ASSESSING ANIMAL WELFARE AT THE FARM AND GROUP LEVEL: THE INTERPLAY OF SCIENCE AND VALUES

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In the social debate about animal welfare we can identify three different views about how animals should be raised and how their welfare should be judged: (1) the view that animals should be raised under conditions that promote good biological functioning in the sense of health, growth and reproduction, (2) the view that animals should be raised in ways that minimise suffering and promote contentment, and (3) the view that animals should be allowed to lead relatively natural lives. When attempting to assess animal welfare, different scientists select different criteria, reflecting one or more of these value-dependent views. Even when ostensibly covering all three views, scientists may differ in what they treat as inherently important versus only instrumentally important, and their selection of variables may be further influenced by a desire to use measures that are scientifically respected and can be scored objectively. Value assumptions may also enter animal welfare assessment at the farm and group level (1) when empirical data provide insufficient guidance on important issues, (2) when we need to weigh conflicting interests of different animals, and (3) when we need to weigh conflicting evidence from different variables. Although value assumptions cannot be eliminated from animal welfare assessment, they can be made more explicit as the first step in creating animal welfare assessment tools. Different value assumptions could lead to different welfare assessment tools, each claiming validity within a given set of assumptions.

Keywords: *animal welfare, ethics, sows, standards, values, welfare assessment*

Introduction

When Dawkins (1980) published her book *Animal Suffering*, subtitled *The Science of Animal Welfare*, much of the science she described was experimental. In experimental science, we can study single variables or treatments, with other variables either controlled or included in a planned or balanced manner. Furthermore, in experimental science we usually examine the average effects of the variables on a reasonably homogeneous sample of animals, and the individual differences in response tend to be treated as sampling error to be minimised in order to make the central tendency more clear.

Today, however, animal welfare science is being asked to take on a much more complex task: not controlled experimentation, but the assessment of animal welfare at the farm and group level. Here the challenge is very different. Instead of single variables and controlled treatments, we often need to consider a range of diverse variables and perhaps combine these

in some manner in a scoring system or evaluation. Instead of examining average effects, we may need to deal with quite different responses by different animals and somehow combine these into an overall assessment of the animals making up the group or farm.

As a further complication, welfare assessment tools are being developed for very different purposes: in some cases to allow retail and restaurant companies to assure customers that welfare standards are being followed within conventional confinement systems; in other cases to identify niche products from animals raised in non-confinement systems; in other cases, to demonstrate compliance with legally required minimum welfare standards. In each of these cases, the stated goal may be to "assess animal welfare", but the actual purpose, and sometimes the underlying philosophy, may be quite different.

In this complex environment, it will be especially important to be clear on what science can and cannot contribute, and on the interplay of science and value assumptions in assessing animal welfare at the farm and group level. The purpose of this paper is to set out some vocabulary and concepts to help in this process.

A valuable model for this task is provided by a unique study by Brunk and colleagues (1991) on the interplay of empirical data and value assumptions in risk assessment. Their study examined a risk assessment hearing for the pesticide Alachlor, with company scientists arguing that the pesticide is safe whereas regulatory scientists argued the opposite. Brunk *et al* (1991) found that the disagreement, which the scientists tended to view as a purely technical issue, arose mainly from different value assumptions underlying the scientists' assessment. In analysing the conflict, Brunk *et al* developed a useful taxonomy, which I largely follow in this paper, of the ways in which value assumptions can become embedded in scientific evaluation.

Welfare assessment gone awry?

To make this rather abstract exercise more concrete, let us consider a recent example where scientists differed strongly in an assessment of animal welfare. In 1997, a scientific committee created by the European Union reviewed the literature on the welfare of intensively kept pigs, and asked (among other questions) whether welfare problems are caused by "gestation stalls" — the stalls where sows are often kept, unable to walk or turn around during most of pregnancy. The review concluded that: "Some serious welfare problems for sows persist even in the best stall-housing system" (von Borell *et al* 1997, section 5.2.11). With this review in hand, the European Union adopted a ban on gestation stalls as of 2013 (Anonymous 2001).

Shortly thereafter, a group of Australian scientists reviewed much the same literature and asked much the same question, but came up with essentially the opposite conclusion, claiming that: "Both individual [including stalls] and group housing can meet the welfare requirements of pigs" (Barnett *et al* 2001, p 13). The swine industry in the United States has used that review to argue that there is no scientific basis for eliminating the gestation stall.

Both of these reviews were done with great thoroughness by very accomplished scientists, and each group may well have felt they were doing the best and most objective job possible. What, then, should we conclude when two groups of scientists, having access to much the same scientific literature, reach opposite conclusions? Is there a fundamental problem with the field of animal welfare science? Is the field less scientific than had been claimed? An exploration of this conflict will help to shed light on the interplay of value assumptions and empirical information in the assessment of animal welfare at the farm and group level.

Three views of animal welfare

During recent decades, while animal welfare science was emerging as a distinct field, three cultural developments influenced societal views about the proper treatment of farm animals and, hence, about how animal welfare should be judged. One development was the remarkable change in animal agriculture that has occurred since 1950, whereby certain traditional, semi-outdoor production methods were largely replaced by more industrialised, intensive, indoor methods, and the pursuit of highly efficient production became the guiding principle of animal agriculture. Roughly the same 50 years saw a remarkable increase in humanitarian attitudes toward animals in the West, perhaps resulting from growing scientific knowledge of animals, the trend for an increasingly urban population to be exposed to pets rather than farm animals, and the role of the media in making the lives of wild animals accessible to people as never before. The result has been a striking increase in the amount of attention and sympathy paid to animals, at least in the European and English-speaking countries of the West. The third development has been a degree of backlash against industrialisation and technology, evidenced today by distrust of big business, global trade and genetic engineering. This trend includes calls for a return to more agrarian and ecological forms of agriculture including smaller, traditional farms and less technological tampering with nature.

These three developments appear to have contributed to, or at least reinforced, three different views about the welfare of farm animals (Duncan & Fraser 1997; Fraser *et al* 1997). One view emphasises the biological functioning of the animal in the sense of health, growth, and productivity. According to this view, newer production methods, however unnatural and restrictive they may seem, are good for animal welfare as long as the animals are healthy, growing, and reproducing well. Thus, one commentator defended intensive production systems because:

> "on balance ... the animal is better cared for; it is certainly much freer from disease and attack by its mates; it receives much better attention from the attendants, is sure of shelter and bedding and a reasonable amount of good food and water." (Taylor 1972)

A second view emphasises the "affective states" of animals — pain, suffering, and other feelings and emotions. According to this view:

> "The welfare of managed animals is dependent upon the degree to which they can adapt without suffering to the environments provided by man." (Carpenter 1980)

Hence, production methods should be judged on the basis of how happy the animals are, or conversely how much the animals are caused to suffer.

A third view is that animals should be allowed to live in as natural circumstances as possible, where they can express their normal behaviour. For example, one critic of intensive production systems urged:

> "Let [farm animals] see the sun just once, get away from the murderous roar of the fans. Let them get to breathe fresh air for once, instead of manure gas". (Anonymous 1989)

These divergent views of animal welfare constitute what Brunk *et al* (1991) call "value frameworks" in the sense of a coherent set of values which may be closely connected to an individual's world view and convictions. The first view, emphasising biological functioning, is commonly heard among those who are involved in animal production (te Velde *et al* 2002), the quote being from a veterinarian working with livestock. The second view, emphasising suffering and other affective states, is commonly heard among humanitarians

concerned about animal welfare (Fraser *et al* 1997); the quote is from a church-based committee of theologians and other concerned citizens. The third view, emphasising natural living, was found to be common among consumers of animal products by te Velde *et al* (2002); the quote is from writer Astrid Lindgren whose popular novels often glorified life lived close to nature and free from the constraints imposed by modern society.

Value frameworks in the scientific study of animal welfare

It would be comforting to think that science could simply set things straight by replacing these different, value-dependent views of animal welfare with objective data about what is truly better for animals. In fact, however, scientists tend to bring to animal welfare assessment much the same three value frameworks outlined above. Thus McGlone (1993) advocated that biological functioning is definitive of animal welfare, and criticised attempts to relate animal welfare to subjective states such as suffering:

> "an animal is in a poor state of welfare only when physiological systems are disturbed to the point that survival or reproduction are impaired."

In contrast, Duncan (1993) saw affective states as definitive of animal welfare:

> "... neither health nor lack of stress nor fitness is necessary and/or sufficient to conclude that an animal has good welfare. Welfare is dependent on what animals feel."

And Kiley-Worthington (1989), emphasising natural living, claimed:

> "in order to avoid suffering, it is necessary over a period of time for the animal to perform all the behaviors in its repertoire..."

These three views of animal welfare are by no means mutually exclusive; indeed, advocates of any one sometimes seem to assume that their own view of welfare would encompass the others, inasmuch as they are important or knowable. Nonetheless, the three views represent three different areas of emphasis which can lead scientists to use quite different criteria in assessing animal welfare.

A careful reading of the European and Australian reviews of the welfare of pigs shows that the two groups of scientists differed in the value frameworks they used. The Australian reviewers saw biological functioning as the key to animal welfare, putting special emphasis on "relative changes in biological ... responses and corresponding decreases in fitness" including "widely accepted criteria of poor welfare such as health, immunology, injuries, growth rate, and nitrogen balance" (Barnett *et al* 2001, p 3). They acknowledged that affective states play a role in animal welfare inasmuch as they are part of the animal's apparatus for survival and reproduction, but they assumed that all risks to welfare should have "consequent effects on fitness variables such as growth, reproduction, injury, and health" (p 3).

In contrast, the European reviewers emphasised affective states directly, claiming that, "Suffering is one of the most important aspects of poor welfare and we should investigate the existence of good or bad feelings wherever possible when trying to assess welfare" (von Borell *et al* 1997, section 1.2). Thus, they included in their assessment of animal welfare "the effects of fear and the behavioural and physiological consequences of lack of control, especially frustration" (section 1.2), without assuming that these problems would necessarily affect functioning-based variables such as growth, reproduction, injury and health. They also saw the opportunity to carry out natural behaviour as beneficial to welfare, stating that "sow welfare will be worse in conditions where exploration of a complex environment, rooting in a soft substratum and manipulation of materials such as straw are not possible" (section 5.2.1);

and they saw high levels of abnormal behaviour as indicative of poor welfare, again without requiring consequent effects on health and other functioning-based variables. It was, in part, evidence of the animals' affective states, natural behaviour and abnormal behaviour that led the European reviewers to conclude that serious welfare problems occur in even the best stall systems.

Thus, the different conclusions reached by the European and Australian reviews were due, at least in part, to the different value frameworks adopted by the groups, which led to different criteria for assessing animal welfare.

The mouldy bread and dry frog errors

However, it seems very unsatisfactory to have scientists drawing opposite conclusions because they insist on using different criteria to assess the key concept in their field. Meteorologists would be in chaos if they used conflicting ways of measuring temperature, or cytologists if they disagreed on what a cell is. To make sense of this, let us consider the "mouldy bread error":

> *In a (fictional) nutrition laboratory, scientists decided to conduct a scientific assessment of bread quality in order to help consumers to buy good bread. They were equipped to measure standard nutrients such as protein and minerals, but they did not have an assay for mould-derived toxins, and they were sceptical of the less objective methods commonly used to assess freshness, texture, and flavour. Noting that nutrients are important components of bread quality, they combined their various nutrient measurements into a "bread quality index" and showed (scientifically, and using the most objective measures available) that stale, mouldy bread is equal in quality to freshly baked bread.*

In this anecdote, the scientists failed to distinguish between scientific concepts and socially constructed concepts. Concepts such as viscosity and metabolic rate are scientific concepts invented within, and taking their meaning from, a field of science. Such concepts may, of course, come to be used in popular culture. For instance, an overweight person might blame his corpulence on a low metabolic rate; whether this is true is an empirical question which a physiologist could answer by certain measurements.

In contrast, concepts such as the quality of bread or the health of a person are socially constructed: they arose in society and have meaning in everyday speech independent of their adoption into scientific discourse. Science can, of course, be applied to these topics, but if scientists try to define socially constructed concepts in terms of scientific variables, they must be careful not to miss or misconstrue the social meaning of the term, or their research may prove irrelevant to its intended social purpose.

Clearly animal welfare is a socially constructed concept. It was part of social discourse before it became the subject of scientific research, and it is widely used in everyday speech to refer to the quality of life of animals, especially when ethical concerns about animals' quality of life are being discussed. Hence, when scientists attempt to assess animal welfare, they need to ensure that their scientific measures reflect the socially constructed meaning of the term (Tannenbaum 1991; Stafleu *et al* 1996).

If, however, we treat animal welfare exactly like bread quality, we might make the dry frog error:

> *In an (also fictional) bedroom, a young boy who had caught a frog as a pet wanted to give the frog the best possible care. Believing that the frog would be cold and*

tired after living in swamps and eating flies, he tucked the frog into his own warm, dry bed with a handful of peppermints.

The dry frog anecdote reminds us that animal welfare is unlike bread quality in that animals themselves have certain interests, and these provide the ultimate criteria for animal welfare. Through scientific knowledge, we can make better judgements about what is good or bad for animals, and thus improve on uninformed opinion or simplistic extrapolation from humans to other species. Hence, our ways of assessing animal welfare need to be scientifically informed, while also needing to capture the social meaning of the term.

As we have seen, however, animal welfare actually carries different social meanings. Ethicists, humanitarians, and consumers tend to emphasise affective states such as suffering and frustration, together with the opportunity to live a relatively natural life. By emphasising these elements in their assessment of animal welfare, the European reviewers helped to align their analysis with this widely held social meaning of the term, thus avoiding the mouldy bread error. The Australian reviewers, seeming particularly mindful of the dry frog error, emphasised the danger of relying on mere public perceptions of animal welfare, noting that "public perceptions may result in difficulties with the concept of confinement housing ... [but] ... the issue of public perception should not be confused with welfare" (p 13). In relying on functioning-based variables such as "growth, reproduction, injury, and health" (p 3), the Australian reviewers adopted a meaning of the term that does not correspond well to the social meaning assumed by ethicists, humanitarians and consumers, although te Velde *et al* (2002) found it to be a common view of welfare among livestock producers.

Inherently *versus* instrumentally important variables

Even when scientists ostensibly include all three value frameworks in assessing animal welfare, they may differ in whether they treat a given aspect as inherently important or merely instrumentally important. For those who adopt a natural-living view of animal welfare, the ability to perform natural behaviour is an inherently important element of welfare. This emphasis is reflected, for example, in the "Five Freedoms", which require freedom to perform most types of natural behaviour as a key element of welfare, comparable to freedom from injury and disease (Webster 1994). From this viewpoint, housing sows so that they cannot walk, turn around, explore, or root in a natural substrate during most of pregnancy would, in and of itself, constitute a welfare problem.

The Australian reviewers, in adopting functioning-based criteria for assessing welfare, evidently viewed freedom to perform natural behaviour as being only instrumentally important; that is, the ability to walk would be important for welfare if (but only if) it led to measurable benefits in terms of health, reproduction, or similar variables. The evidence, they noted, showed that biological functioning measures are, in general, roughly as positive for sows in stalls as for sows in loose housing. Thus, according to their criteria, sow welfare is not significantly impaired by an inability to walk, turn, and perform natural behaviour. However, their approach would not fit with the value framework of those who see natural living as inherently important for welfare.

A similar issue arises over the role played by the affective states of animals in their welfare. Several positions can be discerned in the literature:
1) that affective states are inherently important for animal welfare and should be studied directly (Duncan 1993, 1996);
2) that affective states are inherently important but cannot readily be studied, leaving us to use biological functioning measures as the most practical approach (Gonyou 1993);

3) that affective states are inherently important but are so closely tied to biological functioning that measures of biological functioning should suffice to identify problems involving affective states (Baxter 1983); and
4) that animal welfare depends only on biological functioning (McGlone 1993); affective states are not inherently important, but may be instrumentally important inasmuch as they affect biological functioning.

The European reviewers clearly saw affective states as important inherently, not only instrumentally, for animal welfare. Hence, they took signs that sows are "frustrated" in stalls (section 5.2.2) and that sows find stalls "aversive" (5.2.1) as evidence of welfare problems in stalls. The Australian reviewers incorporated affective states in a different manner. They noted that "animal emotions" play a role in animal welfare "as they would have evolved on the basis of their survival values and contribution to biological fitness" (p 3). However, by assuming that all threats to welfare should have effects on "fitness" variables, the Australian reviewers appeared to view affective states as only instrumentally important for welfare inasmuch as they affect biological functioning (position 4, above), or inherently important for animal welfare but adequately captured by functioning-based measures (position 3). In either case, the Australian reviewers, unlike the European ones, did not look to evidence of negative affective states as primary criteria of welfare problems, and this contributed to their conclusion that gestation stalls "can meet the welfare requirements" of the animals.

Objectivity and scientific respectability

Concerns about objectivity and scientific respectability may also influence the selection of variables for animal welfare assessment. Scientists generally strive for objectivity, in the sense of making measurements that represent the object under study, not the subject (person) making the measurement. Variables such as growth rate, survival, and incidence of infectious diseases can generally be scored in objective ways yielding strong agreement between different observers, and animal welfare scientists have often recommended the use of such objective measures wherever possible. For example, Grandin (1998), in selecting variables to assess the humaneness of animal handling at slaughter plants, favoured measures that can be readily scored in an objective manner.

On the other hand, there is much less consensus on how to assess affective states such as pain, frustration, and suffering. For example, quantitative assessment of pain is often done by subjective scaling methods which are open to substantial disagreement among observers (Beynen *et al* 1987). Moreover, during much of the 20th century, influential scientists claimed that the affective states of animals, not being open to direct observation, fall outside the realm of scientific study (Burkhardt 1997). Today, despite considerable scientific interest in the affective states of animals (eg Panksepp 1998), the subject remains relatively new and continues to evoke scepticism among some scientists.

In our case study, the Australian reviewers appeared to attach substantial importance to the objectivity of the measures they used, and they remarked that their reliance on functioning-based criteria "affords this approach credibility within scientific circles". In so doing, however, the Australian reviewers may have sacrificed capturing some of the widely held social meaning of the term. In contrast, the European reviewers, in embracing measures reflecting affective states and natural behaviour, appeared to come much closer to the social meaning of the term as understood by ethicists, humanitarians and consumers, but they may have incurred the scepticism of those who view such measures as less objective or not scientifically respectable.

It is important to distinguish objectivity in applying measures *versus* objectivity in selecting the measures to be applied. A group of measures may be applied in a highly objective way, but the selection of variables is, nonetheless, likely to reflect the value framework of those making the selection. There is a risk that scientists will confuse these two aspects of objectivity, and claim that because the variables they use to assess animal welfare can be scored in an objective and quantitative way, therefore the assessment of animal welfare is objective in the sense of being free from value assumptions. In reality, although each variable may be scored objectively, values play a key role in the selection, weighting, and interpretation of the variables.

Inherently normative *versus* conditionally normative issues

In their analysis, Brunk *et al* (1991) also distinguished between "conditionally normative" and "inherently normative" issues in risk assessment. In the former, values become involved simply because the relevant scientific data are not sufficiently precise. In the Alachlor study, for example, there were no definitive data on whether the pesticide caused genetic mutation; in the absence of such data, the assessors had to decide how to assign the benefit of the doubt. By contrast, in "inherently normative" cases, the need to apply values could not, even in theory, be resolved by empirical data. For example, scientists defending Alachlor insisted that the compound is safe if handled with appropriate gloves; regulatory scientists noted that many farm workers do not have access to such gloves. The panel, therefore, had to decide whether to base their ruling on the conditions specified on the label or on the conditions likely to occur on actual farms. While empirical data (for example, about the number of farm workers with access to the necessary gloves) might help to clarify the gravity of the problem, the issue remains inherently a value-based decision.

Both conditionally and inherently normative issues arise in animal welfare assessment. Conditionally normative issues often arise when we deal with single variables. If the evidence is unclear on whether hens need 10 cm or 12 cm of trough space in order to eat simultaneously, we may decide to err on the high or low side of the range, depending on whose interests we want to protect. With better data, we might have a definitive answer and not need to apply a value-dependent judgement.

Inherently normative issues are likely to occur in welfare assessment, firstly, when we need to balance different effects on different animals. For example, group housing of pregnant sows allows all animals to socialise, but a few may suffer from excessive aggression. In this case, we need to decide what priority to attach to different classes of animals: the majority, the most vulnerable, the most productive etc. Similarly, with delayed weaning of piglets we may have to balance the nutritional benefits received by the piglets against any costs incurred by the mothers. When we compare costs and benefits for a single animal, we can sometimes use preference research or other methods to help understand the animal's own interests and priorities; but where different animals have conflicting interests, there is no purely objective way to decide which party to favour. Secondly, inherently normative issues may arise when incommensurable variables lead toward different conclusions. For example, hens on pasture have more freedom of movement; hens in cages may have more freedom from coccidiosis. Which is more important for the hens' welfare? Formal scaling systems may help up to a point in combining variables (Scott *et al* 2001), but if scientists and others differ fundamentally in the weight they attach to different aspects of animal welfare, no scaling methods will prevent value assumptions from being invoked (often unwittingly) in weighing different attributes. As noted above, these two

cases — weighing conflicting interests of different animals, and weighing conflicting but incommensurable variables — are complications that arise in assessing animal welfare particularly at the farm and group level.

Conclusions and implications for animal welfare

Brunk *et al* (1991) criticised what they called the "classical model" of risk assessment, whereby the assessment of risk is perceived as a purely objective and scientific task, which is then followed by an ethical decision about whether the level of risk is acceptable. Some scientists have proposed a similar model for the study of animal welfare. For example, Broom (1991, p 4168) suggests that welfare "can be measured in a scientific way that is independent of moral considerations", and that ethical decisions can then be made about whether the situation is morally acceptable. Broom is quite right, of course, to separate ethical decision-making from the scientific study of animal welfare, but as Brunk *et al* note, this model underestimates the role played by values in the assessment process itself.

Instead, as we have seen, values intrude into the assessment of animal welfare in fundamental ways (Tannenbaum 1991; Sandøe & Simonsen 1992; Rollin 1993, 1995). These include: (1) in the value frameworks that scientists bring to animal welfare assessment, (2) in deciding what elements are inherently *versus* instrumentally important for animal welfare, (3) in deciding what importance to attach to measures that are scientifically respected and can be scored objectively, (4) in cases where data do not provide a definite answer to key empirical questions, and (5) in deciding how to weigh incommensurable variables and the conflicting interests of different animals.

Given the many ways that values enter into welfare assessment, it is possible that different sets of values will lead to different welfare assessment tools yielding different conclusions, each correct within the given value assumptions. Thus, in our case study the European reviewers made a good case that the welfare of sows is jeopardised by the gestation stall, given (1) that affective states and an ability to behave in a relatively natural way are inherently important for animal welfare, and (2) that it is better to include such considerations in assessing welfare than to limit welfare assessment to scientifically uncontroversial measures (von Borell *et al* 1997). At the same time, the Australian reviewers made a good case that gestation stalls are not necessarily bad for sow welfare, given a relatively restrictive definition whereby welfare boils down to the biological functioning of the animal, and assuming that welfare assessment should be restricted to measures that enjoy high credibility in scientific circles (Barnett *et al* 2001).

The role of values in welfare assessment does not mean that it is futile to design systems to assess animal welfare at the farm and group level. The danger is not that value assumptions will be involved but that they will be concealed within a system of assessment which its designers consider to be purely objective. In assessing welfare at the farm and group level, we should attempt not the impossible goal of eliminating value assumptions from animal welfare assessment, but the achievable goal of making value assumptions more explicit so that disagreements can be traced correctly to the underlying value differences.

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