Positive Reinforcement Training in Large Experimental Animals

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Summary

The use of large animals such as mini pigs, pigs and ruminants in animal experimentation often includes the need for some kind of force or restraint to perform a variety of procedures, e.g. moving the animal, different dosing regimens and clinical examinations. In animals of a certain size, these procedures are not only highly aversive to the animals but they also often force animal caretakers and technicians to work in ergonomically undesirable ways. To avoid or at least minimize the negative impact of such procedures on animals and technical staff, implementation of positive reinforcement training (PRT, aka clicker-training) is a promising tool, combining cognitive enrichment of the animals, improved animal-human relations and less straining working procedures for the staff. The use of PRT may in some cases even be cost-effective. PRT may present the possibility to do research that would otherwise not have been possible. Implementation of PRT has been carried out with success in both the pharmaceutical industry, in non-clinical safety testing and at the University of Copenhagen. Several procedures have been trained successfully and resulted in a more smooth and gentle working procedure during for example intra nasal dosing, subcutaneous dosing of high volumes, rectal probe measures and flushing of catheters.

This presentation will explain the theories behind PRT, namely classical and operant conditioning, and highlight the usefulness of the method using video examples demonstrating how clicker training has been used to train the animals to actively cooperate with the technicians during the above mentioned procedures.

Keywords: positive reinforcement training, negative punishment, conditioning

In animal experimentation, the use of large animals such as mini pigs, pigs, and ruminants often involves some kind of force to perform a variety of procedures, e.g. moving and restraining the animal, various dosing regimens, and clinical examinations. Experimental procedures and daily handling procedures driven by force and coercion not only are highly aversive to the animals, but they also put the animal caretakers and the technicians at risk. Staff members working under such conditions risk not only having to work in ergonomically undesirable ways and being subjected to noise (e.g., from screaming pigs), but they also risk injury from aggressive or fearful animals.

Positive reinforcement training (PRT), also known as "clicker training," is a concept and a tool named after one of the four learning principles in operant conditioning. It combines learning theories such as habituation, classical conditioning, and operant conditioning.

PRT both minimizes the negative impact of such procedures on animals and technical staff and provides better animal welfare by combining cognitive enrichment of the animals and improved animal-human relations. This technique has been used in laboratory animal facilities for the last decade, mainly for primates and dogs (Clark, 1999; Coleman et al., 2008; Schapiro et al., 2005).

PRT is used to teach an individual an association between something he does (that the trainer wants) and the consequences of exhibiting that behavior. When the animal shows the behavior desired by the trainer, the animal will be reinforced (rewarded, often with food), and hence the consequences will be good for the animal when showing that particular behavior. This will increase the likelihood of the animal exhibiting that behavior again. If an animal does something not wanted by the trainer, no reinforcement is given – a procedure termed negative punishment (NP). The trainer thus punishes an unwanted behavior by taking away/withholding the reward. The consequence for the animal for such a behavior hence will be bad and the likelihood of the animal showing that behavior again will decrease. These two operant procedures always complement each other, and if you are truly working with PRT, these two procedures will be the only operant procedures used.

The two last operant conditioning procedures should be avoided when training an animal to cooperate. Hence negative reinforcement (NR), i.e. applying pressure on the animal

and relieving pressure when the wanted behavior is shown by the animal, or positive punishment (PP), i.e. adding something aversive, when the animal performs an unwanted behavior, should not be used.

Habituation is a non-associative type of learning where the animal will learn that certain new things or situations (e.g. the sound of a high-pressure washer) are not dangerous and need not be reacted to. If the animal already reacts fearfully to the given stimulus, desensitization must be employed prior to training of any operant responding. Desensitization is basically learning that something you fear or dislike is not dangerous or aversive after all. In classical conditioning (Pavlovian conditioning), the animal will learn to associate two stimuli – an unconditioned stimulus (US) that, by definition, will evoke an unconditioned response (UR; a reflex) and a conditioned stimulus (CS), a previously neutral stimulus, that does not inevitably evoke a response (e.g. when the sound of an electrical can-opener becomes associated with cat food or when the sight of a syringe and needle becomes associated with pain and fear). After the animal has learned the association between the US and the CS, the presentation of the CS will evoke that particular behavioral response, which is now a conditioned response (CR). The sound of the electric can-opener will evoke salivation and the sight of the syringe will evoke fear. In PRT, classical conditioning is deliberately used to give positive value to an initially neutral stimulus, such as a sound produced by a "clicker" or a whistle, by pairing the sound of the device with an US such as food. The CS (clicker, whistle, etc.) is then used as a marker for the correct behavior (for details, please refer to e.g. Pryor, 1999, 2009; Ramirez, 1999; Reid, 1996). Classical conditioning is always in play, and it is of utmost importance that the trainer never ignores or underestimates the power of classical conditioning.

In PRT, the trainer will focus on reinforcing wanted behaviors and ignoring unwanted behaviors, thus encouraging the animal to voluntarily offer different behaviors to see which behavior will lead to reinforcement. By providing suitable experiences of success for certain behaviors, the trainer will create relatively permanent changes in behavioral responses in the animals. During training, the animal will experience positive anticipation and an ability to control training-related aspects of the environment, which enhances animal welfare (Cheng et al., 2003; Dudink et al., 2006; Van Der Harst et al., 2003a,b). Moreover, implementing PRT in the lab animal unit provides the animals with cognitive enrichment, further promoting welfare (Manteuffel et al., 2009; Puppe et al., 2007).

PRT also leads to improved working conditions for the staff. Training animals to voluntarily enter enclosures or wagons, or move from one place to another, present body parts for injection, hold position when catheters are flushed or nasal spray applied, etc. reduces the need for forceful handling. Moreover, the animal caretakers are allowed to interact with the animals in a positive, reinforcing way. The use of PRT may in some cases even be cost-effective, since the man-power necessary for training/subsequent work with the animal often can be counterbalanced – or even be less than the man-power needed to handle an un-trained animal. Moreover, PRT may offer the possibility of doing research that would otherwise not have been possible, such as flushing implanted catheters in unstressed, calm, and unsedated animals (Sørensen, 2010). It must also be noted that the use of PRT requires adequate education of animal trainers to optimize the animal welfare benefits (Sørensen, 2010).

Implementation of PRT has been carried out with success in some of the Danish pharmaceutical industry, in Danish non-clinical safety testing, and at the University of Copenhagen. Several procedures have been trained using combinations of habituation, classical conditioning, and positive reinforcement training, which resulted in smoother, gentler working procedures during, e.g. intra-nasal dosing, subcutaneous dosing of high volumes, rectal probe measures, and flushing of catheters. The animals all voluntarily approached the animal handler, accepted the treatment, and received the earned reinforcer (food), making the experimental work with these animals a more pleasant experience for both animals and humans.

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