

USE OF POSITIVE REINFORCEMENT TECHNIQUES TO ENHANCE ANIMAL CARE, RESEARCH, AND WELL-BEING

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Introduction

There is a growing trend in the zoological and biomedical community to recognize the use of operant conditioning techniques as a valuable animal care and management tool (Baker 1991, Priest 1991, Laule 1993). Operant conditioning offers two basic alternatives for influencing behavior: positive reinforcement, and negative reinforcement or escape/avoidance. In assessing the benefits of training to animals, it is important to note that the type of training being discussed here is based on positive reinforcement. Animals are reinforced with rewards they like for the desired behavioral response. Operationally it means that the positive alternatives are exhausted before any kind of negative reinforcement is utilized. On the rare occasions when an escape/avoidance technique is necessary, it's use is kept to a minimum and balanced by positive reinforcement the vast majority of the time. Punishment is only used in a life-threatening situation for person or animal.

Positive reinforcement training does not require any food deprivation. Animals are fed their daily allotment of food, and rewards for training utilize that diet, or consist of extra treats. Finally, this training relies on voluntary cooperation by the animal to succeed.

Positive reinforcement training has proven to be useful in a variety of situations with a wide range of species. The majority of reported work to date has been with primates (Laule & Desmond 1990, Reinhardt & Cowley 1990, Turkkan 1990). In a new elephant handling system called protected contact, positive reinforcement techniques are proving very functional and effective (Desmond & Laule 1991, Maddox 1992). Successful training with species such as canids, felids, ungulates, and ursids has also been reported (Schmidt and Markowitz 1977, Pryor 1981, Shellabarger 1990). To a great extent, the specific techniques currently being used with these species originated in the training of marine mammals for public presentations. It is relevant to this discussion to consider how the application of these techniques evolved from training marine mammals to perform in an oceanarium show, to training terrestrial animals to voluntarily cooperate with veterinary procedures in a zoo or biomedical laboratory.

Positive Reinforcement Training in Marine Mammal Systems

Generally speaking, in oceanariums positive reinforcement training is the primary strategy utilized in meeting behavioral objectives and solving problems (Pryor 1984). Furthermore, it functions as an integral component of the animal management system. The following examples illustrate how training has been used in a comprehensive fashion to address a variety of issues.

To successfully work two adult male California sea lions (*Zalophus californianus*) together in shows requires first addressing the social dynamics between them. Without training the dominant animal to

work cooperatively with the subdominant animal, the result is frequent show-stopping fights between them. Similarly, working cetaceans in groups requires training dominant animals to allow more timid animals to eat and work, and then maintaining that cooperation through ongoing reinforcement (Laule & Desmond 1991).

When the objective is to improve animal health care through more frequent and less stressful physical examinations and sample collection, animals are trained to voluntarily cooperate in a variety of veterinary procedures including sample collection of blood, stomach contents, feces, blow hole exudate, and urine; physical inspection; and ultra-sound examinations (Sweeney, 1989).

A variety of research projects requiring voluntary cooperation of the subjects are routinely addressed with training techniques. Cetaceans and pinnipeds have been trained to participate in ergometric studies (Kamolnick 1985), thermoregulatory studies (Williams et al 1991), cognitive and communication studies (Schusterman & Krieger 1984, Herman and Forestell 1985) and diving and rescue experiments (Ross 1987) to name a few.

Finally, novel problem situations are addressed through training methods. For example, when a female killer whale (*Orcinus orca*) demonstrated good mothering skills except for the ability to nurse her calf, two behavioral strategies were attempted to deal with this problem. She was trained to allow human manipulation of her mammarys in order to collect milk samples. She was also trained to chase down and present her mammarys to a fiberglass model of a calf that was manually propelled around the pool by her trainers (Desmond 1985). Although these efforts did not achieve the desired result of the female nursing her calf, one unexpected outcome of the training was her willingness to physically bring the calf to handlers for regular feedings.

When an educational presentation included sea lions directly interacting with the public, preparation focused on training the animals to tolerate a wide spectrum of sensory stimuli and environmental circumstances they were likely to encounter including different substrates, strange or sudden noises, unusual sights, new locations, and crowds of people. This training resulted in animals that were calm and unstressed by novel events (Laule 1983).

The marine mammal training program just described illustrates the potential benefits of integrating positive reinforcement training into a practical and comprehensive approach to animal care. Careful application of these techniques can address a variety of husbandry, veterinary, and research needs. The basic techniques are the same for all animals, with adjustments for species differences, individual animal differences, different environmental and social situations, and specific operational objectives (Laule 1993).

Husbandry Training

One of the most important and versatile techniques is desensitization. Through the process of desensitization animals learn to tolerate "scary" or uncomfortable stimuli. In very basic terms, desensitization is a process designed to "train out", or overcome, fear. By pairing positive rewards with

an action or object that elicits fear in the subject animal, that fearful entity slowly becomes less negative, less scary, and less stressful. The result is animals that cooperate in physical examinations including offering body parts for inspection and treatment of wounds, tolerating the application of instruments such as a stethoscope and rectal or tympanic thermometer, and allowing blood sampling, urine collection, vaginal examinations, semen collection, nail and hoof trims, and injections (Laule et al 1992, Reichard & Shellabarger 1992). Reports on positive reinforcement training with a variety of species indicates that the reliability of animals voluntarily cooperating in husbandry and veterinary procedures is very high while the stress level is low (Vertein & Reinhardt 1989, Moseley & Davis 1989, Thurston 1992).

As Bloomsmith (1992) reports, multiple benefits are derived from training animals to voluntarily cooperate in husbandry and veterinary procedures. First, data collection can be improved by gaining the ability to collect samples in a shorter period of time, more often, with greater reliability, and with fewer staff. Second, the use of anesthesia can be greatly reduced, improving the quality of sample collection and reducing the physical risk to animals as well as the accompanying stress. Third, peripheral behaviors such as reliable shifting and separation, entering transport or squeeze cages, and positioning in a particular location can be trained to facilitate sample collection.

Training to Enhance Socialization

Training can be utilized to enhance the likelihood of successful introductions and social housing of animals (Laule & Desmond 1990, 1991). It is possible to effectively mitigate dominance-related problems, reduce aggression, and access submissive animals. As with the sea lions and dolphins, socialization issues like these can be addressed by utilizing a technique we call "cooperative feeding". Operationally it entails reinforcing two events simultaneously: dominant animals are reinforced for allowing subdominant animals to work and receive food or attention, while the subdominant animals are reinforced for being "brave" enough to work and accept food or attention in the presence of these more aggressive animals.

This strategy was successfully used with a group of five drill baboons (*Papio leucophaeus*) at the Los Angeles Zoo (Desmond et al 1987). The primary goal of the project was to increase positive social interactions and reproduction among the group members. Animals 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 touching the dominant female, and she was simultaneously reinforced for allowing him to touch her. Animals were also trained to voluntarily cooperate in artificial insemination procedures like tube insertion and semen collection. Results of the seven-month project documented significant increases in all forms of affiliative behavior including grooming, inspection, and mounting during and following the project (Cox 1987).

Training to Reduce Aggression

Another study conducted at the M.D. Anderson Science Park chimpanzee breeding facility in Bastrop, Texas documented the reduction of excessive aggressive behavior of one male chimpanzee (*Pan troglodyte*) toward other group members during feeding time through the use of training techniques

and cooperative feeding (Bloomsmith et al 1992). The eight animals live in a large open corral, where produce is fed from the wall above. The male was trained to sit during feeds then reinforced with special treats for allowing the others to receive and consume their allotted food. In this way, both aggressor and subordinate animals benefitted. Results show significant reduction in the levels of display, submission, and aggression during feeds as a result of the training.

Aggression towards caregivers can be dealt with behaviorally. In the cases of three different bull elephants, keepers, managers, and veterinarians subjectively report dramatic reductions in aggressive behavior toward handlers utilizing positive reinforcement techniques in a protected contact system (Desmond & Laule 1993).

Training can be useful in addressing other animal management issues. Abnormal behavior can be reduced or eliminated by training a behavior that is incompatible with the problem one or raising overall activity and stimulation for the animal (Laule 1983, 1994).

Training to Enhance Psychological Well-Being

Finally, positive reinforcement training can serve as an effective enrichment strategy, contributing to the psychological well-being of captive animals (Laule & Desmond 1993). Petto and Novak (1990) suggest that psychological well-being be generally defined as 'the ability to adapt - to respond and adjust to changing situations.' Of the many observable features that relate to it such as behavior, health, reproduction, and longevity, they suggest that a combination of two or more should be used in assessing psychological well-being. Utilizing those criteria, one could argue that techniques like desensitization and cooperative feeding, and the behavioral results they attain, enhance psychological well-being.

There are other subtle, yet important benefits as well. Animals are predisposed to act on their environment. However, captivity eliminates the need, and in many cases the opportunity, for animals to perform purposeful behaviors that contribute to their survival (Hediger 1950). The conditions and restrictions of captivity offer animals little choice and control over their lives. Furthermore, the traditional dependence on escape/avoidance techniques in captive animal management contributes to this loss of control. Positive reinforcement training provides the greatest opportunity for animals to gain some control over events through their actions.

Training offers animals a chance to work for their food. Laboratory studies have shown that given a choice, animals will most often voluntarily work for their food, even if the same food is available free (Neuringer 1969, Stevens 1978). In 365 protected contact training sessions between four elephants, the animals chose to work 99% of the time (Desmond & Laule 1993).

Mineka, Gunnar, and Champoux (1986) found that rhesus macaque (*Macaca mulatta*) infants that could work for their food showed less fearfulness in response to threatening stimuli and showed better coping responses when separated from other monkeys' than did macaques that received food for free. The researchers discussed their results in terms of the animals' control over the environment.

Positive reinforcement training is based on voluntary cooperation. Restraining an animal for a procedure, or having an animal voluntarily cooperate with the procedure without restraint, are two very different events, for the animal and for personnel. Because the trained animal is a willing, active participant in the process, he gains more choice and greater control over important events. Consider the primate that must get an injection for his physical well-being. Without training, the animal has no choice in how that event occurs. If an injection is required, the animal will be injected, most likely by a rather negative method, and incur the accompanying stress. If escape/avoidance training is used, offering a choice (i.e. present an arm for the injection) requires the threat of another more negative stimulus, exposing the animal to a high level of stress from both stimuli. Utilizing a positive reinforcement approach, the animal is trained through shaping and rewards to present an arm for an injection, and concurrently desensitized to the procedure. One could argue that when the injection is needed, having a clearer choice in how that event happens, and being less fearful of it, contributes to that animal's psychological well-being.

Training offers mental stimulation for animals. Training is teaching; being trained is learning. It is a problem-solving process more challenging and rewarding than the most complex enrichment device. To a great extent, this is because training provides a stimulating human/animal interface (Heath 1989). One recent study documented the impact of human/animal interaction, with positive outcomes such as reduction of abnormal behavior resulting from as little as six minutes interaction per week (Bayne et al 1993).

Operationally, training can be used in conjunction with enrichment activities to expand the usefulness of devices. In fact, how many times have enrichment devices been discarded because the animals did not use them? A relevant question might be, did they know how? In one case, four adult male chimpanzees never used their pipe feeders (PVC pipes attached to the outside of the cage, filled with apple sauce, jello, or other foods which require the animals to use sticks to access the treat). Eventually the caregiver stopped giving them the feeders. However, once two of the chimpanzees were trained to use the feeder, they all subsequently used it.

Measuring the Enrichment Value of Training

The pipe feeder training was part of a study to assess the enrichment value of positive reinforcement training (Laule & Desmond 1993). Conducted at the M. D. Anderson Science park, the four chimpanzees were observed in a baseline period before training, during training sessions where they were worked primarily on husbandry behaviors, and during non-training times. Preliminary results show that during sessions approximately 40% of each animal's time was spent in positive interactions with the trainer. Less than 1% of their time was spent ignoring or aggressing the trainer. In fact, animals remained involved in the sessions even when they weren't directly being trained. Preliminary results also show that three positive changes occurred during training: reduced self-directed behavior, reduced inactivity, and increased social play (Bloomsmith 1992). Each of these behavioral changes is typically considered to be a positive outcome of an enrichment procedure.

Limitations of Training

Training, for all its benefits is not a cure-all or magic formula for solving every behavioral problem or meeting every operational need. It is simply a useful tool. It has its limitations. First, training is a skill that takes time and practice to develop. Poorly planned and implemented training can create more problems than it will solve. Second, training is time and labor intensive, especially in the initial stages of a project. However, those drawbacks can become pluses. Training skills translate directly into problem solving skills, therefore, keepers who become skilled trainers can provide optimum animal care. In the long term, well executed training regimes like animals cooperating in veterinary procedures, can result in significant time and labor savings.

Animal Welfare Implications

The welfare of captive animals can be greatly enhanced by integrating simple positive reinforcement techniques into overall management practices. Consider the following suggestions. Give animals the chance to voluntarily cooperate in basic behaviors such as moving from cage to cage, allowing something to be removed from the cage, or approaching the cage front for visual inspection. Reward compliance with food treats, a squirt of juice, an enrichment toy, or verbal praise. When possible, use enrichment strategies, devices, toys, games, and feedings as reinforcers after stressful events such as medical or research procedures. Finally, identify opportunities for specific behavioral intervention such as an up-coming protocol, a chronic health problem, or an abnormal behavior that threatens the safety of animal or caregiver. In these instances, animal welfare would be positively impacted by the application of appropriate training techniques.

To realize the full range of benefits that positive reinforcement training can offer, it must be fully integrated into the animal management system. This is possible only with support from throughout the chain of command: managers, veterinarians, investigators, technicians, and caregivers. Although working through such an extensive political process may prove to be difficult, it is by far the best way to maximize the benefits of training techniques to behavioral, husbandry, health care, investigative, and environmental enrichment programs.

Conclusions

Positive reinforcement training is gaining stature among animal care professionals as a useful tool for enhancing animal health and welfare. A strong case can be made that training is good for animals. Whether the situation involves a singly-housed animal with limited sensory stimulation, or a group of animals in a naturalistic environment, well planned and implemented training has a place in the management of captive species.

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