ASSESSING ANIMAL WELFARE: WHERE DOES SCIENCE END AND PHILOSOPHY BEGIN?

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Abstract

To be able to assess animal welfare the researcher must presuppose a number of background assumptions that cannot be tested by means of ordinary empirical data collection. In order to substantiate these assumptions two sorts of inferences have to be relied upon, which the authors designate by the terms 'analogies' and 'homologies'. Analogies are evaluative, philosophical reflections by means of which it is made clear what provisions or states constitute the welfare of humans and other animals. By means of analogies it may, for example be argued that animal welfare consists of subjective experiences such as pain, boredom, pleasure and expectation. Also by means of analogies the relative 'weight' of these states can be decided. Homologies are part of theoretical science. They serve to clarify how the relevant experiences are linked to measurable anatomical, physiological and behavioural parameters.

An account is given of the steps which have to be taken to give a full answer to a question concerning the welfare of animals. In the account only farm animals are mentioned, but the same steps, of course, also have to be taken to answer questions concerning the welfare of other kinds of animals be they companion, laboratory, zoo or wild. Eight steps are described, and it is argued that both analogies and homologies are needed at very fundamental levels. Therefore, if animal welfare science is to provide relevant, rational and reliable answers to questions concerning animal welfare, it must be an interdisciplinary inquiry involving philosophical reflections and theoretical biology.

Keywords: *animal welfare, ethics, methodology, philosophy, subjective experiences*

Animal welfare implications

It is important that assessments of animal welfare are based on scientific knowledge concerning behaviour, health and physiology. However, this knowledge does not by itself provide relevant, rational and reliable answers to the questions concerning animal welfare typically raised by the informed public. To provide such answers and thereby help to improve the conditions of farm animals the researcher has to engage in an interdisciplinary inquiry. The aim of the paper is to make researchers aware of the

philosophical and other theoretical assumptions to be made if they want to say something that is directly relevant to the welfare of animals.

Introduction

Over the past three decades there has been growing public concern about the welfare of farm animals. Scientists have responded to it by developing methods for assessing whether and to what extent farm animals suffer in various modern farming systems. These methods are now being utilized in many countries on a regular basis in the development and testing of new production systems.

The new science of animal welfare does not, however, in all respects fit into the standard picture of what 'real' science is. According to that picture science is objective and value-free, and it produces hypotheses of a sort which can be tested empirically. Much of what goes on in investigations of animal welfare is, of course, in accordance with this picture but other parts are not.

Generally animal welfare researchers seem to be caught in a dilemma. Either they stick to doing what is traditionally considered 'real' science, and then the research falls short of providing satisfactory answers to the questions raised by people concerned about animal welfare. Or they try to provide an answer but are then suspected of saying things for which at present there is no scientific justification.

In this paper we articulate the dilemma by finding out at which points, in the investigation of animal welfare, science ends and something else - be it ethics, philosophy or common sense - begins.

First we will present an idealized account of the steps which must be taken in providing a full answer to a typical question concerning the welfare of farm animals. We find eight such steps (see Table 1). Secondly, we sort out some of the crucial assumptions and inferences involved in the various steps, and try to decide which of these are to be considered 'scientific'.

Table 1 Definition of steps involved in assessing animal welfare.

Step	Definition
1	What is to be assessed?
2	What matters to the animal?
3	How are the relevant experiences to be measured?
4	Carrying through the actual measurements
5	Interpretation of the test results
6	Summing up the 'welfare vectors'
7	Summing up the 'net welfare'
8	Deciding the ethical or practical significance of the results

The eight steps involved in assessing animal welfare

The following is meant as a rational scheme which a researcher must go through to give anything like a full answer to the sorts of questions concerning animal welfare typically raised by the informed public. It may, for example, be the question; 'do battery hens suffer unnecessarily?' or it may be the question 'is the welfare of dairy cows being unduly reduced if they are not allowed to graze?'

Step 1: What is to be assessed?

Often the questions raised by the public are of a quite general nature. For example, it is asked whether or not battery hens suffer due to their restricted housing. But researchers, of course, need questions which are much more specific. They must consider, for example, what breed of hen, what sort of battery system, what sort of management?

They may try to simplify the original question by dividing it into a long series of more specific questions. However, for practical reasons the researchers will normally settle for just a few specific questions - or maybe only a single one, eg how do animals X fare when kept in system Y under management Z?

In most cases the researcher will decide to compare the welfare of the relevant animals with the welfare of animals kept in another kind of system and will then end up with one or more questions of the following comparative sort: how does the welfare of animals X, kept in system Y, under management Z, compare with the welfare of animals X, kept in system Q, under management R?

Step 2: What matters to the animal?

Before beginning to undertake the relevant comparisons the researcher must know what constitutes animal welfare. What sorts of provisions or states do we look for, when we are interested in animal welfare?

Most researchers implicitly assume that the relevant states are to be found among the subjective experiences of the animals (Duncan & Dawkins 1983). These are states such as pain, fear, nausea, boredom and frustration. Some researchers will extend this to also include experiences such as pleasure, satisfaction, joy and expectation.

All this is controversial, and we shall come back to it in the discussion. Here we shall, for the sake of the argument, assume that the researcher decides that the right states to look for are experiences of the sorts mentioned.

Step 3: How are the relevant experiences to be measured?

Experiences cannot be measured directly. All that can be measured are physiological, behavioural, pathological and other similar objective parameters which may serve as evidence for the occurrence of the relevant subjective experiences.

The researchers therefore have to find out which measurable parameters will serve as indicators of the occurrence of which experiences. They will at this step arrive at

statements of the following form: if an animal is measured to value V of parameter P there is good reason to think that the animal enjoys experience E.

Step 4: Carrying through the actual measurements
At this step the researcher conducts experiments and makes observations. Measurable parameters which it has been decided will serve as evidence of the states that the researcher is really after are recorded. Hormone levels may be measured; conflict and abnormal behaviour may be observed; various sorts of choice tests can be conducted and disease incidences recorded. (For more full and detailed accounts see Dawkins 1980 and Fraser & Broom 1990). All of these measurements may be evaluated by approved statistical methods. In the end the researcher will have a table or figure of test results.

Step 5: Interpretation of the test results
In some cases it will be fairly easy to interpret the test results in light of the evidential relations established at the third step. There may, however, be two sorts of complications. First, the measured results are all of a reasonably well-defined, quantitative sort, whereas the subjective experiences, the occurrence of which the researcher tries to establish, are less well-defined and cannot be mapped on a quantitative scale. If for example a parameter indicative of pain, such as number of bite wounds on piglets' ears is being measured, the best the researcher may hope for is a conclusion saying that the pain of an individual with a large number of bites is more (or perhaps much more) severe than the pain of another which has a smaller number of bites. This difference between the nature of the test results and the nature of the states that the researcher infers clearly makes the interpretation of the test results more than just a simple mathematical manipulation.

Secondly, the different sorts of evidence may not give a unanimous verdict on the occurrence of the relevant experiences. Thus, notoriously, behaviour and physiology may infer quite different things. For example 'flighty' strains of hens showed far more avoidance and panic to visual stimuli than did 'placid' strains. However, the heart rates of the so-called 'placid' birds took longer to recover than those of the so-called 'flighty' birds (Duncan & Filshie 1980). In such a case the researcher must try to weigh the conflicting pieces of evidence against each other.

Step 6: Summing up the 'welfare vectors'
At this step the researcher has an opinion about which of the relevant experiences occur, with what likelihood, in the different situations that are being compared.

Each of these experiences has been chosen because it contributes, positively or negatively, to the welfare or life-quality of the animals in question. Thus the results may be summed in the form of lists of vectors, one list for each of the situations compared (Sen 1980/81). Each vector is either positive, eg in the case of joy, or negative, eg in the case of pain. Also each vector may have a certain degree of intensity.

Step 7: Summing up the 'net welfare'

In some cases it may be fairly easy on the basis of the welfare vectors to reach a conclusion about the total 'net welfare' in the compared situations. This is so if one set of vectors is in all respects better than the other; but these cases are rare.

If, for example, the situations compared are animals kept isolated in a barren environment with little space, and animals kept in a typical 'free-range' system, then probably each system will have its own characteristic positive and negative sides. One system may, for example, suffer from some of the negative aspects arising from domination and aggression among individuals in a big group which are counterbalanced by better opportunities for the exercise of a wide variety of behaviours. The other system may contain no 'social' problems but pay for this with very poor possibilities for performing important species-specific behaviour.

When the scale does not tip to the same side for all the vectors it is necessary to compare the relative importance of the different vectors to the total welfare of the affected animals. Since it does not seem possible to transform the different vectors into one common utility-scale, a certain amount of judgement seems to be called for at this stage.

Step 8: Deciding the ethical or practical significance of the results

When questions are asked about the welfare of farm animals the aim is usually not only to find out how well or badly off the animals are, but also to decide whether the welfare of the animals is affected in a way and to a degree that is ethically indefensible.

To decide this the researchers, or whoever uses their results, will have to invoke ethical principles and search for all the further facts which, according to these principles, are morally relevant. From some ethical viewpoints it may also be necessary to consider for example, environmental pollution and economical costs/benefits.

Discussion

The first step which seems to involve assumptions and inferences transcending ordinary scientific thinking is *Step 2*; and we shall therefore begin by trying to sort out what goes on here.

Analogies

To be able to assess welfare we need, to some extent, to know what welfare is. This follows from the general truth that we cannot assess or measure anything without having some sort of theoretical preconception of its nature.

However, unlike parameters such as blood-pressure or body temperature, the concept of welfare is not part of the general theoretical framework within which scientific thinking takes place. To explain what is meant by welfare, the scientist will therefore have to leave the realm of ordinary scientific reasoning.

An obvious point for scientists to start with is to consider what is meant by saying that the life of a human being goes well. They can then try to *draw an analogy* between human welfare and the welfare of non-humans. This is not to say that scientists must succumb to some sort of anthropomorphism. They should not be looking for those specific things which contribute to human welfare, such as enlivening work and a rich family life. Rather, they should search for descriptions which are at a level of abstraction that will cover not only humans but all creatures that are capable of experiencing pleasure and suffering.

Even within discussions of human welfare there is a need for this kind of abstraction. Many of the things which will typically contribute to the welfare of a middle-aged professional will not be of any use to an old, retired person. But since we mean the same thing by welfare whether we are talking about the welfare of the middle-aged or the retired, it must be possible to abstract a general concept of welfare - as distinguished from a description of those things which contribute to the welfare of a specific group of people or non-human animals. To formulate a concept of welfare which will also include the welfare of other vertebrates is just to carry this process of abstraction to its logical conclusion.

The starting point is common sense, but the scientist may often seek help from philosophers who have tried to construct general theories of welfare. Philosophers do, however, disagree strongly about which of their theories is the correct one. (For a good overview of the philosophical discussion see Parfit 1984 pp 493-502; for a more detailed account see Griffin 1986). Before seeking philosophical advice however, scientists will have to decide what roughly they take the nature of welfare to be.

Most scientists dealing with animal welfare, however, seem to recoil from making this decision. Instead they pursue what one may call the strategy of the smallest common denominator. That is, they stick to some elements of welfare which are recognized by all influential theories of welfare. They will for example say that welfare consists of the avoidance of states such as pain and frustration.

There are, however, good arguments against such a minimalist strategy. First, since there is much more agreement about the negative, adverse elements of welfare than there is about the positive ones, the strategy will involve an unacknowledged bias against positive welfare. Secondly, just picking the elements which are common to most theories of welfare does not necessarily ensure that the result will be in accordance with all the theories. A better approach might be to adopt a fuller view of welfare which is at least in accordance with some of the influential underlying concepts.

We shall not try to develop a full theory of welfare here, but concentrate on two requirements which, according to our view, any satisfactory conception of animal welfare must satisfy.

The first is the *experience requirement,* according to which something can only affect the welfare of an animal if it affects the conscious experiences of the individual. This means that, for example, the extension of an individual animal's gene-pool occurring *after*

the death of that animal cannot contribute to the welfare of the animal.

It should be noted that there are two ways in which one may affect the conscious experiences of an animal. One is by actually inducing an experience in the animal, the other is by doing something which prevents it from having certain experiences. Therefore it is not possible, on the basis of the experience requirement, to claim that we do not affect the welfare of an animal by preventing it from enjoying certain positive experiences. An important consequence of this first requirement is that welfare can only be ascribed to beings which are sentient, ie beings which have conscious experiences.

The second requirement we will call the *requirement of non-speciesism.* This says that the mere fact that an animal is non-human is not a sufficient condition for restricting the types of experiences which are taken to contribute to its welfare. Thus, if we allow joy and pleasure to count as constituent parts of positive welfare in the case of humans and, if we admit that non-human animals can enjoy some such states, we cannot then, without further argument, exclude these states from consideration in the case of non-human animals.

Another way of stating the requirement of non-speciesism is by saying that we must give specific reasons if we want to claim that human welfare is something special. Such reasons should of course be in accordance with modern science. Our impression is that in most cases no such reasons can be found and that therefore the requirement of non-speciesism ought to make welfare scientists look for a much broader repertoire of animal experiences than is customary.

There may be objections that some of these experiences are very difficult to assess. To this our reply is that it remains to be seen which experiences can and which cannot be assessed, and that if some relevant experiences are not included at this stage, scientists may not even begin to look for ways in which they could be measured.

Until now we have only been talking about the sort of analogy that is involved at the second step, that of finding out what matters to the animal. A similar sort of analogy is involved in ***Step 7***, when the researcher tries to sum up the 'net welfare'. Here the researcher may have to decide the relative importance of conflicting vectors and, since these vectors cannot be transformed into one common utility scale, will have to display a certain amount of judgement (Smidt 1983). Such a judgement may, according to our view, be assisted by drawing an analogy with how we (humans) would solve such conflicts. For example the judgement that a brief experience of intense pain has less weight than lasting boredom seems to be based on such an analogy.

The analogies thus far discussed are not 'scientific'. They concern themselves with an evaluative question. To ask '*what is animal welfare?*', is just another way of asking '*what is good for an animal?*', or '*what ought to be done in order to satisfy the interests of an animal?*' (Tannenbaum 1991 pp 1366 ff.). To deal rationally with this question we need evaluative philosophical reflections which take as their starting point what we think is good for ourselves. By a process of abstraction a general conception of animal welfare is developed.

These analogies differ by virtue of their evaluative nature from other types of analogies which are often, and more properly, termed 'homologies'.

Homologies

In the discussion of animal welfare it is generally accepted that non-human animals can experience pain and suffering homologous with that of man. It should likewise be accepted that animals can experience pleasure and satisfaction - as it is reasonable to believe that the capability to experience pain as well as pleasure may be of evolutionary advantage for both human and non-human animals. Thus the survival and reproduction of an animal depends on its ability to maintain its homeostasis by instinct and in higher animals also by learning about the negative and positive influences from its environment.

According to Wiepkema (1983) animals have two types of feelings or emotions, each with their own function. Pleasure normally signals that the processes which work to keep homeostasis at an optimum are operating correctly, while suffering signals that something is going wrong and needs adjustment. Cabanac (1971) demonstrated that in man, a non-painful stimulus could be perceived as pleasant or unpleasant according to the internal thermal state of the subject. When the internal temperature of a subject was high, cold or cool stimuli were experienced as pleasant, and warm or hot stimuli were unpleasant. The opposite response was given by the subject while in hypothermia; then cold was experienced as unpleasant and warm as pleasant.

By means of homologous comparisons between humans and other animals it is possible to infer what sorts of experiences the relevant animals may enjoy, and how those experiences are linked to measurable physiological and behavioural parameters. Such inferences are therefore essential to the third and fifth step involved in assessing animal welfare.

These inferences are clearly 'scientific', but are of a rather theoretical sort. Like any other theoretical inferences these may be challenged as they have been in the past (Regan & Singer 1989) and occasionally still are (cf eg Harrison 1991); but they are endorsed by most of the scientists and philosophers now working in this area (cf eg Dawkins 1980 ch 2, Rollin 1989, Smith & Boyd 1991 ch 4 & 5). In ordinary empirical research concerning animal welfare, however, the conclusions of these inferences will not be challenged. Rather, they serve as background assumptions.

Thus empirical assessment of animal welfare is based on the assumption that certain behavioural and physiological states are tied to positive or negative experiences in homology with the way similar states are linked to human experience. States commonly considered to be tied to pain or other sorts of suffering are diseases, wounds, abnormal behaviour patterns, some categories of conflict behaviour and chronic physiological stress reactions. Positive experiences may be connected with the fulfilment of a variety of behaviours, eg exploration, play, and a range of appetitive and consummatory behavioural patterns.

A scientific evaluation of animal welfare in two different farm animal production systems may include the recording and statistical analysis of one or more of the relevant

measurable parameters. Diseases and injuries can be measured as recordings of incidences of specific diseases and counts of, for example, cutaneous wounds. Behavioural data may be recorded as the occurrence of specific behaviour events and/or the time they were performed. Physiological data may be collected by blood sampling followed by analysis of, for example stress hormones or neuropeptides.

Statistical analysis of the data may demonstrate that the two production systems differ in one or more of the measured dimensions. But these results by themselves do not tell us anything about the welfare status of the animals in the systems. To do this they must be combined with the previously mentioned background assumptions.

Let us as an example consider tail wounds in two different herds of pigs. Herd A may have a statistically significant higher number of tail wounds as compared with herd B. Before we can conclude anything about the welfare status of the animals in the two systems we need to assume that tail wounds are a negative experience in the pigs and further that generally two or more tail wounds are more unpleasant than one.

It is impossible to decide whether these assumptions are correct or not by the empirical investigation itself. Rather it is necessary to make these assumptions before the scientific study is planned and performed; for the simple reason that the conclusions to be drawn from the investigation presuppose such assumptions.

It is important to point out that this general problem of animal welfare research cannot be solved *merely* by means of supplementary data collection of, for example cortisol or neuropeptide levels in the pigs from the two herds. This is because, as in the previous example, we have to make assumptions as to how the pigs experience these levels of hormones and neuropeptides.

The assumptions in question must be based on a theoretical inference to the effect that they, together with what we already know about the mental life of human beings, serve to give the most simple and coherent picture of how animals (including humans) experience their environment. The inference involves a careful extrapolation from human to non-human species in the light of our knowledge of similarities and differences in physiology and behaviour of the respective species.

Conclusion

Assessment of animal welfare involves comparisons between humans and other animals. However, as we have tried to show, these comparisons are of two very different sorts. One sort we call analogies. These inferences involve evaluative, philosophical reflections about what it is for one's life to go well; the other sort we call homologies. These are part of theoretical science and aim at establishing links between subjective experiences on the one hand and behaviour and physiology on the other.

Since both analogies and homologies are essential to the assessment of animal welfare there is much more to welfare studies than just the measurement of disease, behaviour and physiology. Such measurements only tell us something about animal welfare against the background of theoretical and philosophical assumptions.

It is generally recognized that there is a gap between welfare science and ethics. Thus no serious researchers will claim that they can carry through the eighth of the above mentioned steps by means of ordinary scientific methods. (Whether there are other 'rational' methods by means of which this may be done is a question that we shall not here pursue.)

However, it is not possible for researchers to avoid philosophical questions simply by stopping their investigation at the seventh step. Such questions arise at an earlier level. Thus to find out what sort of things or states to look for, the researchers will have had to find out what constitutes animal welfare. This cannot be done by means of ordinary scientific methods. They must engage in evaluative reflections about what it is for one's own life to go well and must, by a process of abstraction, try to formulate a concept of welfare that will include other animals.

Also, when it comes to summing up the 'net welfare' (*Step 7*), the researcher will have to rely on evaluative reflections, this time about how to add or subtract the different things which matter to us humans. Then by means of analogies, the conclusions must be extended to cover members of other species too.

There are two alternative conclusions that one may draw from this. The first would be that scientists should stop trying to assess animal welfare. Rather they should restrict themselves to the aim of measuring 'objective' behavioural and physiological facts and then leave it to other people to decide what these things have to do with welfare.

The second conclusion would be to admit that the study of animal welfare is an interdisciplinary endeavour involving both philosophy and ordinary science, and thus encourage philosophical reflections within the study of animal welfare.

We recommend the second alternative. Only if philosophy and science go hand in hand will we be sure to get reliable and rational answers to the questions on animal welfare that are raised by the public. This is, of course, not to say that according to our view all scientists engaged in welfare science should become part-time philosophers. Here as in all other areas of research there should be room for a certain division of labour. But all scientists working on animal welfare should try to make clear the philosophical and other assumptions they allow themselves to take for granted.

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References

Cabanac M 1971 Physiological role of pleasure. *Science 173:* 1103-1107

Dawkins M 1980 *Animal Suffering.* Chapman and Hall: London

Duncan I J H, Dawkins M S 1983 The problem of assessing 'well-being' and 'suffering' in farm animals. In Smidt D (ed) *Indicators Relevant to Farm Animal Welfare,* pp 13-24. Martinus Nijhoff Publishers for the Commission of the European Communities: The Hague

Duncan I J H, Filshie J H 1980 The use of radio telemetry to measure temperature and heart rate in domestic fowl. In Amlaner C J Jr, Macdonald D W (eds) *A Handbook on Biotelemetry and Radio Tracking,* pp 579-588. Pergamon Press: Oxford

Fraser A F, Broom D M 1990 *Farm Animal Behaviour and Welfare, 3rd edition.* Baillière Tindall: London

Griffin, J 1986 *Well-being.* Clarendon Press: Oxford.

Harrison P 1991 Do animals feel pain? *Philosophy 66:* 25-40

Parfit D 1984 *Reasons and Persons.* Clarendon Press: Oxford

Regan T, Singer P (eds) 1989 *Animal Rights and Human Obligations, 2nd edition,* pp 13-19. (A selection of quotations) Prentice Hall: Englewood Cliffs, New Jersey

Rollin B E 1989 *The Unheeded Cry. Animal Consciousness, Animal Pain and Science.* Oxford University Press: Oxford

Sen A 1980/81 Plural utility. *Proceedings of The Aristotelian Society, New Series 81:* 193-215

Smidt D 1983 Advantages and problems of using integrated systems of indicators as compared to single traits. In Smidt D (ed) *Indicators Relevant to Farm Animal Welfare,* pp 201-207. Martinus Nijhoff Publishers for the Commission of the European Communities: The Hague

Smith J A, Boyd K M (eds) 1991 *Lives in the Balance: The Ethics of Using Animals in Biomedical Research.* Oxford University Press: Oxford

Tannenbaum J 1991 Ethics and animal welfare: the inextricable connection. *Journal of the American Veterinary Medical Association 198:* 1360-1376

Wiepkema P R 1983 Umwelt and animal welfare. In Baxter S H, Baxter M R, MacCormack J A D (eds) *Farm Animal Housing and Welfare,* pp 45-50. Martinus Nijhoff Publishers for the Commission of the European Communities: The Hague