Learning
• Learning is a relatively permanent change in behaviour that occurs through experience.

• It is a continuous process.

• It is a gradual process.
Process of Learning

- A stimulus could be an event, situation, condition, signal or cue to which a response is made.
- A response is an action.

- Responses can be overt (readily observable) or covert (not readily observable).

- Learning involves associations & relationship.

- Association is normally facilitated by:
  1. **Contiguity**
  2. **Contrast**
  3. **Similarity**
### Learning Theories

<table>
<thead>
<tr>
<th><strong>Behavioral Theories:</strong></th>
<th><strong>Cognitive Theories:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Theories based on the premise that learning takes place as the result of observable responses to external stimuli. Also known as <em>stimulus response theory</em>.</td>
<td>A theory of learning based on mental information processing, often in response to problem solving.</td>
</tr>
</tbody>
</table>
Classical Conditioning

- A neutral stimulus becomes associated with a meaningful stimulus & acquires the capacity to elicit a similar response.
- It is a form of associative learning.
- It is the substitution & association of one stimulus for another.
- Russian physiologist Ivan P. Pavlov demonstrated it in early 1900s while working on the mechanism of digestion.
Pavlov’s Experiment
<table>
<thead>
<tr>
<th>Sequence of Learning in Classical Conditioning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Under normal circumstances</strong></td>
</tr>
<tr>
<td>Conditioned stimulus (CS) → No response</td>
</tr>
<tr>
<td>Unconditioned stimulus (UCS) → UR</td>
</tr>
<tr>
<td><strong>During conditioning</strong></td>
</tr>
<tr>
<td>Conditioned stimulus (CS)</td>
</tr>
<tr>
<td>Unconditioned stimulus (UCS) → UR</td>
</tr>
<tr>
<td><strong>After conditioning</strong></td>
</tr>
<tr>
<td>Conditioned stimulus (CS) → Conditioned response</td>
</tr>
</tbody>
</table>
Unconditioned Stimulus (US) → Unconditioned Response (UR)

US + Conditioned Stimulus (US + CS) → Unconditioned Response (UR)

Conditioned Stimulus (CS) → Conditioned Response (CR)
Prerequisites of Classical Conditioning

- **Contiguity**: Degree of association

  Conditioned responses develop when the interval between CS and US is very short.

  In many instances optimal spacing is a fraction of second.

  (DeCola & Fanselow, 1995; Kimble, 1961; Weidemann et al., 1999)
• **Contingency**: Predictability of the occurrence of one stimulus from the presence of another.

E.g., A flash of lightening is usually followed by the sound of thunder. Light may make one put hands on the ears.
Important Concepts in Classical Conditioning

Important Concepts in Classical Conditioning

- **Unconditioned stimulus (US):**
  - A stimulus that produces a response without prior learning. (Food in Pavlov’s experiment).

- **Unconditioned response (UR):**
  - An unlearnt response that is automatically elicited by the US. (Salivation in Pavlov’s experiment)
Important Concepts in Classical Conditioning

- **Conditioned stimulus (CS):**
  - A previously neutral stimulus that eventually elicits the conditioned response after being associated with the unconditioned stimulus.

- **Conditioned response (CR):**
  - The learnt response to the CS that occurs after CS-US pairing.
Pavlov’s theory can be considered as stimulus substitution.

It states that the nervous system is structured in such a way that the CS and the US bond together and eventually the CS substitutes for the US.
Classical Conditioning: Contemporary Perspective

If CS substitutes US, the two stimuli should produce similar responses.

- Information Theory is a contemporary explanation of why classical conditioning works.
- It states that the key to understanding classical conditioning focuses on the information an organism gets from the situation.
E.C. Tolman said the information value of the CS is important in telling the organism what will follow.

One perspective (Rescorla, 1996) views organism as an information seeker using logical & perceptual relations among events, along with preconceptions, to form a representation of the world.
Leon Kamin’s Experiment (1968)

A rat was conditioned by repeatedly pairing a tone (CS) & a shock (US), until the tone alone produced a strong CR (fear).

The tone continued to be paired with the shock, but the light (second CS) was turned on each time the tone was sounded.

Even though the light & the shock were repeatedly paired, the rat showed no conditioning to light.
Important Concepts in Classical Conditioning

- **Generalization**: Tendency of a similar but new stimulus to elicit a response that is similar to the conditioned response.

- **Discrimination**: The process of learning to respond to certain stimuli and not to respond to others.
Important Concepts in Classical Conditioning

- **Extinction**: Weakening of the conditioned response in the absence of the unconditioned stimulus.

- **Spontaneous Recovery**: A conditioned response recurs after a time delay without further conditioning.
Types of Classical Conditioning

Classical Reward Conditioning
A reinforcer rewards the overt behaviour.

Classical Aversive Conditioning
CS is paired with an aversive stimulus.
Classical Conditioning in Human Beings

• **Albert’s case**
  In 1920 Watson conditioned Albert to fear white rat. The fear was generalized to rabbit, dog & a sealskin coat.
  (He was not reconditioned)

• **Peter’s case**
  An associate of Watson, Mary Cover Jones (1924) conditioned Peter to fear white rat, fur coats, frogs, fish & mechanical toys.
  (Later counter conditioning was done)
Neo-Pavlovian Conditioning

• Forward Conditioning (CS Precedes US)

• Repeated Pairings of CS and US

• A CS and US that Logically Belong to Each Other

• A CS that is Novel and Unfamiliar

• A US that is Biologically or Symbolically Salient
Operant Conditioning

- Also known as **Instrumental Conditioning**.

- It is a form of learning in which the consequences of behaviour produce changes in the probability of occurrence of the behaviour.

- Here response is instrumental in receiving reward or escaping punishment.
Thorndike’s Law of Effect

• At about the same time when Pavlov was experimenting on dog, E.L. Thorndike was conducting research on cats in puzzle box.
Thorndike’s Law of Effect

• Behaviour followed by positive outcomes are strengthened, whereas behaviour followed by negative outcomes are weakened.

? Key question

How the correct S-R bond strengthens & eventually dominates incorrect S-R bonds.
Thorndike’s Law of Effect

• According to him, the correct S-R association strengthens & the incorrect one weakens because of the consequences of the organism’s actions.

• This view is called S-R Theory.

• Later, Skinner expanded his idea.
Operant Conditioning

Skinner’s operant conditioning experiment on the pigeons

B. F. Skinner
Operant Conditioning

- The subject actively responds to stimuli according to the way his/her responses affect the stimuli.

- Operant conditioning advocates shaping of behaviour.

- Shaping: A complex response is learnt by first learning a series of simple responses.
Operant Conditioning
Application: Pigeon-Guided missile

- Skinner came forward with an idea of Pigeon-Guided missile during World War II.
- A gold electrode covered the tip of pigeon’s beaks.
- Contact with the screen on which the image of the target was projected sent a signal informing the missile’s control mechanism of the target’s location.
- A few grains of food occasionally given to the pigeons maintained their tracking behaviour.
A pigeon in the warhead of the missile operated the flaps on the missile & guided it home by pecking at an image of the target.

When the missile was in flight, the pigeon pecked the moving image on a screen.

This produced corrective signals to keep the missile on its course.
Important concepts in Operant Conditioning: Reinforcement

- **Positive Reinforcement**: The frequency of response is strengthened because it is followed by a rewarding stimulus.

- **Negative Reinforcement**: The frequency of response increases because the response is followed by the removal of an aversive stimulus.
Important concepts in operant conditioning: Reinforcement (contd.)

- **Primary Reinforcement**: Refers to innate reinforcers (food, water, sex).

- **Secondary Reinforcement**: Refers to reinforcers that acquire positive value through experience (money, smile).
A Model of Instrumental Conditioning
(As applicable in day to day affair)

Stimulus Situation
(Needs a shirt)

Try Brand X
Unrewarded
(Unfit)

Try Brand Y
Unrewarded
(Colour not preferred)

Try Brand Z
Rewarded
(Perfect fit)

Behaviour is repeated
## Important Concepts in Operant Conditioning

### Schedules of Reinforcement

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Reinforcement</td>
<td>A response is reinforced every time it occurs.</td>
</tr>
<tr>
<td>Partial Reinforcement</td>
<td>A response being reinforced only a portion of the time.</td>
</tr>
<tr>
<td>Fixed-Ratio Schedule</td>
<td>Behaviour is reinforced after a set number of responses.</td>
</tr>
<tr>
<td>Variable-Ratio Schedule</td>
<td>Responses are rewarded an average number of times, but on an unpredictable basis.</td>
</tr>
<tr>
<td>Fixed-Interval Schedule</td>
<td>Reinforces the first appropriate response after a fixed amount of time has lapsed.</td>
</tr>
<tr>
<td>Variable-Interval Schedule</td>
<td>A response is reinforced after a variable amount of time has lapsed.</td>
</tr>
</tbody>
</table>
## Important Concepts in Operant Conditioning

<table>
<thead>
<tr>
<th>Concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extinction</td>
<td>In operant conditioning extinction occurs when a previously reinforced response is no longer reinforced and there is a decreased tendency to perform the response.</td>
</tr>
<tr>
<td>Generalization</td>
<td>Giving the same response to similar stimuli.</td>
</tr>
<tr>
<td>Discrimination</td>
<td>Responding to stimuli that signal that a behaviour will or will not be reinforced.</td>
</tr>
<tr>
<td>Punishment</td>
<td>A consequence that decreases the likelihood of a behaviour.</td>
</tr>
<tr>
<td>Positive Punishment</td>
<td>A behaviour decreases when it is followed by an unpleasant stimulus.</td>
</tr>
<tr>
<td>Negative Punishment</td>
<td>A behaviour decreases when a positive stimulus is removed from it.</td>
</tr>
<tr>
<td>Stimulus</td>
<td>Presented</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Positive</td>
<td>Positive reinforcement</td>
</tr>
<tr>
<td>Negative</td>
<td>Positive punishment</td>
</tr>
</tbody>
</table>

**Behaviour**

- Increased
- Decreased
### Differences between classical & operant conditioning

<table>
<thead>
<tr>
<th>Classical Conditioning</th>
<th>Operant Conditioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involuntary behaviour/ reflexes</td>
<td>Voluntary behaviour</td>
</tr>
<tr>
<td>Mechanistic process of formation &amp; strengthening of association between S-R</td>
<td>Non-mechanistic &amp; voluntary process of formation &amp; strengthening of association between S-R</td>
</tr>
<tr>
<td>Stimuli act upon the individual &amp; the individual responds automatically</td>
<td>Response is controlled by the individual to achieve the goal</td>
</tr>
<tr>
<td>Passive process</td>
<td>Active process</td>
</tr>
<tr>
<td>Reward precedes response because of temporary association</td>
<td>Reward follows the response as it is contingent upon its occurrence</td>
</tr>
<tr>
<td>CS &amp; UCS association depends on contiguity of stimulus</td>
<td>Response-reinforcing stimulus association depends on consequences of responding</td>
</tr>
<tr>
<td>Readily seen in animal learning</td>
<td>Readily seen in human learning</td>
</tr>
</tbody>
</table>
Observational Learning

- Attention
- Retention
- Motor Reproduction
- Reinforcement

Albert Bandura
Observational Learning

- Our complex behaviour are the result of exposure to competent models who display appropriate behaviour in solving problems and coping with their world.

- Imitation and Modelling are the types of observational learning.
Cognitive Learning

• We construct cognitive maps of our experiences that guide our behaviour.

• Tolman interpreted conditioning in terms of expectations.
Cognitive Learning

- **Latent learning**: Things that are learnt without being reflected in immediate behaviour. It is facilitated by cognitive map.

- **Cognitive map**: It is mental image of a spatial environment that helps in problem solving when stimuli in the environment changes.
Models of Cognitive Learning
(Modified according to consumer research)

<table>
<thead>
<tr>
<th>Sequential Stages of Processing</th>
<th>Promotional Model</th>
<th>Tricomponent Model</th>
<th>Decision-Making Model</th>
<th>Innovation Adoption Model</th>
<th>Innovation Decision Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>Cognitive</td>
<td>Awareness</td>
<td>Awareness</td>
<td>Knowledge</td>
<td>Knowledge</td>
</tr>
<tr>
<td>Interest Desire</td>
<td>Affective</td>
<td>Evaluation</td>
<td>Interest Evaluation</td>
<td>Persuasion</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>Conative</td>
<td>Purchase</td>
<td>Trial Adoption</td>
<td>Decision Confirmation</td>
<td></td>
</tr>
</tbody>
</table>
Kohler’s Experiment

Insight Learning

• The founder of Gestalt Psychology, Kohler, did an interesting experiment on chimpanzee named Sultan.

• Sultan was put in a cage & banana was put beyond its reach. Two sticks were also kept.

• After having learnt to drag banana with one stick, Sultan dragged it by putting one stick into the other.
Insightful solutions demonstrated by chimpanzees.
Bio-cultural Factors & Cognitive Learning

- **Cognitive map**: An organism’s mental representation of the structure of physical space.

- **Insight learning**: A form of problem solving in which the organism develops a sudden insight or understanding of a problem’s solution.

- **Preparedness**: Species-specific biological predisposition to learn in certain way but not in others.

- **Instinctive Drift**: Tendency of animals to revert to instinctive behavior that interferes with learning.
Social Learning

- **Local enhancement**: Locate foraging sites by attending to others.

- **Social facilitation**: Animals feed faster in a group.

- **Observational learning**: Observer modifies behaviour after demonstrator

- **Imitation**: Observer matches behavioural action and goal
Learning of Concepts

• A symbolic construct representing general features of objects or events.
• With experience we all learn complex motor and verbal skills.
• Gradually, a learnt concept helps one combat a problem situation.
• Problem solving is considered the highest form of learning.
Learning of Concepts

- Attitude formation is basically attainment of concepts.

- It is learning of concepts that predisposes one towards certain prejudices & stereotypes.
Transfer of Learning

- **Positive Transfer**: When learning of one task facilitates acquisition of the other task.

- **Negative Transfer**: When the previously learnt task interferes with the learning of subsequent task.

- **Zero Transfer**: Learning of one task does not effect performance of another task.