and suffering. He sees no evolutionary significance to suffering and believes that the concept is of value to ethologists only if suffering is actually instrumental in causing behaviour. I agree with **Toates**'s rejection of this viewpoint and prefer to maintain a much more agnostic position, about both the connection (causal or epiphenomenal) between suffering and behaviour and the precise role of subjective feelings. (Incidentally, I fully accept **McFarland**'s point that demand curves relate strictly to the consequences of performing or not performing an activity.

I would like to thank **Archer, Toates, Dantzer, Burghardt, and Walker** for pointing out useful references and links with other work that were not mentioned in the target article. In attempting to show how ideas from several different fields (applied ethology, behavioural ecology, and parts of experimental psychology) could be brought to bear on the study of the problems of animal welfare I inevitably had to omit much that could have been included.

4. Measuring demand curves in practice. I am very grateful to all the commentators who took the trouble to discuss the practical possibilities of and difficulties with the measurement of demand curves. Having had the arrogance to put forward an approach that I claimed had universal applicability to all animals and situations, I welcome these detailed suggestions. The many positive comments were most encouraging and the more negative ones either can be answered by empirical investigation or are genuine limitations of the method. All give a sense of moving from vague generalisations about animals' subjective feelings to possible practical applications in real-life situations.

Turkkan, Shettleworth & Mrosovsky, and Magurran are all concerned about the large numbers of experiments that would have to be done in order to plot demand functions of different animals under different conditions, for different genders, different times of the year, and so on. It is of course true that such an experimental programme would have to be quite extensive, but then so would research on any other measure (or group of measures) of welfare. The behavioural studies of the programme would at least have the advantage that they do not require expensive apparatus and can be conducted without too much stress on the animals (see the next section).

Shettleworth & Mrosovsky perhaps overestimate the number of demand curves that have to be plotted for each species. The outcome of an experiment that simply titrated an animal's need to perform two behaviours by giving it access to two different operant keys for a short period would indeed depend on the degree of hunger and

deprivation of whatever other commodity was being tested. But by studying the time budgets of animals over long periods (days), we can look at the relative importance of a number of different behaviours simultaneously.

Many commentators list the types of factors that might affect the slope of demand curves in particular instances. **Mench & Stricklin** and **Novak & Meyer** are particularly concerned about social factors and point out that the price an animal is prepared to pay for a particular commodity may well depend on whether the animal is alone or with conspecifics. I would go further. The response to conspecifics will itself vary, as **Byrne** points out, and so the demand for social grouping or avoidance may also vary. **Mendl** and **Wemelsfelder** rightly indicate that the developmental background of an animal – what it has experienced early in life – could well affect its perception of its environment and hence its demand for different commodities.

Monaghan points out that even within a species there may be differences and that we should not rule out the possibility that the behaviour of different individuals may produce different demand functions, a prospect that apparently horrifies **Turkkan** and **Shettleworth & Mrosovsky**. **Widowski** argues that demand functions may depend on the availability of substitutes. My response to all these valid points is the same: First, whether or not demand functions are affected by these and other factors is an empirical matter. We should perform the experiments to find out. Second, exactly the same factors could affect all other measures of welfare, so we are not dealing with complications unique to this approach.

I agree with **Dantzer** that using just one response to compare different motivations – such as pecking in the case of a bird – could give very misleading results. As I have already pointed out (section 9 of the target article), the solution is to use several different measures. If the demand curve reflecting motivation to perform one behaviour (pecking a key, working a treadle, avoiding mechanical obstruction,) was consistently much flatter than that for motivation to perform another, then we could conclude that this difference did not depend on one particular method of measurement. It is equally important to bear in mind that demand curves may be non-linear. **Novak & Meyer** and **Monaghan** suggest that either elastic or inelastic demand curves might be obtained depending on the region of the curve being studied. As I have already stated (section 10 of the target article), the solution is to make sure that the range of price change examined is sufficient to determine the time slope of the demand curve.

Ng argues that the areas bounded by demand curves rather than the slopes or elasticities of demand should be the key measure for welfare research. There would seem to me to be practical difficulties in determining the absolute values of points on the graphs presented; consequently, in practice, both measures may give much the same result.

A number of commentators cite examples of situations in which they claim it would be impossible to measure demand functions at all. **Burghardt** implies that sexual and parental behaviour fall into this category, but I see no reason why they should. **Duncan and Hughes** (1988) have shown that cockerels will perform a wide variety of tasks (walking through water, blasts of air, mechanical obstruc-

tion) to gain access to hens. Even grief and loss seem not to be totally unamenable to procedures by which animals could work to gain access to what has been lost. **Wemelsfelder** argues that it is not possible to measure the perceived cost of boredom because boredom refers to a general need for something to do, not the need to attain a specific goal. This is not the place to argue about the value of the concept of the need for general stimulation, but in practice, animal boredom frequently turns out to be due to lack of specific stimulation. For example, **Shepherdson** (1989) showed that various species of zoo animals that previously had free access to food in a dish chose to spend long hours in natural feeding behaviours when given the opportunity to obtain food in that way. **Duncan and Hughes** (1972) found that hens chose to work an operant feeder to obtain a large proportion of their daily food intake rather than to eat food freely available from a dish. **Inglis and Ferguson** (1986) observed a similar effect with starlings. If animals suffer from boredom caused by lack of opportunity to perform a particular behaviour, such as that normally associated with searching for and capturing food, this result is eminently suitable for demand curve analysis. The animals can be asked whether they will work for the opportunity to perform such a behaviour. The answers might surprise **Byrne**, who finds it hard to believe that animals will work for the opportunity to have their food more difficult to obtain.

The answer to **Timberlake's** question about different degrees of suffering in animals that are adapted to intermittent or constant food supplies in nature is also empirical. As discussed in the target article (section 3), it is not always the absence of an end point (such as food ingested) that may matter to an animal; performing a behaviour such as searching may itself be important as well.

Animals' needs for a varied diet can be assessed by experiment. **Segal** asks whether a varied diet is a luxury or a necessity. That, as she realises, is an empirical question, to be tested by determining whether animals will work for varied diets (coupled with measurements of their physical health when on monotonous or varied diets).

Widowski is concerned that consumer theory cannot deal with behaviour that occurs for only a short period, such as nest building in a sow. But demand function analysis really comes into its own in such situations. A behaviour that was performed very infrequently despite major variations in price could, in this sort of analysis, reflect a demand just as inelastic (just as resistant to price changes) as that reflected by a behaviour that an animal performed almost all the time. Demand functions are independent of the absolute frequency of the behaviour since it is the behavioural change (or lack of it) in the face of price changes that is important. This is another advantage of such analyses over simple studies of reinforcement.

Turkkan cites an example in which, paradoxically, squirrel monkeys appear to be working to receive electric shocks, but it is clear that the pattern of response depends on the precise schedule of reinforcement as well as the history of the animal concerned (**Kelleher & Morse** 1968). The reinforcing value of shock seems to be intimately related to the animal's previously learned association with food. It is of course possible that some animals find a

whole range of situations positively reinforcing that we find aversive, but Turkkan's example shows that schedules of reinforcement are another factor that has to be investigated before we can interpret demand curves.

There are clearly some instances in which demand curve analysis is genuinely impossible to apply. Examples are animals that are too ill to make any response, and animals that are generally unresponsive or have undergone "learned helplessness," as Mendl and Toates point out. In such cases we will have to rely on other measures of welfare such as those referred to in section 1 of the target article.

Sapontzis argues that death that is painless and unexpected would not be registered as suffering by demand curve analysis. Here we enter a realm of ethics that is beyond the scope of this Response since it is not clear that even humans can be said to suffer under these circumstances. Byrne raises the possibility that animals (particularly social primates) might suffer as a result of dreading what another individual might be planning for the future. If we ever get to the point where we have assessed animal welfare in all situations except the ones envisaged by Sapontzis and Byrne, I think we will probably be justified in searching for newer and more sophisticated methods of analysis. That day, however, is probably a long way off, in the meantime, with the exception of situations where animals are totally unresponsive, demand curve analysis can help us find answers to a wide range of practical problems in animal welfare.

5. The value of food as a cross-species yardstick. The commentators raise two important issues: whether demand for food can justifiably be used as a standard of comparison with demand for other commodities within a species, and the more difficult question of whether it is possible to compare suffering in different species using demand for food or for anything else. Both Shettleworth & Mrosovsky and McFarland cite the example of the incubating female jungle fowl that undergoes a considerable weight loss during incubation. McFarland wrongly supposes that I would say the hen suffers during this period on the grounds that laying hens have an inelastic demand for food. In reality, such hens seem to have a reduced feeding motivation (Sherry et al. 1980) and would probably work much harder to obtain access to their nests than to food. It is interesting that in this particular case a symptom of physical ill health (weight loss) indicates suffering but behavioural measures (demand for food) indicate otherwise. This is yet another illustration of the dangers of relying on just one measure of welfare.

Monaghan makes the important point that comparison with demand for food may be quite unsuitable for some species such as fish, because the animals may not be prepared to work hard for food. It may be then necessary to start from scratch and find out what the behavioural priorities of that species are, assuming that we can do so by asking the animal to tell us. It might turn out that whereas the demand for food was inelastic, something else (considered completely unimportant to a human) would yield flat demand curves, indicating that this thing was very important to the fish.

Such species-related priorities do not make it impossible to cross species barriers (I disagree with Magnus &

Thiel on this point) because we aim to find out what is important to other species from their point of view. We still have the problem of determining whether a flat demand curve for one commodity in one species means the same (in terms of the accompanying subjective feelings) as does a similar curve in another species. But instead of assuming that all species are the same, we need make only the one assumption that they are alike in this particular respect. Although, like Singer, I remain agnostic on the question of subjective feelings in shrimps and insects and am therefore not prepared to give a definitive answer to the question raised by McFarland, Timberlake, and Magnus & Thiel about exactly which species do and do not suffer, I am ready to be persuaded by empirical evidence. If an animal, even one totally different from myself, shows evidence of clear-cut behavioural priorities as revealed by extensive demand curve analysis, if the animal appears to be prepared to do almost anything to obtain something even when it is made difficult to do so, if the animal will learn an operant response to get something and shows evidence of behavioural and physiological changes when deprived of it – if the animal does all these things, then this would for me constitute powerful evidence of a capacity to suffer.

6. Demand curve analysis as a possible cause of suffering. The importance of not inflicting pain and suffering on animals in the pursuit of demand curves is emphasised by Archer, Hughes & Petherick, Segal, Rachlin and Rollin. There is certainly a danger that this might happen, but there is no need for it. My students and I have carried out a number of price manipulations in studies on hens and have been assured by the Home Office that we do not need to be licensed under the extensive new British legislation covering animal experimentation on the grounds that we are not doing anything likely to cause pain or suffering. Provided that care is taken in the planning stage of each experiment (e.g., A.B.S./A.S.A.B. 1986), demand curve analysis need not raise major ethical difficulties.

Finally, some points made by commentators do not come under any of the six headings. Wall takes me to task for not mentioning ecology or discussing the ethics of chopping down trees. There are many reasons for not damaging inanimate objects and plants, and I in no way intended to imply that a concern for the environment, a desire to preserve unique objects, and so on, are invalid or unimportant. What I have tried to do is to argue that over and above these considerations, we encounter particular ethical problems in our dealings with entities that may have subjective feelings as well. It was this extra dimension that was the subject of the target article.

Fox and Jamieson imply that I should have said more about my own ethical position. Many people, indeed, may find it odd that I have hardly referred to Singer's precommentary. Reticence about my own moral beliefs has been quite deliberate. What I have attempted to do is to put forward a framework for thinking about animal welfare that is of use both to thinkers such as Singer, who believe that nonhuman animals should be given the same moral status as humans, and to those such as Gray and DeGrazia, who do not. As Frey notes, empirical studies of animal welfare are directly relevant to morality. Even if

the suffering of animal is not given as much weight as that of humans, many people wish to put the feelings of animals into their moral calculus somehow, and facts about the animals concerned are therefore essential. I have argued that one of the most important of these facts is the animal's own point of view, and despite the difficulties that the commentators have pointed out, I still maintain it is possible to understand that viewpoint if we are prepared to ask the right questions.

In the light of Singer's comments, I would like to emphasize that I do not pretend to have provided a complete solution to the problem of understanding the feelings of other species or the precise relation between mind and body. Such questions as whether insects suffer or whether machines programmed to behave "as if" they suffer really do experience anything at all are likely to be with us for some time to come. I make no apologies for not having provided an instant solution to problems that have been around for hundreds of years.

My position is much more modest and can best be described as, "The Black Cloud solution" after the 1957 science fiction novel by Fred Hoyle. In *The Black Cloud*, the earth is approached by a huge cloud of gas that blots out the sun, but is also, it turns out, possessed of a great intelligence. The Cloud absorbs an enormous amount of information about human culture, scientific knowledge, and languages through radio transmissions from a small group of scientists on Earth who manage to make two-way contact with it. In return, the Cloud tells the scientists about itself. It has no sense organs, no localised brain structures and is composed of materials totally alien to any known life form. But its undoubted intelligence and capacity for communication eventually provoke the scientists to ask whether it has any feelings and if so, what they are like.

When this issue is raised with the Cloud, its answer is devastatingly simple: "I imagine that my subjective feelings are very different from yours," it transmits to Earth through a series of radio pulses, "except in one particular – like you I regard painful emotions as emotions that I wish to avoid, vice versa for happy emotions" (p.196).

The Cloud makes one assumption only about the similarity between its experiences and those of humans. In the same way, I have made one assumption about the similarity between humans and nonhuman animals, namely, that where we have evidence of an animal apparently doing anything it can to get away from something or to obtain something, it is likely that that animal is suffering. I have not made it my business to prove that assumption or to provide evidence for it. (I have argued elsewhere [Dawkins 1987] that it is a plausible assumption, but it is, and it remains, an assumption.) What the target article tries to explain is that *if* we make such an assumption, then much else follows. We do not do away with the use of analogy between ourselves and other species, but we do severely limit the extent of our analogy, in fact, right down to this "one particular."

Having said this, I believe it is equally important to emphasize again the value of what the "demand curve" kind of analysis can do for us. That it cannot solve all the problems that philosophers of mind might wish it to does not mean it should be dismissed as invalid. On the contrary, it frees us from an entirely human-centred view of animals where animals are seen as exactly like humans

except that they have furry or scaly skins. By paring down the need for analogy to just the "one particular" and forcing us to get most of our information by asking the animals themselves, we come as close as I think it is possible to come to the animal's point of view. The method, as a number of commentators and Singer himself points out, is flexible enough to give information about sexual deprivation, parental deprivation, and a wide variety of other situations in many different species. The reason we cannot, at this stage, point to a great deal of information that has been obtained in this way is quite simply that it is not a method that has been very widely used until now. It is my hope that by airing both its promises and its limitations in these pages, people concerned with a wide variety of animal welfare problems will be inspired to add "the animal's point of view" to the other measures of welfare or suffering they might use. The purpose of the target article was to argue that this is both essential and possible, and it is most encouraging to find that Singer and many others have so much sympathy with this view.

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- Letters "a" and "r" appearing before authors' initials refer to target article and response respectively.
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