

**Positive Reinforcement Training and Environmental Enrichment,
*Enhancing Animal Well-Being***

Gail Ellen Laule, M.A.
Active Environments, Inc.

Introduction

It's been eighteen years since the Animal Welfare Act mandated that facilities housing nonhuman primates provide for their psychological well-being, triggering a concerted effort by scientists and professionals to enhance the welfare of all captive animals. Today, it's difficult to assess the progress made, or whether, overall, captive animals are significantly better off. In general, zoos are good at providing animals with the basics: quality food and medical care, a safe, secure place to live, a naturalistic environment, and appropriate social contacts. Increasing longevity and reproduction of many species are indicators of the success of this pursuit. However, despite these efforts, some observations about a wild animals life in captivity can be made.

These animals are spatially limited in an environment that is sterile and unchanging in comparison to the wild. There are no predators or prey. Social group size and configuration are limited and in most cases there is no diversity of species present. They must eat a fixed diet, when and where it is offered, even if the feeding method is unnatural. And most zoo animals still spend the majority of their time in holding areas that are smaller and more barren than the exhibit spaces zoo visitors see. The net result is that captive animals have little control over their lives. Negative consequences ranging from boredom to stereotypic behavior often result.

Given these realities of zoo life, addressing animal welfare is a daunting task. Most will agree that welfare is not something that an animal either has or does not have. Rather it lies on a continuum from poor to good. Petto et al¹ have suggested that psychological well-being be generally defined as "the ability to adapt - to respond and adjust to changing situations." To assess well-being, they recommend using a combination of variables including: behavior, health, reproduction, and longevity. Desmond² suggests that in pursuing enhanced animal welfare, the behavior of the animal "should be the lens through which we focus our efforts."

Shepherdson³ provides a detailed framework using observable behavior as an indicator of well-being. He notes that most animal welfare researchers would agree that enhanced well-being requires that animals have a reasonable measure of choice and control in their lives, and that they are "behaviorally competent and empowered to act on their own behalf." He suggests that animals experiencing enhanced welfare should be free of behaviors that are abnormal or are indicative of fear and frustration. They should actively explore and interact with their environment, and demonstrate a diversity of behavior similar to that in the wild. Finally, they should demonstrate behavioral flexibility and appropriate responses to changing circumstances.

With these behavioral objectives in mind, this paper will explore how positive reinforcement training and environmental enrichment can address two broad aspects of captive animal welfare: 1) helping animals to cope and prosper in an "artificial" zoological system; and 2) helping animals maintain as much "naturalness" in this new context as possible.

Define Your Training System

In assessing the benefits of training to animals, particularly in regard to welfare, it is important to distinguish the type of training being used and the specific techniques employed. The training recommended in this paper is based on the use of positive reinforcement. Animals are rewarded with something they like 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. Physical punishment is not appropriate as a training technique and no food deprivation is required. Animals are fed their daily diet, and rewards for training use portions of that diet or extra treats. Finally, this training relies on the voluntary cooperation of the animal.

Unfortunately, captive animal management practices have traditionally included a large measure of negative reinforcement. Although this training works, there is an inherent cost to the animal's welfare to be forced to cooperate through the threat of a negative event that elicits fear or anxiety⁴. Consider a primate who must receive an injection for his health. If negative reinforcement is used, training the animal to present a leg for the injection requires the threat of an even more negative stimulus, thus exposing the animal to stress from both stimuli. Using a positive reinforcement approach, the animal is trained through shaping and rewards to voluntarily present the leg, and concurrently desensitized to the procedure to reduce the associated fear or anxiety. It seems reasonable to say that the positive reinforcement training method is consistent with efforts to contribute to that animal's welfare.

Basics of Environmental Enrichment

There have been different names used to refer to the process we call environmental enrichment. In this paper, I am using the term and definition developed by the Behavior Husbandry Advisory Group for AZA. "Environmental enrichment is a process for improving or enhancing zoo animal environments and care within the context of their inhabitant's behavioral biology and natural history. It is a dynamic process in which changes to structures and husbandry practices are made with the goal of increasing behavioral choices available to animals and drawing out their species-appropriate behaviors and abilities, thus enhancing animal welfare."

Research has shown that the key to successful enrichment is in its complexity and variability^{5,6,7}. These features keep enrichment interesting and novel, and encourage animals to act upon, and interact with, their environment. Enrichment is divided into the following categories:

1. Physical Enrichment includes natural features like logs, rocks, water, and substrate and artificial items like culverts, ropes, cargo nets, and platforms to create useful elements like perches, dens, climbing structures, and lookouts. It also includes temperature, light, sound, and space use, as well as manipulable objects and toys, both artificial and natural.

2. Feeding Enrichment includes the type of foods provided and the frequency and method of delivery, with emphasis on novelty and variety. For example, feeding whole, frozen, chopped, and live food items that are dispersed, hidden, buried, or hung in the environment.
3. Sensory Enrichment entails stimulating the senses through, for example: music or nature sounds; perfumes, spices, and urine or fecal scents of other species; edible plantings; varied bedding materials such as straw and shavings; varied light and dark spaces; and temperature variations created by hot rocks, misters, ice shavings, and heated or cooled spaces.
4. Social Enrichment refers to group size, composition, and changes within groups caused by births and the introduction of new animals, as well as compatible mixed species situations.
5. Occupational Enrichment includes items that encourage problem solving and physical manipulation by the animal, and activities like positive reinforcement training.
6. Human-Animal Interactions include play, grooming, brushing, and training for husbandry purposes and other behaviors like painting, retrieval, and A to B's to encourage exercise.

Living in the Zoo – Helping Animals to Cope

In order to help animals cope and prosper in an “artificial” zoological system, we must consider the routine events animals are exposed to that may be in conflict with natural behavior, and a source of short term stress, and in some cases, long term distress.

- Daily routine husbandry activities including shifting animals between enclosures; body exams; short term separations from conspecifics; non-invasive procedures such as skin care, hoof or claw trims, urine collection, and minor wound treatment; and short term restraint.
- Veterinary procedures that are uncomfortable, invasive, require special equipment and/or greater restraint including blood draws, injections, more thorough physical examinations, TB testing, serious wound treatment, x-rays, and ultrasound.
- Social housing and resultant behavioral problems including aggression and excessive dominance that threaten the safety and welfare of individual animals because of a lack of sufficient physical space and alternative social grouping options.

Although husbandry routines, veterinary procedures, and social living are all important components of captive animal care and welfare, each comes with a significant cost to the animal. Positive reinforcement training is an effective technique to minimize these costs and maximize the benefits. The training process rewards animals with something they like for voluntarily cooperating in necessary behaviors - from shifting on and off exhibit to having a blood sample taken. This voluntary cooperation provides animals the opportunity to work for food^{8,9}, achieve greater choice and control over daily events¹⁰, and experience greater mental stimulation¹¹.

A more tangible benefit of voluntary cooperation is a decreased use of physical restraint and anesthesia¹². Trained animals also maintain a high degree of reliability in participating in these

procedures and appear less stressed while doing so^{13,14,15}. Many husbandry and veterinary procedures can be implemented with less disruption to all animals, by reducing the need to separate animals from their social groups¹⁶.

This training relies on a technique called desensitization to help animals overcome the fear or discomfort associated with a particular experience or event. By pairing positive rewards with any action or object that elicits fear, that fearful entity slowly becomes less scary, and presumably less stressful. Using this technique, animals have been desensitized to a wide array of husbandry activities, veterinary procedures, new enclosures, restraint devices, negatively-perceived people like the veterinarian, novel objects, strange noises, and so on. In fact, we have found that animals desensitized to specific stimuli can, over time, become generally desensitized to any novel or unexpected event¹⁷. Observations indicate that they will react less fearfully to new stimuli and, if they do react, are quicker to recover and continue working¹⁸. It seems fair to say that animals that are less fearful, experience a higher level of welfare.

Environmental enrichment can also be used in conjunction with training to maximize voluntary cooperation. Animals are more likely to shift reliably into areas that are physically enriched. This is especially important when asking animals to shift into holding areas where they will remain for a significant length of time, as in overnight. Enrichment can also be used to acclimate animals to new environments, or to squeeze cages and restraint chutes, by placing preferred foods in those areas and then giving animals free access to explore on their own. This acclimation process is an effective initial step before moving on to formal desensitization.

It is most desirable to house naturally social animals in groups^{19,20}. However, because of the constraints captivity imposes upon animals and their ability to avoid or escape negative behavior, social housing must be carefully implemented and monitored or it can become a stressful, negative experience for subordinate animals²¹. Positive reinforcement training has proven to be effective in addressing social issues in a variety of species. Using a training technique we call "cooperative feeding", it is possible to enhance introductions, mitigate dominance-related problems, increase affiliative behaviors, and reduce aggression in socially housed animals²². 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. Cooperative feeding can help insure that all individuals enjoy a quality of life, not just the strongest or more dominant ones.

One study documented the reduction in aggressive behavior of a male chimpanzee (*Pan troglodytes*) toward other group members during feeding time, through the use of cooperative feeding²³. Another study with drills (*Papio leucophaeus*) documented an increase in all forms of affiliative behavior during and following the project^{24,25}.

Environmental enrichment has also proven useful in providing safer and more flexible spaces for socially housed animals. Items like logs, rocks, brush piles, and hanging fire hose strips can be used to create

visual barriers which allow subdominant animals the opportunity to avoid contact with dominant group members. Providing multiple resting areas, wallowing holes, and climbing structures also decreases pressure on subdominant animals. Finally, food is a frequent stimulus for aggressive behavior in social groups. By using feeding and occupational enrichment techniques to deliver food items, tension can be diffused by increasing the amount of time and energy required to search for, process, and consume the food^{26,27}.

Living in the Zoo – Maximizing Species Typical Behavior

Heine Hediger²⁸, former director of the Zoological Gardens in Zurich, wrote in the 1940's and 50's on the care and treatment of wild animals in captivity. Hediger's main contention is that imitating nature in captivity is a mistake that can have serious repercussions. "What cannot be avoided in keeping animals in captivity, is isolation from the cycle of life; therefore a fresh artificial cycle must be created. Naturalness in the treatment of wild animals does not consist, therefore, of a pedantic imitation of one model section of nature. It means that a substitute for it must be found suitable for animals taking into account the new conditions of life in captivity."

Hediger's right. The captive environment is not the natural environment, no matter how similar it may look. The environment in the wild is a reactive one. Under each rock is a potential food item, behind each bush a potential predator, high in each tree a potential refuge. However accurately this environment may be reproduced in a zoo, it is a passive environment. Therefore, strategies for increasing species typical behaviors must be overlaid onto even the most naturalistic exhibit to be successful²⁹.

When using environmental enrichment techniques to increase species typical behavior, we are interested in how animals use objects, rather than how "naturalistic" looking they appear. As Mench and Kreger³⁰ put it, "We must place emphasis on designing zoo environments that meet needs that animals *themselves* perceive to be important." If we want a primate to brachiate from one location to another, we must provide a suitable means for that behavior to occur. A hanging vine might be the natural option, but a rope of similar diameter and flexibility placed at an appropriate height and angle is equally effective in eliciting brachiation. Similarly, a sloth bear may not have access to rotten logs filled with termites, but a capped PVC pipe with holes drilled in it and filled with raisins, provides the same opportunity for the bear to use it's unique "vacuum cleaner" action to obtain food. A supply of sticks and a yogurt cup filled with apple sauce just out of arms reach of a chimpanzee stimulates a species typical tool-use behavior similar to termite feeding in the wild. With ungulates, one zoo found that placing several large piles of maple branches in a sika deer yard stimulated a variety of species typical behaviors. "They became the focus of activity for the herd, which spent several weeks stripping the bark. Newborn fawns bedded in these brush piles. The stag used them to, remove the velvet from his antlers³¹."

Inglis and Fergusson³² suggest that information-gathering is the primary activity of all animals, subsumed only by specific motivations like seeking food. Many studies point to the importance of exploratory behavior as an indicator of well-being^{33,34}. A good enrichment program uses all categories

of enrichment to build complexity, change, and sensory stimulation into the environment, which in turn triggers desirable behaviors like these³⁵.

Another important objective is to reduce abnormal or stereotypic behavior^{36,37}. In studies with primates and marine mammals, positive reinforcement training proved effective in reducing abnormal behavior in a number of ways.^{38,39,40} We can train an incompatible behavior to replace the undesirable one. If fear is the underlying cause, we can address it through desensitization. Or we can simply increase the behavioral repertoire of an animal, providing greater alternatives to the undesirable behavior. Enrichment can be used to reduce stereotypic behavior, by increasing sensory stimulation and overall activity, or by providing the opportunity to perform more species appropriate behaviors^{41,42}.

Conclusions

Optimal care and management of zoo animals requires the recognition of what each captive animal has gained, and what they have lost, in the artificial world of the zoo. Only by recognizing the price an animal pays for the loss of freedom, of 'naturalness', of choice and control in many aspects of their lives can we effectively mitigate those losses. To that end, positive reinforcement training and environmental enrichment offer specific tools and techniques to enhance the lives of captive animals and achieve a higher degree of well-being.

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