SKINNER'S OPERANT CONDITIONING

Although classified and included in the category of conditioning, operant conditioning differs a lot from the classical conditioning advocated by Pavlov and Watson. The most outstanding difference lies in the order related with the initiation and response, i.e. stimulus response mechanism. In classical conditioning the organism is passive. It must wait for something to happen for responding. The presence of a stimulus for evoking a response is essential. The behaviour cannot be emitted in the absence of a cause. The child expresses fear only when he hears a loud noise, the dog waits for food to arrive before salivating. In each of these instances, the subject has no control over the happening. He is made to behave in response to the stimulus situations. Thus the behaviour is said to be initiated by the environment, the organism simply responds.

Skinner opposed the "no stimulus, no response" mechanism in the evolution of behaviour. He argued that in practical situations, we cannot always wait for things to happen in the environment. Men is not a victim of the environment. He may often manipulate the things in the environment with his own initiative. Therefore, it is not always essential that there is some known stimuli or cause for evoking a response. Quite often, most of our responses can not be attributed to a known stimulus. The organism itself initiates the behaviour. A dog, a child, or an individual "does" something, "behaves" in some manner, it "operates" on the environment and in turn, the environment responds to the activity. How the environment responds to the activity, rewarding or not, largely determines whether the behaviour will be repeated, maintained or avoided.

A question may arise as to where Skinner got the clue for such ideas. Definitely, it was from the studies and observations of an earlier psychologist named Edward Lee Thorndike. Through his experiments, for propagating his famous trial and error theory of learning, Thorndike concluded that the rewards of a response (like getting food by the cat after a chance success through randomized movements) leads to repetition of an act and the strengthening of S-R associations. These conclusions made Skinner begin a series of experiments to find the consequences of the rewards in repeating and maintaining behaviour. Based on the findings of his experiments, he concluded that

"behaviour is shaped and maintained by its consequences. It is operated by the organism and maintained by its result." The occurrence of such behaviour was named as operant behaviour and the process of learning that plays the part in learning such behaviour was named by him as operant conditioning.

For understanding what Skinner propagated through his theory of operant conditioning, let us try to build a base by defining and explaining some of the concepts used by him for bringing out his theory.

Respondent and Operant Behaviour

As we have seen, the earlier theories of learning assumed the existence of a known stimulus as a necessary pre-requisite for evoking a response. Skinner, first time, got the idea that most of the responses could not be attributed to a known stimuli. He defined two types of responses – the one 'elicited' by known stimuli which he called as 'Respondent behaviour' and the other 'emitted' by the unknown stimuli which he called as 'Operant behaviour'. Examples of respondent behaviour may include all reflexes such as jerking one's hands when jabbed with a pin and the papillary constriction on account of bright light or salivation in the presence of food.

In the respondent behaviour, the stimulus preceding the response is responsible for causing the behaviour. On the other hand, in the operant behaviour the stimulus causing such behaviour is unknown and it is not important to know the cause of the behaviour. Here it is not the stimulus but the consequences of the behaviour which are more important and hence the operant behaviour is controlled by the strength of its consequences instead of stimuli. Examples of such behaviour may include the behaviour like moving one's hand, arms or legs arbitrarily, a child abandoning one toy in favour of the other, eating a meal, writing a letter, standing up and walking about and similar other everyday activities.

Operant

Skinner considers an operant as a set of acts that constitutes an organism's doing something, e.g. raising its head, walking about, pushing a lever, etc.

Reinforcer and Reinforcement

The concept of reinforcement is identical to the presentation of a reward. A reinforcer is the stimulus whose presentation or removal increases the probability of the recurrence of a response. Skinner thinks of two kinds of reinforcer—positive and negative.

A positive reinforcer is any stimulus the introduction or presentation of which increases the likelihood of a particular behaviour. Food, water, sexual contact, etc., are classified as positive reinforces. A negative reinforcer is any stimulus the removal or withdrawal of which increases the likelihood of a particular behaviour. Electric shock, a loud noise, etc, are said to be negative reinforcers.

The Schedules of Reinforcement

Skinner put forward the idea of planning of Schedules of reinforcement of conditioning the operant behaviour of the organism. The important schedules are as under:

Continuous Reinforcement Schedule: It is a hundred per cent reinforcement schedule where provision is made to reinforce or reward every correct response of the organism during acquisition of learning. For example, a student may be rewarded for every correct answer he gives to the questions or problems put by his teacher.

Fixed Interval Reinforcement Schedule: In this schedule the organism is rewarded for a response made only after a set interval of time, e.g. every 3 or every 5 minutes. The many times he has given correct response during this fixed interval of time does not matter; it is only on the expiry of the fixed interval, that he is presented with some reinforcement.

Fixed Ratio Reinforcement Schedule: In this schedule, the reinforcement is given after a fixed number of response. A rat, for example, might be given a pallet of food after a certain number of lever presses. A student may be properly rewarded after answering a fixed number of questions, say 3 or 5. Fixed ratio schedule is used in some factories, and by employers of casual workers or labourer where salary is paid on a piecework basis, number of garments sewn and number of baskets of fruit packed.

Variable Reinforcement Schedule: When reinforcement is given at varying intervals of time or after a varying number or responses, it is called a variable reinforcement schedule. In this case reinforcement is intermittent or irregular. The individual does not know when he is going to be rewarded and consequently he remains motivated throughout the learning process in the wait of reinforcement. The most common example of such schedule in human behaviour is the reinforcement operation schedules of gambling devices. Here rewards are unpredictable and keep the players well-motivated through occasional returns.

Conclusion about the various Reinforcement Schedules

Reinforcement and its schedules play a key role in the conditioning of operant behaviour and acquisition of a learning. While a continuous reinforcement schedule increases the response rate, the discontinuation or reinforcement may result in the extinction of that response or behaviour. Continuous reinforcement schedule thus yields least resistance to extinction and the lowest response rate during learning. Therefore, learning of a response takes place quickly if every correct response is rewarded, but it is easily forgotten when the reinforcement is stopped. If reinforcement is given after a varying number of correct responses or at varying intervals of time, the response is remarkably resistant to extinction. However, the fixed interval reinforcement schedules are found to provide the lowest yield in terms of performance as the individual may soon learn to respond correctly only when the time or turn of reinforcement arrives. Similarly, he may lose interest in getting reinforcement after a fixed interval or fixed number of correct responses. Weighing all these properly, Skinner suggests to begin with 100 per cent schedule, practice the fixed interval or fixed ratio schedule and finally arrive at the variable reinforcement schedule for better results in learning or training.

Defining Operant Conditioning

Operant conditioning refers to a *kind of learning process whereby a response is made more probable or more frequent by reinforcement.* It helps in the learning of operant behaviour, the behaviour that is not necessarily associated with a known stimuli.

Distinction between Classical and Operant Conditioning

Classical or respondent conditioning is based on respondent behaviour. Specifically, it deals with responses that invariably follow a specific stimulus and are thus elicited e.g., blinking at bright light, jumping at an electric shock, salivation to the test of food, and so forth. In this, greater importance

is attached to the stimulus for eliciting the desired response. Hence, it is also called S type conditioning.

On the other hand, operant conditioning helps in conditioning or learning of operant behaviour—behaviour that is emitted (rather than elicited). The organism seems to initiate operant behaviour on his own without a single, explicit, proceeding stimulus. In this type of learning, much emphasis is placed on the response rather than the stimulus causing the response. That is why, it is also named as type R conditioning. In type S conditioning, the problem for the trainer or teacher is in selecting appropriate stimuli for evoking desired response. On the other hand in R type conditioning, out of many responses which an organism is capable of giving, the problem for the trainer or teacher is to evoke only the appropriate responses and then fix them properly with the help of suitable reinforcement.

The difference between these two types of conditioning may thus be summarized as follows:

Classical respondent conditioning	*Operant conditioning*
1. It helps in the learning of respondent behaviour.	1. It helps in the learning of operant behaviour.
2. It is called type S conditioning to emphasize the importance of the stimulus in eliciting desired response.	2. It is called type R conditioning because of the emphasis on the response.
3. In this type of conditioning, beginning is made with the help of specific stimulus that brings certain responses.	3. Here beginning is made with the responses as they occur "naturally" or unnaturally shaping them into existence.
4. Here strength of conditioning is usually determined by the magnitude of the conditioned response *i.e.* the amount of saliva (as in the case of classical experiment of Pavlov with dog).	4. Here strength of conditioning is shown by the response *i.e.* the rate with which an operant response occurs as a result of some reinforcement.

SKINNER'S EXPERIMENTS REGARDING OPERANT CONDITIONING

B.F. Skinner conducted a series of experiments with animals. For his experiments with rats, he designed a special apparatus known as Skinner's Box. It was a much modified form of the puzzle box used by Thorndike for his experiments with cats. The darkened soundproof box mainly consists of a grid floor, a system of light or sound produced at the time of delivering a pallet of food in the food cup, a lever and a food cup. It is arranged such that when a rat (hungry or thirsty) presses the lever, the feeder mechanism is activated, a light or a special sound is produced and a small pellet of food (or small drops of water) is released into the food cup. To record the observations of the experiment, the lever is connected with a recording system that produces a graphical tracing of the lever pressings against the length of time the rat is in the box (Fig. 17.4).

Skinner, in one of his initial experiments, placed a hungry rat in the above described box. In this experiment pressing the bar in a certain way by the rat could result in the production of a click sound and emergence of a food pellet. The click sound acted as a cue or signal indicating to the rat that if it responded by going to the food cup, it would be rewarded. The rat was rewarded for each proper pressing of the lever. The lever press response having been rewarded, the rat repeated it and when it was rewarded again, it further increased the probability of the repetition of the lever press response and so it continued. In this way, ultimately the rat learned the art of pressing the lever as desired by the experimenter.

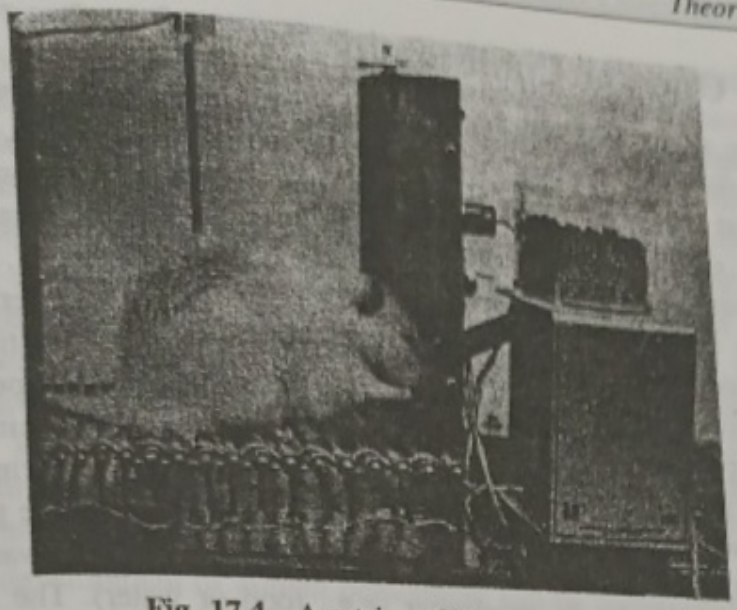

Fig. 17.4 A rat in a Skinner box.

In his experiments with pigeons, Skinner made use of another specific apparatus called the 'pigeon's box' (Fig. 17.5). In this experiment if the pigeon pecked at a lighted plastic key mounted on the wall at head high, it was consequently rewarded with grain.

Fig. 17.5 A pigeon in an operant conditioning box.

With the help of such experiments, Skinner put forward his theory of operant conditioning for learning not only the simple responses like pressing the lever but also for learning the most difficult and complex series of responses.

Mechanism of Operant Conditioning

Operant conditioning as emphasized earlier is correlated with operant behaviour. An operant is a set of acts that constitutes an organism's doing something. Hence, the process in operant conditioning may start with the responses as they occur naturally or at random. In case they do not occur naturally, then attempts may be made for shaping them into existence. How it can be done will be explained later on in this chapter under the heading "Shaping".

Once a response (as desired by the trainer, experimenter or teacher) occurs, it is reinforced through a suitable reinforcer (primary or secondary, positive or negative). In due course, this response gets conditioned by constantly reinforcing it. In Skinner's experiment, a pellet of food worked as a positive primary reinforcer for the hungry rat. He got the reinforcement after emitting a certain response (pressing of the lever as desired by the experimenter). The secondary reinforcement may also produce the results same as brought about by the primary reinforcement. It is a sort of neutral stimulus which acquires the reinforcing properties (rewarding value) after getting paired or associated with a primary reinforcer (e.g., food or water). The clicking of a sound and lighting of a bulb in Skinner's experiment may work as secondary reinforcement if they are paired with the appearance of a pellet of food.

The important thing in the mechanism of operant conditioning is the emission of a desired response and its proper management through suitable reinforcement. Here, the organism is to respond in such a way so as to produce the reinforcing stimulus. The subsequent reinforcement gradually conditions the organism to emit the desired response and thus learn the desired act.

Shaping

There are situations, especially in case of the acquisition of complex behaviour and learning of difficult skills, etc., where there may arise very remote chances of occurrence. In such cases, waiting for an organism to behave in specific way at random (the natural occurrence) may take a lifetime. For example, the chances of a pigeon dancing in a specific way are extremely remote. The same holds true for a child learning a foreign language or even table manners. In these situations, where the desired responses do not occur at random (or naturally), efforts are made for eliciting the appropriate responses. It is done by building a chain of responses through a step-by-step process called "shaping."

In one of his experiments for shaping the behaviour of a pigeon—to teach it to walk in a figure eight—Skinner watched its activity and gave it a small amount of grain (reward) for simply turning in proper direction. At first the pigeon got his reward for simply turning its head in the right direction, then for taking a step in the right direction, then for making the correct turn, and so on, until it had learned to do a complete figure eight.

Shaping in this way, may be used as a successful technique for making individuals learn difficult and complex behaviour and also for introducing desirable modifications in the behaviour. Behaviour modification technique and aversive therapy used in treating the problem behaviour and abnormality have come into existence through the use of shaping of behaviour mechanism.

Implications of the Theory of Operant Conditioning

Theory of operant conditioning has revolutionized the field of training or learning by bringing forward the following practical ideas and implications:

1. A response or a behaviour is not necessarily dependent (contingent) upon a specific known stimulus. It is more correct to consider that a behaviour or response is dependent upon its

consequences. Therefore, for training an organism to learn a particular behaviour or response, he may be initiated to respond in such a way so as to produce the reinforcing stimulus. His behaviour should be rewarded and in turn, he should again act in such a way that he is rewarded and so on. Therefore, the learning or training process and environment must be designed such that it creates minimum frustration and maximum satisfaction to a learner to provide him proper reinforcement for the desired training or learning.

2. The principle of operant conditioning may be successfully applied in the task of behaviour modification. We have to find something which is rewarding for the individual whose behaviour we wish to modify, wait until the desire behaviour occurs and immediately reward him when it happens. When this is done, the rate with which the desired response occurs goes up. When the behaviour occurs for a next time, it is again rewarded, and the rate of responding goes up further. Continuing in the same way, we will induce the individual to learn the desired behaviour.

3. The task of the development of human personality can be successfully manipulated through operant conditioning. According to Skinner, *"We are what we have been rewarded for being. What we call personality is nothing more than consistent behaviour patterns that summarize our reinforcement history. We learn to speak English, for example, because we have been rewarded for approximating the sounds of the English language in our early home environment. If we happened to be brought up in a Japanese or a Russian home, we would learn to speak Japanese or Russian because when we approximately sound in that language, we would have been attended to or rewarded in some other way".* (Hergenhahn, 1976, p. 87).

4. The theory of operant conditioning does not attribute motivation to internal processes within an organism. It takes for granted the consequences of a behaviour or response as a source of motivation to further occurrence of that behaviour. Food is reinforcing to a rat or a pigeon. Knowledge of correct response is reinforcing to a learner. Secondary reinforcers also prove very important sources of motivation for a learner. Verbal praise, positive facial expressions of the trainer or teacher, feeling of success, scores, grades, prizes, medals and the opportunity to do the work of one's liking, all constitute good motivator. In this way operant conditioning provides an external approach to motivation.

5. Operant conditioning lays stress on the importance of schedules in the process of reinforcement of behaviour. Therefore, in trying to train or learn behaviour, great care is to be taken for the proper planning of the schedules of reinforcement.

6. This theory advocates the avoidance of punishment for unlearning the undesirable behaviour and for shaping the desirable behaviour. Punishment proves ineffective in the long run. It appears that punishment simply suppresses behaviour and when the threat of punishment is removed, behaviour returns to its original level. Therefore, operant conditioning experiments suggested rewarding the appropriate behaviour and ignoring the inappropriate behaviour for its gradual extinction.

7. In its most effective application, theory of operant conditioning has contributed a lot towards the development of teaching machines and programmed learning. The theory of operant conditioning has led us to think that learning proceeds most effectively if—
   (i) The learning material is so designed that it creates less opportunities for facing failure and more opportunities for gaining success
   (ii) the learner is given rapid feedback regarding the accuracy in his learning, and
   (iii) the learner is able to learn at his own pace.