THE USE OF POSITIVE REINFORCEMENT TRAINING IN THE MANAGEMENT OF SPECIES FOR REPRODUCTION

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Abstract

Positive reinforcement training holds great potential for enhancing the management of species for reproduction. This paper reviews a wide range of animal training activities and resultant benefits which could have application to captive reproduction programs. Recognized benefits fall into several categories. Basic animal care can be improved through voluntary cooperation by the animals with veterinary procedures and routine husbandry activities. The quality and quantity of physiological data collected for research can be improved through voluntary cooperation with sample collection by the animal subjects. Positive social interaction and reproductive behavior can be increased, and aggressive behavior reduced through employment of a specialized training regime called "cooperative feeding". Good success has been reported with special training programs to facilitate introduction of new members into primate social groups while mixed results have been obtained in efforts to use training to enhance maternal skills. Finally, a discussion of both direct and indirect enhancement of psychological well-being through the use of positive reinforcement training is presented. While positive reinforcement training techniques will not be useful in every situation, information developed to date strongly suggests that these techniques should be given serious consideration when developing comprehensive programs for the management of species for reproduction.

key words: cooperative feeding, socialization, husbandry, animal training, psychological well-being, enrichment

INTRODUCTION

There is growing recognition by professional animal managers in the zoological community of the usefulness of animal training as a valuable tool in animal care and management [Laule and Desmond, 1990; Priest, 1990; Baker, 1991; Reichard et al, 1992; Laule, 1993]. In assessing the benefits of training to animals, it is important to note that the type of training being discussed is based on positive reinforcement. That is, any time the animal does what the trainer wishes, it receives something it likes as a reward. This differs from training based on negative reinforcement, where the animal performs the correct behavior in order to escape or avoid something it does not like. Operationally, it may not be feasible to utilize positive reinforcement exclusively, however, the positive alternatives are exhausted before any kind of negative reinforcement is employed. On the rare occasions when an aversive stimulus (escape-avoidance technique) is necessary, its use is kept to a minimum and balanced by positive reinforcement the vast majority of the time. In addition, positive reinforcement training does not require food deprivation.

Efforts to manage species for reproduction can be enhanced in a variety of ways through well planned and implemented training programs. The following is a brief review of some of the benefits that have been demonstrated to date.

IMPROVED HUSBANDRY AND HANDLING

Training animals to cooperate voluntarily in routine husbandry and veterinary procedures can contribute to enhanced health and reproductive potential by decreasing the need for anesthesia and reducing the risk of injury to animals. Trained animals maintain a high degree of reliability in participating in these procedures and are less stressed while doing so [Reinhardt and Cowley, 1990; Turkkan, 1990; Laule et al, 1992]. Evidence for this includes reports from a number of investigators of reductions in stress - related abortions, physical resistance to handling, and fear responses such as fear grinning, screaming, and acute diarrhea [Moseley and Davis, 1989; Vertein and Reinhardt, 1989].

Common husbandry procedures include collection of blood, feces, urine, and stomach contents samples; hoof and nail trims; injections; body examinations; minor surgical procedures; application of topical medications; sonagrams; taking body temperatures; taking body weight and measurements; and monitoring heart and respiratory function. Other trained behaviors that can enhance health care include: shifting between enclosures; entering transport or squeeze cages; and separating individuals from groups.

Animals have also been trained to cooperate voluntarily in procedures that have a direct impact on reproduction. To facilitate collection of data for charting reproductive cycles, female primates have been successfully trained to present their vaginal swelling to human observers for visual inspection, to allow collection of mid-stream urine samples on a daily basis, and to tolerate vaginal swabs. Voluntary cooperation with artificial insemination procedures has been achieved including tube insertion and injection of semen [Desmond et al, 1987]. This has important implications since there is some evidence that the use of anesthesia may inhibit ovulation [Furudate and Nakano, 1990; Howard et al, 1992]. Finally, males of several species have been trained to allow semen collection without restraint or anesthesia [Fussel et al, 1973; Schaffer et al, 1992; Vandervoort et al, 1993].

Safe keeper access to animals is critical to a good animal husbandry program. A new method of elephant management called protected contact was developed to address keeper safety as well as animal welfare issues [Desmond and Laule, 1991]. Keepers, working from shielded or "protected" positions created by careful trainer position, precise animal position, and physical barriers, use positive reinforcement techniques to access the animals for husbandry purposes. Protected contact training with elephants [Maddox, 1992; Desmond and Laule 1993] and positive reinforcement training with primates [Heath, 1989] has resulted in significant reductions in aggressive behavior towards keepers. Animals that remain comfortable and relaxed in the presence of their caregivers are more accessible for simple husbandry procedures such as visual or tactile inspection. Further, keeper intervention in animal habitats is less likely to trigger aggressive displays or fights which can result in injuries to individuals or their young.

IMPROVED QUALITY AND REDUCED COST OF DATA COLLECTION

Investigators have cited a number of ways that training improves collection of physiological data for research. When the use of anesthesia is not required, the investigator avoids dealing with its accompanying health risks, logistical constraints, and impact on data. Training reduces the time required to collect data, and allows greater control over the time of day, timing between samples, and consistency with which the samples are taken. In addition, more frequent sample collection is possible due to the reduced cost, risk, and stress of these procedures [Reinhardt and Cowley, 1990; Bloomsmith, 1992; Rogers et al, 1992].

Investigators have also pointed out that training can reduce the cost of research by conserving staff involvement, reducing the use of chemical and physical restraint, and reducing the need for modifications of facilities to collect data.

It is important to acknowledge that many of these benefits are realized to the greatest extent over time. Operationally, training is often time and labor intensive in the initial stages of a project. For example, data was analyzed on urine collection training of fifteen female chimpanzees (*Pan troglodytes*) [Thurston, 1991]. The females were trained to: approach the front of the cage when called; climb onto the chain link mesh and maintain that position; allow a small cup attached to the end of a plastic pipe to be inserted through the mesh and held underneath them; and to urinate into the cup within ten minutes. Results showed that the average number of sessions required to collect urine for the first time was 6. However, the number of sessions ranged from 1 to 27. The average number of sessions before successful collection of 3 samples in a row was 12, with a range of 1 to 53. Nearly 70% of the sessions lasted less than 7 1/2 minutes, approximately 19% lasted 15 minutes and the remaining sessions lasted from 22 to 60 minutes.

The urine collection training demonstrates the range of time and effort required to train the same behavior with different individuals. Some animals learned in a matter of minutes in a minimum of sessions, others required hours of time over several weeks. However, even with the most intense initial effort, long-term benefits such as reduced staff time are being realized. Most of the females have continued to urinate reliably in less than 10 minutes, and the current protocol requires collecting urine samples on a monthly basis for as long as the animals are reproductive, a period likely to be 20 years or more.

MANAGING SOCIAL BEHAVIOR

Training techniques have been utilized in a variety of situations to manage social behavior within groups of animals. Training was used with a group of five drill baboons (*Papio leucophaeus*) at the Los Angeles Zoo to increase positive social interactions and reproduction [Desmond et al, 1987]. At the time of the study, despite the presence of sexually mature animals, no breeding had occurred for over 6 years. In addition, observational studies of the drills showed very little affiliative behavior or positive social interaction between group members. The main strategy employed was "cooperative feeding". In a cooperative feeding regime, two events are reinforced simultaneously. The dominant animal is rewarded for allowing the subdominant animal to eat, and the subdominant animal is rewarded for being "brave" enough to eat in the presence of the dominant animal. The drills were cooperatively fed in different dyads and triads, reinforcing them for eating and relaxing in close proximity to one another. To encourage reproductive behavior the dominant male was reinforced for gently touching the dominant female, and she was simultaneously reinforced for allowing him to touch her. Results of the seven-month project showed significant increases in all forms of affiliative behavior including grooming, inspection, and mounting during and following the project [Cox, 1987].

A male western lowland gorilla (*Gorilla g. gorilla*), with a prior history of aggressive behavior toward youngsters, was successfully introduced into a family of females including adults, juveniles, and infants at the Toledo Zoo [Laule and Desmond, 1990]. A training program was developed for the introduction which included: controlled, progressive exposure of the animals to one another while reinforcing affiliative and non-aggressive behavior as it occurred; teaching the male to handle a variety of objects gently in association with the verbal command "easy"; establishing control over the male's movement by teaching him to come to, touch and follow a target; and attaining reliable movement from one enclosure to another on verbal commands.

Training has been used with mixed success in developing appropriate maternal skills in poor mothers [Joines, 1977; Desmond, 1985; Laule and Desmond, 1991]. However, some facilities report success in assisting primate mothers in the feeding of their babies [de Waal 1982; Priest, 1991]. For example, at the Toledo Zoo handlers were able to manipulate and milk a female orangutan and subsequently place her nipple or that of a bottle in the mouth of the baby allowing reintroduction of the infant after only three months [Reichard et al, 1992].

Training has proven to be effective in addressing aggression problems in social groups in a variety of species [Laule and Desmond, 1991]. In one study a male chimpanzee (*Pan troglodytes*), with a history of excessive agonistic behavior toward other group members during feeding times, was trained, through the use of a cooperative feeding training regimen, to remain calm and seated while other members of the group received their food. Investigators documented significant reductions in aggressive, submissive, and display behaviors in the group during feeding time [Bloomsmith et al, 1992]. In the study with drill baboons previously discussed, results showed that aggressive behavior, although increasing on an absolute level as social interaction increased, dropped from 34% to 25% of total social interaction [Cox, 1987].

ADDRESSING WELL-BEING

Maintenance of psychological well-being is seen by many investigators as linked to successful captive reproduction. Petto et al. [1990] suggest that in assessing well-being, a combination of observable features such as behavior, health, reproduction, and longevity be used. From that perspective, utilizing training to achieve results such as voluntary cooperation in medical procedures and increased positive social interactions enhances psychological well-being. There are a variety of other factors that relate to well-being that can be positively affected by training.

In Sackett's [1991] discussion of the human model of well-being and its implications for assessing primate well-being, personality factors such as extroversion and approach-oriented behavior correlated positively with well-being, while neuroticism correlated negatively. In a positive reinforcement environment, animals are free to experiment with a broad range of behavioral responses because there are no negative consequences to that experimentation. In fact, skilled trainers opportunistically reinforce animals for extroverted and exploratory behavior. Also, neurotic or nonadaptive behavior can be reduced or eliminated by training a behavior that is incompatible with the problem one, or by raising overall activity and stimulation for the animal [Laule, 1984]. In two studies involving socialization training with primates, neurotic and self-directed behaviors were significantly reduced as a result of the training program [Cox, 1987; Bloomsmith, 1992].

Enrichment strategies to enhance well-being commonly cite goals of greater mental stimulation and physical activity, improved ability to cope with environmental change, and increased environmental diversity for animals [Markowitz, 1982; Shepherdson, 1989]. Training can be used to augment and enhance the effectiveness of these enrichment programs. The ability to control the movement of animals flexibly throughout the day allows animals to be removed from the exhibit quickly and reliably so enrichment apparatus can be recharged, furniture moved, or food scattered multiple times a day. Also, animals have been trained to accept and use a previously ignored enrichment apparatus when it was determined that they either feared it or simply did not know how to use it [Laule and Desmond, 1993].

In a pilot study recently conducted with four young adult male chimpanzees, preliminary results indicate that training sessions utilizing positive reinforcement techniques have direct enrichment value for animals [Bloomsmith, 1992]. Preliminary results show that comparing baseline data to training sessions, three positive changes occurred during training: reduced self-directed behavior, reduced inactivity, and increased social play. Each of these behavioral changes is typically considered to be a positive outcome of an enrichment procedure. Since the sessions were focused on training husbandry behaviors, these changes occurred without specific training for those outcomes.

CONCLUSIONS

While it will not be useful in every situation, information developed to date strongly indicates that training can be a valuable animal management tool. At the present time, training has not been extensively studied and more careful evaluation of training is needed to determine the precise benefits it has to offer. Moreover, care must be taken to insure good planning and proper implementation by skilled personnel. However, despite these cautionary notes, training allows animal managers to address pro-actively a wide range of problem situations which have

significant implications for successful captive reproduction. Training should be given serious consideration when developing comprehensive programs for the management of species for reproduction.

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