

POSITIVE REINFORCEMENT TRAINING AS AN ENRICHMENT STRATEGY

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There is a growing trend in the zoological, aquarium, and biomedical communities to recognize the use of operant conditioning techniques as a valuable animal care and management tool (e.g., Reichard, 1992; Priest, 1991; Laule and Desmond 1990; Laule, 1993a; Kirkwood et al., 1989). Operant conditioning offers three basic alternatives for influencing behavior: positive reinforcement, negative reinforcement or escape/avoidance, and punishment (Reynolds, 1975; Pryor, 1984). In assessing the benefits of training to animals, particularly in regard to psychological well-being, it is important to distinguish the type of training being used and the specific techniques employed.

The training referred to throughout this paper, and recommended as the approach of choice, is positive reinforcement training. Animals are reinforced with pleasurable rewards for the desired behavioral response. Operationally, it means that the positive alternatives are exhausted before any kind of negative reinforcement is used. On the rare occasions when an escape-avoidance technique is necessary, it is kept to a minimum and balanced by positive reinforcement the vast majority of the time. Punishment, which by definition is used to eliminate a behavior, is only appropriate in a life threatening situation for person or animal. To dispel a common misperception, positive reinforcement training does not require any food deprivation. Animals are fed their daily allotment of food, and rewards for training use that diet, or consist of extra treats. Finally, this training relies on voluntary cooperation by the animal to be successful.

Using these techniques, an impressive array of benefits have been demonstrated. Training animals to voluntarily cooperate in husbandry and veterinary procedures contributes to a decreased use of anesthesia. In addition, trained animals maintain a high degree of reliability in participating in these procedures and appear less stressed while doing so (Reinhardt, 1990; Reinhardt et al., 1990; Turkkan, 1990; Priest, 1991; Laule et al., 1992; Luttrell et al., 1994).

Positive reinforcement training has also proven to be effective in addressing socialization issues in a variety of species (Laule and Desmond, 1991). One study documented the reduction in excessive aggressive behavior of a male chimpanzee (*Pan troglodytes*) toward other group members during feeding time, through the use of training techniques (Bloomsmith et al., 1992). Primates trained with positive reinforcement techniques (Heath, 1988) and elephants (*Elephas maximus* and *Loxodonta africana*) trained through protected contact techniques (Desmond and Laule, 1991; Maddox, 1992) showed significant reduction in aggressive behavior toward trainers.

Finally, training can be a useful tool in addressing novel situations, e.g., training animals that lack proper maternal skills (Joines, 1976; Desmond, 1985) and training voluntary cooperation in physiological studies (Rogers et al., 1992).

The preceding examples are only a small sampling of the benefits training can offer animals, staff, and the institution. The value is apparent and measurable, even if there has been little formal measuring to date. This paper focuses on another benefit, which is not so apparent - the use of positive reinforcement training as an enrichment strategy to enhance the psychological well-being of captive animals.

A Working Definition of Psychological Well-Being

In the continuing quest to define psychological well-being and to evaluate the effectiveness of various enrichment strategies, many approaches have been discussed. Novak and Suomi (Petto et al, 1990) suggest that psychological well-being be generally defined as "the ability to adapt - to respond and adjust to changing situations" (p. 108). Of the many observable features that relate to it, such as behavior, health, reproduction, longevity, etc., these authors suggest that a combination of two or more criteria should be used in assessing psychological well-being. Utilizing this approach, one can argue that specific training techniques can enhance psychological well-being.

Desensitization Training

Through a process termed desensitization, animals learn to tolerate presumably scary or uncomfortable stimuli. In basic terms, desensitization is a process designed to "train out", or overcome, fear. By pairing positive rewards with any action or object that elicits fear, that fearful entity slowly becomes less negative, less scary, and presumably less stressful. Using this technique, animals have been desensitized to husbandry and veterinary procedures, new enclosures, unfamiliar people, negatively-perceived people like the veterinarian, novel objects, strange noises, and so on. In fact, the authors have previously reported that animals being desensitized to specific stimuli can, over time, become generally desensitized to anything novel or unexpected (Laule, 1983; Laule, Desmond, 1991).

Cooperative Feeding

One of the most desirable forms of enrichment is the housing of naturally social animals in pairs or groups (de Waal, 1991; Reinhardt, 1987). However, because of the dynamic nature of social interactions, and the constraints captivity imposes upon animals and upon their ability to avoid or escape negative behavior, social housing can be a double-edged proposition. In fact, if not carefully implemented and monitored, social housing can become a stressful, negative experience for subordinate animals (Coe, 1991).

Using a training technique we call "cooperative feeding", it is possible to enhance introductions, mitigate dominance-related problems, and reduce aggression. Operationally, this entails reinforcing two events within the group simultaneously: dominant animals are reinforced for allowing subdominant animals to receive food or attention, while the subdominant animals are reinforced for being "brave" enough to accept food or attention in the presence of these more aggressive animals.

This was one successful strategy 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. Both of these features have been identified as indicators of psychological well-being (Petto et al., 1990). Animals were cooperatively fed in different dyads and triads, reinforcing them for eating and appearing relaxed 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. 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).

Working for a Living

Another avenue for defining psychological well-being is to look at findings of studies on human well-being as a model for non-human primates. In discussing several factors associated with human well-being, Sackett (1991) identifies monetary income as a major correlate, and suggests, "Perhaps the opportunity to engage in, and succeed at, problem solving could affect a primate's well-being much as income affects well-being in humans" (p. 39). Heini Hediger (1950) points out that captivity deprives wild animals of the need and opportunity to engage in the tasks of survival, i.e., finding food and avoiding enemies. He suggests, "The captive animal must be given a new interest in life, an adequate substitute for the chief occupations of freedom...this substitute can take the form of biologically suitable training and assumes the importance of occupational therapy (p. 158).

Positive reinforcement training offers animals a chance to work for their food, i.e., perform certain tasks/behaviors for a food reward. 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; Anderson and Chamove, 1984). In 365 protected contact training sessions between two Asian and two African elephants, the animals chose to work for the extra treats 99% of the time (Laule and Desmond, 1992).

Mineka, Gunnar, and Champoux (1986) found that rhesus monkey infants (*Macaca mulatta*) that were given the opportunity to work for their food showed less fearfulness when exposed to threatening stimuli and demonstrated better coping responses when separated from cagemates than did monkeys that received food for free. The authors discussed their results in terms of the importance of animals' control over their environment.

Greater Choice and Control

Hanson, Larson, and Snowden (1976) measured cortisol levels in groups of rhesus macaques who were either given or denied control over loud, continuous white noise. Striking results showed that in the group with control over noise, levels of cortisol and aggression did not differ with the control group (i.e., receiving no noise). In contrast, the group without control over noise had significantly higher levels of cortisol and aggression. Furthermore, when control over the noise was taken away from the first experimental group, cortisol and aggression levels were the highest of any condition.

The conditions and restrictions of captivity offer animals little choice or control over their lives. Furthermore, the traditional dependence on the use of escape/avoidance techniques contributes to the animals' lack of control. In our experience, positive reinforcement training provides one of the best opportunities for animals to gain greater, albeit not total, control over events through their actions.

In a positive reinforcement environment, animals are free to experiment with a broader range of behavioral responses because there are no negative consequences to that experimentation. In fact, skilled trainers consistently reward animals not just for overt correct responses, but for more subtle and subjective actions like "problem solving" a task, offering "creative solutions", and "trying" hard.

Positive reinforcement training is based on voluntary cooperation by the animals. However, even in those instances when compliance is mandatory, positive reinforcement still increases the animals' choice and control to a great degree. For example, consider the animal that must receive an injection for its physical well-being. Without training, the animal has no choice in how that event occurs. 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 stress from both stimuli. Utilizing a positive reinforcement approach, the animal is trained through shaping and rewards to voluntarily present an arm for an injection, and concurrently desensitized to the procedure. When the injection is needed, it would seem logical to argue that having a clearer choice in how that event happens, and being less fearful of it, contributes to that animal's psychological well-being.

Abnormal Behavior and Well-Being

In Sackett's (1991) discussion of the relationship between personality factors and human well-being, neurotic behavior correlates negatively with well-being. Studies of captive animals to date have been unable to demonstrate an unequivocal relationship between the presence or absence of abnormal behavior and animal well-being. However, in her discussion of stereotypic behavior, Carlstead (1991) points out that despite the absence of scientific evidence, stereotypic behavior is generally viewed as abnormal, and is considered a possible indicator of poor well-being. In several cases, well chosen environmental enrichment has been successful in reducing stereotypies.

Training, too, has proven useful in reducing abnormal behavior (Laule, 1993b). For example, a bottlenosed dolphin (*Tursiops truncatus*) exhibited two behaviors, swallowing foreign objects and regurgitation, at a rate and frequency that were indicative of an abnormal behavior pattern. Several strategies were implemented to address these behaviors, including training the animal to retrieve objects for a reward as an incompatible behavior with swallowing them, and specific reinforcement of the absence of regurgitation during times observations had shown regurgitation was most likely to occur. Overall activity and stimulation was also increased through multiple daily training sessions. Results of the project showed a complete cessation of the swallowing of objects, and a dramatic reduction in regurgitation (Laule, 1984). In the drill baboon study described earlier, although the focus of the training was to enhance positive socialization, results showed that neurotic and self-directed behaviors were significantly reduced as a result of the training program (Cox, 1987).

It is also of interest to note that Sackett (1990) reports that personality factors like extroversion and approach-oriented behavior correlate positively with human well-being. As previously described, skilled trainers opportunistically reinforce animals for extroverted, exploratory behavior.

Increasing Mental Stimulation and Physical Activity

In reviewing the literature on psychological well-being and enrichment strategies, commonly cited goals include raising the level of mental stimulation and physical activity for captive animals (e.g., Carlstead et al, 1991; Dittrich, 1984; Shepherdson, 1989; Markowitz, 1982). Training can be used to address both. First, training is teaching; being trained is learning. It is a problem-solving process that can easily be as challenging and rewarding as the most complex enrichment device. To a great extent, this is because training provides a stimulating human/animal interface (Heath, 1989; Reinhardt, 1992). 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).

Second, work with marine mammals over the years has demonstrated the value of training in increasing overall activity levels of animals. Animals engaged in training programs spend their day in a variety of activities: performance in training sessions and shows, moving between holding areas and show pools, going outside enclosures as in the case of pinnipeds, and engaging in play and social interactions with trainers and other animals.

Training can contribute to increased activity simply by expanding animals' behavioral repertoires. Trainers anecdotally cite examples of animals utilizing newly trained behaviors outside of training sessions, spontaneously, and in novel ways. For example, bottle-nosed dolphins trained to slide out on a platform as a show and husbandry behavior were observed using the behavior during free time, adding their own variations - twisting around and returning into the water head first, laying with head or tail in the water, spinning around on the deck, or sliding all the way across the platform and back into the water. Animals were only observed using this behavior after they were trained on the basic form of it (Laule, 1992). One training exercise called "innovation training" reinforces animals for inventing new and creative behaviors (Pryor, 1969; Krieger, 1989).

Training a simple behavior like "retrieval" (i.e., bringing an item to the trainer for a reward) can create multiple benefits. In the case of a drill baboon, training her to retrieve provided the opportunity to give her many novel objects, because trainers were confident she wouldn't eat them, but would return them when asked (Laule 1992).

Training to Enhance Environmental Enrichment

Positive reinforcement techniques are useful in training animals to perform peripheral behaviors that allow greater enrichment opportunities. These behaviors include: separation from other group members for individual attention or enrichment; entering transport cages to access remote "play" or "exercise" areas; and shifting between cages and on and off exhibit to allow environmental manipulation of unoccupied areas. Bringing animals off exhibit multiple times a day provides maximum opportunity to rotate enrichment devices and toys, seed exhibits, make minor changes to the environment, add new exhibit furniture, and access animals for daily training sessions. By utilizing flexible and frequent shifting for enrichment purposes, the physical activity of animals is increased, and shifting for routine husbandry purposes becomes easier and more reliable (Laule, 1992).

Training can also be used in conjunction with enrichment activities to enhance their effectiveness. Enrichment devices have sometimes been discarded because the animals did not use them. Lack of use may indicate that the animals simply did not know how. In one case, an adult male chimpanzee never used his pipe feeder (PVC pipes attached to the outside of the cage, filled with apple sauce, jello, or some other treat that required the animal to use a stick to access the treat). Eventually the keeper stopped giving him the feeders. However, when this animal entered a training program, he was taught how to use the feeder. Caregivers now report it is a preferred enrichment device (Bloomsmith, personal communication).

Training as Enrichment

Finally, positive reinforcement training, in itself, has enrichment value for animals. A study was conducted at the M. D. Anderson Science Park chimpanzee breeding facility, to assess the enrichment value of positive reinforcement training (Bloomsmith, 1992). Four group-housed adult male chimpanzees were observed in a baseline period before training, during training sessions (where they were worked primarily on husbandry behaviors such as presenting body parts and accepting injections), and during non-training times. Preliminary results show that during training 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. Three positive changes also occurred during training: reduced self-

directed behavior, reduced inactivity, and increased social play between group members. Each of these behavioral changes is typically considered to be a positive outcome of an enrichment procedure.

Limitations of Training

Despite the many benefits training offers, it is not a magic formula for solving every behavioral problem. It is simply a useful tool, with some limitations. First, even the most basic training skills take time and practice to develop. Poorly planned and implemented training can create more problems than it solves. It can also result in confused and frustrated animals - certainly not a state indicative of enhanced well-being. Second, training is time and labor intensive, which can limit its practicality when used exclusively as an enrichment strategy. However, if integrated into a comprehensive animal management program, the long term benefits far outweigh these costs.

Conclusions

Positive reinforcement training is gaining stature in the zoological, aquarium, and biomedical community as a useful tool for enhancing animal welfare. Through desensitization and cooperative feeding strategies, animal caregivers have pro-active means of improving the well-being of animals under stress from environmental and social factors. Training sessions focus on the problem solving process, presenting animals with mental and physical challenges that allow them to control events in their lives - "occupational therapy" as Hediger (1950) described it. Training also provides a means of addressing sensory deprivation and abnormal behavior. By utilizing control behaviors, such as shifting, in a frequent and flexible manner, training maximizes the effectiveness of environmental enrichment activities by increasing opportunities to provide more diverse enrichment on a more random basis. It can also be used to teach animals how to use enrichment apparatuses.

Finally, while care must be taken to insure good planning and proper implementation by skilled personnel, it is clear that training can be an important, if not critical element in a comprehensive approach to enhancing the psychological well-being of captive animals.

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