Why the Study of Animal Behavior Is Associated with the Animal Welfare Issue

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ABSTRACT: Of the various disciplines within the animal sciences, the issue of animal welfare has been most closely associated with ethology, the study of animal behavior. Prior to the modern welfare movement, applied ethology was primarily involved in studies on feeding and reproductive behavior. The emphasis on freedom of movement and mental experiences in animal welfare resulted in the field of applied ethology developing its current welfare interests. During the past 30 yr, applied ethology has been used to gather appropriate information to develop alternate management systems that accommodate normal behavior. The issue of behavioral needs has been addressed and research interest in motivation has developed. Preference tests have been used for their traditional role of improving comfort and have been modified to assess motivation as well. We have used abnormal behaviors as indicators of poor welfare and are shifting our emphasis to causative factors of these behaviors. The emotional states and cognitive abilities of animals have been studied but will become an increasingly important component of behavior research into animal welfare in the future.

Key Words: Animal Behavior, Animal Welfare

Introduction

Animal welfare is an issue that involves several scientific disciplines that are part of the "animal sciences." Perhaps the discipline that has been most closely associated with the welfare issue is the study of animal behavior, known as ethology. The term "applied ethology" is often used to designate the subdiscipline involved in studying the behavior of animals that are managed in some way by humans, whether they be on farms, in laboratories or zoos, or managed wildlife. Applied ethology involving agricultural species has become so closely associated with the scientific study of animal welfare that some use the terms behavior, ethology and welfare as virtual synonyms. Such was not always the case. The first major book on the behavior of domestic animals (Hafez, 1962), contained over 600 pages of information, indicating that the discipline was based on a large volume of knowledge. However, the terms "welfare" or "well-being" did not appear in either the first or second editions of the book (Hafez, 1969). The initial thrust of applied ethology was not related to animal welfare, but rather to production.

Identification of Ethology as Relevant to Welfare

This paper examines why ethology and the animal welfare issue became and remain so closely associated. The approach will be to discuss three aspects of this association. These are 1) the identification of ethology as a discipline relevant to animal welfare concerns, 2) the rationale for ethological studies on animal welfare, and 3) the future role of ethology in resolving animal welfare concerns.

Identification of Ethology as Relevant to Welfare

It is generally acknowledged that the publication of Animal Machines (Harrison, 1964) played a pivotal role in the beginning of the modern animal welfare movement. Harrison was critical of the intensive animal production practices that had become increasingly common after the second world war, particularly the use of battery cages for hens, crates for veal calves, and large-scale broiler production. Her concerns included not only the welfare of the animals but also the use of drugs in animal production, the quality of animal products, and the esthetics of modern farming. Relatively little discussion of animal behavior was included in the book. She did consult with Lorenz, who later was awarded a Nobel prize for his work in ethology, on two issues. The first point, which Lorenz answered in the negative, was whether chickens
experienced an anticipation and fear of death in poultry processing plants. Lorenz did indicate, in response to the second question, that social behavior would affect the productivity of broilers in large groups. Other references to behavior in the book included vices such as feather pecking and cannibalism in poultry and excessive licking in calves, and the thwarting of instinct in terms of neonatal behavior, food selection, boredom, dunging patterns, and sleep cycles. Harrison aroused the public’s concern for agricultural animals through her implication that animals are viewed as machines, in a similar way that anti-vivisection groups formed in response to Descartes’s reference to animals as automata.

In response to Harrison’s book, the British government appointed a technical committee composed of two veterinarians, four agriculturalists, a surgeon, and two zoologists to enquire into the welfare of intensively farmed animals. One of the zoologists was an ethologist, W. H. Thorpe, well known for his work on bird song, and the other, F.W.R. Brambell, chaired the group that is often referred to as the Brambell Committee (Command Paper 2836, 1965). The committee accepted that animals can experience pain, suffering, and stress and such emotions as rage, fear, apprehension, frustration, and pleasure. It is not surprising, then, that the report’s widely cited statement on welfare refers to “both physical and mental well-being,” and that evaluation of animal welfare must include “scientific evidence available concerning the feelings of the animals that can be derived from their structure and functions and also from their behaviour.” In addition to an emphasis on animals’ feelings, the report stressed freedom of movement, in what became known as the “Five Freedoms”: “An animal should at least have sufficient freedom of movement to be able without difficulty, to turn around, groom itself, get up, lie down and stretch its limbs.” The committee identified the study of animal behavior as critical to the animal welfare issue, and one that had not attracted the attention it deserved. The report of the Brambell Committee, more than any other document, identified ethology as relevant to the issues of the modern animal welfare movement.

The report of the Brambell Committee was frequently cited in terms of freedom of movement and the mental well-being of agricultural animals. Many other aspects of welfare discussed in the report were often overlooked. The government did act on one recommendation of the committee, and that was to appoint a standing advisory committee on animal welfare. The Farm Animal Welfare Committee (FAWC) of the United Kingdom continues to function and make recommendations to the government. The FAWC published what are known as the “New Five Freedoms,” perhaps to correct an imbalance in the reporting of the Brambell Committee’s suggestions. These freedoms, as recently revised (FAWC, 1993), are as follows:

1. Freedom from thirst, hunger and malnutrition by ready access to fresh water and a diet to maintain full health and vigor.
2. Freedom from discomfort by providing a suitable environment, including shelter and a comfortable resting area.
3. Freedom from pain, injury, and disease by prevention or rapid diagnosis and treatment.
4. Freedom to express normal behavior by providing sufficient space, proper facilities, and company of the animal’s own kind.
5. Freedom from fear and distress by ensuring conditions that avoid mental suffering.

In commenting on these freedoms, Stookey (1992) points out that freedoms 1–3 have traditionally been accepted and addressed by agriculturists, but that the latter two freedoms reflect the current concerns raised by society at large. Webster (1993) divides the freedoms into production traits (1–3) and ethological issues (4–5). This latter division emphasizes that ethology is critical to addressing the concerns of the modern welfare movement.

Within months of the publication of the Brambell Committee’s report, the Society for Veterinary Ethology, currently the International Society for Applied Ethology, was formed. The question of the relationship between ethology and animal welfare was raised by the first secretary of the society at the founding meeting (Fraser, 1980). The result was that one of the aims of the society was “to promote the exchange of information between veterinarians and between them and others concerned with the behaviour and well-being of animals” (Petherick and Duncan, 1991). Thus, a scientific society recognized that animal welfare should be addressed by applied ethologists.

Rationale for Past Ethological Studies

Having identified ethology as an important discipline related to animal welfare, agricultural research groups studying welfare began including measurements of behavior in their studies. However, few of the researchers in the 1960s and 1970s were actually trained in ethology. Even today, most departments of animal science do not have applied ethologists. As a result, the rationale of some research has been poorly understood. Although it is not possible to discuss all the themes in ethological studies on animal welfare in this paper, I will examine five that have received significant attention. The studies mentioned were chosen because they illustrate a particular approach or philosophy, even though the results may not have been definitive or necessarily supportive of the original hypotheses.

Accommodating Normal Behavior

The FAWC’s fourth freedom states that animals should be able to express their normal behavior
patterns. One interpretation of this freedom is represented by Kilgour (1978), who suggested, using terminology of McBride (1969; cited by Kilgour, 1978), that we fit farms to animals, not animals to farms. By designing our farms to accommodate normal behavior, we should prevent or minimize distressful situations. Such an approach may seem obvious, but Kilgour suggests that farms have been designed to accommodate humans or economic considerations and not the behavior of the animals that have been forced to live on them. Ewbank (1988) suggests that providing for normal behavior is a means of ensuring that animals have a reasonable opportunity to maintain adequate welfare. This approach can be summarized as follows: in general, animals that can perform normal behavior are more likely to achieve better welfare than those that cannot.

If normal behavior should be accommodated in production settings, then we need to know what normal behavior is for each species. This is the basis of studies that develop ethograms of our livestock (Banks, 1982). These studies have usually been conducted in seminatural environments to ensure that animals have the opportunity to respond to a wide variety of environmental features and to aid in the interpretation of the behaviors observed. Three major efforts of this nature have been conducted with pigs. Feral pigs were studied on an island off the Georgia coast by Graves (1984). Stolba and Wood-Gush (1989) observed groups of pigs in a park near Edinburgh, and Jensen (1986) reported on pigs kept in a wooded area in Sweden. A common misperception of these studies has been that the purpose was to raise pigs commercially in seminatural conditions. Jensen (1991) states that the studies are part of the information gathering step in the scientific method and form the basis for developing hypotheses, which must then be tested before they are applied to animal production in more conventional surroundings.

All these studies have provided information used in designing new housing and management systems for pigs. Graves (1984) reported that sows formed groups of three to six adults with their offspring. A group of similar size was selected for an alternative group housing system for sows (Morris and Hurnik, 1990). Stolba (1981) incorporated findings on social behavior into his “family pen” system that kept pigs with their dams until market. A new system developed in Sweden, which groups sows with their litters together approximately 10 d after farrowing (Högsved, 1990), was based on observations by Jensen (1986). Whether these systems will eventually replace current production methods remains to be seen, but the approach of designing management around behavior is moving forward.

Clearly successful, but less dramatic, examples of this approach are available. Taylor (1990) studied the movements of sows while they were eating and designed a feeder that provided the space envelope necessary for these movements. As a result, sow feeder design has changed dramatically throughout the industry in the past few years. Space envelopes have also been developed for free stalls for dairy cattle and gestation stalls for sows. The former have been adopted by the industry and the latter are currently being investigated.

**Behavioral Needs**

The first approach to accommodating normal behavior is very general and does not consider any specific behaviors as being essential. That is, the goal is to accommodate as many behaviors as possible, but none is considered more important than others. However, a second approach to accommodating behavior considers the possibility that certain behaviors are essential. The concept of a behavioral need is separate from that of a physical need, in that it is the performance of the behavior that is critical, not its physical consequences. Motivation is a critical part of this issue; thwarting a motivation is seen as a means of causing psychological suffering. Dawkins (1983, 1988) and Dellmeier (1989) have addressed the concept of behavioral needs and their importance to the welfare issue.

The concept of behavioral needs has been controversial, partly because ethology was developing new models of motivation at the time that welfare became an issue. Wood-Gush (1973) discussed the conflict of the traditional Lorenzian model, which emphasized internal sources of motivation, and newer models with greater emphasis on external sources. Hughes (1980) suggested that behaviors that are primarily internally motivated are of critical importance in animal welfare, whereas those that are externally motivated are less likely to be considered essential. Jensen (1993) has recently addressed the issue and believes that the source of motivation is less critical than the strength of the motivation. However, most research on motivation has emphasized internal sources, and the increase in motivation if the opportunity to perform the behavior is unavailable. Vestergaard (1980) has studied dust bathing in hens using deprivation or control of early experience. Dellmeier et al. (1985) studied calves in veal crates as a model for deprivation of general movement. Both studies concluded that motivation for these behaviors increased during deprivation. Jensen (1993) examined the prefarrowing behaviors of sows and suggested that they could be divided into those that are triggered by the external environment and those that are primarily under internal control.

The issue of behavioral needs is largely a question of motivation and the consequences of thwarting a highly motivated behavior. As we have seen, part of the research in this area has emphasized the source of the motivation, either internal or external factors.
Other research has addressed the response of animals if a particular behavior is prevented from occurring, in terms of increasing levels of motivation or performance of displaced behavior. Of critical importance is the measurement of motivation (Dawkins, 1983). This will be addressed in the next section of this paper.

Preference Tests

The Brambell Committee (Command Paper 2836, 1965) recommended that chicken wire, thin wire woven in a hexagonal pattern, not be used as flooring in cages for hens. They suggested that a thicker wire in a rectangular pattern would be more comfortable. This judgement was based on conjecture, rather than scientific evidence. This statement serves as an example of the problems of insufficient behavioral research. When a study was conducted, Hughes and Black (1973) concluded that chicken wire was probably more comfortable than the suggested alternative, because hens spent more time on the chicken wire than on other floors when given a choice among several. Hughes and Black (1973) used a preference test; this type of test has been widely used to study floors and lighting and thermal conditions to improve the comfort of animals.

The traditional preference test has allowed the animal to choose between two conditions, both of which are conducive to the same behavior. For example, animals have access to two floors, to determine which is preferred for lying on. Dawkins (1983) introduced two new concepts to the use of preference tests in welfare related research. The first is to examine motivation, as opposed to comfort. In such a test the animal is given access to two situations that are suitable for different behaviors. By giving hens access to food in one choice and dust in the other, the test determines which motivation, for feeding or dustbathing, is greater (Dawkins, 1983).

The second concept introduced by Dawkins is the measurement of the strength of a motivation (Dawkins, 1983). Using consumer demand theory, Dawkins argued that by increasing the cost of obtaining access to a condition in which a behavior was possible, we could measure the strength of the relevant motivation. Increasing the cost has often been accomplished by increasing the reinforcement ratio in operant conditioning studies. Matthews and Ladewig (1987) reported that pigs demonstrate a preference to be with other pigs and that they will work to obtain access to them. However, as the reinforcement ratio increased, pigs quickly ceased to work. The motivation to be with other pigs exists, but it is not very strong. Conversely, Hutson (1991) reported that sows fed typical gestation diets will continue to work for food at very high reinforcement ratios. The sows were highly motivated to eat, suggesting that their freedom from hunger was not being met.

Problem Behaviors and Indicators of Poor Welfare

Agriculture is a goal-oriented industry and we are encouraged to move our research quickly to a definitive stage. In the case of animal welfare, there is considerable interest in assessment, in determining whether welfare is good or poor. In terms of ethology, the interest has been in abnormal or deleterious behaviors that indicate that welfare is poor. Some examples of these behaviors are aggression, injurious behaviors such as feather pecking or tail biting, and stereotypies. However, assessment does not improve the welfare of animals unless it is accompanied by a determination and elimination of the causes. Unfortunately, many behaviors that are considered indicative of poor welfare have multiple causes, and the determination of causation has been the focus of much ethological research.

Aggression is one aspect of social behavior. By increasing our understanding of the social behavior of our domestic species, we might be able to reduce aggression through management. Studies such as those of McBride and James (1964), Meese and Ewbank (1973), and McGlone (1985) are examples of this approach involving pigs. Craig (1992) has studied aggression in hens in a similar manner. Other injurious behavior, such as feather pecking, tail biting, and the buller syndrome, have also been studied as social behaviors. All these behaviors may be indicative of other problems in the animals' environment. Frustration and discomfort may result in increased aggression. Lack of an enriching substrate, such as straw in the environment, may result in greater tailbiting (Fraser et al., 1991) or feather pecking (Blokhuis and Arkes, 1984). Applied ethologists working with companion animals recognize that aggression problems in dogs fall into several categories and must be diagnosed and treated appropriately (Borchelt and Voith, 1982). A similar diagnostic approach is needed in animal welfare research.

Stereotypies have been the subject of much applied ethological research. Cronin and Wiekema (1984) suggested that stereotypies were the result of restraint and began as attempts to escape. Boredom or lack of environmental enrichment have been considered possible causes. Duncan (1970) demonstrated that frustration could lead to stereotypes in chickens. Appleby and Lawrence (1987) reported that low feeding levels, typical for gestating sows, are a cause of stereotypes. Most recently, Lawrence and Terlouw (1993) developed a model for the development of stereotypies in sows that includes hunger (internal feeding motivation), external feeding cues, general arousal, and a barren environment as contributing factors.

Emotional States and Cognitive Abilities

The question of animal cognition is controversial. Emotions and cognitive abilities are said by some to be
outside the realm of scientific investigation and the result of anthropomorphism. The Brambell Committee (Command Paper 2836, 1965) stated that feelings (emotional states) must be considered when discussing animal welfare, but also indicated that the feelings of animals are likely to differ from those of humans. Nevertheless, the committee maintained that animals can experience such emotions as “rage, fear, apprehension, frustration and pleasure.” It has recently been argued that not only should animal feelings be included in considerations about welfare, but that welfare is entirely a question of the animal’s mental, psychological, and cognitive needs (Duncan and Petherick, 1991).

Studying the mental experiences of animals is not easy, but it can be accomplished by careful design. Bateson (1991) describes not only the importance, but also the methodology, of studying pain in animals. Pain associated with standard agricultural practices such as beak trimming (Duncan et al., 1989) and castration (McGlone et al., 1993) has been evaluated. We have also developed methods to study fear (Jones and Faure, 1981) and frustration (Duncan, 1970) in poultry. We have often attributed normal behavior to boredom in our animals, but the study of boredom itself is in its infancy (Wemelsfelder, 1991). In terms of cognitive abilities, Harrison (1964) suspected that chickens were able to anticipate death. It is appropriate that anticipation of future events by chickens, even if only related to feeding, is now the subject of research (Petherick and Waddington, 1991).

The Future of Ethology in Animal Welfare

Although a considerable knowledge base on farm animal behavior existed before the modern welfare movement began, much of the information was obtained from studies on nutrition and reproduction (Hafez, 1962). Few agricultural institutions had researchers trained or specializing in ethology. The International Society for Applied Ethology now has over 350 members, most of whom are interested in the welfare of agricultural animals. Duncan (1993) identified approximately 65 applied ethologists working with agricultural animals at institutions in the United States, Canada, the United Kingdom, Denmark, and The Netherlands. Again, most of these would be involved in welfare-related research. On a global basis, the number of applied ethologists is now sufficient to make significant contributions to improving animal welfare. However, the effort directed at resolving welfare problems remains disproportionately low, even among the well-developed agricultural countries listed above (Duncan, 1993).

In addition to having adequate expertise and personnel, countries must also include ethology in their long-term research plans if their efforts are to be effective. The FAWC continues to recommend ethological studies to the British government (FAWC, 1993). In Canada, an expert committee of the Ministry of Agriculture recommends that welfare and ethological research be maintained or expanded (Expert Committee, 1993). The recent Food Animal Integrated Research conference in the United States recommended animal well-being and behavior as an important part of future agricultural research with animals (FAIR, 1993). Assuming these recommendations are accepted and appropriate funding is provided, applied ethology should be maintained or expand in these countries.

The direction of welfare-related research in applied ethology in the future will include many of the approaches used in the past 30 yr. However, some change in emphasis may occur. It is my opinion that too much emphasis has been placed on using behavior as a means of assessing welfare, and too little on the behavioral basis of welfare problems (Gonyou, 1993). I predict that research on the use of abnormal behaviors as indicators of welfare will receive less emphasis in the future, and that ethology will be seen as a means of answering questions about the animals’ welfare requirements. Thus, preference testing to determine comfort and motivation will increase. Design and development of management systems will be increasingly based on ethological studies. The emphasis on animal cognition in recent theoretical papers (Duncan and Dawkins, 1983; Dawkins, 1990; Duncan and Petherick, 1991) will likely lead to the development of methodologies for determining the cognitive abilities of our animals and the degree to which they experience pleasant and unpleasant emotional states.

Implications

Applied ethology will continue to play a major role in animal welfare research. Countries in Europe, North America, and Australasia will lead in this field as their governments recognize and fund appropriate research. As research shifts to address the basis of animal welfare, as opposed to its measurement, a greater degree of expertise will be required to answer the difficult questions arising. To achieve and maintain competence in applied ethology, agricultural and veterinary colleges will need to expand teaching of applied ethology at both the undergraduate and graduate levels. As students who have taken such courses enter industry and academia, the general understanding of animal welfare issues and the role of ethology in addressing these issues will increase.

Literature Cited


