

# Learning Theory

## Made Simple

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### KEY POINTS

- Classical conditioning forms an association between two stimuli, whereas operant conditioning forms an association between a behavior and a consequence.
  - Positive and negative reinforcement strengthen behavior.
  - Positive and negative punishment weaken behavior.

**B**ecause we cannot read minds (either of animals or humans), all we can do is observe behavior and try to understand what has happened when that behavior changes. When behavior does change – either temporarily or permanently – we can assume that learning has taken place on some physical level.<sup>1</sup>

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Learning theory is a discipline of psychology that attempts to explain how learning takes place.<sup>1</sup> Ask a group of psychologists to define *learning*, and you will likely stir up a heated debate. Simply because an animal has learned to do something does not mean that the animal will actually do it! Therefore, it is difficult to define learning based solely on what an individual does or does not do.

For example, we have learned to answer the door when the doorbell rings. Consider, however, that perhaps you're in a bad mood one day and don't feel like talking to anyone. The doorbell rings, and you don't get up to answer it. In this case, you simply chose not to answer the door. However, a casual observer will not know this. He or she will assume that you never learned the meaning of a doorbell.

Although it is important to question what is going on inside the mind of an individual, motivation cannot be measured objectively. This is how the science of behaviorism began.<sup>1</sup> Behavior can be observed, measured, and manipulated. Because of this, behavior is open to scientific investigation.<sup>1</sup>

This article explains some of the laws (or principles) that have been defined by scientists as the rules that govern learning. Examples are provided for each law discussed.

## CLASSICAL CONDITIONING

In classical conditioning, associations are made between two events (or stimuli) that occur close together in time.<sup>2</sup> Russian scientist Ivan Pavlov first described classical conditioning – also known as respondent or Pavlovian conditioning – in 1927.<sup>2</sup>

Not interested in learning theory at all, Pavlov set out to study the salivating reflex of dogs. Because of their biological makeup, dogs salivate when food (in Pavlov's study, meat powder) is placed on the tongue. Pavlov soon discovered, however, that the dogs in his experiment began to salivate as soon as the food was presented to them, even before it was placed on their tongues. In fact, the dogs would salivate as soon as the food presenter walked into the room – without food – and even while they were being placed into the feeding room.<sup>3</sup>

Curious to explain his discovery, Pavlov decided to ring a bell just before placing food on the dogs' tongues. (The bell was rung behind a two-way mirror.) After a few repetitions of the experiment, the sound of the bell alone caused the dogs to salivate in anticipation of receiving the food.<sup>3</sup>

Prior to conditioning, the meat powder (an *unconditioned stimulus*) was used to elicit salivation (an *unconditioned response*). At the outset of Pavlov's experiment, the bell was a *neutral stimulus*. During conditioning, however, as the dogs began to associate the food and the bell, the bell became a *conditioned stimulus* that elicited a *conditioned response* – salivation. Pavlov no longer needed to present the dogs with food to elicit the salivating behavior; the bell alone sufficed.<sup>3</sup>

Classical conditioning is a technique used to elicit such reflexive, or involuntary, responses as salivating, blinking,

## Glossary

**Conditioned response** – Reflex acquired as a result of training and repetition

**Conditioned stimulus** – Previously neutral stimulus that elicits a conditioned response because it has been paired repeatedly with a stimulus that already elicited that response

**Conditioning** – Learning

**Punishment** – A stimulus that, when presented following a particular behavior, renders that behavior less likely to recur

**Reflex** – A simple unlearned response to a stimulus

**Reinforcer** – A stimulus that, when presented following a particular behavior, renders that behavior more likely to recur

**Response** – Reaction to a stimulus that can be observed and measured

**Stimulus** – Change of environment of sufficient intensity as to evoke a response in an organism

**Unconditioned response** – Unlearned response to an unconditioned stimulus

**Unconditioned stimulus** – Stimulus that elicits a response from an organism prior to conditioning

hunger, thirst, urinating, defecating, shaking, panting, and coughing. Animal trainers and behaviorists often use classical conditioning principles to treat anxiety, fears, and phobias.<sup>2</sup> The technique is less effective in modifying voluntary behaviors such as barking, jumping, or running.

It is important to note that in classical conditioning no specific response is required from the subject animal. The unconditioned stimulus is presented regardless of what kind of response is elicited from the animal.<sup>1</sup> In Pavlov's experiment, the dogs received the food regardless of whether they salivated when the bell rang. Classical conditioning techniques include habituation, counter-conditioning, systematic desensitization, and flooding.

## Habituation

Habituation (or adaptation) is the process by which the negative response to a stimulus decreases after repeated exposure to the stimulus.<sup>2</sup> For example, a dog that hunts with its owner may be startled by the sound of a rifle on its first trip into the woods. After hearing several rifle shots, however, the dog habituates to the sound and grows less startled by the noise. As another example, many coffee drinkers say that they didn't like the taste of coffee the first time they drank it. After several cups, however, they became habituated to the bitter taste.

It is important to keep in mind that habituation does not always result in desirable behavior. An owner may squirt his or her cat with a water pistol when it jumps onto the kitchen



Hunting dogs that habituate to the repeated sound of rifle shots are no longer startled by the loud noise.

counter. After many trips onto the counter, however, the cat may habituate to the initial unpleasantness of the water pistol and continue the unwanted behavior. Similarly, dogs often habituate to shock collars.

Sensitization, a classical conditioning technique that is the opposite of habituation, is the process by which an animal's negative response increases after repeated exposure to a stimulus.<sup>2</sup> For example, in an attempt to habituate a cat to the presence of dogs, the owner may place the cat in a room with a young Labrador retriever for 5 minutes a day. After a week, instead of habituating, the cat sensitizes to the dog and becomes even more fearful of the retriever (and all dogs). In this case, the outcome may have been different if an older, less active, and less intimidating dog had been used in the sensitization process.<sup>1</sup>

### Counter-Conditioning

Counter-conditioning is a technique used to reverse, or counter, the effects of previous conditioning. It often involves associating something that was once unpleasant with something pleasant.<sup>2</sup> Although uncommon, it can also be used to change something that once was pleasant into something aversive. In most cases, however, counter-conditioning is used to alleviate fear or anxiety.<sup>2</sup> For example, if a cat exhibits fearful behavior when strangers enter the home, the owner may attempt to counter-condition the fear by giving the cat a special treat when a stranger enters. The cat does not receive this treat any other time. Eventually the cat associates the arrival of strangers with the treat and exhibits less fearful behavior.

Counter-conditioning can also be used to extinguish a negative or undesirable behavior (such as jumping up or barking). This is done by teaching the animal a "substitute" behavior that is incompatible with the unwanted behavior.<sup>4</sup> For example, a dog may have been conditioned to greet people by jumping up on them. The owner decides that he

would rather have the dog sit quietly when greeting people. A dog cannot jump up and sit at the same time; these behaviors are incompatible.

The owner then allows the dog to greet people if the dog is sitting. If the dog jumps up on the visitors, they may be instructed to turn around and walk away. The owner must not allow any visitors to reinforce the dog's former behavior by giving the dog any attention – which includes yelling or pushing the dog away – if the dog jumps on them. Some dogs are happy with any form of attention and will continue the undesirable behavior to get that attention!

### Systematic Desensitization

One type of counter-conditioning, called *systematic desensitization*, involves gradual exposure to increasing levels of a fear-provoking stimulus until the stimulus no longer evokes a fearful response.<sup>2</sup> For example, a dog that is terrified of thunderstorms can be desensitized using a tape recording of a thunderstorm. As the volume is gradually increased over several sessions to the level of a real thunderstorm, the dog becomes desensitized to thunderstorms. (In this case, it would be advisable to train the animal during the winter months to avoid the setback a real thunderstorm would cause.) As another example, a person who is afraid of spiders is shown pictures of spiders and then watches spiders on television. She then watches spiders crawl around inside a cage and then goes into a room where there are free-roaming spiders. Eventually she may allow a spider to crawl on her arm.

The desensitization process can be very lengthy – days or even weeks may be spent at each stage.<sup>1</sup> Throughout the process, reinforcers should be given for appropriate behavior. In addition, the animal (or person) must be comfortable before advancing to the next level of exposure to the stimulus. To avoid a setback, exposure to the full-blown stimulus should be avoided at all costs until the animal is ready.

### Flooding

During flooding, which is the opposite of systematic desensitization, an animal is exposed to a fear-provoking stimulus and is not permitted to escape.<sup>2</sup> For example, a dog that is terrified of having its nails trimmed may be held down by four members of the veterinary staff. The dog becomes so agitated during the process that it loses control of its bladder and bowels. Physical exhaustion renders the animal incapable of responding to its fears any longer, and it succumbs to the nail trimming. As another example, a person who is afraid of spiders is locked in a small room. Several tarantulas are then dumped on her head.

The goal of flooding is to cause so much physical and emotional exhaustion that the animal or person is unable to react with escape or avoidance behaviors and extinction occurs.<sup>1</sup> Because flooding teaches no positive adaptive behaviors, it rarely works. Its usefulness is limited to those with very mild fears.<sup>4</sup> Often the animal experiences such

fright and discomfort that the fear becomes even stronger.<sup>2</sup> Scientists believe that systematic desensitization is a much more humane and ethical method of treating fears and anxieties in both animals and humans.<sup>2</sup>

## OPERANT CONDITIONING

In his 1911 work entitled *Animal Intelligence*, psychologist Edward L. Thorndike established the Law of Effect, which states that rewarded responses tend to increase in frequency.<sup>2</sup> However, it was not until B. F. Skinner wrote *The Behavior of Organisms* in 1938 that operant conditioning was truly defined.<sup>2</sup> In operant (or instrumental) conditioning, an individual learns to engage in a particular behavior because of the effects of that behavior. Relationships are formed between stimuli, responses, and consequences.<sup>2</sup>

Operant behaviors are controlled by consequences. Behaviors that lead to positive consequences increase in occurrence; behaviors that result in negative consequences decrease in occurrence.<sup>3</sup>

Although Skinner's work began in the laboratory, it was soon carried out into real-world settings. Animal trainers and psychologists alike believed the principles of operant conditioning could be used to improve the lives of both animals and humans.<sup>2</sup> The primary applications of operant conditioning are in teaching new skills or maintaining and improving an animal's performance.

### Reinforcement Strengthens Behavior

An operant behavior is defined as a voluntary behavior that is reinforced.<sup>3</sup> There are two types of reinforcement: positive and negative. Both types strengthen the behavior (i.e., make it more likely to recur).<sup>3</sup>

#### Positive Reinforcement

Positive reinforcement involves the addition of something good when a particular behavior occurs.<sup>1</sup> For example, a client asks her dog to sit. After the dog sits, the client opens the door to let the dog outside. The sitting behavior is positively reinforced because the dog gets to go outside and have fun.

Keep in mind that positive reinforcement does not always result in positive behavior. For example, a people-loving dog may see a neighbor walking down the sidewalk. The dog pulls on its leash and drags the owner toward the neighbor. The behavior of pulling on the leash has been positively reinforced once the owner and dog reach the neighbor and the dog receives the attention it craves, but this is not a behavior most owners would want to reinforce.

#### Negative Reinforcement

Negative reinforcement involves subtracting (stopping or removing) a negative consequence when a particular behavior occurs.<sup>1</sup> For example, an owner tells her dog to sit. When the dog sits, the owner stops pulling up and choking the dog with a noose collar. Sometimes, negative reinforcement results in negative behavior. For example,



This dog's behavior of sitting at her owner's request will be positively reinforced when the dog is let out to play.

when a client attempts to clean his dog's ears, the dog resists by squirming and trying to get away. The owner becomes frustrated and eventually gives up on the ear cleaning and lets the dog go. In so doing, the owner has negatively reinforced the behavior of resisting an ear cleaning. So the next time the owner tries to clean his dog's ears, the animal will be even more likely to resist his efforts.

It is important to note that what may be positive reinforcement for some animals may be negative reinforcement for others.<sup>2</sup> One person may give his dog a carrot for a job well done, but his neighbor's dog may hate carrots. Thus pet owners must heed and cater to individual preferences.

### Punishment Weakens Behavior

#### *Positive Punishment*

Positive punishment involves adding a negative consequence when a particular behavior occurs.<sup>1</sup> For example, if a cat jumps up on the kitchen counter, its owner may squirt it with a water bottle to discourage the behavior. The negative consequence (the water) weakens the cat's behavior – that is, the behavior is less likely to occur again – because the cat has been punished for jumping on the counter.

#### *Negative Punishment*

Negative punishment involves the subtraction of something pleasant when a particular behavior occurs.<sup>1</sup> For example, an owner may show his dog a piece of meat and then ask the dog to sit. If the dog doesn't sit, the owner may eat the meat himself instead of giving it to the dog. Thus the dog's behavior (not sitting) has been punished (the meat was taken away).

As in reinforcement, it is important to remember that what may be punishment for one animal may not be punishment for another.

### *Extinction*

Extinction occurs when a behavior that has been previously reinforced is no longer reinforced. As a result, that behavior ceases.<sup>2</sup> For example, if an owner stops giving table scraps to a dog that begs at the table, the reinforcement (table scraps) is eliminated, and the begging behavior stops.

The increase in intensity, duration, or frequency of a behavior that is not reinforced during extinction is called an *extinction burst*.<sup>2</sup> During this burst, an animal may appear very anxious and frustrated because it has been accustomed to receiving reinforcements in previous situations. Over time, however, the bursts become less intense, and eventually the behavior stops.

If the owner of the begging dog is unaware of extinction bursts, he or she may eventually give in to the dog and give it a table scrap, thinking that the whole extinction principle is hogwash. This unintentionally serves to make the behavior worse.<sup>2</sup>

### *Stimulus Control*

Unlike reinforcement, punishment, and extinction, which occur after the behavior, stimulus control involves the use of antecedent events – that is, events that occur before the behavior.<sup>2</sup>

A behavior is said to be under stimulus control when there is an increased probability that the behavior will occur as a result of the presence of a specific antecedent stimulus.<sup>2</sup> For example, a family gathers around the table for a meal (antecedent); the dog begs at the table (behavior) and is given table scraps (consequence). Another example would be an owner retrieving a dog leash from the closet (antecedent); the dog gets excited, jumps up and down (behavior), and gets to go for a walk (consequence).

### CLASSICAL VERSUS OPERANT CONDITIONING

In a controlled laboratory setting, it is easy to draw a distinction between classical and operant conditioning. When working in real-world situations, however, things can get a little more muddled.

For example, when a pet owner rattles a cookie jar, her dog may come running, jump up and down, wag its tail, and salivate in anticipation of getting a treat. In this scenario, any principles of both classical and operant conditioning are occurring at the same time<sup>2</sup>: The running, jumping, and tail wagging are voluntary activities that indicate that operant conditioning has taken place; the salivation is indicative of classical conditioning.

Usually when they encounter problems with modifying a particular behavior, trainers soon discover that they have been focusing their efforts too much on one form of conditioning.<sup>2</sup> This singular focus is especially problematic when working with animals that have deep-rooted problems involving fear and anxiety.<sup>2</sup> Problems can be avoided if the trainer realizes that both classical and operant conditioning play a role in the learning process.

### Learning Theory in Practice: Clicker Training



Clickers are used to open the lines of communication between humans and animals. Clicker training incorporates principles from both classical and operant conditioning.

Traditionally, a clicker is a plastic box that makes a cricket "click" sound (although other devices such as whistles or lights are also used<sup>2</sup>).

Clickers can be used to teach animals new skills in a fun, positive way. They can also

have a powerful effect as a behavior modification device.

The clicker is a neutral stimulus that, with conditioning, becomes a conditioned reinforcer to the animal. Remember the bell and Pavlov's salivating dogs? The clicker is paired with something positive, usually a highly palatable treat or something else the animal finds intrinsically rewarding.

Eventually the reinforcement (e.g., treat) is faded and a cue is added for the desired behavior. The click continues to be used as a conditioned reinforcer until the animal makes the connection and the behavior is learned.

Some veterinary hospitals have begun using clickers during their office procedures. Dogs and cats become less stressed

during exams when the clicker is used to build confidence and alleviate stress and anxiety.<sup>5</sup> The animal's attention goes from "Hey! What's happening here?" to "Oh, this is a great way for me to get hot dogs."<sup>6</sup> Clickers are also effective in training aggressive and fearful animals that do not like to be handled by strangers.<sup>3</sup>

Animal shelters nationwide have also been using clickers to communicate to shelter animals that desirable behaviors result in desirable consequences. Once the animals learn how to modify their environment by modifying their behavior, they become less stressed and more adoptable.<sup>5</sup> Animal trainers have also found that using clickers and positive training techniques result in better long-term recall, faster learning, as well as more eager participation by both trainers and trainees.<sup>3</sup>

Look for more in-depth information about clicker training in an upcoming article in *Veterinary Technician*.

#### Clicker Training Resources

Shaw J: A click does the trick! Operant conditioning theory in dogs. *Vet Tech* 20(7):391-397, 1999.

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## CONCLUSION

Pets that exhibit behavioral problems are often euthanized or abandoned by their owners. Recent estimates indicate that between 6 and 15 million dogs and cats are euthanized each year in the United States in shelters alone, less than 5% for medical reasons.<sup>4</sup>

Veterinary technicians can use the principles of learning theory to improve the lives of their clients' pets. Many behavioral problems having no underlying medical cause can be easily resolved using the principles of learning theory. The result is fewer unwanted pets in animal shelters and better relationships between pets and their owners.

In many cases, there are easy solutions to these problems if the pet owner is given proper and timely information. As animal health care professionals, we need to use the principles of learning theory to help pets live more comfortably and safely in the world that has been created for them.

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## Article #1 CE Test

The article you have read qualifies for 0.05 Continuing Education Unit. To receive credit for your study from Alfred State College, choose the best answer to each of the following questions; then mark your answers on the postage-paid envelope inserted in *Veterinary Technician*.

1. In \_\_\_\_\_, associations are made between two events that occur close together in time.
  - a. classical conditioning
  - b. operant conditioning
  - c. counter-conditioning
  - d. stimulus control
2. Some examples of classical conditioning principles include
  - a. habituation, systematic desensitization, and positive reinforcement.
  - b. positive reinforcement, negative reinforcement, and flooding.
  - c. habituation, counter-conditioning, and flooding.
  - d. extinction, flooding, and habituation.
3. Classical conditioning is used to explain behaviors such as
  - a. salivating, blinking, thirst, and defecating.
  - b. barking, jumping, urinating, and hunger.
  - c. salivating, blinking, barking, and jumping.
  - d. shaking, panting, barking, and running.
4. The Law of Effect states that responses that
  - a. produce rewards tend to decrease in frequency.
  - b. produce rewards tend to increase in frequency.
  - c. remove rewards tend to decrease in frequency.
  - d. remove rewards tend to increase in frequency.
5. Negative reinforcement involves \_\_\_\_\_ when a particular behavior occurs.
  - a. adding something pleasant
  - b. adding something unpleasant
  - c. subtracting something pleasant
  - d. subtracting something unpleasant
6. Positive punishment involves \_\_\_\_\_ when a particular behavior occurs.
  - a. adding something pleasant
  - b. adding something unpleasant
  - c. subtracting something pleasant
  - d. subtracting something unpleasant
7. Which of the following learning theory principles involves the use of antecedent events?
  - a. reinforcement
  - b. stimulus control
  - c. punishment
  - d. extinction
8. What occurs when a behavior that has been previously reinforced is no longer reinforced?
  - a. positive punishment
  - b. negative reinforcement
  - c. flooding
  - d. extinction
9. Which learning theory principle is used when an animal is exposed to a fear-provoking stimulus and escape is not permitted?
  - a. systematic desensitization
  - b. extinction
  - c. flooding
  - d. counter-conditioning
10. Classical conditioning principles of learning theory are often used to
  - a. teach new skills.
  - b. maintain performance.
  - c. treat anxiety, fears, and phobias.
  - d. improve performance.