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Understanding Behavior: "Classical Conditioning: Learning by Association"

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An interesting finding among veterinary staff is that many of our own pets are relaxed in the veterinary hospital, whereas many clients' pets are fearful and clearly dislike the hospital setting. This difference in behavior can be attributed to classical conditioning, a type of learning elucidated by Ivan Pavlov.

PAVLOV'S DOGS

In the early 1900s, Pavlov, a Russian physician and researcher, studied digestion in dogs.[1] He fed meat powder to them and then measured salivation. After several repetitions, he noted that the dogs frequently began salivating before food entered their mouths. The salivation was triggered by the sight of food and the sound of people approaching with a meal. With this discovery, Pavlov changed the focus of his research to these "psychic secretions." Pavlov paired feedings with the sound of a stimulus that previously had no meaning to the dogs. He chose a bell because animals do not normally have an innate response to bells. He rang the bell and then immediately presented the food. After doing this many times, he found that when he rang the bell in the absence of food, the dogs salivated.

These results can be explained by the following. The food alone elicited an **involuntary response**--one that occurs without conditioning or training. Consequently, this stimulus is called an **unconditioned stimulus**, and the salivation response is an **unconditioned response**. After the neutral stimulus bell was paired with the food several times, the bell **elicited** salivation even in the absence of food. Thus the bell was initially a **neutral stimulus**, but when paired enough times with food, it essentially acquired the same meaning as the food. The bell became a **conditioned stimulus**--one that was learned-and elicited salivation, which is now called a **conditioned response** because the dogs were trained to have it.

OTHER STUDIES

Since Pavlov's findings, the process of associative learning has been found to work across many different stimulus-response systems. In the 1950s, Garcia and Koelling[2] at the Radiologic Defense Laboratory found that rats developed a taste aversion to solutions they drank as they were irradiated. This aversion was presumably due to associating the food with nausea after irradiation. Similarly, most humans have eaten a particular food while ill or immediately before becoming ill and subsequently developed an aversion to the food.

Classical conditioning can also affect the immunologic system. There have been anecdotal reports of classical conditioning and learned allergic reactions. A 19th century medical journal[3] reported that a patient with a known allergy to roses experienced an asthma attack when exposed to an artificial rose.

More recently, researchers[4] found that guinea pigs could be trained to exhibit histamine release in response to a novel odor. The guinea pigs were immunologically sensitized to bovine serum albumin (BSA) by injection into their footpad, which led to histamine release. Then, during classical conditioning training, each guinea pig was injected with saline as a control on five separate occasions and BSA on five separate occasions. Injections were spaced 1 week apart to allow recovery from allergic reactions, and the order of injections was randomized. The injections-one with BSA and the other with saline-were paired with one of two odors. The odors were dimethyl sulfide (a sulfur smell) and triethylamine (a fishy smell). Half of the animals received dimethyl sulfide paired with BSA and

triethylamine paired with saline. The other half received triethylamine paired with BSA and dimethyl sulfide paired with saline.

After the 10 training trials, each animal underwent test trials. In the first trial, the researchers presented the odor that had been paired with BSA (i.e., dimethyl sulfide in half of the guinea pigs, and triethylamine in the other half), but in the absence of a BSA injection. In the second trial, the odor that had been paired with saline was presented in the absence of a saline injection. The third trial was a repeat of the first trial. All eight guinea pigs showed marked histamine response during presentation of the odor that had been paired with BSA. Thus the odor paired with BSA had become a conditioned stimulus. The histamine response level was comparable with the response that would be elicited by an allergen. Conversely, when the subjects were exposed to the odor that had been paired with the control saline injection, histamine release was minimal.

DETRIMENTAL ASSOCIATIONS

Considering that the types of classically conditioned responses and stimuli can vary so greatly, it would be expected that classical conditioning is a common phenomenon that occurs daily. Animals are constantly making associations, whether people are present or absent. Unfortunately, animals often make detrimental associations regarding humans, other animals, objects, and environments. One such association occurs in training situations. Many trainers use methods that focus on the use of strong corrections, including shock collars.

A study by Schilder and van der Borg[5] on working dogs in the Netherlands revealed that dogs that had been trained using shock collars showed signs of fear, stress, and pain when shocked. They yelped, lowered their tails, crouched, flicked their tongues, and lowered their ears in response to the shock. The dogs also showed subtle but consistent signs of fear and stress during obedience and protection training as well as while free walking with their handlers both on the training ground and in the park when they were not being shocked. These signs included lip licking, paw raising, and ear lowering. The results indicate that the dogs learned to associate situations, environments, and their handlers with the pain and fear induced by the shock collar. In some instances, the dogs learned to associate a command with a shock. In several cases, when a dog had been shocked following a command and the command was given later, the dog immediately yelped when hearing it in absence of the shock.

In addition to developing a learned fear response to handlers, animals can develop aggression when techniques involving fear and pain are applied.[6] This finding has been demonstrated in many species, including rats and humans.[6,7] The aggression can be directed toward the object causing fear and pain or redirected toward humans, other animals, or inanimate objects.[8] Consequently, when aversive methods (e.g., shock collars, choke chains) are used to correct behaviors (e.g., barking at, pulling toward, or lunging at dogs or people), these methods may have the unintended effect of more negatively associating pain or fear with the object, person, or animal toward which the dog was directing its aggression (Figure 1). This can cause an inappropriate behavior to escalate to overtly aggressive behavior.

This type of negative association does not occur solely during owner-supervised interactions or interactions on an owner's property. It occurs within the context of the veterinary hospital and starts even before the client arrives there. For example, when a client brings a new kitten to a hospital for the first time, the client puts the kitten in a travel carrier, which is a new experience, and drives the kitten to the hospital. Along the way, the kitten may salivate or vomit because of nausea induced by the ride. When arriving at the hospital, the kitten is exposed to foreign scents and sounds, causing a fear response. In the examination room, the kitten receives a painful vaccination. Although the owner and veterinary staff may think that the examination went well because the kitten did not hiss or struggle, the visit 3 weeks later may reveal something different. When the owner brings out the carrier to prepare to go to the hospital, the kitten may hide. It has been classically conditioned to associate the carrier with the pain, fear, and nausea of her last trip to the hospital, and the kitten is having an involuntary physiologic response. At the hospital, rather than stiffly lying sternally with her ears back and head low (a posture indicating fear), the kitten hisses and yowls. It has been trained to associate the hospital and veterinarian with aversive conditions, and because it cannot escape, it responds

aggressively. If the kitten is restrained and vaccinated, its anxiety, fear, and aggression may remain at the same level or increase during the visit and future visits. The kitten's response is not likely to improve on its own.

Veterinarians probably train animals in this type of association on a daily basis. This classical conditioning can have several detrimental effects. First, it makes it more difficult for owners to bring their pets to the hospital; consequently, they may bring their pets less frequently. Second, it affects our ability to examine and care for animals. It may also make it more difficult for pet owners to perform necessary husbandry, such as ear cleaning or nail trimming, because the veterinary visit may have sensitized the animal to these procedures. If the patient is already fearful of people or other animals that might be at the hospital, a veterinary visit can greatly worsen this fear and even become the catalyst for fear aggression toward people and other animals. I have seen a number of cases in which one traumatic event affecting a fearful dog or cat has been followed by overt aggression in the hospital, home, and/or outside environment. This aggression sometimes leads to euthanasia.

COUNTERCONDITIONING

Although veterinarians may unintentionally classically condition undesired associations in clients' pets, they can alleviate these problems by classically conditioning a different association.[9] For instance, we can train fearful kittens to associate the carrier, car ride, and veterinary hospital with food, thus eliciting all of the pleasurable physiologic changes associated with food (see box). This is called **counterconditioning** because it involves countering the association that was previously classically conditioned. Counterconditioning usually starts with a low-intensity version of the stimulus because the animal will be too fearful of the usual stimulus to eat the food. The intensity should be gradually increased in small increments. This process is called **systematic desensitization**.

Counterconditioning and systematic desensitization may sound time-consuming because of the number of steps involved, but when performed correctly, they can take just minutes, thereby saving time and manpower at future veterinary visits. The pleasant results should eventually classically condition the veterinary staff, pet, and owner to enjoy veterinary visits.

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See box for Additional Resources.