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On Measuring Progress in Animal Welfare

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ON MEASURING PROGRESS IN ANIMAL WELFARE

(Report for the World Society for the Protection of Animals)

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Executive Summary

- *Animal protection and welfare organizations and agencies are accountable to their donors and supporters to make efficient and effective use of their limited resources.*
- *In the interests of accountability, these organizations should employ an empirical, evidence-based approach to evaluate progress in animal welfare, and to determine which of their policies and practices are effective.*
- *Outcomes assessments of animal welfare interventions should aim to collect baseline data prior to the intervention, and incorporate at least one matching 'control' sample or group that is monitored over the same period in the absence of the intervention.*
- *Evidence-based approaches also require the use—and, if necessary, the development—of reliable/repeatable, valid, and culturally appropriate measures to evaluate progress, and to assess the effectiveness of any particular welfare or humane intervention.*
- *To be practicable for use by non-specialists in challenging 'field' situations, these measurements need to be relatively easy and inexpensive to perform.*
- *Measures that can be used to assess progress in animal welfare include: Direct animal-based assessments of an animal's mental and physical state; indirect measures of environmental factors that affect the welfare of animals; and indirect 'human dimensions' of animal welfare, including people's behavior towards animals, and the attitudes and values that tend to predict this behavior.*
- *Depending on species and context, the following direct, animal-based measures of welfare are recommended:*
    - *Obvious signs of poor health that can either be counted or scored reasonably objectively and repeatably.*
    - *Reliable existing and ongoing records of health and/or productivity.*
    - *Overt and quantifiable behavioral responses to standardized stimuli, such as being approached, touched, or exposed to novel objects or sounds.*
    - *Presence and frequency of obvious stereotypic or other abnormal behavior.*
    - *One or more physiological indicators of welfare when this information can be collected safely and easily without harming or distressing the animals (e.g. via saliva, fecal, or hair samples).*

- *Depending on context, the following environmental parameters are also likely to affect animal welfare and should also be evaluated in before-and-after welfare assessments:*
  - *Space available per animal.*
  - *Availability and access to food, water and shelter.*
  - *Ability to engage in 'high value' behavior patterns.*
  - *Levels of environmental hygiene.*
  - *Exposure to extreme temperatures or weather conditions, fear-evoking situations, aggression or 'bullying' by other animals, rough or coercive handling or overt cruelty by humans, and/or obvious physical hazards likely to cause injury or death.*
- *Regarding the human dimensions of animal welfare, changes in people's actual behavior toward animals or animal-based products and activities are likely to provide the most accurate assessments of progress over time. These can be measured or monitored either directly through observation of human-animal interactions, or via published reports on trends in human activities (e.g. consumer surveys).*
- *Where this kind of behavioral information is either unavailable or inaccessible, correlates of behavior such as animal-related attitudes, opinions, and values should be measured by means of appropriately designed and validated questionnaires.*
- *The field of animal protection would benefit from the development of new quantitative measures of animal-related attitudes and values as standardized methods of monitoring local, national, and global variation and progress in attitudes to animals and their welfare.*
- *Such attitude measurement tools should aim to include questions addressing people's:*
  - *Age, sex, income, educational level, demographic background, and religiosity.*
  - *Current and childhood involvement with animals and animal-related activities.*
  - *Emotional and/or empathic responses to different categories of animals.*
  - *Perceptions of animals' instrumental, material, or 'utility' value.*
  - *Approval/disapproval of various consumptive and non-consumptive uses of animals.*
  - *Culturally transmitted values and beliefs regarding particular animals and animal uses.*
- *The adoption of reliable, standardized measures of progress in animal welfare that focus on the animal, its environment, and the associated attitudes and behavior of humans, is an essential stage in the development of evidence-based practice in animal protection.*

1. Introduction

Improvements in the welfare of animals arise from two primary sources: Changes in public attitudes and beliefs regarding what constitutes acceptable treatment of animals, and mandatory changes in behavior toward animals imposed by governments and regulatory authorities. During the last 30-40 years, public and political support for improvements in animal welfare has increased dramatically in many countries. Funding from both governmental and non-governmental sources continues to grow, and the relatively new field of animal welfare science has emerged and expanded to support and inform these efforts. Many experts in the field recognize, however, that there is still a distinct gap between the science and the practice of animal welfare, and that policies and actions that aim to protect animals from harm are sometimes implemented in the absence of reliable evidence that they actually work (Dawkins, 2006; Lockwood, 2005; Main et al., 2003; Scott et al., 2001).

In some cases, this mismatch between research and practice is understandable. Much of the work done by animal welfare agencies is—of necessity—reactive. Unwanted animals are rehomed or euthanized; injured or diseased animals are treated; neglected or abandoned animals are rescued, and people who abuse animals are prosecuted (McCrindle, 1998). Public pressure to bring immediate relief to suffering animals, especially during times of sudden disaster or crisis, tends to override questions concerning the long-term effectiveness of particular interventions. Ultimately, however, the goal of producing significant and sustained improvements in the treatment of animals will only be reached by employing the kinds of evidence-based approaches that are increasingly applied or advocated among other 'crisis' disciplines, such as clinical medicine and wildlife conservation (Ferraro & Pattanayak, 2006; Pullin & Knight, 2001; Rosenberg & Donald, 1995; Sackett et al., 1996; Stevens & Milne, 1997; Sutherland et al., 2004). Such approaches place strong emphasis on the experimental deployment of remedial interventions, and the careful assessment of outcomes, to determine which policies and practices are successful and which are not. As applied to the field of animal protection, a key component of this evidence-based approach is the identification and, if necessary, development of valid and reliable measures of animal welfare—or of things that affect animal welfare—that can be readily applied in a particular context of interest, and used to evaluate progress over time.

For the sake of clarity, the present review separates these kinds of measures into three distinct categories: Direct animal-based measures that are believed to provide an immediate

indication of an animal's mental and physical state; indirect measures of environmental factors that are known or believed to affect the welfare of animals; and various indirect 'human dimensions' of animal welfare, such as the various attitudes and values that influence people's behavior toward animals. Due to time and space limitations, this overview will not address in detail some of the more obvious, macro-level measures of progress in the animal protection arena that have been discussed recently elsewhere (e.g. Herzog et al., 2001; Lockwood, 2005; Rowan & Rosen, 2005; RSPCA, 2006). These include, for example, temporal changes in the actual numbers of animals used or abused in different contexts; changes in financial resources spent on animals; changes in the numbers and characteristics of organizations and individuals involved in, or supportive of, animal protection; changes in the amount of attention given to animals and animal-related issues in the media, and the growth and evolution of animal protection laws and regulations.

2. Direct animal-based measures of welfare.

The term "animal welfare" generally refers to the state of an animal, and the extent to which it is faring well or ill in a particular situation or at a particular point in its life. Different experts tend, however, to give priority to different aspects of an animal's state when assessing its welfare: Some emphasize unpleasant or pleasant subjective feelings (Boissy et al., 2007; Duncan, 1993; Dawkins, 1980), while others focus on the animal's ability to express 'natural' or species-typical behavior (Rollin, 1995), or its capacity to adapt to, or cope with, the demands of its environment (Broom & Fraser, 2007). One thing they all seem to agree on is that there is no single, reliable measure of an animal's welfare (Mason & Mendl, 1993; Appleby, 1999). Rather, the welfare of an animal is represented as being something like the 'safety' of a building (Fraser, 1995). A group of engineers might all agree that a particular structure is unsafe, but their opinions would likely be based on multiple criteria, and they wouldn't necessarily agree as to which criteria were most important for making this determination. Likewise, a group of animal welfare scientists and practitioners might all agree that a particular animal's welfare is poor but base this conclusion on different measures or by assigning different weights to the same measures. Most animal welfare experts therefore advocate taking multiple measurements of things that are likely to be relevant to an animal's welfare while at the same time recognizing that the final determination inevitably involves a degree of subjectivity (Dawkins, 1980; Fraser, 1995; Mason & Mendl, 1993).

The best measures or 'indicators' of an animal's welfare will also depend on the species of animal involved, and the context in which it is being assessed. The methods used to evaluate the welfare of urban stray dogs, for instance, are unlikely to be the same as those used to assess the welfare of broiler chickens during transport or slaughter. Furthermore, large discrepancies in the volume of research dedicated to the welfare of different kinds of animal means that reliable welfare measures are more readily available for some species than others. Specifically, the measurement of welfare parameters in farmed and laboratory animals is relatively advanced, while it is still at a nascent stage of development for working, companion, and captive wild animals. Despite these provisos, animal welfare scientists tend to focus on a limited range of categories of welfare 'indicators' when making their assessments.

2.1. Health: Although health and welfare are not synonymous, there is widespread agreement among experts that an animal's welfare is certainly compromised if it is injured, diseased, malnourished, or in any sense unhealthy (Broom, 1991; Dawkins, 1998; Fraser 1995). This is not just because unhealthy animals are often thought to be experiencing pain or discomfort, but also because unhygienic, overcrowded or stressful environmental conditions may predispose animals to health problems; for example, by increasing their exposure to injuries and disease pathogens, or by suppressing immune function. Since poor health also limits an animal's usefulness to people (e.g. by reducing its working ability, productivity, or the quality of its products), health-based indicators of animal welfare may carry more weight with animal users or producers than other measures (Scott et al., 2001). Overt signs of ill-health—wounds, lesions, abrasions, sores; skin, coat or feather problems; parasite loads; lameness or abnormal gait; lethargy; difficulty standing up or lying down; diarrhea and vomiting; shallow, rapid or labored breathing; physical deformities; overall body condition, and so on—should therefore be in the forefront of any welfare assessment. Because they are overt, and relatively simple to score or quantify, symptoms of poor health tend to be repeatable (consistent) both within and between raters, and are therefore also likely to be useful as before-and-after measures of progress in animal welfare.

Some good examples of the use of health and body condition indices as both measures of welfare and of progress in welfare have been provided by recent assessments of working equines (horses, mules and donkeys) in developing countries. One such study developed a standardized protocol for the assessment of health-related welfare indicators for working equines, as well as

taking an evidence-based approach to determining the effectiveness of future welfare interventions (Pritchard et al., 2005). Another used indirect health evidence derived from interviews with animal owners, and comparisons of 'treatment' and 'no treatment' control populations, to determine the effectiveness of strategic veterinary interventions in improving the welfare of donkeys in Ethiopia (Martin Curran et al., 2005). Comparable, though less comprehensive, health assessments have also been employed to evaluate welfare in dairy cattle (Whay, 2002), pigs (Leeb et al., 2001), dogs (Patronek, 1998), and broiler chickens (Kestin at al., 1992); and are a frequent component of on-farm quality assurance assessments and audits of 'humane' or 'welfare-friendly' production systems (Main et al., 2003; Rousing et al., 2001; Whay et al., 2003). Such assessments also tend to make use of health and production records as measures of on-farm welfare, although the reliability of such records as sources of evidence may be questionable in some cases.

2.2. Productivity: As with health, the use of productivity (e.g. growth rates, reproductive fertility and fecundity) as a welfare indicator has the potential advantage of appealing directly to the interests of animal users and producers. It is important to emphasize, however, that high productivity is not necessarily always indicative of acceptable levels of welfare. In some intensive farming systems, for example, severe welfare problems among individual animals may coexist with exceptionally high levels of farm productivity (McInerney, 2004). A further limitation of this method is its lack of immediacy, since changes in growth and reproductive parameters tend to take time to assess in the absence of detailed, long-term records.

Probably the best-known examples of the use of animal productivity as a welfare indicator come from a series of studies that demonstrated that rough handling during routine husbandry procedures significantly retarded growth rates, pregnancy rates, and sexual development in young pigs (Hemsworth, 2003; Hemsworth et al., 1986; see also Waiblinger et al., 2006 for reviews). Productivity indicators are most likely to be valuable for measuring progress in animal welfare in situations, such as commercial farms, laboratories or zoos, where systematic records of production traits are reliably maintained. However, informal interviews with animal owners and users may also yield useful information relevant to welfare in some circumstances (Martin Curran et al., 2005).

2.3. Behavior: Behavioral indicators are widely used in the assessment of animal welfare on the assumption that an animal's behavior provides an immediate reflection of its internal emotional and/or motivational state. The most basic types of behavioral evaluation generally focus on characteristics of posture, demeanor, or locomotion that are symptomatic of underlying pain or morbidity. For example, Kestin et al. (1992) assessed the prevalence of leg weakness (a symptom of degenerative joint disease) in different strains of broiler chickens by subjectively scoring levels of behavioral abnormality in their gait. Similarly, Moloney & Kent (1997) used differences in standing and lying body postures in lambs to assess the levels of pain associated with different methods of castration. Simple measures of behavior, such as 'flight' distance, approach distance, or irritability/aggression, are also widely used as indicators of rough or inappropriate handling on farms or in other contexts in which domestic and captive animals are in regular contact with humans (Breuer et al., 2003; Hemsworth et al., 1994; Pritchard et al., 2005), although some authors have questioned the reliability and validity of such assessments (de Pasillé & Rushen, 2005). Most such studies attempt to score behavior using objective criteria and trained observers. However, some scientists argue that even subjective behavioral evaluations by relatively unskilled observers can provide the basis for reliable and valid welfare assessments, particularly in combination with other measures (Wemelsfelder et al., 2000; Wemelsfelder et al., 2001; Wemelsfelder & Lawrence, 2001). Whether subjective evaluations of animal welfare of this type will ever carry the same evidentiary weight as more objective measures remains to be established. Recently, there have also been calls for greater emphasis on behavioral indicators of *positive*, as opposed to purely *negative*, emotional states in animals. Behaviors such as play, social affiliation, and allogrooming are all potential markers of general well being in mammals that tend to disappear from the repertoire when welfare is poor (Boissy et al., 2007).

The inability to perform normal or 'natural' behavior due to physical or social constraints, such as close confinement or lack of access to particular resources, is often taken as an indicator of poor welfare on the grounds that animals are likely to suffer if deprived of the opportunity to perform most natural behavior (Farm Animal Welfare Council, 1992). The use of behavioral deficits as welfare measures is, however, somewhat controversial. For instance, the loss of some 'natural' behavior, such as escaping from predators, is unlikely to be a source of distress or frustration to most animals. So, in the absence of information concerning how strongly an animal is motivated to perform a particular behavior (see below), it is probably erroneous to assume that

'natural' is necessarily always desirable, or that an animal needs to be able to perform all of the behavior in its repertoire in order to enjoy an acceptable level of welfare (Dawkins, 1998, Spinka, 2006). On the other hand, when an animal is so restricted that it is unable to perform most of its behavioral repertoire, its welfare is certainly likely to be at risk (Baxter, 1994), and it should in theory be possible to quantify the extent of such restrictions (see below).

The use of stereotypic behavior (i.e. repetitive, invariant, and seemingly functionless actions and activities) as a welfare indicator is also controversial, primarily due to a number of studies that found that individual animals exhibiting high levels of stereotypies were sometimes experiencing better welfare—based on other indicators—than those that did not. There are a number of possible explanations for these apparent anomalies including the idea that the performance of stereotypies may represent a behavioral coping strategy that helps the animal to deal with restrictive or stressful housing conditions. In light of such findings, the current consensus among experts is that the performance of stereotypic behavior by animals should always be taken seriously as a warning sign of potential suffering, but that it should never be used as the sole measure of welfare (see review in Mason & Latham, 2004). Hansen et al. (2007) provide a good example of this approach in a study of the effects of increasing cage size *versus* the provision of enrichment materials on the welfare of farmed mink. The results showed that doubling the cage size had little of no effect on behavioral indicators of welfare or on glucocorticoid secretion, whereas mink in the enriched cages showed fewer movement stereotypies, less tail-chewing behavior, and reduced levels of fecal cortisol, indicating improved welfare.

Behavioral measures are also valuable for answering questions about what animals do and don't like or want (Dawkins, 2003). Such approaches may consist of simple preference tests in which animals are allowed to choose between two (or more) alternative resources—e.g. straw bedding *versus* concrete floors (Fraser, 1985)—or more sophisticated experiments in which animals have to perform work or overcome conditioned aversion in order to gain access to something they want. Rushen (1990), for example, demonstrated that sheep find certain shearing practices (i.e. electro-immobilization) more aversive than others by showing that these animals were far more reluctant to walk toward the site where they were previously sheared in order to gain access to food. Likewise, Mason et al. (2001) were able to show that farmed mink will work hard by pushing open extremely heavy barriers to gain access to water to swim in. Another

approach has been to measure levels of anticipatory behavior; behavior that animals tend to perform in expectation of the arrival of rewarding or aversive stimuli (Spruijt et al., 2001). The great advantage of such approaches is that they provide a means of quantifying how highly an animal values a particular behavior or resource or, conversely, how much it fears or dislikes a particular handling or husbandry procedure. Most recently, economic theories have been applied to preference testing in such a way that an animal's desire for access to particular resources (e.g. a larger cage, or social partners) is calibrated against a competing resource of known value (e.g. access to food after a specified period of food deprivation). Such studies generate so-called 'demand curves' that are believed to reflect how much an animal would be expected to suffer if it were deprived of a particular resource or the opportunity to engage in a particular behavior (Dawkins, 1983, 1990; Houston, 1997; Matthews & Ladewig, 1994; Cooper, 2004). Unfortunately, because they were developed primarily to assess animal's likes and dislikes rather than their welfare 'state', such approaches are unlikely to be useful as measures of progress.

Finally, behavior has also been used as a means of accessing animals' internal emotional states via their performance on cognitive tasks. Carey & Fry (1995), for example, trained pigs to perform different operant tasks when they were under the influence of an anxiogenic drug (a drug that induces anxiety) *versus* when they were not. Subsequently, these pigs performed the drug-associated task spontaneously in various anxiety-provoking situations but without the drug, suggesting that they had some conscious awareness of their own anxiety state. More recently, Harding at el. (2004) designed experiments to measure 'pessimistic response biases' as possible indicators of negative emotional states in rats subjected to unpredictable, and therefore stressful, housing conditions. Human studies had previously shown that anxious and depressed people tend to be pessimistic—i.e. make negative judgments about events, and interpret ambiguous stimuli unfavorably. The stressed rats in this experiment showed similar cognitive biases, implying that the housing conditions had induced a depression-like emotional state in the animals. Although valuable as a guide to how animal's may be feeling in a particular context, such approaches are unlikely to be applicable to the long-term measurement of progress in animal welfare because the experimental protocols require the animals to be pre-trained.

2.4. Physiology: A considerable variety of physiological indicators have been used to assess the welfare of animals. Short-term physiological responses include elevated or variable heart and

respiratory rates, body temperature increases, adrenalin and corticosteroid secretion in blood and saliva, and plasma levels of glucose, lactate or acute phase proteins, all of which may indicate changes in welfare status. Longer-term measures of welfare also include such indicators as elevated urinary, fecal and/or hair cortisol, adrenal gland enlargement, or suppressed IgA secretion and immune function (Accorsi et al., 2007; Boissy et al., 2007; Broom & Fraser, 2007; Dawkins, 2003; Geers et al., 2003). All such measures present difficulties of interpretation since none is exclusively a symptom of poor welfare. Depending on the context, for example, elevated glococorticoid secretion might indicate a classic "stress" response, a response to harmless physical exertion, a response to a pleasurable activity such as mating, or even the result of normal diurnal fluctuations in adrenal activity (Dawkins, 1998). For this reason, most animal welfare scientists argue that physiological indicators are only useful in combination with other evidence (Broom & Fraser, 2007; Barnett & Hemsworth, 1990; Dawkins, 2003; Rushen, 1991). With respect to the measurement of progress in animal welfare, physiological indicators may have an increasingly important role to play as before-and-after assessment tools. Until recently, the collection, storage and analysis of physiological samples was too expensive and labor intensive to be worthwhile outside of university facilities. However, the development of standardized, low-cost assay kits for most physiological markers is now making the process a great deal easier and more accessible. Although still at an experimental stage of development, levels of hair/fur and feather glucocorticoids seem to provide a new and potentially valuable, non-invasive measure of chronic stress in mammals and birds that may prove particularly useful for the assessment of progress in animal welfare (Accorsi et al., 2007).

3. Environmental factors affecting animal welfare.

Following the widespread adoption of intensive farming systems in the postwar period, it has been recognized that environmental factors, such as confined and restrictive housing conditions, can have an adverse impact on animal welfare (Fraser, 2001). For the purposes of this review, the term 'environmental factors' refers to any aspect of an animal's immediate environment that is known or believed to affect its welfare. Depending on the species of animal and its circumstances, these environmental factors might include aspects of housing or living area (e.g. space availability; stocking density; floor and air quality; access to suitable food, water, shelter, bedding, and enrichment materials; general hygiene; ambient temperature and noise levels;

obvious physical hazards, etc.), and the quality and quantity of the animal's interactions with other animals and with humans (e.g. degree of social isolation or affiliation; frequency of fighting or 'bullying' by conspecifics or positive interactions such as play or allogrooming; gentle *versus* rough or abusive handling by humans, and the frequency of such interactions; and access to veterinary care). In theory, all of these kinds of environmental variables can be assessed, and used as indirect measures of progress or improvement in animal welfare.

Currently, the majority of on-farm quality assurance and welfare assessment programs in Europe and North America place heavy emphasis on environmental factors affecting welfare, although there is widespread disagreement among experts regarding the validity of these assessments—particularly those involving aspects of housing—when conducted in the absence of confirmatory measures of behavior and/or physiology (Bartussek, 1999; Edwards, 2007; Main et al., 2003; Ofner et al., 2003; de Pasillé & Rushen, 2005; Whay et al., 2003). As with animal welfare assessments in general, the main difficulty lies in deciding how to weight different environmental variables in terms of their impact on welfare since research results are often contradictory or confusing in this regard (Appleby, 1999; Dawkins, 1998; Edwards, 2007). In contrast, large numbers of studies have now confirmed that poor stockmanship or animal husbandry involving rough or aversive handling of animals has adverse effects on their welfare, while gentle handling has the opposite effect (Boivin et al., 2003; Hemsworth, 2003; Rennie et al., 2003; Rushen et al., 1999; Waiblinger et al., 2006). Such findings argue in favor of including some form of assessment of this aspect of husbandry as a welfare measurement tool whenever possible.

4. Human dimensions of animal welfare

Sustained progress in animal welfare cannot occur in the absence of changes in human values, attitudes, and behavior toward animals (Lockwood, 2005). In terms of validity, it is preferable to measure or monitor changes in human behavior toward animals or animal-related products or activities, either directly through observation of human-animal interactions (e.g. Coleman et al., 1998), or via market research reports on trends in consumer spending (e.g. sales of hunting permits or free-range eggs, expenditure on veterinary care for companion animals, and so on) (Fearing & Matheny, 2007). Where this kind of behavioral information is either unavailable or inaccessible, it is necessary to rely on less accurate but more easily measured correlates of

behavior, such as attitudes, opinions and values. The extent to which people's professed attitudes predict their actual behavior is the subject of considerable debate in the psychological literature. Recent meta-analyses of the results of many studies found average correlations of between 0.41 and 0.52 between people's attitudes and their behavior on various issues, although the strength of these associations depended greatly on a variety of external and experiential factors. In other words, attitudes tend to predict some behaviors better than others (Wallace et al., 2005; Glasman & Albarracín, 2006).

Despite the vast literature on human attitude psychology, and a growing body of research on attitudes to the environment and environmental issues, surprisingly little attitude research has focused specifically on animals or on animal welfare (Serpell, 2004). Human attitudes to animals are, nevertheless, of critical concern to the field of animal protection. At the societal level, changes in people's attitudes and opinions are usually the driving force behind improvements in animal-related legislation and public policy (Kirkwood & Hubrecht, 2001; Lockwood, 2005). More direct connections between human attitudes and animal welfare have also been demonstrated. For instance, people's willingness to support the conservation of endangered wildlife depends markedly on their attitudinal responses to the particular species involved (Bandara & Tisdell, 2002; Kontoleon & Swanson, 2003; Martín-López et al., 2007). Likewise, in a series of studies conducted on swine and dairy farms in Australia, researchers demonstrated that stockpersons with negative attitudes towards pigs or cattle tended to handle them more roughly and aggressively than those with more positive attitudes. This in turn had a negative impact on the behavior and welfare of the animals, making them more fearful of humans in general, and significantly reducing their commercial productivity (Coleman et al., 1998; Hemsworth et al., 1986; Hemsworth & Coleman, 1998; Hemsworth, 2003). Significantly, they also found that this vicious cycle could be reversed. Exposing stockpersons to a period of 'cognitive-behavioral' training not only changed their attitudes and behavior but also had a positive knock-on effect on the animals by reducing their fear of humans. Such findings suggest that abundant opportunities exist to improve the welfare of animals by changing people's animal-related attitudes and values. Such efforts, however, will require the development of reliable instruments to measure attitudinal change.

4.1. Measuring attitudes to animals and their welfare:

The standard instrument of attitude measurement is the questionnaire survey. The development of valid and reliable attitude surveys is a somewhat laborious process. Typically, open-ended interviews or focus groups involving various stakeholders are used initially to identify the main attitude domains or constructs, and as the basis for generating an initial set of questionnaire items to explore these constructs. This initial, and sometimes very large, questionnaire is then pre-tested on a sample of participants, and the results subjected to exploratory factor analysis (Tabachnick & Fidell, 2001) to identify subsets of closely related items (usually known as 'factors' or 'subscales'), and to reduce the overall number of items in the questionnaire to a manageable level. Ideally, the factors are then tested for both internal and external reliability and validity before being distributed to a random sample of the population of interest (DeVellis, 2003). Attitude survey items take a variety of forms. The majority consists of attitude statements about the object or issue of concern (e.g. "I like walruses" or "walrus hunting should be banned"), and participants are asked to express their level of agreement or disagreement with these statements on Likert rating scales (e.g. agree strongly, agree, neither agree nor disagree, disagree, disagree strongly). For evaluating purely affective responses, some surveys have made use of so-called 'semantic differential' ratings (e.g. good—bad, clean—dirty, etc.) as a method of assessing attitudes to particular categories of animals (Poresky et al., 1988), while problems of variable literacy among respondents have sometimes been addressed by asking participants to respond to images or photographs of either animals or situations involving animals without requiring them to read or interpret written text (e.g. Martín-López et al., 2007).

In addition to taking different forms, existing animal attitude surveys are designed for a wide variety of different purposes. Many focus on attitudes and/or behavior toward specific kinds of animals—e.g. companion animals (Guymer et al., 2001; Munsell et al., 2004; Poresky et al., 1988; Thompson & Gullone, 2003a; Wilson et al., 1987), farm animals (Coleman et al., 1998), wildlife (Dayer et al., 2007; Teel et al., 2007), or particular species (Barney et al., 2005). Others are mainly concerned with assessing how much people value or approve of various animal-related activities—e.g. whaling (Hamazaki & Tanno, 2001), farming (Eurobarometer Survey, 2005), wildlife hunting (Butler et al., 2003), the use of animals in research (Franklin et al., 2001; Pifer et al., 1994), euthanasia of pets (Kogure & Yamazaki, 1990), or the exploitation of animals in general (Bowd, 1984; Henry, 2004; Herzog et al., 1991; Hills, 1993, 1995; Kellert & Berry,

1980). Distinguishing between attitudes to animals *per se*, and attitudes to specific animal-related activities is probably important since the two are not necessarily always concordant. A person who approves of deer hunting, for example, may not have a negative or indifferent attitude to deer, while conversely, someone who strongly opposes cock-fighting on ethical grounds may feel little affection for chickens or birds in general.

The vast majority of animal attitude surveys were developed in Europe or North America, and few have been tested or used outside of their countries of origin. Translations of some American surveys have been used to explore cross-cultural variation in attitudes to animals: Modified versions of Kellert & Berry's (1980) methodology were used to explore variation in wildlife attitudes in Botswana, Costa Rica, Germany, Japan and Norway with varying degrees of success (Bjerke et al., 1998; Drews, 2003; Kellert, 1993; Mordi, 1991), and an adaptation of the 'Pet Attitude Scale' (Templer et al., 1981) was employed successfully in a comparative study of British and Japanese university students' attitudes to companion animals (Miura et al., 2002). Recent cross-cultural studies of environmental attitudes suggest that well designed attitude surveys that tap into basic emotional and empathic responses to animals and nature can be applied successfully across different human cultures (Schultz et al., 2005; DeGroot & Steg, 2007).

4.2. Factors influencing human attitudes to animals and their welfare.

The results of these various animal attitude surveys have demonstrated that a considerable number of different factors influence people's attitudes to animals. For clarity and convenience, they are grouped here into four categories: animal attributes; individual human attributes; knowledge, education and experience; and worldviews.

4.2.1 Animal attributes: Animal's intrinsic attributes are known to affect how people respond to them. In particular, animals that are close phylogenetically to humans—e.g. apes, monkeys—or that are physically, behaviorally or cognitively similar to them—e.g. penguins, dogs, dolphins, charismatic megafauna—tend to evoke greater empathy and concern for their welfare than those that are phylogenetically distant or dissimilar—e.g. reptiles, fish, invertebrates (Burghardt & Herzog, 1989; Driscoll, 1992; Eddy et al., 1993; Gunnthorsdottir, 2001; Kellert, 1993; Kellert & Berry 1980; Kirkwood & Hubrecht, 2001; Knight, 2008; Nakajima et al., 2002; Plous, 1993).

Animals perceived as 'cute', beautiful, or otherwise aesthetically appealing or admirable also tend to be preferred (Burghardt & Herzog 1989; Glickman 1995; Gould 1979; Gunnthorsdottir, 2001; Herzog & Burghardt, 1988; Kellert, 1983; Kellert & Berry, 1980; Lawrence, 1989; Myers, 2002; Serpell, 1996, 2002), as are those that are regarded as especially vulnerable in some way—rare, fragile, sensitive, and so on (Gunnthorsdottir, 2001). In the case of potentially dangerous animals, simple proximity may have an effect on people's attitudes. In a study of public attitudes to wolves in Sweden, for instance, the strongest predictor of attitudes was the distance the person lived from the nearest wolf territory—the greater the distance, the more positive the attitudes (Karlsson & Sjöström, 2007). Human emotional responses to these intrinsic characteristics of animals are generally immediate and spontaneous, and are often assumed in the literature to be the result of biological predispositions (Kellert, 1993; Serpell, 1996; Wilson, 1984).

In general, instrumental attributes do not reliably predict attitudes to animals. Useful or beneficial animals are sometimes regarded more positively than those perceived as useless or detrimental—compare, for example, attitudes to honey bees and cockroaches—but there are many exceptions to the rule (Herzog & Burghardt, 1988; Kellert 1980; Serpell 1996). Despite being the mainstay of biomedical research, for instance, laboratory mice and rats evoke relatively little affection or concern, and in the USA are exempt from protection under federal animal welfare laws that apply to all other mammals (Rowan & Loew, 2001). At the opposite end of the spectrum, overabundant white-tailed deer (*Odocoileus virginianus*) in the eastern United States are economically and environmentally damaging, and pose significant health and traffic hazards. Yet public affection for these animals often protects them from lethal control measures (Dizard, 2003).

These findings suggest that while both affective and instrumental or utility concerns may play a part in influencing human attitudes to animals and their well being, measures designed to assess progress in animal welfare should probably give greater emphasis or weight to people's emotional and empathic responses to animals and animal-related issues.

4.2.2 Individual human attributes: Even when considering people's views of a single animal species, it is clear that there are large individual differences in human attitudes that are independent or semi-independent of the animal's intrinsic attributes (Kellert & Berry, 1980). A growing body of literature has begun to document the sources of these individual differences in

people's attitudes to animals and their welfare. By far the most important factor to emerge from multiple studies is the effect of gender. Women and girls tend to display stronger affective responses to animals and to be more concerned about animal welfare than men and boys. Young adults contrast similarly with seniors, although this is probably an age-cohort rather than a maturational effect (Bowd & Bowd, 1989; Burghardt & Herzog, 1989; Driscoll, 1992; Herzog, 2000; Herzog et al., 1991; Hills 1993; Kellert & Berry, 1980; Pifer et al., 1994; Serpell, 2004, 2005; Wells & Hepper, 1995; Bjerke et al. 1998; Galvin & Herzog 1998; Kruse, 1999; Paul, 2000; Nakajima et al., 2002). Higher levels of education also tend predict more positive regard for animals (Kellert & Berry, 1980), as does income and urban *versus* rural residence (Kellert & Berry, 1980; Bjerke et al. 1998; Reading et al., 1999), although such effects may not be consistent across cultures (e.g. Shuxian et al., 2005). Religiosity (i.e. both religious fundamentalism/conservatism and frequency of attendance at religious services) has been linked to more materialistic and less affectionate attitudes to animals, although most such studies have focused exclusively on Western religions (Bowd & Bowd, 1989; Driscoll, 1992; Kellert & Berry, 1980). At least two studies have found evidence of more caring or empathic responses to animals among "intuitive/feeling" and "sensitive/imaginative" personality types compared with their opposites (Broida et al., 1993; Matthews & Herzog 1997). These associations may, however, be confounded by the fact that these personality types also tend to be more prevalent among women (Matthews & Herzog 1997). More recently, Taylor & Signal (2005) found that high scores on a human empathy scale were associated with greater concern for the welfare of animals in women but not in men; while Herzog & Golden (2008) have detected a positive correlation between 'disgust sensitivity' and opposition to animal exploitation among a sample of American adults.

Some authors have invoked the concept of 'biophilia' to explain people's attitudes to animals. The 'Biophilia Hypothesis', first outlined by Wilson (1984), postulates the existence of a biological predisposition to attend to, and be attracted by, the activities of animals and other living things that modern humans have supposedly inherited from their hunter-gatherer ancestors (Kellert 1993). Although empirical support for the existence of this biophilic predisposition is still very limited (Kahn, 1997), it is nonetheless an intriguing idea that may help to explain at least some of the observed variation in people's attitudes to, and behavior toward, animals.

As Herzog & Burghardt (1988) have emphasized, individual attitudes to animals tend to be highly idiosyncratic, and none of the human attributes described above appears to account for

more than a relatively small proportion of the variance in overall attitudes (Driscoll, 1992; Herzog et al., 1991). In addition, the direction of the effects of these individual characteristics on attitudes is to some extent culturally determined. For example, while female gender has been found to predict greater affection for animals in Europe and North America (Herzog, 2007), studies in some non-Western countries (e.g. Kuwait, Sri Lanka, and Malawi) have yielded the opposite result with women generally displaying less positive attitudes to animals than men (Al-Fayez et al., 2003; Bandara & Tisdell, 2003; Morris, 1998).

4.2.3 Knowledge, education, and experience: The relationship between knowledge of animals, and people's attitudes and behavior towards them is complex. Kellert & Berry (1980) found that the least knowledgeable sectors of the American population tended to have predominantly negative or indifferent attitudes to animals that tended to focus on materialistic or instrumental considerations. Involvement in any kind of animal-related activity (including consumptive ones) was associated with higher knowledge scores, especially if these activities were recreational (e.g. bird-watching, hunting, fishing, etc.) rather than occupational (e.g. farming). Greater knowledge, however, isn't necessarily always associated with more positive attitudes. A study of attitudes to wolves among hunters and non-hunters in Sweden, for example, found that hunters had the most knowledge of wolves but also the most negative attitudes towards them (Ericsson & Heberlein, 2003). Knowledge of how animals are used for different purposes (e.g. biomedical research or intensive farming) can also provoke concern for their welfare, although in interviews many people will admit to avoiding such information for fear of finding the knowledge emotionally and ethically disturbing (Knight & Barnett, 2008).

Current engagement in non-consumptive, affectionate interactions with animals is generally associated with greater concern for their welfare (Hills 1993; Kellert & Berry, 1980; Reading et al., 1999; Kafer et al., 1992; Robertson et al., 2004; Serpell, 1996, 2004; Taylor & Signal, 2005). Similarly, early (childhood) exposure to affectionate/affilliative relationships with animals (especially pet keeping) appears to predispose people to develop greater concern for animal welfare later in life, while the opposite seems to apply to those exposed to consumptive, coercive or abusive childhood interactions with animals (Ascione, 1993; Bjerke et al., 2001; Henry, 2006; Miura et al. 2002; Paul 2000; Paul & Serpell, 1993; Serpell & Paul 1994; Tallichet & Hensley, 2005). Lockwood (2005) noted that the majority of animal protection supporters and activists are

either current or former pet owners, and has also demonstrated that survey respondents who obtained high scores on a 'Pet Lovers Index' questionnaire were also highly supportive of animal protection. In a study of veterinary students, Serpell (2005) found that childhood pet ownership not only predicted caring attitudes to animals in general but also professional choices regarding the types of animals students wished to work with in future. Such findings suggest that the experience of keeping pets, and the formation of social attachments with particular animals, promotes greater empathy for animals in general and more pronounced concern for their welfare (Myers, 2007; Robertson et al., 2004). One author even claims that affection for pets is the, "primary portal to compassion and concern about a wide array of animal protection issues" (Lockwood, 2005, p. 8). The results of these kinds of studies also point to the active suppression of affective/empathic responses to animals among animal-users or abusers, and/or to a more exclusive focus on instrumental or utility considerations among these groups (Ascione, 1993; Hills, 1995; Serpell, 1996). It is, however, extremely difficult to isolate the direct influence of animal exposure from the possible confounding effects of social pressures, and parental attitudes and modeling when interpreting such findings (Ascione 1993; Paul & Serpell 1993; Schenk et al. 1994).

The primary goal of humane education is to manipulate human perceptions of animals so as to improve attitudes and behavior towards them. Given that these kinds of educational interventions have been employed for well over a century, there have been surprisingly few successful attempts to evaluate their outcomes in terms of sustained improvements in animal-related attitudes and behavior (Ascione, 1992; Ascione & Weber, 1996; Coleman et al., 1998; Lindeman-Matthies, 2005; Paul, 2000; Thompson & Gullone, 2003b; Unti & DeRosa, 2003; Weng et al., 2006). As suggested by Ascione (1997) there is a considerable need to develop reliable and valid methods for evaluating humane education programs by measuring short- and long-term changes in attitudes and behavior toward animals. Ideally such methods would be designed to generalize across different species and different animal-related issues, and be readily adaptable to different cultural contexts.

4.2.4 Worldviews: For the purposes of this review, 'worldviews' can be defined as culturally-transmitted values, beliefs and norms that exert an influence on individual attitudes and behavior toward animals and the natural world (Myers & Russell, 2003). Substantial cross-cultural differences in attitudes to animals have been amply documented in the literature (Douglas, 1966;

Kellert, 1993b; Noske, 1997; Kellert, 1993b; Serpell 1995; Shuxian et al., 2005; Morris, 1998). Animals, both specifically and collectively, carry quantities of cultural and symbolic baggage that greatly influence how people regard them and treat them. These cultural factors include historical attitudes, religious and ideological beliefs and values, and various culture-defining practices.

Historical analyses of people's attitudes to animals suggest that, although attitudes change gradually over time, they may also persist long after they have ceased to be culturally or practically relevant. Modern attitudes sometimes reflect these historical legacies. For example, although the wolf (*Canis lupus*) has long since ceased to be a significant threat to human life and livelihood in most of the northern hemisphere, wolves—or at least the idea of wolves—still inspire negative attitudes for many people (Kellert, 1985; Ericsson & Haberlein, 2003). Religious and ideological beliefs and values may promote particular attitudes toward animals—both generally and specifically. The Judaeo-Christian worldview that animals were divinely created to serve human interests represents an example of a materialistic value orientation toward animals promoted by religious ideology (Serpell, 1996). The special sanctity of cows among Hindus in India, and the unclean, 'taboo' status of pigs among Islamic and Judaic cultures (Harris, 1978; Douglas, 1966), provide examples of religious effects on species-specific affective responses to animals.

Animals also acquire peculiar significance through their association with various culture-defining practices or rituals. The unusually positive status of bulls in Spain, for instance, derives from their central role in the definitively Spanish bullfight or *corrida*, and all the various social and cultural meanings embodied by this highly ritualized activity (Marvin, 1988). Similarly, modern Japanese reluctance to discontinue the practice of whaling, despite strong opposition from nonwhaling countries, is based on a centuries-old cultural tradition of eating whale meat (Hamazaki & Tanno, 2001). Unfortunately, foreign opposition to these culture-defining practices often provokes fiercely nationalistic sentiments that tend to reinforce the original attitudes and behavior (Shuxian et al., 2005).

Socio-cultural values and norms are continually reinforced by the ways in which animals are represented (or misrepresented) in art, language, literature, science, the media, and so on (Baker, 1993). The symbolic and metaphorical potency of animals as exemplars of human attributes and

behavior has long been recognized by social scientists (Douglas, 1966; Leach, 1964; Levi-Strauss, 1966), and there can be little doubt that they continue to exert powerful effects on the ways in which people think about animals and their exploitation. The extensive use of animals in product advertising exemplifies this phenomenon. Even the language used to describe animals tends to reinforce culturally constructed roles (Dunayer, 1997). Classifying cows, pigs and poultry as 'food animals' or 'production animals', for instance, inevitably constrains people to thinking about them from an instrumental perspective. Monitoring changes in these kinds of cultural representation of animals may provide another method of measuring progress in animal welfare (Lockwood, 2005).

Our understanding of the socio-cultural origins of cruelty and kindness to animals would benefit greatly from well-designed cross-cultural studies of animal-related attitudes, beliefs and values. The development of appropriate methods to access this kind of information from people of widely different linguistic, educational and cultural backgrounds represents a significant challenge but, judging from recent work by environmental psychologists (e.g. Schultz et al., 2003; DeGroot & Steg, 2005), it is an achievable goal that would amply repay the effort involved. The development of a set of standardized instruments for measuring attitudes to animals and animal-related issues cross-culturally would also provide valuable tools for monitoring local, national, and global progress in animal welfare.

5. Conclusions and Recommendations

Animal protection and welfare organizations have an obligation, both to animals and their supporters, to make efficient and effective use of their limited resources. Ensuring that these resources are deployed appropriately to bring about significant and sustained improvements in animal welfare requires an empirical, evidence-based approach to evaluate overall progress in animal welfare, and to determine which policies and practices protect animals most effectively and when (Dawkins, 2006). There will always be animal welfare problems that require urgent rescue efforts, and in such cases crisis management, rather than evidence-based approaches, will inevitably be implemented. However, even in these cases, particular efforts could and should be made to carefully document the results of interventions, and to make this information freely available to other groups and agencies for future reference.

Evidence-based approaches require the use of reliable, valid, and culturally appropriate measurements both *before* and at intervals *after* a particular intervention is deployed. The importance of collecting baseline data cannot, therefore, be overemphasized. Ideally, any outcomes assessment of an animal welfare intervention should also incorporate at least one, and preferably several, 'control' groups—matching or equivalent samples or populations that are measured and monitored over the same period in the absence of the intervention (Ferraro & Pattanayak, 2006). To be practicable for use in potentially challenging 'field' situations, measurements relevant to the welfare of animals should also be relatively easy, inexpensive, and quick to perform, such that relatively non-specialized observers or raters can make valid and reliable assessments (Edwards, 2007). In most cases, they also need to be species-specific.

With respect to direct animal-based measures of welfare, the following indicators appear to offer the greatest promise:

- Obvious signs of poor health that can either be counted (e.g. numbers of lesions) or scored reasonably objectively and repeatably using standardized rating scales based on pre-defined criteria (e.g. degrees of lesion or lameness severity, degree of difficulty standing up or lying down, overall body condition, etc.).
- Reliable information on health and productivity, such as veterinary visits/interventions, mortality and morbidity, conception and birth rates, and other production measures. Animal owners may, in some cases, be able to provide relevant information of this sort, if questioned appropriately (e.g. see Martin Curran et al., 2005).
- Overt and quantifiable behavioral responses to standardized stimuli, such as approach by an unfamiliar person, sensitivity to being touched on various body parts, or exposure to novel objects or sounds. Again, animals' responses should be scored on standardized scales with clear definitions of what each score means.
- Presence and frequency of obvious stereotypic or other abnormal behavior.
- One or more physiological indicators of welfare (e.g. salivary IgA, fecal or hair glucocorticoids, etc.) when this information can be collected safely and easily without harming or distressing the animals. Although still at an experimental stage of development, levels of hair/fur and feather glucocorticoids appear to offer a potentially valuable, non-invasive measure of chronic stress in mammals and birds that would be likely to repay further investigation.

With the exception of health indicators, improvements in any one of these categories would not normally be considered reliable evidence of progress in animal welfare on its own, but most authorities would agree that positive changes or trends in two or more of these different measures (e.g. health, behavior, and physiology) would be indicative of progress. In the case of behavioral responses and physiological indicators, random and/or representative subsets of animals should be sampled rather than attempting to sample the target population as a whole.

Environmental parameters that are likely to affect animal welfare should also be included in before-and-after welfare assessments. These should broadly reflect the so-called "Five Freedoms" (FAWC, 1992) and include (depending on context) estimates or ratings of:

- Space available per animal.
- Availability, and frequency of access to, food, water and shelter.
- Ability to engage in 'high value' behavior patterns (e.g. dust-bathing in poultry, rooting in pigs, swimming in mink, etc.).
- General levels of environmental hygiene.
- Exposure to extreme temperatures or weather conditions.
- Exposure to fear-evoking situations.
- Obvious physical hazards likely to cause injury or death (e.g. unsafe housing or flooring, badly designed harnesses, excessively heavy loads, traffic, etc.).
- Prevalence of aggression or 'bullying' by other animals.
- Prevalence of rough or coercive handling or overt cruelty by humans (e.g. shouting, slapping, hitting, kicking, beating, prodding, etc.).

With respect to the human dimensions of animal welfare, changes in people's actual behavior toward animals or animal-based products and activities are likely to provide the most accurate and meaningful assessments of progress over time. These can sometimes be measured or monitored either directly through observation of human-animal interactions, or via published reports on trends in human activities (e.g. consumer surveys). Long-term behavioral trends can also be inferred by monitoring changes in the numbers of animals exploited in different contexts; the numbers of organizations and individuals involved in, or supportive of, animal protection; the amount of attention given to animals and animal-related issues in the media; and the

development of animal protection laws and regulations (e.g. Herzog et al., 2001; Lockwood, 2005; Rowan & Rosen, 2005; RSPCA, 2006).

When behavioral information is unavailable, or the focus is on shorter-term changes, it is often easier to measure people's attitudes and values since these tend to predict behavior to some extent. Unfortunately, few reliable and validated instruments currently exist that appear to be ideally equipped to measure change in animal-related attitudes and values over time, or across different populations and cultures. Those that do exist were developed originally with Western participants in mind, and would need to be adapted or modified to fit other cultural contexts (Bowd, 1984; Herzog et al., 1991; Kellert & Berry, 1980). There would be considerable advantages to developing new quantitative measures of animal-related attitudes and values, both as tools for evaluating the outcomes of educational interventions, and as methods of monitoring local, national, and global variation and progress in attitudes to animals and their welfare. Ideally, such measurement tools would need to include questions addressing respondents':

- Age, sex, income, educational level, urban/suburban/rural background, religious affiliation and religious observance.
- Current and childhood involvement with animals and animal-related activities (e.g. pet keeping, hunting, farming, fishing, etc.).
- Emotional and/or empathic responses to different categories of animals (e.g. food animals, draft animals, wild animals, companion animals, etc.).
- Perceptions of animals' instrumental, material, or 'utility' value.
- Approval/disapproval of various consumptive and non-consumptive uses of animals.
- Worldviews—i.e. culturally-transmitted values and beliefs pertaining to particular animals and animal uses.

In conclusion, animal welfare policies and practices should be justified by good scientific evidence that they actually work to reduce animal suffering. The development and adoption of valid, reliable, and standardized measures of progress in animal welfare represents an essential stage in the evolution of this evidence-based approach to animal protection. Since no single measurement on its own is likely to provide a reliable indicator of welfare improvement or change, the most successful and compelling evidence of progress will probably involve combinations of measures at the different levels of assessment—i.e. the animal, its environment,

and associated human attitudes and behavior. The choice of precisely which measures to include in any particular progress evaluation should be determined by considerations of feasibility given the circumstances ‘on the ground’ and the species of animals involved.

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