

Animal welfare: the concept & the issues

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Introduction

The first part of this chapter concerns the concept of animal welfare. A definition of welfare is presented and then discussed in relation to other relevant concepts such as stress and animals' needs and feelings. In the final section of this chapter, there is a discussion of the circumstances in which welfare can be poor and where this is perceived by the general public to pose ethical problems.

Requirements for a definition of animal welfare

Welfare is a term which is restricted to animals including man. It is regarded as particularly important by many people but requires strict definition if it is to be used effectively and consistently. A clearly defined concept of welfare is needed for use in precise scientific measurements, in legal documents and in public statements or discussion. If animal welfare is to be compared in different situations or evaluated in a specific situation, it must be assessed in an objective way. The assessment of welfare should be quite separate from any ethical judgement but, once an assessment is completed, it should provide information which can be used to take decisions about the ethics of a situation.

An essential criterion for a useful definition of animal welfare is that it must refer to a characteristic of the individual animal rather than something given to the animal by man. The welfare of an individual may well improve as a result of something given to it, but the thing given is not itself welfare. The loose use of welfare with reference to payments to poor people is irrelevant to the scientific or legal meaning. However, it is accurate to refer to changes in the welfare of an initially hungry person who uses a payment to obtain food and then eats the food. We can use the word welfare in relation to a person, as above, or an animal which is wild

or is captive on a farm, in a zoo, in a laboratory, or in a human home. Effects on welfare which can be described include those of disease, injury, starvation, beneficial stimulation, social interactions, housing conditions, deliberate ill treatment, human handling, transport, laboratory procedures, various mutilations, veterinary treatment or genetic change by conventional breeding or genetic engineering.

We have to define welfare in such a way that it can be readily related to other concepts such as: needs, freedoms, happiness, coping, control, predictability, feelings, suffering, pain, anxiety, fear, boredom, stress and health.

Welfare definition

If, at some particular time, an individual has no problems to deal with, that individual is likely to be in a good state including good feelings and indicated by body physiology, brain state and behaviour. Another individual may face problems in life which are such that it is unable to cope with them. Coping implies having control of mental and bodily stability and prolonged failure to cope results in failure to grow, failure to reproduce or death. A third individual might face problems but, using its array of coping mechanisms, be able to cope but only with difficulty. The second and third individuals are likely to show some direct signs of their potential failure to cope or difficulty in coping and they are also likely to have had bad feelings associated with their situations. The welfare of an individual is its state as regards its attempts to cope with its environment (Broom, 1986). This definition refers to a characteristic of the individual at the time. The origin of the concept is how well the individual is faring or travelling through life and the definition refers to state at a particular time (for further discussion, see Broom, 1991a, 1993; Broom & Johnson, 1993). The concept refers to the state of the individual on a scale from very good to very poor. This is a measurable state and any measurement should be independent of ethical considerations. When considering how to assess the welfare of an individual, it is necessary to start with knowledge of the biology of the animal. The state may be good or poor, however, in either case, in addition to direct measures of the state, attempts should be made to measure those feelings which are a part of the state of the individual.

The assessment of welfare is summarized in Table 9.1 and indicators of good and poor welfare are listed in Table 9.2 and Table 9.3. Most indicators will help to pinpoint the state of the animal wherever it is on the scale from very good to very poor. Some measures are most relevant to

Table 9.1. Summary of welfare assessment

General methods	Assessment
Direct indicators of poor welfare	How poor
Tests of (a) avoidance and (b) positive preference	Extent to which: (a) animals have to live with avoided situations or stimuli (b) what is strongly preferred is available
Measure of ability to carry out normal behaviour and other biological functions.	How much important normal behaviour or physiological or anatomical development cannot occur

Table 9.2. Measures of poor welfare

Reduced life expectancy	
Reduced ability to grow or breed	
Body damage	
Disease	
Immunosuppression	
Physiological attempts to cope	
Behavioural attempts to cope	
Behaviour pathology	
Self-narcotization	
Extent of behavioural aversion shown	
Extent of suppression of normal behaviour	
Extent to which normal physiological processes and anatomical development are prevented	

(From Broom & Johnson, 1993.)

Table 9.3. Measures of good welfare

Variety of normal behaviours shown	
Extent to which strongly preferred behaviours can be shown	
Physiological indicators of pleasure	
Behavioural indicators of pleasure	

(From Broom & Johnson, 1993.)

short-term problems, such as those associated with human handling or a brief period of adverse physical conditions, whereas others are more appropriate to long-term problems. (For a detailed discussion of measures of welfare, see Broom, 1988; Fraser & Broom, 1990; and Broom & Johnson, 1993.)

Some signs of poor welfare arise from physiological measurements. For instance, increased heart-rate, adrenal activity, adrenal activity following

ACTH challenge, or reduced immunological response following a challenge, can all indicate that welfare is poorer than in individuals which do not show such changes. Care must be taken when interpreting such results, as with many other measures described here. The impaired immune system function and some of the physiological changes can indicate what has been termed a pre-pathological state (Moberg, 1985).

Behavioural measures are also of particular value in welfare assessment. The fact that an animal avoids an object or event strongly gives information about its feelings and hence about its welfare. The stronger the avoidance, the worse the welfare whilst the object is present or the event is occurring. An individual which is completely unable to adopt a preferred lying posture despite repeated attempts will be assessed as having poorer welfare than one which can adopt the preferred posture. Other abnormal behaviour such as stereotypes, self-mutilation, tail-biting in pigs, feather-pecking in hens or excessively aggressive behaviour indicates that the perpetrator's welfare is poor.

In some of these physiological and behavioural measures it is clear that the individual is trying to cope with adversity and the extent of the attempts to cope can be measured. In other cases, however, some responses are solely pathological and the individual is failing to cope. In either case, the measure indicates poor welfare.

Disease, injury, movement difficulties and growth abnormality all indicate poor welfare. If two housing systems are compared in a carefully controlled experiment and the incidence of any of the above is significantly increased in one of them, the welfare of the animals is worse in that system. The welfare of any diseased animal is worse than that of an animal which is not diseased but much remains to be discovered about the magnitude of the effects of disease on welfare. Little is known about how much suffering is associated with different diseases. A specific example of an effect on housing conditions which leads to poor welfare is the consequence of severely reduced exercise for bone strength. In studies of hens (Knowles & Broom, 1990; Norgaard-Nielsen, 1990) those birds which could not sufficiently exercise their wings and legs because they were housed in battery cages had considerably weaker bones than those birds in percherics which could exercise. Similarly, Marchant & Broom (1994, 1996) found that sows in stalls had leg bones only 65% as strong as sows in group-housing systems. The actual weakness of bones means that the animals are coping less well with their environment, so welfare is poorer in the confined housing. If such an animal's bones are broken, there will be considerable pain and the welfare will be worse. Pain may be assessed by aversion,

physiological measures, the effects of analgesics, e.g. Duncan *et al.* (1991) or by the existence of neuropeptides (Gentle, 1986). Whatever the measurement, data collected in studies of animal welfare gives information about the position of the animal on a scale of welfare from very good to very poor.

The majority of indicators of good welfare which we can use are obtained by studies demonstrating positive preferences by animals. Early studies of this kind included that by Hughes and Black (1973) showing that hens given a choice of different kinds of floor to stand on did not choose what biologists had expected them to choose. As techniques of preference tests developed, it became apparent that good measures of strength of preference were needed. Taking advantage of the fact that gilts preferred to lie in a pen adjacent to other gilts, van Rooijen (1980) offered them the choice of different kinds of floors which were either in pens next to another gilt or in pens further away. With the floor preference titrated against the social preference, he was able to get better information about strength of preference. A further example of preference tests, in which operant conditioning with different fixed ratios of reinforcement were used, is the work of Arey (1992). Pre-parturient sows would press a panel for access to a room containing straw or one containing food. Up to two days before parturition they pressed, at ratios of 50–300 per reinforcement, much more often for access to food than for access to straw. At this time, food was more important to the sow than straw for manipulation or nest-building. However, on the day before parturition, at which time a nest would normally be built, sows pressed just as often, at fixed ratio 50–300, for straw as for food. Another indicator of the effort which an individual is willing to use to obtain a resource is the weight of door which is lifted. Manser *et al.* (1996), studying floor preferences of laboratory rats, found that rats would lift a heavier door to reach a solid floor on which they could rest than to reach a grid floor.

The third general method of welfare assessment listed in Table 9.1 involves measuring what behaviour and other functions cannot be carried out in particular living conditions. Hens prefer to flap their wings at intervals but cannot in a battery cage whilst veal calves and some caged laboratory animals try hard to groom themselves thoroughly but cannot in a small crate, cage or restraining apparatus.

In all welfare assessment, it is necessary to take account of individual variation in attempts to cope with adversity and in the effects which adversity has on the animal. When pigs have been confined in stalls or tethers for some time, a proportion of individuals show high levels of

stereotypes whilst others are very inactive and unresponsive (Broom, 1987). There may also be a change with time spent in the condition in the amount and type of abnormal behaviour shown (Cromin & Wierkema, 1984). In rats, mice and tree shrews it is known that different physiological and behavioural responses are shown by an individual confined with an aggressor and these responses have been categorized as active and passive coping (von Holst, 1986; Koolhaas, Schuurmann & Fokema, 1983; Benuš, 1988). Active animals fight vigorously whereas passive animals submit. A study of the strategies adopted by gilts in a competitive social situation showed that some sows were aggressive and successful, a second category of animals defended vigorously if attacked whilst a third category of sows avoided social confrontation if possible. These categories of animals differed in their adrenal responses and in reproductive success (Mendl, Zanella & Broom, 1992). As a result of differences in the extent of different physiological and behavioural responses to problems, it is necessary that any assessment of welfare should include a wide range of measures. Our knowledge of how the various measurements combine to indicate the severity of the problem must also be improved.

Welfare: deduced from measurements and varying over a range

If welfare were viewed as an absolute state which either existed or did not exist, then the concept of welfare would be of little use when discussing the effects on individuals of various conditions in life or of potentially harmful or beneficial procedures. It is essential that the concept be defined in such a way that welfare is amenable to measurement. Once the possibility of measurement is accepted, welfare has to vary over a range. If there is a scale of welfare and the welfare of an individual might improve on this scale, it must also be possible for it to go down the scale. There are many scientists assessing the welfare of animals who accept that welfare can get better or can get poorer. It is therefore illogical to try to use welfare as an absolute state or to limit the term to the good end of the scale. Welfare can be poor as well as good.

The view of welfare as referring only to something good or conducive to a good or preferable life (Tannenbaum, 1991) is not tenable if the concept is to be practically and scientifically useful. Fraser (1993), referring to well-being as the state of the animal, advocates assessing it in terms of level of biological functioning such as injury or malnutrition, extent of suffering and amount of positive experience. However, despite using well-being to refer to scales of how good the animal's condition is, some of his statements explaining well-being imply only a good state of the animal, a

limitation which is neither logical nor desirable. Fraser (1993) does, however, follow Broom (1986) and Broom and Johnson (1993) in drawing a conceptual parallel with the term 'health', which is encompassed within the term welfare. Like welfare, health can refer to a range of states and can be qualified as either 'good' or 'poor'. Health can also imply absence of illness or injury. Welfare has the same range of colloquial meaning but when the term is used precisely, it must mean the range of states and it must be possible to refer to poor welfare and good welfare.

Welfare and needs

Animals have a range of functional systems controlling body temperature, nutritional state, social interactions, etc. (Broom, 1981). Together, these functional systems allow the individual to control its interactions with its environment and hence to keep each aspect of its state within a tolerable range. The allocation of time and resources to different physiological or behavioural activities, either within a functional system or between systems, is controlled by motivational mechanisms. When an animal is actually or potentially homeostatically maladjusted, or when it must carry out an action because of some environmental situation, we say that it has a need. A need can therefore be defined as a requirement, which is fundamental in the biology of an animal, to obtain a particular resource or respond to a particular environmental or bodily stimulus (Broom & Johnson, 1993). When needs are not satisfied, welfare will be poorer than when they are satisfied. The degree to which welfare is poor will vary and this has to be scientifically assessed.

Some needs are for particular resources, such as water or heat, but control systems have evolved in animals in such a way that the means of obtaining a particular objective has become important to the individual animal. The animal may need to perform a certain behaviour and may be seriously affected if unable to carry out the activity, even in the presence of the ultimate objective of the activity, for example rats and ostriches will work, in the sense of carrying out actions which result in food presentation, even in the presence of food. In the same way, pigs need to root in soil or some similar substratum (Hudson, 1989), hens need to dust-bathe (Vestergaard, 1980) and both of these species need to build a nest before giving birth or laying eggs (Brantas, 1980; Arey, 1992). In all of these different examples, the need itself is not physiological or behavioural, but may be satisfied only when some physiological imbalance is prevented or rectified, or when some particular behaviour is shown.

Some needs are associated with feelings, which might also be called

subjective experiences, and these feelings are likely to change when the need is satisfied. If the existence of a feeling increases the chances that the individual will carry out some adaptive action and hence be more likely to survive, the capacity to have such a feeling is likely to have evolved by natural selection. Furthermore, if the state of an individual in certain conditions is desirable from an evolutionary viewpoint, there should be a propensity for that individual to have good feelings. On the other hand, if a state is one which should be quickly altered, it should be associated with unpleasant feelings which prompt avoidance or some other action. Feelings are part of a mechanism to achieve an end, just as adrenal responses or temperature regulatory behaviour are mechanisms to achieve an end.

When there are no needs which have to be satisfied immediately and the animal's welfare is good, the animal is likely to experience positive feelings. Likewise, when there are unsatisfied needs and welfare is poor, there will often be bad feelings. Feelings will usually result in changed preferences, hence preferences can give some useful information about needs. Other information about needs is obtained by observing the abnormalities of behaviour and physiology which result when needs are not satisfied.

Needs vary in urgency and the consequences if they are not satisfied range from those which are life-threatening to those which are relatively harmless in the short term (see Broom & Johnson, 1993). This range of meaning of need can be expressed in German by two words *Bedarf* and *Bedürfniss*. A *Bedarf* is a need which must be satisfied if life is to continue whereas a *Bedürfniss* is a need which the individual wishes to be satisfied. Since we know that strong preferences by an individual for or against a resource or activity usually relate to something important for the biological success of that individual, a *Bedürfniss* has to be considered very carefully in relation to welfare.

Welfare and feelings

The subjective feelings of an animal are an extremely important part of its welfare (Broom, 1991b). Suffering is a negative unpleasant subjective feeling which should be recognized and prevented wherever possible. However, whilst we have many measures which give us some information about injury, disease and both behavioural and physiological attempts to cope with the individual's environment, fewer studies tell us about the feelings of the animal. Information can be obtained about feelings using preference studies but this must be complemented by the other information about welfare mentioned above.

As discussed above, feelings are aspects of an individual's biology which must have evolved to help in survival (Broom, 1998), just as aspects of anatomy, physiology and behaviour have evolved, so it is not logical to concentrate on feelings to the exclusion of other mechanisms when defining welfare. It is also possible, as with any other aspect of the biology of an individual, that some feelings do not confer any advantage on the animal but are epiphenomena of neural activity (Broom & Johnson, 1993). If the definition of welfare were limited to the feelings of the individual, as has been proposed by Duncan and Petherick (1991), it would not be possible to refer to the welfare of a person or an individual of another species which had no feelings because it was asleep, or anaesthetized, or drugged, or suffering from a disease which affects awareness. A further problem, if only feelings were considered, is that a great deal of evidence about welfare like the presence of neuropeptides, extreme physiological responses or various abnormalities of behaviour, immunosuppression, disease, inability to grow and reproduce, or reduced life expectancy would not be taken as evidence of poor welfare unless bad feelings could be demonstrated to be associated with them. Evidence about feelings must be considered, for it is important in welfare assessment, but to neglect so many other measures is illogical and harmful to the assessment of welfare, and hence to attempts to improve welfare.

In some areas of animal welfare research, it is difficult to identify the subjective experiences of an animal experimentally. For example, it would be difficult to assess the effects of different stunning procedures using preference tests. Disease effects are also difficult to assess using preference tests. There are also problems in interpreting strong preferences for harmful foods or drugs. However, research on the best housing conditions and handling procedures for animals can benefit greatly from studies of preferences which give information about the subjective experiences of animals. Both preference studies and direct monitoring of welfare have an important role in animal welfare research.

Welfare and stress

The word stress should be used for that part of poor welfare which involves failure to cope. If the control systems regulating body state and responding to dangers are not able to prevent displacement of state outside the tolerable range, a situation of different biological importance is reached. The use of the term stress should be restricted to the common public use of the word to refer to a deleterious effect on an individual (see Broom &

Johnson, 1993 for more detailed information on this subject). A definition of stress as just a stimulation or an event which elicits adrenal cortex activity is of no scientific or practical value. A precise criterion for what is adverse for an animal is difficult to find but one indicator is whether there is, or is likely to be, an effect on biological fitness. Stress can be defined as an environmental effect on an individual which over-taxes its control systems and reduces its fitness or seems likely to do so (Broom & Johnson, 1993; see also Broom, 1983; Fraser & Broom, 1990). Using this definition, the relationship between stress and welfare is very clear. First, whilst welfare refers to a range in the state of the animal from very good to very poor, whenever there is stress, welfare is poor. Secondly, stress refers only to situations where there is failure to cope but poor welfare refers to the state of the animal both when there is failure to cope and when the individual is having difficulty in coping. It is very important that this latter kind of poor welfare is included in the definition of welfare as well as the occasions when an animal is stressed. For instance, if a person is severely depressed or if an individual has a debilitating disease, but there is complete recovery with no long-term effects on fitness, then it would still be appropriate to say that the welfare of the individuals was poor at the time of the depression or disease.

Welfare assessment and ethics

Scientific measurement can be used in an investigation of welfare, for example, in a comparison of different animal transport procedures. However, a pertinent question in such studies is to what extent can, or should, the steps in the investigation depend upon ethical considerations? Tannenbaum (1991) argues that welfare is a concept in which values are intricately involved, so it is not possible to separate what does and does not involve ethics. This is a confusing use of the term values and fails to provide a basis for welfare investigation.

There are four components in a study like that of methods of transport of farm animals. The first is to decide that there is a problem. Ethical considerations are involved here. For instance, it is considered that welfare of farm animals should not be very poor and that welfare may be worse during one transport method than during another. The second component in the study may be to make a scientific comparison of the welfare of the animals during these methods of transport. In this step, the only ethical consideration is that the scientist should be as objective as possible in selecting measurements and in carrying out the study. The scientist should

take care to use all possible information about the biology of the animal and the likely environmental effects on the animal when selecting measures. The third component, that is when the measurements are made and analysed, like the second, must be objective and independent of any ethical view about which method of transport is desirable. When the scientific process is completed and the results are presented, ethical decisions can be taken. This is the fourth component. Ethical values are involved in the first and fourth components of the process but only scientific values should be involved in components two and three.

Actual and publicly perceived welfare problem areas

Members of the general public are usually most disturbed by reports of pain or disturbing and bizarre images which concern animals with which they can readily identify. The injured or emaciated dog or horse elicits a greater response from the average person than a similarly injured or emaciated rat, sheep or chicken. The term welfare refers to all animals even if there is variation in the sophistication of the life control mechanisms and hence in the variety of ways in which welfare can be poor.

The nature of human use of an animal or interaction with it has no effect on the extent to which the animal can suffer or be otherwise adversely affected (Broom, 1989). There is an illogical tendency for people to be more concerned about pets than about animals kept in large numbers or largely hidden from their view. Suppose that a rabbit has a certain level of injury or disease. Its welfare is just as poor whether it is a pet, a laboratory animal, a farmed animal or a wild animal.

The most important influences on the welfare of most animals are the living conditions during the majority of their lives. Hence if welfare is poor because of inadequate housing, this is worse for the animal than some painful but brief interlude. A measure of how poor welfare is, multiplied by the duration of that poor welfare gives an indication of the overall magnitude of the problem for that individual (Broom & Johnson, 1993). Hence, the worst-case scenario would be severe prolonged problems.

If the welfare of individuals is poor, the more animals which are affected, the greater the problem. The largest numbers of animals with which man interacts are of farm animals, but there are also substantial numbers of pest species, pet animals, hunted animals, laboratory animals and zoo animals.

In the light of the considerations detailed above, and taking into account the fact that there are more chickens than any other domestic animal, the

most extreme welfare problem areas would seem to be leg problems in broiler chickens and the consequences of confinement in laying hens kept in battery cages. Next, would come confinement of sows in stalls and tethered and of calves in small crates, disease in young calves and piglets, disease in farmed trout, mastitis and lameness in dairy cows and leg problems in turkeys and sheep. The inadequacy of stimulation possibilities in housing conditions for laboratory rodents and rabbits is an important problem, whilst injurious laboratory procedures on animals would be important although at a lower level than the problems resulting from housing. Before coming to laboratory procedures, we should consider the effects of transport on farm animals, of untreated disease in pet animals and of painful trapping or shooting of wild animals including fish. Farm operations such as castration, tail-docking or dehorning usually have severe effects as do tail-docking or other widespread mutilations in dogs. Neglect of pet animals and deliberate cruelty to domestic animals come quite low down on this list of problems. Even lower come housing conditions for zoo or circus animals and the consequences of damaging training methods for horses, dogs and other species.

This list of the severity of problem areas in animal welfare is based on the animals' point of view and is not the same order as that which most people would perceive. It is clearly desirable that people should be informed about the importance of the animal welfare, how to assess it scientifically and about where the really severe problems exist.

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