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# Applying animal learning theory: training captive animals to comply with veterinary and husbandry procedures

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## Abstract

*Animals within zoo environments are learning continuously: they learn signals that predict when food is going to arrive or that the presence of a certain person means that something unpleasant may happen. They may learn to control their environment and caregivers: for example, they may learn that if they perform a particular behaviour (eg repetitive behaviour) they will receive a reward (ie food or attention from a caregiver). Using standard operant conditioning and classical conditioning techniques we can easily modify the behaviour of animals in zoos. Animals can be trained to comply with almost all minor veterinary procedures and examinations, such as injection, the measurement of heart rate, the cleaning of teeth and the treatment of superficial injuries. Compliance can be achieved using standard animal learning abilities without the need for punishment type I (ie physical punishment) or immobilisation (chemical or physical). In this paper we discuss how we apply learning theory to such procedures, the dangers associated with such programs (eg injury to the trainer) and the benefits (eg the treatment of large endangered animal species without the use of anaesthetic drugs). Additionally, we briefly discuss the selection and management of animal trainers. The methods we describe here are equally applicable to laboratory, farm and pet animals. Finally, as with all management processes applied to animals, a written policy on animal training needs to be produced by any institution training animals.*

**Keywords**: *animal welfare, behavioural management, classical conditioning, husbandry procedures, operant conditioning, veterinary procedures*

## Introduction

In all institutions that maintain animals in captivity throughout the world, an animal caregiver (eg zoo keeper) is expected to visually inspect the health of the animals in their care at least once per day. Normally, a zoo keeper achieves this by shaking his/her collection of keys near to the animal's enclosure and soon after this signal (stimulus) is emitted, the animal usually appears. How does the animal know to appear and how does the caregiver know to do this? Usually, we discover that the caregiver has paired (associated) the sound of the rattling keys with the subsequent presentation of a reward such as food (positive reinforcer). Thus, the animal associates the sound of the keys with a food reward or with another positive reinforcer, such as comfort. What has occurred here is classical conditioning (Chance 1998). In terms of classical conditioning the animal has learnt that the key noise (stimulus) indicates that a food reward (positive reinforcer) has become available. Most caregivers know how to train animals in this way, although few would call it training (Lukas *et al* 1998). In many zoos, caregivers learn such methods from more experienced caregivers (ie social or observational learning) or develop the method themselves. If you were to ask caregivers to describe the aforementioned process in terms of animal learning theory, few of them would be able to (and, in our experience, many would argue that it is not animal training). In fact, the term 'animal training' has become so inextricably linked with animals performing 'tricks' for people's amusement that many in the animal industries refer to veterinary or husbandry training as 'behavioural management' (which usually also includes environmental enrichment) to differentiate the situations (Bloomsmith *et al* 1994, 1998).

From the animal's perspective, the performance of a 'trick' or of a behaviour to facilitate a veterinary procedure are the same: ie a behaviour is emitted upon a cue and a reward is subsequently received. The difference is in the human perception of the animal's trained behaviour. We do not wish to discuss here the ethical value of animal training as this is a complex issue beyond the scope of this article.

Given that our caregiver has a legal obligation to visually inspect his animals every day, why else might we be interested in training zoo-housed animals? The simple answer is to improve their quality of life (ie animal welfare). Specifically, there are many times in a captive animal's life when we need to manage some aspect of its well-being, most commonly its physical well-being (Mellen & Ellis

1996). In the past, the treatment of physical well-being problems (eg injuries) or the monitoring of physical well-being (ie medical examination) required that the animal be either physically (eg in a crush cage) or chemically restrained (eg anaesthetised). Both processes normally cause some distress and danger both to the animal and to its caregiver (Pollard *et al* 1992; Grandin *et al* 1995; Phillips *et al* 1998). Additionally, in the case of chemical immobilisation, there is often a considerable health risk associated with the use of the chemicals. For example, approximately 35% of anaesthetised giraffes die from the effects of anaesthesia (Bush 1993, 1996), and other large mammal species such as elephants and rhinos face similarly high risks. With all species, but particularly with those of high conservation importance, such risks must be minimised, especially since the adverse effects both of physical and chemical restraint can be accumulative on the physical and psychological well-being of the individuals concerned. It is well known for example that certain drugs used for immobilisation accumulate within the animal's body. Thus, each subsequent chemical restraint/anaesthesia increases the risk of a physical health problem (Bush 1993, 1996). The physical well-being of trained animals is also improved since they are usually much easier to handle and manage (Grandin *et al* 1995), negating the need for the use of force to control their behaviour.

It was suggested by Hediger (1955) that the training of animals might be equated with occupational therapy. A number of studies have supported this suggestion regarding the positive effects of training on the psychological well-being of animals. For example, a general reduction in the performance of abnormal behaviour has been reported for animals undergoing behavioural training (Kastelein & Wiepkema 1988; Mellen & Ellis 1996; Laule & Desmond 1998). It has also been suggested that animals may derive pleasure from performing behaviour that results in them gaining a reward (Wiepkema & Koolhaas 1992). Thus, in terms of animal welfare, the behavioural training of animals is very important.

The purpose of this article is to explain clearly and simply the basics of training animals for husbandry and veterinary procedures, since outside North American zoos and laboratories knowledge of animal training is often lacking. By outlining the basic principles and pointing out potential pitfalls, we hope to guide institutions in the use of animal training to improve animal welfare. Our experience has shown us that badly designed and badly implemented behavioural training programmes usually result from a lack of knowledge. Attempts to train animals by people without a basic understanding of how animals learn, not only result in failure, but also frequently in a decrease in animal welfare. For example, many people still believe that punishment is an essential part of the animal learning process (see Monks of New Skete Staff 2002; and for discussions see Kiley-Worthington 1990; Stevenson 2002). Punishment not only reduces animal welfare but also increases the risk that the animal being trained will attack its trainer (see Chance 1998).

## Veterinary and husbandry training

The range of behaviours that animals can be trained to perform for veterinary and husbandry purposes tends to depend on the species' and the individual's characteristics. In terms of veterinary care and examinations, we can train animals to accept the following procedures (sometimes using local anaesthesia):

- Removal of blood using a syringe.
- Injection of drugs using a syringe.
- Treatment of surface wounds and skin diseases.
- Inspection and cleaning of teeth.
- Foot care and the trimming of nails and hooves.
- Dentistry work (with local anaesthesia).
- X-ray examinations.
- Ultrasound examinations.
- Body weight measurements.
- Provision of urine samples.
- Presentation of body parts for inspection.
- Semen sampling.
- Milk sampling.
- Oral consumption of drug treatments.

In terms of husbandry we can train animals to do the following:

- Move to a requested location.
- Move into a crate for transportation.
- Return an object dropped into their enclosure.
- Appear for a visual inspection.

We can also modify the behaviour of animals that are aggressive or display other undesirable behaviours.

## Safety

The most important aspect of any animal training program is the safety both of the animal and the trainer. In zoos throughout the world, animal caregivers and trainers have been killed or seriously injured when they have had physical contact with their animals (Mellen & Ellis 1996). Animal training often involves some physical contact between the animal and a human trainer. Therefore, each species that is to be trained must first be fully risk-assessed; that is, the specific dangers from an animal of a particular species must be established. The number of years that a caregiver has worked with a particular species or even with a particular individual does not reduce their risk — one only has to look at the records of caregivers killed by zoo-housed elephants to recognise this. It must be stressed and re-stressed to all animal trainers by their managers that the animals they train are not their 'friends', and that one day they could attack them. The animal might treat them as a member of their social group (ie of the same species) and just 'knock them out of the way', but if an elephant does this then it could result in serious injury or death.

Thus, the training facility (area) and the training protocol to be employed must minimise the risk of injury or accident both to animals and to trainers (caregivers). Principally, for the trainer, the risk is from the animal being able to get hold



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of them or bite them. Thus, whenever possible, training should be conducted from outside the animal's enclosure using a method called 'protected contact' (Desmond & Laule 1991), which was originally developed for working with elephants. Although, this method of training goes against the beliefs of many animal trainers, the evidence that protected contact works is irrefutable (see Stevenson 2002). Thus, one often needs to think about human culture and about re-educating (ie training) people if you already have animal trainers on staff.

The physical construction of any area to be used for animal training must therefore not permit the animal to reach with a limb or trunk and grab hold of a trainer. However, it must allow for food rewards to be given rapidly to the animal being trained (normally within 2 s of the behaviour being performed [Chance 1998]). This can be achieved by using a tube down which food rewards are delivered or a bowl into which they can be dropped. As a general rule the food should never be directly given to the animal because any facility design that permits this would probably also allow the animal to grab the person. If food is to be placed directly into the animal's mouth, then it should be done so on the end of a weak 'stick', and not from the fingers of the trainer. Thus, if the animal bites the stick or takes it into its enclosure, this will not compromise human safety. In some animal training scenarios we may wish to inspect an animal's limb, such as the feet of elephants. Therefore, there will through necessity be an area where an animal could potentially grab a trainer, and this 'danger zone' should be clearly marked on the floor.

In the case of some species, such as elephants, two people are often required for training: one person actually trains the elephant and the other delivers the food rewards on cue from the trainer. Given the enormous strength that elephants have in their trunks, it is vital that they cannot touch the trainer or the person delivering the rewards — ideally the food reward should be thrown into a bowl on the ground.

It is always worth having two people present during the training of animals: one to act as the trainer and the other to observe the training process. A training process can become a two-way training situation in that the animal may start training the human trainer; having a person observe the training session can minimise this possibility. Pryor (1995) has described how dolphins try to train their trainers, through the process of shaping, to lean out further and further over a pool. Personally, we have seen great apes attempt to shape a trainer to come within 'grabbing range'. Normally, the animal nearly touches a target (eg an object such as a stick that the animal has been trained to touch), but not quite, perhaps failing by a distance of 3 cm or so. Often, in response, the trainer moves the target closer to the animal, which usually also involves them moving their body closer to the animal and into the danger zone.

Animals that have the ability to reach and take hold of an object, such as primates, should be first taught to hold onto metal bars that are visible to the trainer. This can normally be achieved through target training (see later for full description): the animal is trained to place its hands wherever a target is placed, and receives a food reward for doing so. Thus, in the case of primates, one of the first commands that should be taught is "secure hands". Furthermore, the animal should whenever possible keep its hands secured to the bars, unless of course this makes carrying out a procedure impossible (eg visual inspection of the animal's back).

Given the close physical proximity of the trainer and animal during training sessions, we also need to think about the possibility of the trainer transmitting diseases to the animal and vice versa. Therefore, basic precautions, such as wearing a facemask and disposable gloves, and not allowing a trainer who is ill to train an animal, should be followed (Mellen & Ellis 1996).

## Signalling (stimuli)

The most fundamental part of a training program is that the animal must be able to perceive the signals that the trainer is providing. One must always consider the species' sensory abilities and constraints on learning (Roper 1983) when deciding what signals to use during training; for example, one needs a signal that transmits in water for dolphins. Training signals are the commands by which the trainer solicits behaviour from the animal. If verbal signals are to be used, it is best to use one-word or a maximum of two-word commands or cues (ideally each word should have only one or two syllables) — never use a sentence. Examples of good verbal commands are "foot" or "other foot" when we want an animal to present its two feet in succession (Ringer 1986).

It is also important that the signal is novel to the animal. For example, some Brazilian zoos have large populations of wild marmosets that communicate using high-pitched, almost whistle-like vocalisations (Stevenson & Rylands 1988). Thus, the use of high-pitched whistles as training signals is unlikely to be successful in this situation. Furthermore, it is best to use signals that the public cannot copy. The novelty of a stimulus has also been demonstrated to be important in the speed with which a classically conditioned response is learnt (Chance 1998): the more novel the signal (stimulus), the quicker the acquisition of the response.

## The reinforcer

It is common practice to restrict an animal's food intake prior to a training session. However, we have found this not to be necessary if highly prized positive reinforcers, such as favourite food items, are used. Mild food restriction may assist the learning process in some species, but if the level of restriction is too high the animal can become frustrated, aggressive and unresponsive to the trainer (see Breland & Breland 1961). It should be noted that many things can act as positive reinforcers, including toys, physical contact with the trainer, the opportunity to socially interact with other animals, and so on. However, food tends to be used in veterinary and husbandry training because it is a powerful positive reinforcer that is effective within a short period of time. Some positive reinforcers, such as the opportunity to engage in play, are difficult to use in the training process as

they disrupt the sequence of training. Physical contact reinforcers, such as stroking the animal, can be powerful positive reinforcers but often carry with them a high risk of physical injury to the trainer. Most animal trainers use verbal praise when a solicited behaviour has been performed (eg they say "good"), and some studies indicate that this may accelerate learning (Reid 1996; Burch & Bailey 1999).

It can prove difficult to condition the behaviour of some animals with food rewards because of their digestive systems or metabolic demands. Studies on sheep, for example, show that these animals find it difficult to learn an operant task in a Skinner box (Jackson *et al* 1999). We have discovered that it is difficult to find a food reward that will motivate rhinos to express behaviour, whereas scratching their backs with a broom motivates them to express the behaviours we are training.

We have also found that it is good practice to conclude all training sessions by saying "bye", and then giving the animal a lot of food before leaving the training area. Often an animal initially responds to this situation by making a lot of noise: either vocalising or 'bashing' the structure of the enclosure. This is not surprising given that the animal's source of positive reinforcement (ie the trainer) has left and it wishes this reinforcement to continue. We have also found this system to be beneficial when training animals that live in social groups — normally we need to leave the training area for 5 to 10 mins before calling the next animal for its training session.

## First command

The first command we usually condition is to come into the indoor enclosure or training area. Personally, although we believe that it is good for the public to know that the animals are being trained for veterinary and husbandry purposes, we do not believe in conducting training in front of the public for a number of reasons: (1) When members of the public see a human interacting with an animal, they may believe that the animal is not dangerous (for educational and safety purposes it is important that the zoo-going public perceive dangerous animals as dangerous [Coe 1985]); (2) Seeing human–animal interaction may encourage zoo visitors to try to interact with the animal (most zoos have had experience of members of the public going to great lengths, such as climbing fences, to interact with dangerous species, such as chimpanzees, often resulting in horrific injuries); (3) Educational research shows that when humans interact with an animal or see an animal being interacted with, their attitude towards the animal changes from one of respect to one of viewing animals as children (Russell 1995); (4) We do not want members of the public to attempt to train our animals themselves, which is a possibility if they see animals being trained (this problem is compounded by the fact that usually we wish an animal to respond to any trainer); (5) In terms of education and conservation in zoos, it is very important that the animals behave normally when they are in the on-exhibit (public) area, including ignoring the trainers. If the behaviour of the animals on-exhibit and outside the training area is highly modified, for example if primates stop grooming to observe their trainers (Catlow *et al* 1998), then the program has failed. Therefore, it is important that trainers do not attempt to interact with their animals outside the training session.

Normally we use a compound stimulus — usually a whistle (a dog whistle set at a specific frequency) and the animal's name — to communicate to the animal that we wish it to come inside to the training area, which is out of the view of the public. This behaviour is usually easy to train providing that the animal has not previously been forced into its indoor enclosure using aversive stimuli, such as soaking it with water. Before a training program begins, it is vital that all forms of aversive behavioural control, such as chasing or frightening the animals, have stopped. Thus, a good relationship is essential between the trainer and the animal care staff to: (a) find out how the animal has been managed in the past, and (b) if necessary, modify the behaviour of the animal's caregivers. If the animal has been forced into its indoor enclosure in the past using aversive stimuli, then it will first be necessary to eliminate the negative association with this area. Normally, this can be achieved by using plenty of environmental enrichment and by providing food treats in this area, in addition to totally eliminating the use of aversive stimuli (this may also entail changing the animal's caregivers if the animal associates them with the use of aversive stimuli). By limiting access to this now highly reinforcing area by closing and locking the door, we can start to condition the animal to come into the area. Pairing the opening of the area with the whistle is one way to condition the animal to come into the area. It is important that no training takes place in the area until the animal is 'happy' to rest in it once all of the food and enrichment items have been emptied. For animals with a great fear of an indoor area, we can 'shape' them to enter the area by throwing them food rewards so that they gradually move towards the area and eventually enter it. This process may take several weeks, and throughout it is important that the indoor area is highly enriched and contains food treats. It is absolutely vital that once the animal enters the indoor area it is not locked inside — this can be trained, but much later into the program when the animal is more confident in the area. Once the animal is calm and confident inside the enclosure, the trainer can then enter the area slowly and reward the animal for staying calm in their presence.

## The training process

All of the training that we undertake uses basic operant and classical conditioning techniques combined with positive reinforcement. The use of negative reinforcement (ie giving the opportunity to avoid an unpleasant stimulus) to train animals, while theoretically possible, would in practice be much more difficult to apply to veterinary or husbandry training. Furthermore, many people confuse negative reinforcement and punishment type I (ie physical punishment). This is not surprising since these processes can appear very similar. Take the example of blasting a gorilla with a water hose until it enters its indoor enclosure. The animal is being



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conditioned to move away from an aversive stimulus (ie negative reinforcement). However, if the animal was blasted with water solely for not entering its indoor enclosure, this would be punishment type I. In the first scenario the behaviour of entering the indoor enclosure has been reinforced (by the avoidance of the water), whereas, in the second, the animal has been punished for not entering the indoor enclosure.

Normally we use clicker training combined with target training. In clicker training, the clicker becomes a secondary or conditioned reinforcer by being paired with a primary reinforcer (eg food). This pairing of clicker with food must occur before the clicker can be used to reinforce behaviours in operant conditioning. Subsequently, each time the animal performs the desired behaviour, the trainer sounds the clicker. In this way, the clicker sound becomes a secondary reinforcer that predicts the arrival of the primary reinforcer, which is usually food. Some animal trainers refer to this secondary reinforcer as a 'bridge' because it bridges the gap between the performance of the behaviour and the animal receiving the primary reinforcer (Mellen & Ellis 1996). Many trainers believe that this signal 'tells the animal that it has done the correct behaviour'; undoubtedly, it increases the amount of reinforcement the animal receives and this is important in the learning process (Pryor 1985). It should be noted that while clicker training is not an essential part of animal training, virtually all successful animal trainers use this method.

Target training is also a non-essential component of animal training but one that greatly facilitates animal training (Mellen & Ellis 1996; Chance 1998). Basically, target training gives the trainer locomotor control over the animal. The first step in target training is to teach the animal that if it touches a target with a desired part of its body (eg hands or forehead) it will receive a food reward. Animals usually learn this response quickly, and often try to grab hold of the target, which is usually a long stick with a ball on one end. If the animal attempts to grab the target, the target should be withdrawn and the trainer should ignore the animal for 60 s, often referred to as a 'time out'. The trainer should never use physical punishment (because this can lead to an aggressive response) or engage the animal in a tug-of-war over the target. Once the animal has learnt to touch the target it can then be moved around the training area using the target. Initially, the animal can be shaped to move a small distance to touch the target and after a few reinforcements the animal will have learnt to follow and touch the target. Now that the trainer has locomotor control over the animal, more than one target can be used. For example, one might be used to guide the animal's head position and another to guide its body position. Through target training we are able to position an animal exactly where we want it in order to train other behaviours, such as acceptance of an injection without restraint. We have successfully used target training with giant anteaters to move them around a zoo without the need for putting them in crates or physically forcing them to move in a certain direction. Moving animals using target training is not only less stressful for animals and their human caregivers, but also much quicker.

The first step in injection training is to simply show the syringe to the animal and reward it for staying calm (Laule *et al* 1996). If at any point in the training process the animal does not stay calm, the trainer should terminate the training session and later continue with training the present step until the animal stays calm. The second step is to hold the syringe close to the animal's body and to swab the injection area with alcohol; again rewarding the animal for staying calm. At the third step, we swab the area of the animal's body and gently touch the injection site with a needle-less syringe; again only rewarding the animal if it stays calm. The next stage is to introduce a needle. So we now swab the area and lightly penetrate the injection site with a fresh needle (some people connect the needle to the syringe by a tube to reduce its movement, but we have not found this to be necessary). Again, the animal is rewarded for staying calm. Next we penetrate the injection site a little deeper each time until we are almost at a full injection depth. The final stage is to inject the animal with distilled water (which should be done under the supervision of a veterinary surgeon). Once this behaviour is trained we do not inject the animal with distilled water each week, but instead we stop at the stage where the needle is breaking the animal's skin. This is because, although the animal will now accept injections, we believe that injections are painful and do not wish to expose it to unnecessary suffering. The process of shaping an animal to accept injections normally takes several weeks, but depends on the animal's reaction to the syringe and the pain caused by the needle. It is absolutely essential that the animal is totally calm at each step before proceeding to the next. The process we have just described is known as the operant shaping of behaviour (Grandin *et al* 1995; Laule *et al* 1996). We warn against taking advantage of syringe-naive animals rather than training them to accept syringes: in our experience it is possible to inject such animals — but only once — after which these animals often display an extreme fear of syringes, which can take a long period of time to reverse.

The golden rule of animal training is to use positive reinforcement and never punishment type I (ie physical punishment). This method of animal training is often referred to as the "carrot and more carrot method", whereas the old fashioned technique of positive reinforcement and punishment is often referred to as the "carrot and stick method". Laboratory studies on type I punishment show that it is ineffective in eliminating undesirable behaviours and often evokes an aggressive response from the animal (Chance 1998). Type II punishment, in which the animal trainer ignores the animal and withholds positive reinforcement (sometimes referred to as 'omission' punishment or 'time out'), can be employed if the animal is not cooperating with the training process.

## Distributed or massed learning

The training sessions in which animals learn new behaviours or are asked to display an already trained behaviour should be short in duration and frequent. Usually, our training sessions are less than 20 mins in duration and only one training session is given per day. It appears that animals, like humans, learn very inefficiently when training sessions are long and occur infrequently (Groeger 1997). However, once effectively trained, it is our experience that even after more than one year without practise, animals remember trained behaviours. Normally, we ask animals to perform already trained behaviours two or three times per week in short training sessions. However, if the veterinary surgeon or caregivers are utilising the behaviour, additional training sessions are unnecessary.

## Choosing a trainer

Despite the mystique that some animal trainers imply about their abilities (see Kiley-Worthington 1990), animal training is not a complex process and most people can learn the principles rapidly. However, not everyone has the personality characteristics necessary to be a trainer. Hemsworth and colleagues (Hemsworth & Barnett 1987; Hemsworth & Gonyou 1997) have demonstrated that personality is a large determinant of how good a person is as an animal caregiver (stockperson). It is also our experience that selecting people with the correct personality characteristics is the most important factor in determining the success of a training program. Principally, the trainer must have a great deal of patience, have a calm demeanour, be consistent in their behaviour and be able to analyse their behaviour. Unfortunately, few people have these personality characteristics. A useful non-psychological profiling technique for assessing a person's suitability to become an animal trainer is to ask them to shape the behaviour of a pet or laboratory rat. Most people lack the patience to be able to do this effectively and often subsequently realise their shortcomings. In fact, from the perspective of their managers, practising shaping on rats is a highly desirable component of an animal trainer's training.

## Managing animal trainers

It is unwise for an institution to have only one or two animal trainers since people move jobs, can become ill or may be unavailable for other reasons. Furthermore, if an institution has only one animal trainer it is possible that the animal will only obey commands from that specific trainer. This appears to be especially true of species such as elephants (Hart 1994; Hart & Sundar 2000). Therefore, it is important that an institution has a number of animal trainers. However, all trainers within an institution need to train the animals in the same way and this means that the same person should train them initially, and also ideally that the training procedures should be written down. It is vital that trainers understand the seriousness of what they are doing and do not let 'just anyone' attempt to train their animals (eg we have heard of the children of trainers being brought in to do some training).

In some zoos, trainers teach the animals the desired veterinary and husbandry behaviours but it is the caregivers who actually utilise the training. In other zoos, the trainer not only trains the animal but also is present to control husbandry and veterinary procedures. Personally, we have found that this second situation provides better control, since the consistency of the training process is high. In the past when we have used the first system, we often found that the animals became quickly 'troublesome' (ie unresponsive or aggressive) and required a considerable amount of re-training. We are not suggesting that the first method cannot work, but just that it often requires more management and staff training than may be practically possible.

In our experience, many species, especially primates, appear to become stressed if trainers are changed at a high frequency. Therefore, we recommend that two trainers work together for one month, and that a third trainer then substitutes for the first trainer for the next month, and then a fourth trainer substitutes for the second trainer for the following month, and so on. In this way, although trainers would be changing, there would always be a relatively familiar trainer working with the animals, hence the animals would learn to accept being trained by several people.

## Conclusion and animal welfare implications

The process of animal training is not complex. However, it is potentially very dangerous and these dangers need to be fully appreciated by all animal trainers and by zoo management. Animal trainers in particular need to be made aware of two potential pitfalls: (1) that the animals they train are not their 'friends', and (2) that the animals will try to train them. The benefits of a well-managed animal training program in terms of reduced health risks and improved animal welfare are enormous. However, it is important that the reason for training animals is clear, with goals and objectives that coincide with the aims of the institution involved; therefore, the institution should have a written policy on animal training. For example, many zoos use a completely 'hands-off' policy as regards their animals, believing that this encourages more normal animal behaviour (Catlow *et al* 1998) — something that is important in terms of their conservation and education programs.

Animal training is not a panacea for the welfare problems that confront animals living in captivity; it is a tool that is effective in resolving certain problems associated with animal husbandry or veterinary procedures. We will explain by way of an example: Imagine that we have a zoo-housed bear that will not leave its indoor enclosure to enter its outdoor enclosure due to fear. It would be possible to train this bear to enter its outdoor enclosure through operant conditioning. However, this process could take many months. Alternatively, we could plant more bushes and trees in the enclosure, creating cover, and add environmental enrichment to encourage the animal outside. This latter solution would probably solve the problem more quickly because it is treating the problem's cause.

While we have presented evidence that the behavioural training of animals improves their welfare (see



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Introduction), the use of animal training does not substitute for the application of other methods of improving animal welfare, such as environmental enrichment. In fact, animal training is most effective when used in combination with methods that improve animal welfare, because animals that are not stressed learn more quickly (Sapolsky 1996).

In conclusion, a properly managed behavioural training programme can significantly increase the physical and psychological well-being of animals. Furthermore, we believe that the types of training we have described here have two further benefits: (1) they may be applied to an animal holding institution's other activities (eg reintroduction training techniques for zoos [see Maloney & McLean 1995; Miller *et al* 1998; Griffin *et al* 2000; Brown & Laland 2001]), and (2) they may provide insights into the cognitive abilities of animals, which may be important in assessing animal welfare (see Byrne 1999).

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