Science Education Collection

Positive Reinforcement Studies

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Abstract

Researchers study learning of a behavior through the use of operant conditioning. This type of learning involves associating the behavior with a consequence, which is a reward or punishment. If the consequence is a reward, it leads to reinforcement of the desired behavior. One type of reinforcement approach is positive reinforcement, where the behavior is rewarded with an artificial, natural, or social reinforcer. Studies using positive reinforcement as a tool can help tease out important details about neurological functioning associated with different behaviors.

This video reviews the concepts behind reinforcement studies by using an example of a man training a dog to sit. Following this, we look at a generalized procedure of positive reinforcement commonly used by behavioral researchers. This involves, training rodents to perform a behavior (lever press) to get a reward (food). Lastly, specific applications demonstrate how scientists use positive reinforcement to understand behavior.

Transcript

Positive reinforcement is an important factor that influences human and animal behavior. Scientists study this phenomenon using a type of learning called "operant conditioning." Simply put, operant conditioning shapes a behavior by associating it with a specific consequence. For positive reinforcement, the consequence is a reward when a behavior is performed. This increases the likelihood that the behavior will occur again in the future.

This video covers principles of positive reinforcement, a generalized experiment, and some of the related applications.

Let's begin by discussing how positive reinforcement works. We'll do this using the example of a man trying to train a dog to sit. Initially, when the man instructs the dog to sit, the dog takes a long time, but when he does sit, the man offers him a bone. Here, sitting is the behavior encouraged by the reward, which is the positive reinforcer. Now the dog learns to associate the positive reinforcer with the command, and learns the behavior. The next time the man says "sit," the dog takes less time to do so, as he knows the reward is a bone. This is different from negative reinforcement, where a behavior is strengthened by the removal of a negative stimulus, such as pressure from a leash, which acts as a negative reinforcer. In this case, the dog learns to associate the negative reinforcer with the command, and learns the behavior. Now the dog will know to sit quickly to avoid the pressure from the leash.

Reinforcement is not restricted just to animals; for us, there are many types of positive reinforcers that influence our behavior. Some of the more tangible reinforcers are food, money, and drugs or alcohol. There are also natural reinforcers, such as getting a good grade on a test. In addition, there are social reinforcers, exemplified by a teacher telling a student "Good Job" in front of a class.

The neurophysiology behind positive reinforcement is based on the dopamine centers of the brain. Dopamine is a neurotransmitter associated with reward-seeking behaviors. When the reward is greater than expected, the firing of dopamine neurons increases, which consequently increases the desire for the reward.

Now that you have an idea of the principles behind positive reinforcement, let's take a look at how to perform an experiment studying this phenomenon.

The goal of these types of experiments is to train an animal to associate a voluntary behavior with a consequence, such as associating a lever press with a reward. Many different animals, such as mice, rats, or even pigeons, can be used to study this phenomenon.

This experiment makes use of an operant chamber, which is a soundproof box with ventilating fans. Here, the chamber is equipped with two levers-one active and one inactive-that are positioned on either side of a central food dispenser. A stimulus light is located above each lever, and a food pellet dispenser is positioned outside of the chamber.

The animal must execute a behavioral response in the chamber in order to receive a reward. First, the animal is put into the chamber to become accustomed to the new environment. In order to reinforce the lever-pressing behavior, it is important to have one active lever that will deliver a reward once pressed, and an inactive lever that will not deliver any reward when pressed. The animal will learn to hit the active lever more often in order to get more rewards. The number of lever presses per reward can also be adjusted.

Now that you know how to perform a positive reinforcement experiment, let's look at some applications where scientists are using this paradigm to learn valuable information about neurological functions.

Researchers can test different concentrations of a reinforcer to determine the relationship between concentration and strength of behavior reinforcement. In this experiment, scientists allow rats to get accustomed to an operant chamber, where the animals learn to press a lever in order to get a dose of sugar solution. Different sugar concentrations are used, and for each, the number of lever presses is recorded, in order to determine the effect of concentration on reinforcement. This shows that higher sugar concentrations have a greater ability to reinforce lever-pressing behavior.

Another application for positive reinforcement involves testing attention. Here, by placing a rat in a chamber with five apertures, behavioral researchers study attention and impulse control using positive reinforcement. The experiment is designed so that when the light is illuminated, the

rat must poke its nose into the aperture in order to get the food pellet located on the opposite side of the chamber. The more attention the rat pays to the illuminated aperture, the more food pellets it will receive.

Finally, positive reinforcement experiments are used for determining neural activity during learning. In this study, pigeons are first trained to correctly discriminate between two stimuli, and learn which screen to tap in order to receive a reinforcing food reward. Next, in order to measure neural activity, electrodes are attached to a pigeon's head, and a behavioral task is performed. The positive reinforcement helps elicit the necessary behavior, allowing scientists to study neuronal firing during the learned response.

You've just watched JoVE's introduction to positive reinforcement. This video covered the principles of positive reinforcement, explained a generalized experiment, and reviewed some current applications. Understanding the psychology and neuroscience behind positive reinforcement can help scientists figure out the factors affecting human decision-making. As always, thanks for watching!