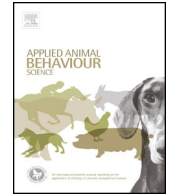




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## Review

# Training is enrichment—And beyond

Karolina Westlund\*

AFL, Comparative Medicine, Karolinska Institute, Tomtebodav. 2, Stockholm 17177, Sweden

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### ABSTRACT

With regards to the issue of animal training in the zoo community, there is some debate as to whether or not it should be considered a type of environmental enrichment (EE). This article suggests four criteria by which an intervention may be considered enrichment. The putative enrichment should (a) give the animal more control over its environment; (b) add behavioral choices; (c) promote species-appropriate repertoires; and (d) empower the animal to deal adequately with challenges. Using these criteria, I demonstrate that formal training using operant conditioning fulfills them all; some training may thus indeed be regarded as EE. Moreover, the application of a comprehensive training program will help animals obtain better welfare than can be achieved by conventional environmental enrichment (CEE) alone through the addition of other training techniques such as counter conditioning and systematic desensitization. A holistic behavior management plan should include CEE as well as a well-orchestrated and enriching training program; they complement one another and produce synergic welfare effects.

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## 1. Introduction

The systematic training of zoo animals originated in marine mammal parks that trained animals to perform shows in front of an audience (Martin, 1997). Since then, training has evolved to encompass husbandry procedures including veterinary access to a collaborating un-anesthetized animal (Brando, 2010). Nowadays, the scene is vastly different: training is used to help animals

overcome fear (Laule et al., 2003: primates), help reduce aggression in social groups (Bloomsmith et al., 1994: chimpanzees), reduce abnormal behavior (Dorey et al., 2009: baboons), easily weigh animals (Miller and King, 2013: storks), give voluntary eye medication (Brando, 2010: marine mammals) and take blood draws (Weiss and Wilson, 2003: tortoises), just to mention a few applications and the range of genera it applies to. Training does more than simply facilitate veterinary intervention, as in making such procedures less time-consuming and reducing potential dangers to staff and animals; it actually reduces distress during husbandry procedures – even procedures that the animals were not trained for, as evidenced by

\* Tel.: +46 709129690.  
E-mail address: [Karolina.Westlund@ki.se](mailto:Karolina.Westlund@ki.se)

e.g. Bassett et al. (2003). Training thus has potentially immense welfare benefits when it comes to reducing fear associated with human interventions (Brando, 2012). But training still carries the connotations that it is undignified, just “teaching the animal little tricks” as in the early days, or as Melfi (2013) puts it: training results in “artificial behavior”. In my experience, the zoo community considers training to be inferior to conventional enrichment, and it is not prioritized. Melfi (2013) even suggests that it may be omitted for some zoo species; such a notion would be unthinkable if the proposed intervention was conventional environmental enrichment (CEE). As will be explained, this is a very unfortunate situation, since training has great promise when it comes to improving captive animal welfare and dealing with behavior and welfare problems that CEE cannot solve (Brando, 2012).

Can training be labeled enrichment, or not? Some authors have tried to examine this question through a practical experimental approach, whereby they compared behavior outside training sessions on training days with behavior on adjacent days where there was no intervention, CEE interventions or both CEE and training interventions (McCormick, 2004). This type of approach neglects to consider that training and CEE (one or both) might give long-term effects spilling over to non-training or non-enrichment days also. Indeed, Fernström et al. (2009) showed that macaques remember what they learned for at least 27 days; we would therefore not expect effects of training to be confined exclusively to the same day that training occurred. Thus, McCormick (2004) could very well have been measuring a ceiling effect. Hare and Sevenich (2001) compared the stimuli, windows of opportunities, behavioral responses, and reinforcements involved in training versus enrichment scenarios, and whilst conceding that training is enriching, they admonished that “enrichment” and “training” were not synonymous terms or concepts. Melfi (2013) took another approach by formulating and discussing hypotheses to test whether training could be labeled enrichment or not – she concluded it could not, yet called for the need of further studies. However, her choice of hypotheses was questioned in a Letter to the Editor (Westlund, 2014). The aim of this article is to test four hypotheses examining the extent to which training qualifies as enrichment.

### 1.1. Definitions

I propose that, when assessing whether or not a procedure should be characterized as enrichment, we first need to approach one or several of the current definitions of enrichment to which there is some consensus in the scientific community. Young (2008), based on a consensus statement from the AZA Behavior Scientific Advisory Group 1999, defines environmental enrichment (EE) as follows: “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 to animals and drawing out their species appropriate behaviors and abilities, thus enhancing animal welfare”. The purpose of enrichment is

thus welfare benefits; indeed, Newberry (1995) defined enrichment as “improvement in the biological functioning of captive animals resulting from modifications to their environment”. Young (2008) goes on to suggest a number of goals of enrichment, one of which is to increase the ability to cope with challenges in a more normal way. Sambrook and Buchanan-Smith (1997) conclude that successful enrichments have one thing in common; they give animals control. Note that the definitions and goal proposed here do not accept just any welfare-promoting change in the animals environment as enriching (as suggested by Melfi, 2013); enrichments should address the animals’ behavioral biology, natural history, behavioral choices, species-typical behaviors and abilities.

What is training, then? Interestingly, it seems that a formal definition of training, based on consensus by the zoo community, is lacking. When authors discuss training, they may be very explicit in using predominantly one technique, or they may refer to a battery of different learning mechanisms and training techniques. Many authors refer to training as positive reinforcement training, all but equating the two terms (e.g. Anderson et al., 2003; Bloomsmith et al., 1994; Desmond and Laule, 1994; McKinley et al., 2003; Melfi and Thomas, 2005). Sometimes training is referred to as operant conditioning (Savastano et al., 2003). Phillips et al. (1998) use the term conditioning, involving habituation techniques and positive reinforcement. Weiss and Wilson (2003) refer to their training as classical and operant conditioning. According to Mellen and Ellis (1996) training entails human-dictated changes in behavior resulting from practice or experience (that is; learning), through the processes of operant conditioning, classical conditioning, habituation and complex learning. Clay et al. (2009) examine desensitization and counter conditioning. Dorey et al. (2009), introduce the concept of functional analysis in the zoo training literature. Farhooody (2012) discusses the 2-term contingency (stimulus-response in classical conditioning), the 3-term contingency (the ABCs of operant conditioning) and the 4-term contingency (considering the motivational state of the animal in the behavior equation) in her paper *behavior analysis – the science of training*. Laule and Desmond (1998) simply state “training is teaching, being trained is learning”. Notably, operant conditioning, particularly positive reinforcement training, is the common feature in most of the methods described above. Heidenreich (2012) summarizes the status quo: “influencing animal behavior utilizes science, nature and technique. Those who excel at creating behavioral change understand, practice and draw on knowledge in all three areas” indicating the complexity of animal training, and the skills necessary to become a good animal trainer in the 21st century – the science of behavior analysis is considered an integral part of such skills (Heidenreich, 2012). It thus seems that animal training is an evolving process, that it nowadays involves targeting many different learning systems, and using multiple training techniques. In the zoological community training has evolved from a show-oriented technique through one addressing common husbandry situations (Mellen and Ellis, 1996), to one that takes a holistic view of all the animal’s learning opportunities, both in formal training situations (see below)

and addressing the informal learning that goes on outside such formal training sessions, including addressing problem behavior (Brando, 2010, 2012). Needless to say, trainer skill is of pivotal importance in accomplishing such learning goals in a zoo environment.

The goals of training are diverse, and may in the zoo environment be to facilitate animal husbandry and veterinary interventions (e.g. by teaching the animals to shift between enclosures) or to improve human-animal-relationships (HAR), which increases the animals' practical behavioral choices through the reduction of avoidance behavior. Furthermore, training goals may be to improve animal welfare (by e.g. reducing distress), or prolong staying time for zoo visitors through training demonstrations or shows (Anderson et al., 2003) (thus generating more income for zoos). Training often occurs in formal training sessions, whereby the trainer is directly interacting with the animal using predominantly operant conditioning techniques. Note, however, that informal training goes on all the time. The same learning principles are still active whether caretakers are aware of them or not, and all events that occur in captive animals' lives are to some extent orchestrated or controlled by humans; thus we are constantly setting the stage for learning to occur whether we plan for it or not. In a sense, zookeepers are always training (Brando, 2012).

Could all of these training techniques and tapping in to these learning mechanisms be considered enrichment, then? Probably not. In the discussion below, I focus on examining whether formal training sessions (here defined as trainer and animal in direct interaction, using operant conditioning) can be classified as "enrichment".

## 2. Hypothesis testing

Based on these published definitions and consensus goals of enrichment and the proposed formal training definition, I propose a set of four hypotheses to assess whether a certain intervention (conventional or unconventional) qualifies as enrichment or not. They are chosen with the criterion that they should be included in the formal definitions of EE (Young, 2008); goals of EE (Young, 2008); and pivotal effects of EE (Sambrook and Buchanan-Smith, 1997). These are not exhaustive, but capture the essence of conventional enrichment effect. It seems reasonable that all four criteria should be met by a putative enrichment; most CEE would.

- The putative enrichment should give the animal more control over its environment.
- The putative enrichment should add behavioral choices.
- The putative enrichment should promote species-appropriate repertoires.
- The putative enrichment should empower the animal to deal adequately with challenges.

Below I examine these hypotheses one by one, the putative enrichment under scrutiny being formal training as defined above.

- The putative enrichment should give the animal more control over its environment.

Control reduces stress, which improves welfare (Veissier and Boissy, 2007; Weiss, 1968). Does formal training achieve this? Control implies affecting the environment by doing something. "If I do this, then that happens". Operant conditioning is behavior changing as a function of consequences (Skinner, 1963). Since it is the animal's behavior that brings about the consequences from which it learns, this process is clearly associated with control (the animal's behavior influencing the likelihood of an event occurring (Sambrook and Buchanan-Smith, 1997)). By this criterion, formal training is enrichment.

- The putative enrichment should add behavioral choices.

There should be more options available to the animal with the enrichment than without. Training using positive reinforcement, the predominant type of formal training in zoos today, undoubtedly gives animals choices (Laule et al., 2003) – but see Hare and Sevenich (2001). Choosing to participate or not in the training session. Choosing to try a new behavior, see what works, what produces the reward – in a context of positive reinforcement, there are no adverse repercussions to trying (in contrast to a punishment scenario). During most husbandry training, participation is voluntary and the animal can terminate the session at any time. Certainly, there is more choice involved in a situation where the animal is trained with positive reinforcement than with the traditional escape/avoidance techniques (Laule and Desmond, 1998): an animal caught by net, gloves or restrained in a squeeze cage has very few choices. In addition, training can reduce fears which may cause animals to refrain from using certain parts of their enclosure, effectively adding more choices than would be available without training. Thus, formal training equals enrichment using this criterion.

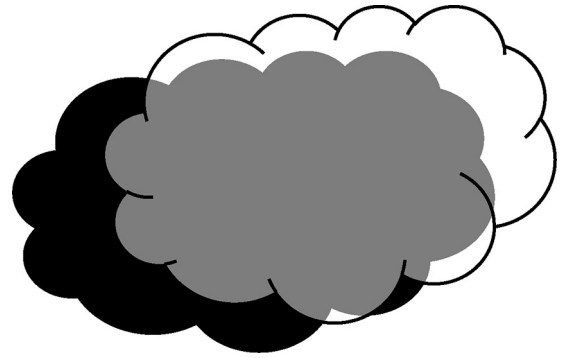
- The putative enrichment should promote species-appropriate repertoires.

Does formal training really promote species-appropriate repertoires? This criterion is the difficult nut to crack, and at first sight it may seem that this is where training sinks and CEE soars. How can training a rhesus macaque to accept a blood draw, or a marabou stork to enter a transport box, ever be considered addressing the species-appropriate repertoire? Melfi's example (2013) is very telling. By shaping, you can train a tiger to perform certain elements of scent-marking behavior, but it looks stereotyped in comparison with the real thing, the frenzied scratching, snorting and back-rolling triggered by a simple application of scent on a tree (Hare and Sevenich, 2001). However, this is an unfortunate choice of comparison, much akin to comparing apples and oranges. True scent-marking behavior is motivated by a need-to-scent-mark (whether it is e.g. socially or play-motivated); whereas in the case of the shaped behavior, the animal's scratching is food-motivated. The trained tiger is performing the behavior because each trained response that is up to current criteria produces a treat (Hare and Sevenich, 2001). I believe that, to truly discuss the main effects of positive

reinforcement training we need to consider foraging instead, and switch from focusing on overt behavior (that we can observe) to covert behavior (which we cannot). I argue that since most formal training is done using food as reinforcers, foraging motivation is activated during the training session and so is the core emotion SEEKING (Westlund, 2012), a fundamental emotional system in the brain (Panksepp, 2005). One might be concerned that animals trained with food rewards may be more prone to beg for food – which may be considered a species-inappropriate behavior, but this is true only to the extent that begging behavior is reinforced. Animals do what works (Friedman, 2007). Using food rewards, even though the animal may be trained to present a limb for injection, its foraging drive is on full alert, particularly if a clicker or some other secondary reinforcer is used (Westlund, 2012). But why are the animal's emotions important? Because emotions are behaviors (Leigland, 1997). SEEKING is the fundamental food-getting emotion ubiquitous to all mammal species and probably birds too, and it is triggered in excess by positive reinforcement training (Panksepp, 2005; Westlund, 2012). Formal training triggers species-appropriate covert behaviors. Ergo: formal training falls under enrichment by this criterion also.

- d) The putative enrichment should empower the animal to deal adequately with challenges.

Does formal training help captive animals deal with challenges? Wild animals become problem-solvers. They are exposed to adverse situations that they must learn to deal with, or they will not survive: food scarcity, the risk of predation, finding and winning a mate. Through experiences, they learn to deal with such situations as best they can. They are exposed to new stimuli on a daily basis, and habituate or sensitize to them as needed. In contrast, in a zoo environment, there are fewer environmental changes from one day to another, despite the best intentions. The animal soon knows every crevice of its enclosure. Keepers may appear at random, CEE adds some variability and novelty, but it must be recognized that perhaps the biggest challenge for zoo animals is dealing with humans! Keepers and other humans are part of the ecology of captive animals (Dorey et al., 2009). In my opinion, freezing, avoiding or aggressing toward humans is not “dealing adequately with challenges” in the zoo environment, yet these are very common occurrences in zoos and are often acknowledged and grudgingly accepted as an unfortunate and unavoidable fact. If a hands-off non-training approach is used disregarding the animals learning environment, any major relocation, transport or veterinary intervention may catapult the naïve animal into a panic because of the sudden forced contact with humans, or being flooded with novel stimuli (Boissy, 1995; Brigham and Sibley, 1999; Bush, 1996). Training may reduce the impact of such procedures in ways that CEE cannot. The result of training in this context may thus be animals that are less traumatized (Boissy, 1995). Using systematic desensitization and counter conditioning, the trainer can facilitate acclimatization to new stimuli and



**Fig. 1.** Welfare advantages of conventional environmental enrichment (CEE) (black) and training (white). There is overlap (gray) but some effects can only be obtained with CEE, and some only with training. Combining both practices (a behavior management approach) gives the greatest welfare advantage.

help the animal overcome even intense fear (Goldstein, 1969) – the latter is, in my opinion, much more difficult – perhaps impossible, using CEE. In addition, operant conditioning can be used to reduce stress and improve coping responses in aversive situations induced by common husbandry procedures (Bassett et al., 2003; Mineka et al., 1986). To conclude, formal training can be considered enrichment because it empowers the animal to deal adequately with challenges.

### 3. Discussion

To summarize, formal training gives animals control, choices and teaches them to deal with challenges in the environment, also stimulating species-appropriate covert behavior. All four hypotheses were thus accepted, and I conclude that formal training (the trainer using operant conditioning in direct interaction with the animal) may be called enrichment. However, conventional environmental enrichment (CEE) is very diverse and as discussed above, so is training. It would seem that other forms of training would not qualify as enrichment, such as training using systematic desensitization and classical counter conditioning (which may perhaps only qualify as EE with regards to hypothesis (d) – empowering the animal to deal with challenges). Despite being immensely beneficial from a welfare perspective, such an intervention would thus not be termed enrichment according to three out of the four criteria proposed in this article.

In conclusion, we provide various behavioral interventions to improve welfare, and the results of the hypotheses is that there is a substantial overlap (the ‘gray areas’ suggested by Hare and Sevenich, 2001) in the effects of CEE and formal training, so yes, formal training is enrichment – to some extent (Fig. 1). I propose that it is more than just a “slice of the enrichment pie” (Hare and Sevenich, 2001), though. Just as all CEE do not lead to the same effect, formal training does not cover all facets of all possible CEE. As discussed above, positive reinforcement training predominantly stimulates foraging motivation. CEE also addresses foraging but does not rely on cues given by humans to evoke behavior; the behavioral contingency may also be very

different, resulting in other overt responses and greater behavioral diversity over extended periods of time (Hare and Sevenich, 2001). In addition, CEE targets other motivations (social behavior, play and comfort behavior, for instance, triggering certain types of covert behavior (emotions), for instance, such as CARE and LUST (Panksepp, 2005)), and is therefore necessary to complement formal training (Fig. 1) for maximal welfare benefit. And vice versa, there are welfare effects of training that cannot be achieved with CEE, such as systematic desensitization and counter conditioning to intensely fear-inducing stimuli, and using functional analysis to address problem behaviors that could compromise welfare (Dorey et al., 2009; Friedman, 2007) (Fig. 1). One definition of psychological well-being is “the ability to adapt – to respond and adjust to changing situations” (Petto et al., 1990), which in essence captures the gist of hypothesis (d). The latter is therefore perhaps the most important of the hypotheses identified here, and it is also where the other types of training not included in the “formal training” definition have the most impact. In contrast, typical CEE arguably seems to have the least impact regarding hypothesis (d) in comparison with how CEE impacts the other hypotheses suggested here.

A skillful trainer has more to his or her trade than the operant techniques (PRT/NRT/punishment) mentioned by Melfi (2013), illustrating that the zoo community perhaps has a poor understanding of what training may entail, and thus what it may accomplish. I argue that training has enormous yet largely unrecognized welfare benefits, and it is not inferior to conventional enrichment but rather complements it. Indeed, the lack of a training program affects welfare negatively (Brando, 2012). Zoos should recognize this, take charge of what the animal learns and elevate the status of the practice of training to that of conventional enrichment. The combination of CEE and training has been referred to as behavior management (Laule, 1993). Behavior management procedures can achieve higher welfare than CEE or training alone.

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