

Operant conditioning

Operant conditioning, also known as instrumental conditioning, is a method of learning normally attributed to B.F. Skinner, where the consequences of a response determine the probability of it being repeated. Through operant conditioning behaviour which is reinforced (rewarded) will likely be repeated, and behaviour which is punished will occur less frequently. By the 1920s, John B. Watson had left academic psychology, and other behaviourists were becoming influential, proposing new forms of learning other than classical conditioning. Perhaps the most important of these was Burrhus Frederic Skinner. Although, for obvious reasons, he is more commonly known as B.F. Skinner. Skinner's views were slightly less extreme than those of Watson (1913). Skinner believed that we do have such a thing as a mind, but that it is simply more productive to study observable behaviour rather than internal mental events.

The work of Skinner was rooted in a view that classical conditioning was far too simplistic to be a complete explanation of complex human behaviour. He believed that the best way to understand behaviour is to look at the causes of an action and its consequences. He called this approach operant conditioning. Skinner is regarded as the father of Operant Conditioning, but his work was based on Thorndike's (1898) law of effect. According to this principle, behaviour that is followed by pleasant consequences is likely to be repeated, and behaviour followed by unpleasant consequences is less likely to be repeated.

Skinner introduced a new term into the Law of Effect - Reinforcement. behaviour which is reinforced tends to be repeated (i.e., strengthened); behaviour which is not reinforced tends to die out-or be extinguished (i.e., weakened). Skinner (1948) studied operant conditioning by conducting experiments using animals which he placed in a 'Skinner Box' which was similar to Thorndike's puzzle box.

A Skinner box, also known as an operant conditioning chamber, is a device used to objectively record an animal's behaviour in a compressed time frame. An animal can be rewarded or punished for engaging in certain behaviours, such as lever pressing (for rats) or key pecking (for pigeons).

Skinner identified three types of responses, or operant, that can follow behaviour.

- Neutral operants: responses from the environment that neither increase nor decrease the probability of a behaviour being repeated.
- Reinforcers: Responses from the environment that increase the probability of a behaviour being repeated. Reinforcers can be either positive or negative.
- Punishers: Responses from the environment that decrease the likelihood of a behaviour being repeated. Punishment weakens behaviour.

We can all think of examples of how our own behaviour has been affected by reinforcers and punishers. As a child you probably tried out a number of behaviours and learned from their consequences. For example, if when you were younger you tried smoking at school, and the

chief consequence was that you got in with the crowd you always wanted to hang out with, you would have been positively reinforced (i.e., rewarded) and would be likely to repeat the behaviour.

If, however, the main consequence was that you were caught, caned, suspended from school and your parents became involved you would most certainly have been punished, and you would consequently be much less likely to smoke now.

Positive Reinforcement

Positive reinforcement is a term described by B. F. Skinner in his theory of operant conditioning. In positive reinforcement, a response or behaviour is strengthened by rewards, leading to the repetition of desired behaviour. The reward is a reinforcing stimulus.

Skinner showed how positive reinforcement worked by placing a hungry rat in his Skinner box. The box contained a lever on the side, and as the rat moved about the box, it would accidentally knock the lever. Immediately it did so a food pellet would drop into a container next to the lever.

The rats quickly learned to go straight to the lever after a few times of being put in the box. The consequence of receiving food if they pressed the lever ensured that they would repeat the action again and again. Positive reinforcement strengthens a behaviour by providing a consequence an individual finds rewarding.

Negative Reinforcement

Negative reinforcement is the termination of an unpleasant state following a response. This is known as negative reinforcement because it is the removal of an adverse stimulus which is 'rewarding' to the animal or person. Negative reinforcement strengthens behaviour because it stops or removes an unpleasant experience.

Skinner showed how negative reinforcement worked by placing a rat in his Skinner box and then subjecting it to an unpleasant electric current which caused it some discomfort. As the rat moved about the box it would accidentally knock the lever. Immediately it did so the electric current would be switched off. The rats quickly learned to go straight to the lever after a few times of being put in the box. The consequence of escaping the electric current ensured that they would repeat the action again and again.

In fact Skinner even taught the rats to avoid the electric current by turning on a light just before the electric current came on. The rats soon learned to press the lever when the light came on because they knew that this would stop the electric current being switched on.

Punishment (weakens behaviour)

Punishment is defined as the opposite of reinforcement since it is designed to weaken or eliminate a response rather than increase it. It is an aversive event that decreases the behaviour that it follows. Like reinforcement, punishment can work either by directly applying an unpleasant stimulus like a shock after a response or by removing a potentially

rewarding stimulus, for instance, deducting someone's pocket money to punish undesirable behaviour.

There are many problems with using punishment, such as:

- Punished behaviour is not forgotten, it's suppressed - behaviour returns when punishment is no longer present.
- Causes increased aggression - shows that aggression is a way to cope with problems.
- Creates fear that can generalize to undesirable behaviours, e.g., fear of school.
- Does not necessarily guide toward desired behaviour - reinforcement tells you what to do, punishment only tells you what not to do.

Schedules of Reinforcement

Imagine a rat in a "Skinner box." In operant conditioning, if no food pellet is delivered immediately after the lever is pressed then after several attempts the rat stops pressing the lever (how long would someone continue to go to work if their employer stopped paying them?). The behaviour has been extinguished. Behaviourists discovered that different patterns (or schedules) of reinforcement had different effects on the speed of learning and extinction. Ferster and Skinner (1957) devised different ways of delivering reinforcement and found that this had effects on

1. The Response Rate - The rate at which the rat pressed the lever (i.e., how hard the rat worked).

2. The Extinction Rate - The rate at which lever pressing dies out (i.e., how soon the rat gave up).

schedules of reinforcement

Skinner found that the type of reinforcement which produces the slowest rate of extinction (i.e., people will go on repeating the behaviour for the longest time without reinforcement) is variable-ratio reinforcement. The type of reinforcement which has the quickest rate of extinction is continuous reinforcement.

(A) Continuous Reinforcement

An animal/human is positively reinforced every time a specific behaviour occurs, e.g., every time a lever is pressed a pellet is delivered, and then food delivery is shut off.

Response rate is SLOW

Extinction rate is FAST

(B) Fixed Ratio Reinforcement

Behaviour is reinforced only after the behaviour occurs a specified number of times. e.g., one reinforcement is given after every so many correct responses, e.g., after every 5th response. For example, a child receives a star for every five words spelled correctly.

Response rate is FAST

Extinction rate is MEDIUM

(C) Fixed Interval Reinforcement

Once reinforcement is given after a fixed time interval providing at least one correct response has been made. An example is being paid by the hour. Another example would be every 15 minutes (half hour, hour, etc.) a pellet is delivered (providing at least one lever press has been made) then food delivery is shut off.

Response rate is MEDIUM

Extinction rate is MEDIUM

(D) Variable Ratio Reinforcement

Behaviour is reinforced after an unpredictable number of times.

Response rate is FAST

Extinction rate is SLOW (very hard to extinguish because of unpredictability)

(E) Variable Interval Reinforcement

Providing one correct response has been made, reinforcement is given after an unpredictable amount of time has passed, e.g., on average every 5 minutes. An example is a self-employed person being paid at unpredictable times.

Response rate is FAST

Extinction rate is SLOW

Behaviour Modification

Behaviour modification is a set of therapies / techniques based on operant conditioning (Skinner, 1938, 1953). The main principle comprises changing environmental events that are related to a person's behaviour. For example, the reinforcement of desired behaviours and ignoring or punishing undesired ones. This is not as simple as it sounds — always reinforcing desired behaviour, for example, is basically bribery.

There are different types of positive reinforcements. Primary reinforcement is when a reward strengthens a behaviour by itself. Secondary reinforcement is when something strengthens behaviour because it leads to a primary reinforcer. Examples of behaviour modification therapy include token economy and behaviour shaping.

Token Economy

Token economy is a system in which targeted behaviours are reinforced with tokens (secondary reinforcers) and later exchanged for rewards (primary reinforcers). Tokens can be

in the form of fake money, buttons, poker chips, stickers, etc. Rewards can range anywhere from snacks to privileges or activities. For example, teachers use token economy at primary school by giving young children stickers to reward good behaviour. Token economy has been found to be very effective in managing psychiatric patients. However, the patients can become over reliant on the tokens, making it difficult for them to adjust to society once they leave prison, hospital, etc.

Behaviour Shaping

A further important contribution made by Skinner (1951) is the notion of behaviour shaping through successive approximation. Skinner argues that the principles of operant conditioning can be used to produce extremely complex behaviour if rewards and punishments are delivered in such a way as to encourage move an organism closer and closer to the desired behaviour each time. To do this, the conditions (or contingencies) required to receive the reward should shift each time the organism moves a step closer to the desired behaviour. According to Skinner, most animal and human behaviour (including language) can be explained as a product of this type of successive approximation.

Educational Applications

In the conventional learning situation, operant conditioning applies largely to issues of class and student management, rather than to learning content. It is very relevant to shaping skill performance.

A simple way to shape behaviour is to provide feedback on learner performance, e.g., compliments, approval, encouragement, and affirmation. A variable-ratio produces the highest response rate for students learning a new task, whereby initially reinforcement (e.g., praise) occurs at frequent intervals, and as the performance improves reinforcement occurs less frequently, until eventually only exceptional outcomes are reinforced.

For example, if a teacher wanted to encourage students to answer questions in class they should praise them for every attempt (regardless of whether their answer is correct). Gradually the teacher will only praise the students when their answer is correct, and over time only exceptional answers will be praised.

Unwanted behaviours, such as tardiness and dominating class discussion can be extinguished through being ignored by the teacher (rather than being reinforced by having attention drawn to them). This is not an easy task, as the teacher may appear insincere if he/she thinks too much about the way to behave.

Knowledge of success is also important as it motivates future learning. However, it is important to vary the type of reinforcement given so that the behaviour is maintained. This is not an easy task, as the teacher may appear insincere if he/she thinks too much about the way to behave.