Operant Conditioning

A technique used to modify behavior by reinforcing desired behaviors, and ignoring or punishing undesired behaviors.[1]

Operant conditioning is probably the most researched and well-known technique used to modify behavior. The technique involves increasing or decreasing a particular behavior by associating the behavior with a positive or negative condition (e.g., rewards or punishments). Operant conditioning is commonly applied to animal training, instructional design, video game design, incentive programs, gambling devices, counseling, and behavioral therapy. It is also finding increased application in artificial intelligence. There are three basic operant conditioning techniques: positive reinforcement, negative reinforcement, and punishment.[2]

Positive reinforcement increases the probability of a behavior by associating the behavior with a positive condition; pulling the lever on a slot machine results in positive visual and auditory feedback, and a possible monetary reward. Negative reinforcement increases the probability of a behavior by associating the behavior with the removal of a negative condition; fastening a seat belt in a car silences an annoying buzzer. Punishment decreases the probability of a behavior by associating the behavior with a negative condition; touching a poison mushroom in a video game reduces the score. Positive and negative reinforcement should be used instead of punishment whenever possible. Punishment should be reserved for rapidly extinguishing a behavior, or it should not be used at all.

Reinforcement and punishment are administered after a behavior is performed one or more times. When there is a clear and predictive relationship between the frequency of a behavior and an outcome, behavior will be paced to do just what is required to receive reinforcement or avoid punishment. When there is not a clear and predictive relationship between the frequency of behavior and the outcome, behavior will be performed more frequently and will be more resistant to extinction (the loss of the desired behavior). An optimal behavior modification plan typically includes predictable reinforcement early in training (fixed ratio schedules) and less predictable reinforcement later in the training (variable ratio schedules).

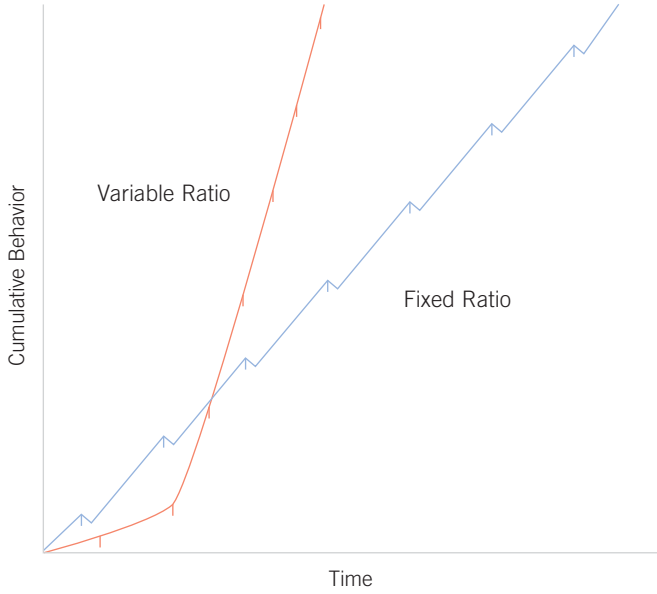
Use operant conditioning in design contexts where behavioral change is required. Focus on positive or negative reinforcement, rather than punishment whenever possible. Use fixed ratio schedules of reinforcement early in training. As basic behaviors are mastered, switch to variable schedules of reinforcement.

See also Classical Conditioning and Shaping.

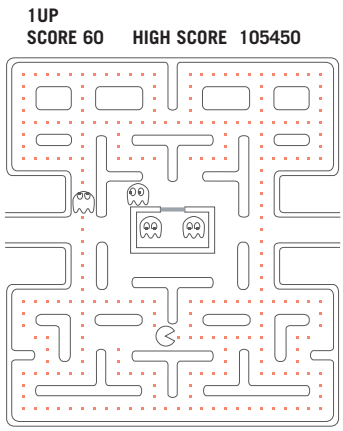
[1] Also known as *instrumental conditioning*.

[2] The seminal work on operant conditioning is *The Behavior of Organisms: An Experimental Analysis* by Burrhus F. Skinner, Appleton-Century, 1938; a nice contemporary book on the subject is *Don't Shoot the Dog: The New Art of Teaching and Training* by Karen Pryor, Bantam Doubleday Dell, 1999.

This graph shows how reinforcement strategies influence the frequency of behavior. Variable ratio schedules provide reinforcement after a variable number of correct responses. They ultimately achieve the highest frequency of behavior and are useful for maintaining behavior. Fixed ratio schedules provide reinforcement after a fixed number of correct responses. They are useful for connecting the reinforcement to the behavior during the early stages of learning.



The addictive nature of video games and gambling machines is a direct result of their application of operant conditioning.



In the game Black & White, the nature of the characters evolve to become good, neutral, or evil based on how their behaviors are rewarded and punished.