Learning To Behave: The science behind animal behaviour and animal management

Dr Linda C. Marston, Anthrozoology Research Group, Monash University

PAVLOV = Russian Physiologist studying digestion

Over the last 10-15 years there have been significant changes in the way dogs and their owners are trained. Techniques once common only in the training of exotic or dangerous animals are now regularly applied to dogs. There has also been a huge explosion of interest in understanding canine cognition i.e. how dogs think, and it appears that the millennia of selectively breeding dogs to be human companions and workmates has resulted in the creation of a species that understands human communication and emotions significantly better than our closest evolutionary relatives, the primates. It is also becoming increasingly apparent that dog behaviour is not 'watered-down' wolf behaviour but something quite different and this is causing us to re-evaluate many long-held beliefs about pack behaviour and how these apply to dog training. This presentation will present a brief overview of learning theory, the role of punishment and reward, consistency and the setting of appropriate limits. Recent relevant research will be presented and there will be some discussion of the on-going controversy regarding coercive and rewards based training techniques.

Modern DNA analysis makes it clear that dogs have evolved from wolves (Pang et al. 2009; Vila et al. 1997) but while are they are technically the same species (*Canis lupus)* there are many behavioural & morphological differences that have resulted from the domestication process and from subsequent selective breeding. Belyaev's work in Russia has shown that domestication can occur very quickly (Belyaev, Ruvinsky, & Trut 1981). In his experiments silver foxes were selectively bred based solely upon whether they were sociable to humans. Within 40 years he had bred a domesticated fox that actively sought human interaction, was playful, even as an adult, barked, and showed significant physiological differences in the stress and reproductive systems (Hare et al. 2005). Not surprisingly, many of the differences seen in wolves and dogs revolve around social behaviour. For example, wolves require extensive, intensive socialisation to humans for the first five months of life to enable them to live with us, whereas dogs require relatively little exposure (Topál et al. 2005). Wolves also have a relatively rigid social structure whereas dogs have a more flexible structure, which can embrace multiple species, and enables them to become livestock guardians as well as companion animals. In fact, the behaviour of these species has differentiated to such a degree that dogs are now more capable of reading our body language, social cues and emotionality than any other species (Hare & Tomasello 2005; Hare & Tomasello 1999). This is why dogs are our most popular companion animal and probably explains why dogs, as a species, are thriving, whilst wolves are living on the edge of extinction.

Many dog training techniques were traditionally based upon wolf behaviour. However, in recent times much of what we thought we 'knew' about wolves has been proven wrong (van Kerkhove 2004) and the theoretical basis of such training must now be questioned. Other changes have occurred in dog training, particularly in the last decade (Pryor 2010), as a result of adapting techniques used by zoos and theme parks (Pryor 2002). These organisations began to develop training protocols partly in response to the embargos on replacing exotic animals with wild caught ones, making the longevity and welfare of their existing animals of paramount importance. A key part of this was to reduce the risk of general anaesthesia to perform routine husbandry. By teaching animals to voluntarily present a flank for injections, or 'station' themselves on scales for weighing reduced the need for anaesthesia. It was soon established that aversive training techniques were less efficient than reward based training and with many of the larger exotic animals carried significantly greater risk to the human trainers.

At this time the general public also began to realise that stereotypical behaviour in exhibited animals, which was very common, was not 'normal' behaviour. Training provided a way to reduce these stereotypies. Economic realities also meant that, to attract the fee paying public, many animal parks needed to develop 'entertainments' rather than simply displaying the animals in cages. Rewards based training enabled humans to work with animals in environments that the human is disadvantaged in such as the air or ocean. While laboratory studies on animal learning began in the early 1900's, the use of rewards based animal training really started with training free flight bird displays and training dolphins to detect mines for the US navy during the second world war.

The knowledge gained from these endeavours has triggered many changes in dog training which traditionally obtained obedience by coercion and punishment. This paper will briefly outline some of the major concepts of learning (Blackshaw, 2003). In general, two main types of training, or conditioning, are widely used.

Classical Conditioning

Classical conditioning results from repeatedly pairing involuntary behaviours such as salivation in response to meat (unconditioned stimulus), with a neutral stimulus (conditioned stimulus). Over time this results in an association being developed such that the neutral stimulus evokes the physiological response by itself. Pavlov's dogs are the classic example of this. In Pavlov's experiment dogs were presented with food which caused tem to salivate. Repeated pairing of a noise with the presentation of the food resulted over time with the noise triggering salivation in the absence of any food.

Crucially, in classical conditioning, the neutral stimuli i.e. the noise, was followed by the delivery of food, regardless of what the dog was actually doing when it heard the noise and conditioned a physiological response. This provides us with a powerful tool to work with canine reactivity, by allowing us to work with the stress response of an animal, which is not under the animal's voluntary control.

Operant conditioning

Operant conditioning was first recorded by Thorndyke in 1911. He confined cats in a box, from which they could escape by pulling a lever. Operant conditioning occurs when an animal performs a voluntary behaviour and is rewarded for it, with freedom in this case. He found that pairing a reward with a specific behaviour increased the probability of that behaviour being repeated and his cats became very fast at escaping from the box. B.F. Skinner used a Skinner box (a box equipped with a lever and food dispenser) to identify that the rate of reinforcement and punishment affect how rapidly leaning proceeds. The effects of the differing schedules of reinforcement will not be discussed here, except to say that while a new behaviour is being learned it must be rewarded frequently, but that once learned they should be rewarded occasionally to ensure that the learned behaviours are resistant to extinction (see below).

Rewards and Punishment

There is much discussion about the 'four quadrants' of learning i.e. positive reinforcement, positive punishment, negative reinforcement and negative punishment. However, most people find these terms very confusing. For the purposes of this paper a far simpler definition will be used. A reward (or reinforcement) is something that increases the probability of a behaviour occurring while a punishment decreases the probability of a behaviour occurring i.e. whether something is a reward or punishment should be evaluated by its effect upon the animal's behaviour. If praise i.e. a trainer's saying "good dog" in response to a dog's heel-work has no effect on the dog's future behaviour then the praise was not reinforcing. Enlightened dog trainers do not tell owners to praise their dogs but rather to make their 'dogs wag their tails' to ensure that the owner's behaviour has, in fact been rewarding to the dog.

Rewards (or reinforcers) can be either primary or secondary in nature. Primary reinforcers refer to resources that animals have evolved to seek such as food, water, liberty, play or reproduction. Secondary reinforcers are stimuli that are not intrinsically rewarding but that have become associated with primary reinforcers these might include noises or lights. A common example is a clicker which is a small hand held device that emits a loud click when pressed. A clicker is used to 'mark' a desirable behaviour before the trainers provides a reward such as food or play. This allows the trainer to 'bridge the gap' between the time at which an animal responded correctly and the arrival of a primary reinforcement. The clicker signals 'That's the right behaviour. A reward is coming very soon'. Clicker training is very useful when training behaviours in a hands off environment such as a free fight display, off lead activity or where it is not possible or feasible to physically reward the animal within the 0.5 seconds required to reinforce the desirable behaviour.

It is important to remember that dogs, like humans, have individual preferences. Some are more motivated by food or social interaction than others. A skilled trainer takes this into account, treating each animal as an individual. Other factors affect how rewarding something might be, such as habituation or satiation. For example, a dog that is extremely well fed may not be motivated by a treat or a familiar toy is not as interesting as a new one.

Punishment

Recent research has identified that the use of punishment increases aggressive and disobedient behaviour in dogs. A comparison of the relative effectiveness of the positive and punitive training methods established that dogs trained using rewards were more obedient than those trained with punishment (Hiby, Rooney, & Bradshaw, 2004). With punitive training there was a corresponding rise in the number of unwanted behaviour such as aggression. Punishment-based training increases canine cortisol (stress hormone) concentrations (Horvath, Doka, & Miklosi 2008) and anxiety (Arhant, Bartels, Bubna-Littitz, & Troxler 2010). Owners who used confrontational training techniques reported greater aggression from their dogs than others who did not (Herron, Shofer, & Reisner 2009). The authors concluded that "The source of dog aggression has nothing to do with social hierarchy, but it does, in fact, have to do with fear. These dogs are acting aggressively as a response to fear". Some authors suggest that behavioural problems could be reduced by avoiding habits of punishment that might reinforce fear or fear-related aggression (Arhant et al. 2010).

Aversive techniques often mask the underlying the problem. If a dog is punished for growling then it may stop growling but that doesn't mean that it is not feeling aggressive or fearful. What will happen is that the amount of warning that such a dog may give before biting will decrease/vanish, which may make the dog far more dangerous. A growling dog is communicating its feelings to you and giving you the opportunity to avoid being bitten. In general, and certainly in the less skilled hands of a normal pet owner, the use of punishment as a training method should be discouraged.

Shaping

Shaping is the process of reinforcing an animal's behaviour for approximations that get closer and closer to a desired behaviour. This technique is often used in zoo and marine park settings. Timing the reward correctly is critical to being successful at shaping behaviour.

Luring

To speed up the acquisition of behaviour, luring may be used to 'get' a behaviour which can then be rewarded. In early obedience training, luring is often used to get sits, drops and stands from pet dogs.

Generalisation and discrimination

The classic example of generalisation is the story of Little Albert. Every time Albert saw a white rabbit he received an electric shock. Understandably he became fearful of white rabbits but, over time, he became fearful of many other white fluffy things. He had generalised his fear. By nature dogs are contextual learners.

This means that a response trained to one stimulus or in one circumstance will not occur in response to another stimulus or in another place. A dog that is taught to sit on command in the garden, will only ever sit on command in the garden. To generalise the training of the response must occur in many places and with many stimuli. For example, he or she has to be trained in many other locations before realising that the word 'Sit' means sit wherever the command is given. Discrimination is the opposite *of* generalisation. If a response is only rewarded under certain specific circumstance then the frequency of that behaviour will increase under those circumstances. For example drug detection dogs will only alert when certain substances are located, while ignoring other stimuli.

The above processes have described how new behaviour can be trained but often undesirable behaviour needs to be modified or eradicated. Traditionally punishment was widely used to suppress unwanted behaviours. Please note the use of the word 'suppress'. Punishment does not remove the undesirable behaviour from the animal's repertoire. Also, trainers who use punishment to eliminate undesirable behaviour have to be careful that the wrong association is not created. Many animals trained with punishment learn to fear the trainer or the training area. Precise timing is absolutely critical to the appropriate use of punishment and most people do not have the skills to use punishment correctly therefore the best way to deal with unwanted behaviour is either by extinction or counter-conditioning.

Extinction

Extinction occurs when a previously learnt behaviour is no longer reinforced. The frequency of the unwanted behaviour diminishes and eventually disappears. Dogs that beg at dinner tables will stop begging if they never again receive any food from the table. Early in the extinction process it is common for the animal to make more emphatic or frequent responses i.e. 'Things will get worse before they get better'. This is called an 'extinction burst' and occurs because the animal's expectations are no longer being fulfilled. For example, a dog that has been rewarded with attention for jumping up, will become even more demanding when owners begin to ignore its behaviour.

Extinction proceeds optimally when the unwanted behaviour is **never** rewarded. If there is a long break between situations which elicited the original undesirable behaviour then sometimes the original behaviour will re-emerge (spontaneous recovery).This is particularly true when desensitising fearful stimuli, which can show spontaneous recovery if reinforcement of an alternate behaviour is withheld. To prevent the original fearful response reoccurring, the trainer must expose the animal to the relevant stimuli from time to time. However, the extinction of 'recovered' behaviour is very quick.

Counter-conditioning

Counter-conditioning occurs when an animal is taught a behaviour that is incompatible with an undesirable behaviour such as sitting instead of jumping up.

Replace an undesirable behaviour with a desirable one.

Differential reinforcement of other behaviours

Another technique used to reduce the frequency of less desirable behaviours is the *differential reinforcement* of other behaviours. A trainer may choose to ignore one behaviour but reinforce a variety of other behaviours. Predictably, this results in a reduction in the frequency of the non-reinforced behaviour and an increase in the frequency of the more desirable rewarded behaviours.

Other terms that are important in learning theory:

Habituation

Habituation occurs when repeated exposure of a stimulus, without any associated reward or punishment, decreases the strength of a response. This occurs in many prey animals. If you enter a paddock and stand quietly for a period of time, the animals will become less fearful of you and may even become curious and approach you. However, habituation also means that toys, or other enrichment strategies, lose their novelty value after a time. To maintain interest, dog toys should be rotated, so that the dog is allowed to play with some for a period of time, after which these are hidden and replaced by others. Similarly, an enrichment strategy that is used too often becomes normal, and less interesting or challenging. The old adage 'variety is the spice of life' is particularly pertinent to enrichment.

Sensitisation

Sensitisation is the opposite of habituation and is often the consequence when a stimulus is intrinsically unpleasant or aversive. The strength of the response to a stimulus increases with exposure. Dogs may be noise sensitive or thunder-phobic and this may generalise to other loud noises, resulting in the dog becoming more reactive at lower levels of stimulation.

Desensitisation

Desensitisation is the repeated exposure to a stimulus that normally evokes a response at a level where the normal response is not elicited. Over time the strength of the stimulus is progressively and systematically increased as the threshold increases. Desensitisation is often used to treat fears and phobias.

Consistency is important

Owner consistency and setting appropriate limits are important regardless of the type of training method used (Arhant et al. 2010). Inconsistency not only slows the rate of learning but correlates with greater incidence of problem behaviour ($P<0.05$)(Casey, Twells, & Blackwell 2007). The best trainers are calm, consistent, clear in their own communication with the dog, have great timing and provide a good fair structure for the dog to work within.

As can be seen, even in this very brief outline, the science of learning is complex and continues to evolve but by applying the principles outlined, it is possible to manage and modify much undesirable behaviour.

Reference List

Arhant, C., Bartels, A., Bubna-Littitz, H., & Troxler, J. (2010). • Owner Behavior And Its Relationships With Characteristics Of The Owner And The Dog. *Journal of Veterinary Behavior: Clinical Applications and Research, 5,* 23.

Blackshaw, J. K. (2003). *Notes on Some Topics In Applied Animal Behaviour*. Brisbane: University of Queensland.

Casey, R. A., Twells, C., & Blackwell, E. J. (2007). An investigation of the relationship between measures of consistency in owners and the occurrence of 'behavior problems' in the domestic dog. *Journal of Veterinary Behavior: Clinical Applications and Research, 2,* 83-84.

Hare, B., Plyusnina, I., Ignacio, N., Schepina, O., Stepika, A., Wrangham, R. et al. (2005). Social cognitive evolution in captive foxes is a correlated by-product of experimental domestication. *Current Biology, 15,* 226-230.

Hare, B. & Tomasello, M. (1999). Domestic Dogs (Canis familiaris) Use Human and Conspecific Social Cues to Locate Hidden Food. *Journal of Comparative Psychology, 113,* 173-177.

Hare, B. & Tomasello, M. (2005). Human-like social skills in dogs? *Trends in Cognitive Science., 9,* 439-444.

Herron, M. E., Shofer, F. S., & Reisner, I. R. (2009). Survey of the use and outcome of confrontational and non-confrontational training methods in client-owned dogs showing undesired behaviors. *Applied Animal Behaviour Science, 117,* 47-54.

Hiby, E. F., Rooney, N. J., & Bradshaw, J. W. S. (2004). Dog training methods: their use, effectiveness and interaction with behaviour and welfare. *Animal Welfare, 13,* 63-69.

Horvath, Z., Doka, A., & Miklosi, A. (2008). Affiliative and disciplinary behavior of human handlers during play with their dog affects cortisol concentrations in opposite directions. *Hormones and Behaiour., 54,* 107-114.

Pang, J. F., Kluetsch, C., Zou, X. J., Zhang, A. B., Luo, L. Y., Angleby, H. et al. (2009). mtDNA data indicate a single origin for dogs south of Yangtze River, less than 16,300 years ago, from numerous wolves. Molecular Biology and Evolution., *26,* 2849-2864.

Pryor, K. (2002). *Don't Shoot The Dog: The New Art Of Teaching And Training*. Ringpress Books, Limited.

Pryor, K. (2010). *Reaching The Animal Mind: Clicker Training And What It Teaches Us About All Animals*. USA: Simon & Schuster.

Topál, J., Gácsi, M., Miklósi, A., Virányi, Z., Kubinyi, E., & Csányi, V. (2005). Attachment to humans: a comparative study on hand-reared wolves and differently socialized dog puppies. *Animal Behaviour*.

van Kerkhove, W. (2004). A fresh look at the wolf-pack theory of companion-animal dog social behavior. *Journal of Applied Animal Welfare Science, 7,* 279-285.

Vila, C., Savolainen, P., Maldonado, J. E., Amorim, I. R., Rice, J. E., Honeycutt, R. L. et al. (1997). Multiple and ancient origins of the domestic dog. *Science, 276,* 1687-1689.

ABOUT THE AUTHOR

Dr Linda Marston
Email: linda@marston.com.au

Linda Marston is a Research Fellow with the Anthrozoology Research Group at Monash University. She completed her PhD in 2006, investigating ways to improve the success of dog adoptions from animal welfare shelters. This research has resulted in the development of many strategies to improve the well-being of dogs in shelters and has been recognised by the International Fund for Animal Welfare.

Over the past four years Linda has worked with many Australian state governments to inform policy related to the management of dogs and cats in the community and to improve reporting from the shelters and pounds in their jurisdiction.

She has published widely in the scientific literature, writes occasionally for the print media, contributes to the review panels of a number of scientific journals and presents her research regularly at local and international conferences.

Linda has designed and delivers courses on animal behaviour and handling for AMOs and pound employees, is currently involved in developing animal welfare education for children with Animal Aid. She works closely with urban planners to promote the positive incorporation of dogs and cats into the urban landscape.

Her research is focused on the human-companion-animal relationship in all its forms including; the welfare of companion animals, the effects of companion animals on human health and well-being and cultural differences in pet ownership.