7

The Art of 'Active' Training

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7.1 Introduction

An artistic animal trainer goes beyond the basics of positive reinforcement training to fine tune antecedents and consequences to promote a level of learning that transcends basic animal training practices. The 'art' of animal training can be described as the intuitive non-scientific application of animal training 'rules', which have developed through practical experience working with animals, and the people who care for them. The focus of this chapter is to describe animal training from this perspective, and provide a background of how it can be achieved in zoos and aquaria.

7.2 Motivation

At the heart of all animal training is motivation. Professionals in Applied Behaviour Analysis (a sub-discipline of psychology) refer to a motivating operation as something that changes the effectiveness of a consequence. For instance, warming meat before a training session can sufficiently change a lion's perception of the meat (reinforcer), so that it results in an increase in the lion's motivation to perform a cued behaviour for that particular reinforcer. Motivating operations that increase behaviour are called establishing operations and motivating operations that decrease behaviour are called abolishing operations. For instance, an establishing operation may involve slightly increasing the distance between the trainer and a nervous lion in an enclosure to increase motivation for the animal to participate in a training.

Some zoo professionals have a myriad of tools in their training toolbox to influence motivation. These tools are generally associated with careful attention to antecedent arrangement and establishing operations, such as limiting distractions, careful attention to an animal's body language and responding appropriately, using a high rate of high-value and a wide variety of reinforcers, and much more. Unfortunately, some have yet to learn the vast array of motivating operations available to them and often focus only on food reinforcers in their positive reinforcement training programme.

Zoo professionals have recently begun to understand and quantify an extensive list of motivating operations that influence training sessions with their animals. Of the countless motivating operations that affect the behavioural choices of the animals in training programmes, the following are amongst the most influential.

7.2.1 Relationship

A trusting relationship between animal and trainer is an important influence on motivation. Trust levels are on a continuum specific to each animal and the conditions in which it

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behaves. Though we often focus on trust between animals and humans, trust also relates to how the animal perceives and responds to various objects and situations; which are equally important to the animals and training programmes. Animals build trust in exhibit features, housing furniture, other animals, and even enrichment items, in a similar way that they build trust in humans. When a gibbon jumps on a 3-inch thick branch in a tree and the branch supports its weight, the behaviour is reinforced and the animal builds trust in similar sized branches. When a keeper first shows a target stick to a zebra, it may take several approximations of approach behaviour without aversive consequences before the animal builds enough trust in the target to touch it with its nose to gain a reinforcer. The higher the level of trust an animal has in a person, the more likely the animal is to participate in interactions with that person.

The relationship between a trainer and the animals she/he trains might be considered as a trust account at their bank of relationships. Each time a trainer does something the animal likes, i.e. provides something desirable that an animal will work to gain, the trainer is making a deposit into a trust account. If the trainer does something the animal dislikes, i.e. will work to avoid, the trainer makes a withdrawal from the trust account. Restricting a tiger's movements in a squeeze chute to give an injection may be a withdrawal from the trust the tiger has in the trainer and the squeeze chute behaviour. After only a few repetitions of the squeeze chute behaviour, the resulting withdrawals may bankrupt the trust account, resulting in decrease or termination of future approach behaviour with both the chute and the trainer. Using positive reinforcement to teach the tiger to accept injections may take longer, but the training will pay dividends as the multiple deposits into the trust account results in reliable behaviour that will endure the occasional withdrawal.

Past experiences become antecedent conditions for future behaviour. Zoo professionals often wonder if they should be in the room with one of their animals during a stressful experience such as a vet immobilising the animal. Usually, the best answer to this question is, 'It depends. How is your trust account with that animal?' If a person has a high trust account with an animal, he or she may provide some level of comfort to the animal once it is darted, caught in a net, or otherwise put in a stressful situation. We often see animals with high trust accounts go directly to a familiar trainer after a stressful experience. A male gorilla *(Gorilla gorilla)* at Cheyenne Mountain Zoo presented his shoulder for an injection by the same keeper who delivered a successful hand-injection anaesthetic the day before. At Columbus Zoo the keepers have hand-injected vaccinations with their kinkajou and two wart hogs, and all three animals returned immediately to the trainer and participated in additional injection training behaviours. Both examples demonstrate that a level of trust remained despite the previous negative interaction, and there are countless other examples of animals returning to a keeper the day after that keeper was involved with an injection and anaesthetic the day before. However, there are also many examples of a stressful experience completely bankrupting a keeper's trust account simply by being in the room when an aversive event occurred.

7.2.2 Ability

Animals build skill and behavioural fluency through reinforced practice. Some behaviours require more effort than others and are therefore more difficult for the animal to perform. As an animal develops its skills with a specific behaviour, the motivation to perform that behaviour increases. For instance, a leopard that had no access to trees whilst growing up at one facility may be transferred to another facility with hopes of it being the star attraction in their new exhibit that has the perfect branch for it to lay on over the heads of the guests. With no previous tree-climbing skill the animal may be poorly

motivated to attempt to climb trees. In this case a keeper may need to shape the climbing behaviour by first teaching the leopard to touch a target outside the mesh and move the target to where the cat needs to jump on the log to touch the target. Or, a trainer can teach the animal to touch a laser dot as a target on the log, and then gradually approximate the dot up the tree branch. In some cases it might be best to make the behaviour easier by teaching the leopard to touch the dot on a log laying on the ground or leaning on a rock then generalise the behaviour to increasingly steeper angles, raising the tree a foot or two each day, until the tree is vertical.

7.2.3 Learning History

Past consequences have strong antecedent influence on motivation for future behaviour. Many trainers have experienced the frustration associated with trying to teach a parrot with previously clipped wings the skill of flying from one place to another. If the bird's wings were clipped during its first year of life, its flight attempts will have been punished by repeated crashes to the floor or running into walls or other objects, thus reducing its motivation to attempt to fly later in life. It is certainly possible for a parrot to learn to fly later in life after its wing feathers have grown in. However, it will require much more time and effort for the bird to acquire the skills than it would have if it learned to fly in its first few months of life. It will take an enormous amount of reinforced repetitions to counteract the bird's punishing history of flight attempts. Additionally, teaching an older bird to fly requires a very capable trainer to lead the bird through the repetition of small approximations to acquire the ability and confidence in the action of flying (Figure 7.1).

Learning history associated with the type and amount of reinforcers is an important motivating operation. If the amount and type of food reinforcer is consistent each time, the

Figure 7.1 Bird flight has been used as a central theme in many captive bird displays, like this one at Disney's Animal Kingdom. *Source: Steve Martin.*

motivation to perform a behaviour will likely decrease over time. If you received the same lunch items each day the behaviour of opening the lunch box will likely decrease over time, especially when you have other alternatives. However, if the reinforcer for behaviour varies randomly, the motivation to perform the behaviour will likely increase. If your lunch contains different food items each day, especially if someone else packed your lunch, the behaviour of opening the box to discover what is inside might increase. Varying the type and quantity of reinforcers is often key to motivating animals to participate in training.

The benefit of delivering a variety of reinforcers is evident in the free-flight macaws at Disney's Animal Kingdom. Three groups of 20 macaws make two flights each day across the park. They are released from their holding facility, and then fly half a mile past the Tree of Life to a perch on the other side of the park. Once they are at the designated landing area, the macaws receive a variety of food items, such as pellets, nuts, and fruits. After a 10 minute interpretive programme the macaws are cued to return to their holding facility where they make their way into individual cages and receive a mixture of high value food items that change with every flight. These food items include pellets, nuts, fruits, vegetables, and even a few healthy human food items such as granola bars, crackers, trail mix, etc. After each bird eats their food the birds are let out into the large flight pen where a table is spread with additional fruits, vegetables, and other treats. Additionally, after each flight the trainers add a wide variety of items ranging from browse, to hidden treats, to large bins filled with chewable objects. These birds perform these flights twice a day at ad-lib weight. They choose to come to the holding facility because the reinforcers inside their facility out-compete the myriad of other reinforcers available to them in the park, including unlimited browse, great views, and the acorns that some of them learned to eat in the trees along the way.

7.2.4 Control

Watson found (as cited in Friedman 2005) control of one's outcomes to be a primary reinforcer for behaviour, and loss of control can punish, or reduce, behaviour. Challenges that occur when training animals to enter crates, chutes, and other confined areas are often associated with the animal's perception of a loss of control. By giving animals a higher level of control over their environment trainers can solve many shifting problems in zoological and aquarium settings. For instance, shifting problems are often associated with the consequence of the moving-inside behaviour being the loss of access to outside. Locking an animal inside an enclosure can punish future behaviour of coming inside. If the consequences of coming inside results in both a food reinforcer and opening the door for the animal to go back outside, future behaviour of coming inside is likely to increase. However, at some point a keeper needs to lock the animal inside. In that case, after several repetitions of coming in and going back out, a trainer can then offer increased quantity of high-value reinforcers to offset the possible aversive nature of losing access to outside (Figure 7.2).

At Givskud Zoo in Denmark, the keepers wanted to teach their chimpanzees *(Pan troglodytes)* to participate in husbandry and medical behaviours in a chute leading from the night holding area out to the exhibit. The chimp's previous history of being locked in the chute where it was darted and anesthetised punished the behaviour of coming inside when a keeper was anywhere near the shift door. A new plan was designed for the keepers to give the chimps 'control' of the door. The trainer started the session by reinforcing the dominant female for taking small steps towards the inside of the chute. Each time the animal moved forward the trainer reinforced the behaviour with the animal's favourite food. The next step involved the trainer and a second keeper giving the animal 'the power', through her body language, to control the behaviour of the keeper near the

Figure 7.2 Chimpanzee at Givskud Zoo sits inside the chute after learning she could control the keeper's behavior of closing the shift door by looking at him. *Source:* Steve Martin.

door. Any time the chimp looked at the keeper, he would back away from the door. However, when the chimp 'allowed' the keeper to come forward, the chimp received a high value reinforcer from the trainer. Soon, the chimp walked fully inside the chute, sat in front of the trainer, and allowed the keeper to put his hand on the slide door. As he moved the door, the chimp received a treat from the trainer. If the chimp looked at the keeper, he backed off. Through several repetitions, the training progressed to the point that reinforcement became contingent upon door closing. The chimp's level of control also progressed from looking at the keeper to get him to back up, to moving towards the door as the cue for the keeper to open the door. Through the entire process the chimpanzee maintained control of the door through her body language, which was a huge reinforcer for her behaviour of staying in the chute whilst the door was closed.

The above events may lead some to think this was a training process conducted over several weeks or months by an expert trainer. Actually, the person doing the training had little or no training experience (however she was coached by an experienced trainer) and the animal had no previous training history. Additionally, the training was conducted over one, 20-minute session! Not only did the chimpanzee learn to sit in the chute with the door closed in the very first session, she also learned three other behaviours on cue. She learned to offer three body parts for the keeper to touch on the verbal cues: 'finger, arm, and head', all in the first 20-minute training session. This is an excellent example of the progress that can be made in training sessions when animals have control of their environment.

7.2.5 Environmental Influences During Training

Training sessions occur in a variety of locations, from the relative quiet of indoor holding facilities to the noisy unpredictability of on-exhibit training areas. No matter where training occurs there will be opportunities

for a wide variety of stimuli in the environment to interrupt training sessions and impact an animal's motivation to participate.

A contact call from a conspecific can disrupt a session as an animal stops what it's doing to listen or establish communication with other animals. An alarm call can send an animal bolting from the session just as it would in the wild where the alarm call might signal the presence of a predator. Some animals show more motivation when they can see other animals in the group. For others, it might be distracting for one animal to see another during a training session. Training environment should be adjusted according to each animal's behaviour to maximise motivation.

Some trainers prefer to train in a quiet and controlled environment with few distractions. This enables the animal and trainer to increase focus on the session at hand and reduce distractions to the point that it actually disrupts their motivation and performance in the future. What might be small distractions for most animals can be huge distractions for animals trained in uncharacteristically tranquil settings. Quiet settings are helpful to establishing new behaviour, but once an animal has learned to perform a behaviour without hesitation in response to a cue, the next step should be to generalise that behaviour to novel environments, including new people, locations, and degree of distractions.

7.2.6 Rate of Reinforcement

Maintaining motivation to participate in training is often related to the rate at which an animal earns reinforcers. The rate of reinforcement can be thought of as how many reinforcers per minute the animal receives during a training session. Trainers may thin the reinforcement ratio when using an intermittent schedule of reinforcement to shape various behaviours, such as duration of a target hold or open-mouth behaviour. Stretching the ratio too far or too fast can lead to performance breaking down, a phenomenon called ratio strain (Chance 2014).

The rate of reinforcement can also decline when trainers make too large an approximation when shaping a particular behaviour. For instance, teaching an animal to step inside a travel crate typically involves many successive approximations. There is often a critical point in the process when the animal's whole body is inside the crate, except its back feet. Up to this point, the animal has performed each approximation without hesitation, but is now stalled and reluctant to make that final step. If a trainer holds out too long for just 'one more step' the animal may lose motivation and just walk away, no matter how much cueing and prompting the trainer uses. The best approach in this case is to return to an earlier successful approximation and reinforce smaller approximations at a higher rate of reinforcement. Instead of waiting for both hind feet to be inside, reinforce approximations associated with lifting one foot, moving that foot towards the crate, touching the crate, etc. The size of the approximations is determined by the progress of the animal. If the animal is slow to move forward, make the approximations smaller until each approximation is performed without hesitation. With this approach a trainer builds behavioural momentum (Mace et al. 1988), which often helps the animal move past the point in the approximations where it hesitated before.

7.3 Two-way Communication

Contemporary trainers operating at the highest level are skilled observers of animal body language and give the animal a strong voice in their relationship. They form partnerships with animals that supersede the dominance-based relationship that was once so prevalent in the zoological world.

Through careful observation of an animal's body language a trainer can empower the animal with a level of control in its environment where its 'voice' (through its body language) is as meaningful as the trainer's voice and actions. A trainer gives a cue for the animal to perform a specific behaviour, then

the animal's body language provides feedback about its level of motivation to participate or not. If the body language shows the animal is not motivated, the trainer can change the antecedents and/or consequences to encourage the animal, or stop the training session and try again later. When cues and criteria for behaviour are clear, the animal may learn quicker and motivation may increase. When animals don't learn as expected, a trainer should review antecedent conditions including cues, criteria, and reinforcers.

The most successful animal trainers are often the ones who are the most sensitive to animals' body language. As a trainer approaches an animal's enclosure there is an important opportunity for the trainer to observe the animal's body language and determine the most helpful speed of approach, or if approach is even advisable. Too often, keepers just march up to a training area with little or no concern for what the animal's behaviour might be telling them. Like humans, each animal has its own personal space and the data flows the moment the animal can perceive the trainer's presence.

7.3.1 Personal Space

The concept of personal space was introduced by Edward T. Hall in his book *The Hidden Dimension*. He said, 'Most people value their personal space and feel discomfort, anger, or anxiety when their personal space is encroached' (Hall 1966). Personal space is also considered 'flight distance' in animals and can be seen as the distance at which an animal shows comfortable body language as a person or other animal approaches. Judith Bardwick, author of *Danger in the Comfort Zone*, defines the comfort zone as a behaviour state where a person operates in an anxiety-neutral position (Bardwick 1995). Flight distance and comfort zones are directly related to the relationships we have with animals in our care and are strongly influenced by current conditions. A lion *(Panthera leo)* at Assiniboine Zoo was new to training and just beginning to learn target training. As the keeper moved the target forward the lion snarled and aggressed repeatedly with feet hitting the wire mesh. As soon as the keeper backed up no more than one foot, the lion stopped the aggression and sat calmly in the presence of the keeper. Those 12 inches made a world of difference in the attention span and motivation of the lion.

A trainer can have a high trust account with a particular animal then one day, with no apparent reason from the trainer's point of view, the animal might retreat at the trainer's approach. Though we will never know what an animal is thinking, we can observe what the animal does. When an animal's body language shows distrust or concern, a trainer should stop what he or she is doing, quickly evaluate the conditions, and move back to the animal's comfort zone. No matter how high the trust account or how much history a person has with an animal, trainers should always approach an animal with careful observation of its body language, and only enter an animal's personal space when the animal's body language invites them in. If we give animals control of our behaviour though their body language we will gain trust, improve personal space or flight distance, increase their comfort zone, and have more productive training sessions.

Even when a trainer has established a high trust account with an animal, standing too close can be a problem that disrupts training sessions. Some animals focus intently on a person's hand, target, food container, etc., and stop paying attention to the other important aspects of the training environment. There are times when we want an animal to hold its nose or other body part against a target. However, there are also times when a target held too close to the mesh could cause an animal to try to bite or lick the target instead of moving as indicated to the target. Additionally, when an animal is 'cross-eyed' on a close target it may not see the rest of the environment including prompts and cues. When you look cross-eyed at something close to your face everything else goes out of focus. The same happens when trainers use

prompts, cues, targets, bait sticks, etc. too close to an animal. For instance, giving an open mouth cue right at the bars or mesh barrier might cause an animal to focus intently on the hand to try and bite or lick it (Figure 7.3).

Move the hand back 3 or 4 inches and the animal gets a different perspective on the situation and will be more likely to perform a behaviour in response to the cue. Expert trainers understand the critical distances associated with presenting cues and prompts in ways that provide clear communication of contingencies.

7.3.2 Shared Information

As trainers we bring only part of the information to the training session. No matter how much time, effort, and thought we put into the training plan – or how many managers have approved it – the animal's contribution to the information in the session is just as important as the information we bring to the session. The best training occurs when the trainer is flexible to change the plan when an animal's body language suggests an alternative approach will produce better results. Some trainers say they don't want to change their plan because they want to avoid confusing the animal, or they want to build on what they have started, or they are sure their plan will work if given enough time. If the animal is motivated to participate in training and the plan isn't working then chances are the animal is already confused. To continue on the same path may lead to more confusion, frustration, aggression, or the animal simply walking away from the session. A skilled trainer can see when the animal's body language encourages moving forward according to the plan, or to jettison the plan and start a new one. Training plans should be dynamic not dogmatic.

7.3.3 Event Markers

Whistles and clickers may be effective auditory event markers when an animal is working away from a trainer or in a crowded or noisy environment where a trainer's voice may not be heard. Visual event markers, such as movement of the hand or even turning the body or walking a certain direction can be strong bridging stimuli for animals across an exhibit that are taught to hold on a particular

Figure 7.3 An excellent open-mouth behaviour, but moving the hand away from the mesh a bit may allow this lion to see more of it's environment, including the training and the cue. *Source:* Steve Martin.

station until a visual bridge is given. Tactile markers are good communication tools when animals are in close proximity to the trainer and not looking at the trainer, such as when a chimp performs a back inspection behaviour, or a sea lion has its head underwater but its body is near the trainer. The most appropriate event marker for the animal and current conditions should be used.

Many trainers have said things like 'I tried clicker training and it didn't work', or 'We haven't started our training programme yet because we don't have a clicker'. There is no magic in the clicker; the magic is in the very act of marking the behaviour and closing the gap between criterion performance and the backup reinforcer. Tightening the contiguity between the behaviour and consequence is clear communication that seems to help the animal understand the function of its behaviour. In my experience, event markers like the clicker are great in many conditions. However, in some conditions a whistle, verbal, visual, or even a tactile event marker might be a better tool for the job. For instance, when training great apes or carnivores behind barriers, some trainers find a verbal event marker can be a better tool than a clicker or whistle. The verbal marker frees up the trainer's hands to hold targets, give hand cues, and deliver reinforcers. Plus, without a whistle in the mouth it is easier for a trainer to give verbal cues and prompts along with the event marker.

In some circles it has become routine to use a marker without a well-established backup reinforcer. For instance, the animal may perform three behaviours to criteria and receive an event marker for each behaviour, but only receive a food reinforcer after the third or fourth behaviour. This is a very common reinforcement strategy at zoos, and it is also one of the most confusing reinforcement strategies for animals. I have found that animals trained with this type of inconsistent pairing of bridge and backup reinforcer often lose motivation to participate in the training session, exhibit a high level of incorrect responses to cues, and show frustration-induced aggression. When this happens trainers often blame the animal for the poor performance, labelling the animal as distracted, aloof, messing with their minds, etc. By placing the blame on the animal, trainers relieve themselves of responsibility for the outcomes, but miss valuable information about how to increase motivation through clear communication of cues and high rates of reinforcement.

Some trainers believe since the marker is reinforcement for behaviour they don't have to provide a backup reinforcer. They incorrectly call this a 'variable schedule of reinforcement'. However, if the marker is an effective conditioned reinforcer (as evidenced by its ability to increase or maintain behaviour on its own), the trainer is using a continuous schedule of reinforcement – at least until the reinforcing strength of the bridge extinguishes. Each time the bridge is given without a backup reinforcer can thus be logically viewed as a respondent extinction trial. Just as Pavlov paired the metronome sound with meat powder to elicit the dog's salivation at the sound of the metronome alone, trainers pair the marker stimulus to a backup reinforcer, often food. When Pavlov stopped backing up the sound of the metronome with the meat powder, the metronome extinguished as an elicitor. Similarly, when trainers unpair the bridge and the backup reinforcer, animals eventually stop listening to the marker and begin focusing on more reliable, salient signals of the backup reinforcer to come. This is often the action of the trainer's hand moving to the backup reinforcer, e.g. hand to feedbag. This visual bridging stimulus can serve the function of the intended marker, keeping the animal in the training environment a bit longer. However, eventually the low rate of backup reinforcement reduces motivation and the animal either leaves the session, shows aggression, or the behavioural response deteriorates to the point the trainer ends the session.

A keeper with a long history of training a male gorilla *(G. gorilla)* with this inconsistent pairing of the marker and backup reinforcer agreed to participate in a small experiment. She first demonstrated her usual training

session with the animal performing several behaviours in rapid-fire succession and each correct performance receiving a click but only every third or fourth click being backed up with a food reinforcer. The animal performed several behaviours correctly and several behaviours incorrectly, often after multiple cues. About half way into the session the gorilla stood up and hit the top of the door with all his might and ran off to the adjoining den.

A few weeks later the same keeper and the same gorilla did another small experiment. This time the keeper backed up each bridging stimulus with a food reinforcer. The keeper even mentioned that this session might be difficult for her because she has never paired every bridge with a food reinforcer before. The training session went perfectly. Every cue brought a correct response, and every correct response resulted in a marker followed by a food treat. The session went on and on and neither the keeper nor the gorilla looked like they wanted to stop. The high rate of reinforcement provided clear communication of the behaviour–consequence contingencies and increased the gorilla's performance and motivation to stay in the training session.

Some of the most common reasons keepers say they use their bridging stimuli without the backup reinforcer include the following erroneous rationale: not backing up each bridge makes training more interesting for the animal; it builds stronger behaviour because it is a variable schedule of reinforcement; the clicker is a reinforcer so you don't need two reinforcers; it reduces frustration elicited aggression if a trainer runs out of food; it means good job and keep going. Each of these are not scientifically sound. A more detailed discussion of these points is found in the article called, 'Blazing Clickers' (Dorey and Cox 2018; Martin and Friedman 2011).

7.3.4 Prompts

Prompts are antecedent stimuli trainers use to increase the likelihood that an animal will perform a specific behaviour. At the Denver Zoo a trainer taught a jaguar *(Panthera onca)* to roll over by kneeling in front of the cat's cage, leaning to her side, tipping her head over, and motioning with her hand as if to guide the cat's head. The jaguar followed the trainer's body language, and the trainer reinforced approximations of the roll behaviour until the cat finally rolled all the way over. The trainer then began to systematically fade out each of the prompts until the cat rolled over given the verbal cue 'roll'.

A trainer at Cheyenne Mountain Zoo taught a Wolf's Guenon *(Cercopithecus wolfi)* to brachiate around the exhibit by walking along the edge of the exhibit and reinforcing small approximations of the animal following her along the barrier. Many trainers have taught animals to open their mouths, lift their arms, move from one area to another and countless other behaviours using their own body language to prompt the behaviour. Prompts can be very important tools to help shape behaviour. However, the rule of prompts is to fade them out as soon as the behaviour will allow. When prompts are not faded the animal's behaviour will become dependent on the prompt. If the trainer at Denver Zoo had not faded the prompts the jaguar would not perform the behaviour unless the trainer knelt down, leaned to her side, tilted her head and gestured with her hand. As the trainer systematically fades prompts, the animal gains a better understanding of criteria, cue, and consequence. Ultimately, past consequences should drive future behaviour, not antecedent prompts, and the signal for the behaviour is a deliberate one.

Baiting, or luring, is also a prompt. Many keepers show an animal food to get it to come into a holding area, go into a crate, or move from one area to another. Baiting can be a helpful prompt to establish new behaviour, but baiting can be a liability if not faded out of the training programme early. When an animal comes to a shift door and sees the food already placed on the floor inside, it can decide if that type or amount of food is worth going into the holding area. If the animal decides to stay outside, many keepers will up

the ante and offer more food. This only compounds the problem as some animals learn waiting will result in higher value reinforcers being offered inside. As with all reinforcers, food, especially favourite food items, should be presented after the animal has come inside the area and the door is closed.

Trainers at free-flight bird programmes often experience problems associated with prolonged use of the baiting strategy. To encourage a hawk to fly to the glove, many trainers will show the bird a particular food item, such as a small piece of lean meat. From the perch where the bird sits it can see the food and decide if that type or quantity or reinforcer is worth the effort of flying to the glove. Often, after a short delay, and whilst the trainer is ad-libbing dialogue, the trainer reaches into the bait bag to add a piece of food to the offering. Too often if the bird delays longer the trainer will offer even more food, maybe even a whole, dead mouse, the bird's favourite treat. I often wonder if these birds are thinking, 'these humans are so easy to train!'

If baiting is used to help encourage behaviour, the trainer should provide an additional backup reinforcer after the bird has landed on the glove. If the trainer needs to prompt with a small piece of food in the early stages of training, additional food items should be hidden in the glove. Occasionally, the bird should discover a whole mouse or other high value reinforcer when it lands on the glove. As the consequence reinforcer hidden in the glove encourages quick flights, the bait should be faded out completely.

7.3.5 Jackpots

Trainers often talk about delivering 'magnitude reinforcement' or 'jackpots' for particularly high levels of performance of behaviour. Their hope is to increase the likelihood the animal will recognise the large quantity of food is delivered in response to a super-criterion performance of behaviour, thus increasing performance in subsequent trials. However, that may not be the case. Two important aspects of shaping are the fluidity of movement from one approximation to the next and the contiguity in the cue-behaviour-consequence sequence. The longer an animal takes with a reinforcer, the farther away in time the animal is from the next behaviour. For instance, an otter can eat a 3-g piece of fish in a couple seconds, but if the animal is given a 20-g piece of fish, it might take 10 seconds to eat the fish. Those extra eight seconds can upset the flow resulting in the need to move backward in the approximations to regain the momentum and get back on track.

The shaping process is most successful when the animal moves quickly across approximations to the goal behaviour. The size and type of food reinforcer should promote quick consumption to keep the animal progressing smoothly through the approximations and focused on criteria and consequences. The jackpot reinforcer not only disrupts the flow, it distracts the animal as it takes extra time to eat the increased quantity of food, and results in faster satiation. This small distraction may not ruin a training session or even cause problems, but a jackpot in the middle of a shaping session may not help the animal learn quicker or better either. Jackpots and magnitude reinforcers may be best used at the end of the training session to reinforce calm behaviour when the trainer leaves the training session.

7.3.6 Fluency and Speed

During shaping many trainers follow an 80% rule, requiring 8 correct responses out of every 10 trials (or 4 out of 5, etc.) before moving to the next approximation towards the goal behaviour. Other trainers think of the 80% rule in a more subjective manner, such as a behaviour being 80% perfect before moving to the next approximation. Either way, many people follow a shaping strategy that involves the animal performing multiple correct behaviours of a specific approximation before moving to the next approximation. In this manner a trainer puts a previously reinforced behaviour on extinction and selectively

reinforces the next correct closer response to the goal behaviour.

A common problem with shaping behaviour in this manner results when a trainer reinforces too many repetitions of one approximation. Performing multiple repetitions of one approximation creates reinforcement history that can slow progress and make it more difficult to move from one approximation to the next. To create the best flow of behaviour, a trainer should move to the next approximation when the current approximation is performed *without hesitation*. With this strategy animals may perform approximations only one time when the trainer and animal are really in sync. If the animal hesitates, the trainer can always repeat that approximation or even move back in the approximations to gain behavioural momentum.

Shaping should involve letting the animal's behaviour determine the size and speed a trainer should move through the approximations. Through careful observation, a skilled trainer can recognise the subtle changes in the natural variation of an animal's behaviour and reinforce small increases in movements towards a goal behaviour. Other times an animal might offer larger approximations that are more obvious to trainers. Either way, the animal's behaviour combined with the trainer's observational and mechanical skills determines the speed of training.

Animals can learn faster than most trainers give them credit for, which is generally faster than most trainers are comfortable training. Where one trainer might believe it will take a year to teach a primate to accept an injection, another trainer might believe it will take two weeks. Some animals learn faster than others and some trainers teach faster than others. However, the trainer who believes it will take a year to teach the behaviour will almost certainly take significantly longer to train the behaviour than the person who believes it can happen in two weeks. Training at the animal's speed is a valuable skill that is developed over time and with much practice.

7.3.7 Adding the Cue

Some trainers prefer to add the cue after the behaviour is performed at a high level of fluency. In this manner the cue is associated with only the mastered behaviour instead of approximations leading up to the goal behaviour. For instance, teaching a giraffe to walk into a chute or giraffe restraint devise (GRD) may involve shaping the behaviour through a baiting strategy involving the trainer holding browse just out of reach of the giraffe and reinforcing each step closer to the GRD. After several repetitions the giraffe may walk straight into the GRD without seeing the browse because it has learned through its reinforcement history to expect the browse once it is fully into the GRD. Now that the goal behaviour is performed with a high level of fluency, it is time to help the animal understand reinforcers will only be available for the GRD behaviour in certain conditions. The trainer will then begin associating the cue, which is generally a visual or audible stimulus. The trainer may say 'Shift' or point her finger straight out to her side as the giraffe enters the GRD to receive a reinforcer. After the giraffe comes out of the GRD, the trainer can reinforce the behaviour of approaching the trainer, then cue the GRD behaviour. With each repetition the trainer starts a bit farther away from the GRD until she can give the cue across the room and the animal will leave her to walk across the room and enter the GRD.

Other trainers prefer to add the cue as they shape the behaviour. For instance, some mouth-open behaviours are taught using a target on the top of an animal's nose and then a second target on the animal's chin. If these two targets are the trainer's finger and thumb, the prompts of spreading the finger and thumb gradually farther apart become the cue for the open-mouth behaviour. Even when shaping a turn behaviour for a macaw, a lay down behaviour for a cheetah, or any other behaviour for that matter, some trainers add a verbal or hand cue during the shaping process.

The merits associated with adding the cue after mastery of a behaviour or during the

shaping process are often debated in various circles. However, it is important to remember every animal is an individual, every trainer is an individual and conditions are constantly changing. What works for one trainer and animal may not work for another trainer and animal. As with most questions about the specifics of training approaches, it is often best to use your good judgement and 'test it'. If it works, do it again. Except in welfare issues, it is often best to not worry too much about what others say and discover for yourself which strategy works best.

7.3.8 Consequences Drive Future Behaviour

The skilled and artistic application of scientific principles is seen in trainers who understand consequences, not antecedents, are the most important factors in driving future behaviour. Antecedent cues tell an animal that the opportunity for reinforcement is available contingent upon their performing a specific behaviour. It is the reinforcing consequence that follows the behaviour that increases the likelihood that the behaviour will occur again.

The trainers at Natural Encounters Inc., trained a young Grey Crowned Crane *(Balearica regulorum)* to fly from one trainer to the other about 200 m apart. After the crane ate the food reinforcers from a trainer's hand, the trainer at the other end of the field began calling (prompting) and gesturing with hand cues for the bird to fly back to the first trainer. After a few minutes of picking at the grass, exploring objects on the ground, and looking at the trainer by its side, the crane finally looked towards the trainer at the other end of the field. Only then was the crane ready to receive the cue, and quickly took off in the direction of the trainer who had been giving the cue and prompts for the past two minutes. This repeated cuing and prompting had no effect on behaviour and quite possibly served to decrease the meaning of the cues and prompts since they weren't immediately followed by reinforcement.

To address this latency in behaviour and strengthen the cue-behaviour response the trainers shortened the distance between them to about 20 m. The trainer standing next to the bird held completely still so not to distract the crane. The trainer away from the bird waited for the crane to start moving in her direction before delivering the cue. When the crane arrived at the trainer it received the reinforcers and the sequence was repeated going back to the other trainer. The trainers realised the crane took time to investigate its surroundings before it was ready to receive the cue. They also realised they did not even need to call the bird because its reinforcement history motivated the animal to go from one trainer to the other. Once the behaviour was performed fluently, the trainers inserted the cue into the antecedent position.

Even in the best circumstances, animals will not always respond immediately to the cue and this is where skill and experience are most valuable. When an animal fails to perform after a cue, a skilled trainer will read the animal's body language and determine if the animal saw the cue or not. If the trainer is sure the animal saw the cue but is momentarily distracted, she may wait for a few seconds, then recue the behaviour when the animal is looking at her. If the trainer does not think the animal saw the cue, she will present another cue even if it was only one or two seconds after the first cue. Lack of contiguity between the presentation of the cue and performance of the behaviour may weaken stimulus control, promote offering of the behaviour at random times, and encourage latency of performance in response to the cue.

Once an animal has learned to perform a behaviour at a high level of stimulus control, the behaviour is usually put on a maintenance schedule, i.e. the trainer only cues and reinforces the behaviour occasionally, or the behaviour is performed as part of its daily routine, such as shifting on and off exhibit. Some trainers run through an animal's entire repertoire of behaviours on a daily basis, as if

they are worried that the animal might forget the behaviours. Animals remember behaviour in proportion to their practice and reinforcement history. They rarely forget behaviour with strong reinforcement history, but they do lack motivation under certain conditions. When trainers run through an animal's repertoire on a daily basis, often these training sessions involve the animal doing quick, short duration, performances of many behaviours in succession. This rapid-fire performance of behaviours serves little useful purpose for husbandry or medical procedures and may even decrease performance of these important behaviours in the future. Short duration practice of a behaviour that requires long duration performance to be useful for medical procedures can be counterproductive. It is far better to do fewer behaviours at long duration performance than to do several behaviours at short duration, which are below criterion for intended purposes of the behaviour.

During maintenance schedules is when some behaviours regress and performance drops off to a point that a bit of 'tune-up' may be required to get the behaviour back to a high level of stimulus control. For instance, there is a tendency in some trainers to allow the animal additional time to perform a behaviour that has lost some of its fluency. From a primate that used to perform with crisp response now taking 30 seconds to present its shoulder, to a bear taking 30 minutes or longer to shift inside, latency is a common problem in training programmes at zoological facilities.

Poor performance of behaviour is often caused by lack of practice, poor motivation, or trainer errors associated with reinforcing behaviour below criteria. It is often the case that trainers will unwittingly reinforce gradually decreasing criteria of behaviour. For instance, an animal that once shifted within 30 seconds of the door opening, maybe takes 45 seconds to come inside because it was distracted by animal activity in the next exhibit. The following day the animal may be sleeping in the soft grass on a sunny day and take two minutes to come inside. The next week the animal might take 10 minutes to come out of the pool to go inside. Each time the animal takes longer, but the keeper still reinforces the behaviour, it increases the chances the latency will continue or get worse. Similarly, an animal that once held its shoulder against the bars for three minutes pulls away at two minutes but may still receive reinforcement for 'a good effort'. Soon the animal is pulling away at one minute, then 30 seconds, and soon the behaviour is no longer useful for injections. It is important for trainers to hold to criteria and only reinforce full-criteria behaviour, even if they have to devote an entire training session to rebuilding duration behaviour through successive approximations of increasingly long duration of a behaviour.

7.3.9 Short Window of Opportunity

Motivating operations for animals in human care are different from their wild counterparts that respond quickly to environmental stimuli, often to obtain food or to keep from becoming someone else's food. Consider a brown bear *(Ursus arctos)* hunting salmon in a stream. If the bear moved like many of its counterparts in zoos it surely would not catch many fish. The only thing keeping a brown bear in a zoo from moving as fast as its wild counterparts is motivation, which is created through reinforcement history. The bear at the zoo has learned the keeper will leave the door open for at least 30 minutes, and the same type and quantity of food will probably be waiting inside, so what's the hurry? However, if the keeper opens the door of the shift cage and then closes the door after one minute, the bear will lose its opportunity to come inside for the food reinforcer. Through this 'limited hold' contingency (Pierce and Cheney 2013), the bear learns the consequence of staying outside when the door opens is the lost opportunity to eat the food. This short window of opportunity to gain the food resource will give the bear a reason to perform more quickly in the future.

Plus, the trainer in this case has experienced a 1-minute training session instead of a 30-minute session.

Some keepers report they do not have time to train with all of the other work required of them. In some cases, trainers can shorten training sessions simply by giving animals a shorter window of time to perform behaviour (limited hold). A hawk sitting in a tree watching a mouse scurry about in a meadow has a short window of opportunity to perform the mouse-catching behaviour before the mouse disappears down a hole. However, a hawk in a zoo, like most other animals, has little reason to perform behaviour with any sense of urgency because it knows the food will always be waiting when it decides to shift inside. Shortening the window of opportunity by reducing access to reinforcers can help speed up training sessions and give keepers valuable time to work on other projects.

7.3.10 Ending on a Good Note

Some training sessions last longer than an animal's attention span as trainers try to squeeze out one more good repetition because they believe they should 'always end on a good note'. Ending a session with quick behavioural response and fluent behaviour is what many keepers shoot for. However, it can be an unrealistic goal for every session, condition, or animal. When an animal walks away from a training session it is often a good sign that the animal has ended the session. In this case, a trainer is best advised to let his or her partner in the training session – the animal – determine the end of the session. Attempts to bring the animal back to station for one more successful repetition may actually hurt training progress as cues and prompts are ignored and criteria for behaviour is compromised. On the other hand, ending a session when an animal is highly engaged and motivated to work for reinforcers may also be ill advised. In that case it might be best to end the session on a good performance of behaviour and an extra-large amount of food reinforcers, desirable enrichment item, or another conditioned reinforcer that will keep the animal engaged as you walk away.

7.3.11 End of Session Cue

In addition to walking away from the training area, some trainers use an additional 'end of session' cue to convey to an animal that the session is over. Other trainers wonder if they should use an end of session cue or not. The best answer is 'it depends'. If the animal responds to the end of session cue with calm behaviour, especially turning and leaving the training area, the end of session cue can be a useful tool. However, if the animal shows aggression in response to the cue it may be best to withhold the cue and develop a plan to replace the aggression with a more desirable behaviour.

For some animals, an end of session cue can lead to frustration and ultimately aggression. This aggression can range from subtle body language to more dramatic behaviour such as spitting, attacking the barrier or loud, aggressive vocalisations. An animal that practices aggression will often get better at it. Therefore it is generally better to replace unwanted behaviour, such as this aggression, with a more desirable behaviour, such as sitting calmly at the barrier.

Several years ago, the male sea lion *(Zalophus californianus)* at Singapore Zoo would block the trainer's exit path and approach the trainer aggressively when the trainer gave the end of session cue. To keep from being bitten the trainer had to toss several fish into the pool to encourage the sea lion to leave the path and go into the pool for the fish. The trainer also had to have a stick in his boot to defend himself if the sea lion attacked him. After some discussion, the trainers developed a plan involving differential reinforcement of incompatible behaviour (DRI) to use half of the animal's food for a stationing behaviour that was incompatible with attacking the trainer. They also changed the meaning of the end of session cue to signal the animal to go to a particular station for reinforcement. They first taught the sea lion

to swim to a rock on the island across the pool from the trainer's exit. Using a variable duration schedule the trainer increased the amount of time between reinforcers as the sea lion sat on the rock. The trainer then took a couple of steps towards the exit and tossed the sea lion a fish to reinforce the behaviour of sitting on the rock as the trainer moved towards the exit. The trainer made a few steps forward, tossed the sea lion another fish and then went back on the spot on the path where he started. He repeated these steps until he could leave through the gate, and then come back to reinforce the stationing behaviour of the sea lion. Soon, the end of session cue meant go to the rock across the pool and wait for the trainer to go to the gate. As the sea lion sat on the rock, the trainer came back and reinforced the behaviour with varying type and quantity of primary and secondary reinforcers.

Two male lions at another zoo worked perfectly in their training sessions until the keeper gave the end of session cue, which resulted in the lions' loud vocalisations and feet clawing at the bars. This behaviour continued for years because the trainers were instructed to always give an end of session cue to their animals when they ended a session. On a suggestion from another trainer, they developed a plan to replace aggressive behaviour with calm behaviour in response to the end of session cue. The trainer gave the end of session cue and immediately gave a piece of food to the lions. After a few repetitions of associating the cue with the reinforcers, the trainer had shaped calm behaviour that replaced the previous aggressive behaviour when the cue was presented. The trainer then used a variable duration schedule of reinforcement to extend the amount of time the lions performed the calm behaviour before reinforcement. After calm behaviour of about five seconds was on a high level of stimulus control, the trainer began moving away from the barrier after giving the cue and reinforced approximations of calm behaviour as he walked away from the lions. In this one training session the keeper was able to give the end of session cue, leave the area of the lions and go fully inside the office, then come back to reinforce the lion's calm behaviour.

The trainer then found other ways to reinforce calm behaviour. Before each indoor training session, he scattered enrichment items and hid food treats in the exhibit. At the end of the training session, the trainer gave an end of session cue and when the lions showed calm behaviour he opened the shift door to the outdoor exhibit. Access to the variety and value of treats and enrichment in the exhibit became reinforcers for calm behaviour after the end of session cue.

7.4 Training Specific Behaviours

7.4.1 Target Training

One of the first behaviours many trainers teach animals in zoos it to touch its nose or other body part on a target (Figure 7.4). This target can be the end of a stick, a ball on the end of a stick, a balled-up fist, or any other object that the trainer can move around from place to place. Animals can learn to touch a target with their nose, hand, foot, side, or almost any body part. Targets can be used in protected contact by placing them just outside the barrier and the animal will touch the inside of the barrier at the location of the target. Targets increase motivation for some animals' approach behaviour, give clear directional cues, provide safer training environments, and generally give trainers a tool for moving animals with more precision, comfort, and fluidity. Laser dots are also used as targets when animals are taught to touch the dot. Teaching an animal to touch a laser dot with its nose can be dangerous if the laser hits the animal's eye for a prolonged period of time, which is why some trainers prefer to teach animals to touch laser dots with their hand, foot, or finger.

A long duration hold is an important part of target training. Using a variable duration

Figure 7.4 This hippo is being trained to touch its nose to a target; this is often one of the first behaviours included in a training programme. *Source:* Steve Martin.

schedule of reinforcement a trainer systematically teaches the animal to hold progressively longer duration of hold behaviour. The keepers at Denver Zoo taught a Spotted hyena *(Crocuta crocuta)* to target its nose on a hand target (closed fist) though the mesh barrier. They extended the target hold behaviour to several minutes. They used the target behaviour to raise the hyena's head straight up whilst placing its shoulders against the mesh. In this position the hyena holds perfectly still with its nose targeting the keeper's hand through the mesh as the vet tech draws blood from the hyena's jugular vein. Many primates are taught to hold clips or carabineers attached to the mesh and positioned so that the animal's arms are fully outstretched when performing the behaviour. The location of these targets can be adjusted to position the animal's arms for body examinations or even as a safety measure to position the animal's hands away from the keeper. The trainers at Maryland Zoo taught several of their chimpanzees to station their arm away from their body so the keepers can draw blood from the animal's arm without an arm sleeve (Figure 7.5).

During shaping it is important to carefully observe the topography of the target behaviour that is being shaped. Some animals will try to bite a target during the shaping process, others will try to nudge or push the target with their nose or mouth. One poorly timed reinforcer can result in persistent biting at a target. Precise timing of the bridging stimulus will help trainers shape for gentle contact and constant pressure of the body part on the target.

7.4.2 Station Training

Some trainers make the distinction between target training and station training in that targets are moveable and stations are stationary objects, as their name suggests. A station can be a bench, rock, tree, stool, patch of grass, or any area that an animal can learn to go to and hold a position in relation to that station. At Northwest Trek a keeper taught the North American porcupine *(Erethizon dorsatum)* and North American beaver *(Castor canadensis)* to station on tree stumps instead of standing at the door when she

Figure 7.5 The chimpanzees at Maryland Zoo were trained to station with an arm extended away from the body, which facilitated further husbandry behaviours like taking blood samples. *Source:* Steve Martin.

approached. Keepers at Columbus Zoo taught a silvery-cheeked hornbill *(Bycanistes brevis)* to fly from her cage across the African exhibit and land on a tree station in the middle of the exhibit. The keepers at Cheyenne Mountain Zoo used a laser target to teach an orangutan *(Pongo abelii)* to climb to a specific high point in the exhibit. When the laser prompt was faded that location in the exhibit became the station for the termination of the animal's climbing behaviour and a place where the animal waited for the bridging stimulus, then returned to the trainer for the food reinforcer.

7.4.3 Medical and Husbandry Behaviours

There is no limit to the range and number of behaviours animals can learn to perform in zoological facilities. What people could barely imagine only a few years ago is now old news in contemporary zoological settings. There was a time not long ago that people were amazed a primate was trained to put its arm in a sleeve and let a veterinarian draw blood. Today, the number and types of animals taught to participate in voluntary injections, blood draws, ultrasounds, and more, exceed the expectations of most zoological professionals.

The strategies used to teach these medical and husbandry behaviours vary between each institution, and even each trainer. However, there is a growing list of best practices disseminated in publications, conferences, and records exchanged between institutions with animal transfers, some of which are described below.

7.4.4 Injection Training

As with training any new behaviour, teaching an animal to participate in injection or blood draws involves a partnership where the animal has choice and control. Forcing an animal to accept an injection by squeezing it in a chute can destroy trust that took weeks to build. By shutting an animal in a restraint devise, a keeper takes away an animal's choice and control in the situation, which often reduces an animal's motivation to participate in training. Unless the animal's behaviour of being closed in the restraint devise is exceptionally well generalised to novel conditions,

it is best to train the animal whilst the doors are open giving it the ability to leave. Positive consequences should drive future behaviour of staying in the restraint devise, not closed doors and reduced access. Making it the animal's choice to stay in the chute for training should be the goal, which is best accomplished by giving it the power to leave. Many skilled trainers have learned that when an animal can leave it is more likely to stay, when the positive consequences are worth it.

The first step to teaching an animal to accept an injection is to desensitise the animal to the training area and to the syringe, and possibly to an alcohol swab. If the animal shows fearful body language a systematic desensitisation process involving counterconditioning will often be the best approach to building trust in the syringe. The veterinarian or technician may also be part of this counterconditioning programme to promote trusting relationships that will be important for medical behaviours in the future.

The successive approximations for training the injection behaviour will vary from one animal to the next as each animal brings its own learning history to the session. Most injection training is conducted in a protected contact environment. Even for animals that are tame and tractable, it is often best to teach the injection behaviour through wire mesh, bars, or some other barrier to give the animal more control and ability to move away. Additionally, wire mesh or other barriers provide a station for animals to press into, which will steady the animal's body and make the injection behaviour easier to accomplish.

Teach the lean-in behaviour only after the animal shows comfortable body language in the training area. The lean-in behaviour often starts with some form of targeting behaviour to guide the animal's head into a position where its side is near the training barrier. A trainer can then lightly touch the side of the animal with a hand, finger, dowel, stick, or any other object that will fit through the barrier. We will use a stick for the examples below. Some animals are comfortable with tactile contact and some have to learn the association of the contact with positive reinforcement. Either way, shaping the behaviour of touching the stick usually begins with letting the animal see and smell the stick as the trainer reinforces closer approximations of the stick towards the animal. Teaching the animal to move towards the stick, instead of the trainer moving the stick towards the animal, is the best approach because the animal has more control. The trainers at Cheyenne Mountain Zoo taught their reticulated giraffe *(Giraffa camelopardalis reticulata)* to touch its shoulder on an 8-inch piece of 1-inch thick plastic garden hose fixed on the inside of the barrier at shoulder height for the giraffe. They used a target pole to direct the giraffe into a position where it touched the plastic hose with its shoulder. After a few repetitions, the giraffe learned that touching the plastic hose was associated with food reinforcers and the behaviour of leaning into the hose increased. Within a few more repetitions the trainers were able to generalise the shoulder lean-in behaviour to a trainer's hand and ultimately to other objects.

Often it is best to start with a touch of the stick on the neck or shoulder of an animal and approximate the touch farther down the animal's body until reaching the hip. Other animals are comfortable being touched on the hip and a trainer can start there. The animal's behaviour will determine the placement of the touch and rate of progress. A trainer can hurt or even destroy trust by trying to sneak the stick in to touch the animal when it is not looking. Always let the animal have the opportunity to see what is happening and pair that experience with positive reinforcement as you establish the conditioned reinforcer.

Once an animal is comfortable with a light touch of the blunt stick (or other object) on its shoulder or hip, the trainer can shape an increase in pressure through successive approximations. Consider a range of pressure on a scale of 1 to 10, with 10 being almost as hard as a person can push. The pressure of the stick against the animal's muscle should increase to about level four, as

the trainer reinforces each approximation of increased pressure. After a few repetitions (approximately four or five) at an intensity of level four the animal should begin to understand reinforcement is contingent on pressure at level four. This is when the trainer should reduce the pressure to about level one and wait for the animal to lean-in to apply pressure on the stick. This allows the animal to gain control of the pressure and the trainer can selectively reinforce successive approximations of increased pressure that the animal puts on the stick.

Introduce the syringe only when the animal is putting pressure on the stick at a level six or seven, and the animal's body is up against the barrier. It's important to show the syringe to the animal in the same way the stick behaviour was shaped earlier. The animal will quickly learn to generalise the lean-in behaviour to the needless syringe and the trainer can shape increased pressure to seven or eight. Some keepers add a step at this point and use a paper clip, ballpoint pen, or other semi sharp object to help generalise the behaviour to sensations other than the force of the needless syringe. Blunted needles have also been used but can be dangerous as they are more likely to penetrate the skin causing a higher level of pain and significant setback in the training. It is important to keep in mind that the animal creates the pressure, not the trainer. Finally, the goal is for the amount of discomfort associated with the pressure the animal puts on the needleless syringe or other objects should be greater than the discomfort of the needle during the actual injection.

With clear contingencies and reinforcing consequences there are few limits to what an animal can accomplish with injection training. Trainers at Denver Zoo taught their Titi monkey *(Paralouatta Aureipalatii)* to accept insulin injections, and he has performed the behaviour fluently twice a day for the past four years. An Andean bear *(Tremarctos ornatus)* at Cheyenne Mountain Zoo took his painful rabies vaccination and walked away only to come right back for another vaccination injection. He has also been hand-injected and immobilised, but he always returns to his trainers for more injection training after these stressful experiences. There are many more examples of animals trained to voluntarily receive injections and return immediately for more training. Most often these success stories are associated with high trust accounts, empowered animals, and strong reinforcement history.

7.4.5 Blood Draw Behaviour

Training an animal to participate in blood draw behaviour is similar to teaching an animal to accept an injection. However, with blood draw training there is often a need to shave the hair from the injection site. Desensitising an animal to electric clippers can be more challenging than teaching an injection, however, the shaping process is the same. Counterconditioning the fear response with incrementally closer approach of the clippers is a good approach. Each approximation should be associated with a high value reinforcer. The keepers at Cheyenne Mountain zoo taught their Grizzly bear *(Ursus arctos horribilis)* to voluntarily put its foot through a door in the training panel and accept its foot being shaved. They then taught it to accept scrubbing with an alcohol swab, then to voluntarily participate in blood draws from the top of its foot whilst remaining in position calmly throughout the procedure. These behaviours are performed routinely at the on-exhibit training wall in view of the guests.

Many animals, especially primates, are taught to put their arm through a sleeve and hold onto an object such as a peg or bolt at the far end of the sleeve. Holding the peg gives the animal a target to hold and helps stabilise the arm. A veterinarian can then access the animal's arm through a small opening at the top of the sleeve. A critical behaviour in this sequence is the long duration hold of the peg. Some trainers reinforce the peg-holding behaviour then provide multiple treats with no particular behavioural

criteria. This type of 'distraction training' is meant to simply encourage the animal to keep its arm in the sleeve whilst being distracted with the food. An approach to training the behaviour with more clear contingencies involves shaping longer duration of peg-holding behaviour. In this procedure the animal learns reinforcers are contingent on longer duration of the hold behaviour.

7.4.6 Foot-work

Participating in hoof trims is an especially important behaviour for many exhibit animals. Where animals had to be darted and anesthetised to have their hooves trimmed in the past, animals are now taught to present their hooves and allow keepers and farriers to perform this necessary work. Elephants and even rhinos are also taught to present their feet and hold for long duration as a keeper provides valuable routine inspections and footwork. There are few limits to what types of animals can be taught to perform voluntary foot inspections, plus husbandry and medical behaviours.

As with blood draws, there is a tendency with some trainers to simply allow an animal to feed from a bucket whilst a person raises its leg and trims its hoof or works on a foot. If the animal's motivation to eat the food is high enough, the act of eating may distract it from the work being done on its foot. This approach can work in some situations; however the behaviour will be less reliable than the same behaviour shaped through approximations of longer duration holds using positive reinforcement. The shaping process builds trust and behavioural fluency, unlike distraction training that is not built on approximations to fall back on if the behaviour breaks down.

Sixteen reticulated giraffe *(G. camelopardalis reticulata)* at the Cheyenne Mountain Zoo are trained to lift each foot onto a station, curl their hoof, and hold still as a keeper works on their foot. Using a variable duration schedule of reinforcement, the trainers taught the animals to place and hold their foot on a station for several minutes as the trainer, or a farrier, trims its hooves. The animals learned reinforcement is contingent on placing and holding their foot in a specific spot for a variable amount of time. If the animals had been trained by distracting them with their head in a bucket of food they would not understand the criteria for reinforcement and the work on the foot may seem like an annoyance to them, like a fly biting their leg, which could make things dangerous for the person working on the foot.

7.5 The Right Tool for the Job

Training animals in a zoological setting is far more than clicking a clicker and giving an animal some food. Most contemporary animal trainers work with multiple species, in a wide variety of training environments and are responsible for meeting demanding programme goals. To accomplish the training tasks at the highest level a keeper must have a good working knowledge of the science of behaviour change principles combined with outstanding mechanical and observational skills.

Unfortunately, the majority of animal caregivers learn training skills on the job, often just by doing it on their own with little or no guidance. The number of zoological institutions with formal behaviour management programmes is small compared to the number of facilities where keepers are involved with training animals each day.

Directors, veterinarians, curators, and a wide variety of zoological managers boast of having expert animal trainers at their facilities. However, what education, experience, or knowledge prepared them with the ability to tell an expert from an average animal trainer? Without standards with which to judge a trainer's performance, the title of 'expert' can be used to describe a wide range of performance. Operationalising what an expert trainer *does* should be helpful to the zoological community in general.

The following is a list of a few of the most important behaviours commonly observed in 'expert' animal trainers:

Uses positive reinforcement
Teaching animals to perform some behaviours can be quickly accomplished through negative reinforcement, such as shifting a rhino out onto exhibit by squirting it with cold water, or shifting gazelle inside by chasing them with push boards. Expert trainers understand the value of using positive reinforcement whenever possible to teach behaviours even though it may take a bit more time and effort.

Avoids punishment
Many people fail to realise that anything they do that results in a decrease in behaviour is punishment, including the timeout procedure. Expert trainers avoid punishment whenever possible, partly because they understand the potential for detrimental side effects such as aggression, apathy, escape/avoidance, and generalised aversion to the environment. Expert trainers replace unwanted behaviour with desirable behaviour through differential reinforcement of alternative or incompatible behaviour.

Takes responsibility for behaviour
Expert trainers avoid blaming their animal and understand poor performance is most often associated with antecedent and consequence conditions that they have failed to effectively establish.

Demonstrates flexibility
Expert trainers understand no matter how hard they worked on the training plan, it is only about half the information; the animal brings the other half of the information. Adjusting the training plan in response to the animal's behaviour is a trait of expert trainers.

Carefully arranges antecedent and consequence conditions
The condition in which learning occurs varies from moment to moment and antecedent stimuli can make or break a training session. Expert trainers carefully evaluate and adjust current antecedent conditions to encourage desirable behaviour, and provide reinforcing consequences that motivate animals to participate in the learning experience.

7.5.1 A Reinforcing Future

Contemporary animal training starts with the skilful and ethical application of the scientific principles of behaviour change. A commitment to the most positive least intrusive training strategies, improves behavioural outcomes and welfare for animals in human care. The fields of animal welfare and animal training should advance together as practitioners improve their knowledge and skills to teach animals to willingly participate in husbandry and medical procedures thereby reducing stress and danger that resulted from immobilisations and restraint in the past.

Where trainers once used force, coercion, and hunger to motivate animals, trainers now create motivation by first forming trusting relationships and empowering animals with choice and control. By allowing communication to flow in both directions, trainers give their animals a 'voice', expressed through the animal's body language resulting in reciprocal influence.

Trainers who once understandably worried about clocking out on time because their animals would not shift inside can now teach quick response to shift cues at any time of day. Animals once labelled 'slow, obstinate, aggressive, untrainable' and more, now respond quickly to cues presented by trainers who have changed their behaviour and maybe their lives through clear communication, antecedent arrangement, and reinforcing consequences. Problem behaviours are opportunities for skilful trainers to understand that all behaviour has function and by changing conditions, we can replace problem behaviours with more appropriate behaviours.

Visitors to zoological facilities also benefit when they see programmes displaying ani-

mals empowered to use their senses and adaptations to earn a living in similar ways as their wild counterparts. By demonstrating these species-appropriate behaviours in exhibits, trainers help people learn more about the species and its relationship with the natural world. Through demonstrating behaviours (instead of lecturing about behaviours), keepers improve their ability to inspire caring and conservation action in guests viewing public programmes.

Even though the field of animal training has greatly improved, there is still much room for growth. It is helpful for zoological supervisors, managers, veterinarians, and directors to improve their knowledge of the science of behaviour change principles and gain insights into how to tell an average trainer from an expert, or artistic trainer. A deeper understanding of the skills seen in high-performing trainers will help managers empower their staff and provide better welfare for the animals in their care. Animal welfare in zoological facilities is directly related to the training competencies of animal caregivers.

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