LEARNING AND BEHAVIOUR
CALICUT UNIVERSITY
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CORE COURSE OF

B Sc COUNSELLING PSYCHOLOGY
V SEMESTER

LEARNING AND BEHAVIOUR

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SDE COMPUTER CELL
MODULE--1

LEARNING AND BEHAVIOUR

Behavior can be described as a reaction to a stimulus, which is an internal or external event that leads to a response. Many forms of behavior are essential to an organism's survival. Examples of behaviors range from hunting skills to avoiding predators, to migrating south in the winter to mating rituals. Innate behaviors, which are often called inherited or instinctive behaviors. These can be very simple or complex. Innate behaviors are fully functional the first time they are performed - even without previous exposure to the stimulus.

INNATE BEHAVIOR PATTERNS AND HABITUATION

• Many learned behaviors are derivatives, extension, or variations of innate behaviors
• Features of learned behaviors have parallels in inborn behavior patterns
  ⇒ Learned behavior e.g., Control by environmental stimuli, and their mechanism of temporal sequencing.
• Learning psychologist use barren and artificial environments in order to discover general principles of learning that don’t depend on specific types of stimuli.
• The field of Ethology— The study of animal behavior in its natural setting in order to determine how behavior helps it survive in its environment.
  ⇒ What behaviors do we already possess when we enter the world?
• Control Systems Theory—A comparison between the actual state of the world and a goal state: Used to explain goal directed behavior
Both learned and unlearned behavior appears to be purpose/goal-directed.
• Characteristics of Goal-Directed Systems
  ⇒ Goal-directed behavior based upon feedback system (e.g. central cooling unit)
  ⇒ Control systems theory: the comparator compares the actual input and the reference input, if they do not match, the comparator signals the action system.
  ⇒ Action system—furnace
  ⇒ Comparator(thermostat) receives 2 types of input and compares them:
    ♦ Actual input— actual physical characteristic (air temp near thermostat)
    ♦ Reference input— conceptual entity (thermostat setting - temp, when reached, will open and stop switch)
  ⇒ Product of an action system is the output (warm air)
  ⇒ Disturbance— affects the actual input (affects the air temp near the thermostat)
• Innate Stereotyped Movements
  ⇒ Reflex—A stereotyped movement of a part of the body reliably elicited when presented with appropriate stimulus
    • Innate reflexes=Sucking, pulling away from pain, grasping, pupil dilation/constriction, coughing, blinking.
- E.g. rapid withdrawal of hand caused by bending elbow.
- Requires sensory neurons, interneurons and motor neurons

SEQUENCES OF LEARNING

Sequence learning is inherent to human ability because it is an integrated part of conscious and non-conscious learning as well as activities. Sequences of information or sequences of actions are used in various everyday tasks: "from sequencing sounds in speech, to sequencing movements in typing or playing instruments, to sequencing actions in driving an automobile". Sequence learning can be used to study skill acquisition and in studies of various groups ranging from neuropsychological patients to infants. Sequence learning, more known and understood as a form of explicit learning, is now also being studied as a form of implicit learning as well as other forms of learning. Sequence learning can also be referred to as sequential behavior, behavior sequencing, and serial order in behavior.

Types of sequence learning

There are two broad categories of sequence learning—explicit and implicit—with subcategories. Explicit sequence learning has been known and studied since the discovery of sequence learning. However, recently, implicit sequence learning has gained more attention and research. A form of implicit learning, implicit sequence learning refers to the underlying methods of learning that people are unaware of—in other words, learning without knowing. The exact properties and number of mechanisms of implicit learning are debated. Other forms of implicit sequence learning include motor sequence learning, temporal sequence learning, and associative sequence learning.

HABITUATION

Habituation is a term used in the school of behavioral psychology as the simplest form of learning. Habituation occurs as the decrease in the strength of a response after repeated presentation of a stimulus that elicits a behavioral response, for example getting use to a light's intensity. Constant exposure leads to a decrease in response arousal and therefore this technique is commonly used in therapeutic settings as a basic process used to extinguish various fears.

Some related phenomena to habituation include sensitization and stimulus generalization/discrimination. Sensitization is the opposite process to habituation, i.e. an increase in the elicited behavior from repeated presentation of a stimulus. There may also be an initial increase in response immediately prior to the decline (a sensitization process followed by a habituation process). Another related phenomenon is stimulus generalization, when habituation occurs in response to other stimuli that are similar to the original stimulus. The opposing process, stimulus discrimination, is when habituation does not occur to other stimuli that are dissimilar to the original stimulus.
There are **Five Principles** of Habituation:

1. **Course of Habituation**: When a stimulus is repeated, habituation of a response occurs (decrease in sensitivity as a result of an increase in familiarity).
2. **The Effects of Time**: If a stimulus is withheld for a period of time, habituation decreases.
3. **Relearning Effect**: If habituation to a stimulus has occurred in the past but is withheld for a period of time and then re-administered, the stimulus will take less time to re-habituate.
4. **Effects of Stimulus Intensity**: Organisms can habituate to weak to moderate stimuli but very strong stimuli may not result in habituation.
5. **Stimulus Generalization**: Transfer of habituation occurs from one stimulus to another.

**The Characteristics of Habituation**

Some of the key characteristics of habituation include the following:

- If the habituation stimulus is not presented for a long enough period before a sudden reintroduction, the response will once again reappear at full-strength, a phenomenon known as spontaneous recovery.
- The more frequently a stimulus is presented; the faster habituation will occur.
- Very intense stimuli tend to result in slower habituation. In some cases, such as deafening noises like a car alarm or a siren, habituation will never occur.
- Changing the intensity or duration of the stimulation may result in a reoccurrence of the original response.
- Habituation can generalize to similar stimuli.

**Why Does Habituation Occur?**

A few different theories have been proposed to explain why habituation occurs.

- **Single-factor theory of habituation** suggests that the constant repetition of a stimulus changes the efficacy of that stimulus.
- **Dual-factor theory of habituation** suggests that there are underlying neural processes that regulate responsiveness to different stimuli. The habituation process is responsible for decreases in responsiveness to stimuli while the sensitization process is responsible for increases in responsiveness to stimuli.

**STIMULUS – RESPONSE THEORIES**

- **THORNDIKE – CONNECTIONISM**

Edward Thorndike (1874 - 1949) is famous in psychology for his work on learning theory that lead to the development of operant conditioning within behaviorism. Whereas classical conditioning depends on developing associations between events, operant conditioning involves learning from the consequences of our behavior. Skinner wasn’t the first psychologist to study learning by consequences. Indeed, Skinner's theory of operant conditioning is built on the ideas of Edward Thorndike.
The learning theory of Thorndike represents the original S-R framework of behavioral psychology: Learning is the result of associations forming between stimuli and responses. Such associations or "habits" become strengthened or weakened by the nature and frequency of the S-R pairings. The paradigm for S-R theory was trial and error learning in which certain responses come to dominate others due to rewards. The hallmark of connectionism (like all behavioral theory) was that learning could be adequately explained without referring to any unobservable internal states.

Thorndike’s theory consists of three primary laws:

(1) Law of effect - responses to a situation which are followed by a rewarding state of affairs will be strengthened and become habitual responses to that situation,

(2) Law of readiness - a series of responses can be chained together to satisfy some goal which will result in annoyance if blocked, and

(3) Law of exercise - connections become strengthened with practice and weakened when practice is discontinued. A corollary of the law of effect was that responses that reduce the likelihood of achieving a rewarding state (i.e., punishments, failures) will decrease in strength.

The theory suggests that transfer of learning depends upon the presence of identical elements in the original and new learning situations; i.e., transfer is always specific, never general. In later versions of the theory, the concept of "belongingness" was introduced; connections are more readily established if the person perceives that stimuli or responses go together (c.f. Gestalt principles). Another concept introduced was "polarity" which specifies that connections occur more easily in the direction in which they were originally formed than the opposite. Thorndike also introduced the "spread of effect" idea, i.e., rewards affect not only the connection that produced them but temporally adjacent connections as well.

Application

Connectionism was meant to be a general theory of learning for animals and humans. Thorndike was especially interested in the application of his theory to education including mathematics (Thorndike, 1922), spelling and reading (Thorndike, 1921), measurement of intelligence (Thorndike et al., 1927) and adult learning (Thorndike et al., 1928).

Example

The classic example of Thorndike's S-R theory was a cat learning to escape from a "puzzle box" (see fig. 1) by pressing a lever inside the box. After much trial and error behavior, the cat learns to associate pressing the lever (S) with opening the door (R). This S-R connection is established because it results in a satisfying state of affairs (escape from the box). The law of exercise specifies that the connection was established because the S-R pairing occurred many times (the
law of effect) and was rewarded (law of effect) as well as forming a single sequence (law of readiness).

![Image](image_url)

**Principles**

1. Learning requires both practice and rewards (laws of effect /exercise)
2. A series of S-R connections can be chained together if they belong to the same action sequence (law of readiness).
3. Transfer of learning occurs because of previously encountered situations.
4. Intelligence is a function of the number of connections learned.

**GUTHRIE - CONTIGUITY THEORY**

Guthrie's contiguity theory specifies that "a combination of stimuli which has accompanied a movement will on its recurrence tend to be followed by that movement". According to Guthrie, all learning was a consequence of association between a particular stimulus and response. Furthermore, Guthrie argued that stimuli and responses affect specific sensory-motor patterns; what is learned are movements, not behaviors.

In contiguity theory, rewards or punishment play no significant role in learning since they occur after the association between stimulus and response has been made. Learning takes place in a single trial (all or none). However, since each stimulus pattern is slightly different, many trials may be necessary to produce a general response. One interesting principle that arises from this position is called "postremity" which specifies that we always learn the last thing we do in response to a specific stimulus situation.

Contiguity theory suggests that forgetting is due to interference rather than the passage of time; stimuli become associated with new responses. Previous conditioning can also be changed by being associated with inhibiting responses such as fear or fatigue. The role of motivation is to create a state of arousal and activity which produces responses that can be conditioned.
Application

Contiguity theory is intended to be a general theory of learning, although most of the research supporting the theory was done with animals. Guthrie did apply his framework to personality disorders (e.g. Guthrie, 1938).

Example

The classic experimental paradigm for Contiguity theory is cats learning to escape from a puzzle box (Guthrie & Horton, 1946). Guthrie used a glass paneled box that allowed him to photograph the exact movements of cats. These photographs showed that cats learned to repeat the same sequence of movements associated with the preceding escape from the box. Improvement comes about because irrelevant movements are unlearned or not included in successive associations.

Principles

1. In order for conditioning to occur, the organism must actively respond (i.e., do things).
2. Since learning involves the conditioning of specific movements, instruction must present very specific tasks.
3. Exposure to many variations in stimulus patterns is desirable in order to produce a generalized response.
4. The last response in a learning situation should be correct since it is the one that will be associated.

Punishment

Guthrie also had theories as to how punishment worked that were at odds with the likes of Thorndike and other learning theorists of his own time. Guthrie thought that punishment was only as effective as the amount of change in behavior the punishment caused. Guthrie’s theory required that presentation of punishment happen while the stimulus is still around. He did warn that if the punishment did not stop the undesirable response or if it was not presented in the presence of the stimulus that the punishment could actually strengthen the undesired response.

Breaking Habits

Guthrie believed that dozens of tiny movements make up what most see as a single behavior; much like waving good-bye actually involves dozens of muscle movements. Guthrie viewed habits as a response connecting with a large number of stimuli, which causes the habit to happen more often to a wide variety of things. He postulated that there were three different ways to break a habit, the threshold method, the fatigue method, and the incompatible response method.
The threshold method involves introducing stimuli that are associated with the habit response at such a weak level that it doesn’t actually elicit the response. The strength of the stimuli is increased slowly until the stimuli can be presented at full strength without eliciting the habit response. Guthrie compared this method to "horse whispering."

The fatigue method is quite simple, you keep presenting the stimulus until the person with the habit no longer replies with their habitual response. Guthrie considered this method similar to "breaking the horse."

The incompatible response method pairs the stimuli that causes the habitual behavior with another stimulus that triggers a response that is opposite or incompatible with the habit that you want to get rid of.

➢ **HULL - DRIVE REDUCTION THEORY**

Hull developed a version of behaviorism in which the stimulus (S) affects the organism (O) and the resulting response (R) depends upon characteristics of both O and S. In other words, Hull was interested in studying intervening variables that affected behavior such as initial drive, incentives, inhibitors, and prior training (habit strength). Like other forms of behavior theory, reinforcement is the primary factor that determines learning. However, in Hull's theory, drive reduction or need satisfaction plays a much more important role in behavior than in other frameworks (i.e., connectionism, operant conditioning).

Hull's theoretical framework consisted of many postulates stated in mathematical form; They include: (1) organisms possess a hierarchy of needs which are aroused under conditions of stimulation and drive, (2) habit strength increases with activities that are associated with primary or secondary reinforcement, (3) habit strength aroused by a stimulus other than the one originally conditioned depends upon the closeness of the second stimulus in terms of discrimination thresholds, (4) stimuli associated with the cessation of a response become conditioned inhibitors, (5) the more the effective reaction potential exceeds the reaction threshold, the shorter the latency of response. As these postulates indicate, Hull proposed many types of variables that accounted for generalization, motivation, and variability (oscillation) in learning.

One of the most important concepts in Hull's theory was the habit strength hierarchy: for a given stimulus, an organism can respond in a number of ways. The likelihood of a specific response has a probability which can be changed by reward and is affected by various other variables (e.g. inhibition). In some respects, habit strength hierarchies resemble components of cognitive theories such as schema and production systems.

**Application**

Hull's theory is meant to be a general theory of learning. Most of the research underlying the theory was done with animals, except for Hull et al. (1940) which focused on verbal learning.
Miller & Dollard (1941) represents an attempt to apply the theory to a broader range of learning phenomena. As an interesting aside, Hull began his career researching hypnosis – an area that landed him in some controversy at Yale (Hull, 1933).

**Example**

Here is an example described by Miller & Dollard (1941): A six year old girl who is hungry and wants candy is told that there is candy hidden under one of the books in a bookcase. The girl begins to pull out books in a random manner until she finally finds the correct book (210 seconds). She is sent out of the room and a new piece of candy is hidden under the same book. In her next search, she is much more directed and finds the candy in 86 seconds. By the ninth repetition of this experiment, the girl finds the candy immediately (2 seconds). The girl exhibited a drive for the candy and looking under books represented her responses to reduce this drive. When she eventually found the correct book, this particular response was rewarded, forming a habit. On subsequent trials, the strength of this habit was increased until it became a single stimulus-response connection in this setting.

**Principles**

1. Drive is essential in order for responses to occur (i.e., the student must want to learn).
2. Stimuli and responses must be detected by the organism in order for conditioning to occur (i.e., the student must be attentive).
3. Response must be made in order for conditioning to occur (i.e., the student must be active).
4. Conditioning only occurs if the reinforcement satisfied a need (i.e., the learning must satisfy the learner's wants).
MODULE 2:
CLASSICAL CONDITIONING

Classical conditioning is a type of learning that had a major influence on the school of thought in psychology known as behaviorism. Discovered by Russian physiologist Ivan Pavlov, classical conditioning is a learning process that occurs when a conditioned stimulus is paired with an unconditioned stimulus. Usually, the conditioned stimulus (CS) is a neutral stimulus (e.g., the sound of a tuning fork), the unconditioned stimulus (US) is biologically potent (e.g., the taste of food) and the unconditioned response (UR) to the unconditioned stimulus is an unlearned reflex response (e.g., salivation). After pairing is repeated (some learning may occur already after only one pairing), the organism exhibits a conditioned response (CR) to the conditioned stimulus when the conditioned stimulus is presented alone. The conditioned response is usually similar to the unconditioned response, but unlike the unconditioned response, it must be acquired through experience and is relatively impermanent.

In classical conditioning, the conditioned stimulus is not simply connected to the unconditioned response; the conditioned response usually differs in some way from the unconditioned response, sometimes significantly. For this and other reasons, learning theorists commonly suggest that the conditioned stimulus comes to signal or predict the unconditioned stimulus, and go on to analyze the consequences of this signal.

Classical conditioning differs from operant or instrumental conditioning: in classical conditioning, behavioral responses are elicited by antecedent stimuli, whereas in operant conditioning behaviors are strengthened or weakened by their consequences (i.e., reward or punishment).

Pavlov’s Experiment

Ivan Pavlov provided the most famous example of classical conditioning, although Edwin Twitmyer published his findings a year earlier (a case of simultaneous discovery). During his research on the physiology of digestion in dogs, Pavlov developed a procedure that enabled him to study the digestive processes of animals over long periods of time. He redirected the animal’s digestive fluids outside the body, where they could be measured. Pavlov noticed that the dogs in the experiment began to salivate in the presence of the technician who normally fed them, rather than simply salivating in the presence of food. Pavlov called the dogs' anticipatory salivation "psychic secretion." From his observations he predicted that a stimulus could become associated with food and cause salivation on its own, if a particular stimulus in the dog's surroundings was present when the dog was given food.

In his initial experiments, Pavlov presented a stimulus and then gave the dog food; after a few repetitions, the dogs started to salivate in response to the stimulus. Pavlov called the stimulus the conditioned (or conditional) stimulus (CS) because its effects depend on its
association with food. He called the food the unconditioned stimulus (US) because its effects did not depend on previous experience. Likewise, the response to the CS was the conditioned response (CR) and that to the US was the unconditioned response (UR). The timing between the presentation of the CS and US affects both the learning and the performance of the conditioned response. Pavlov found that the shorter the interval between the CS (e.g. metronome) and the appearance of the US (e.g. food), the stronger and quicker the dog learned the conditioned response.

As noted earlier, it is often thought that the conditioned response is a replica of the unconditioned response, but Pavlov noted that saliva produced by the CS differs in composition from that produced by the US. In fact, the CR may be any new response to the previously neutral CS that can be clearly linked to experience with the conditional relationship of CS and US. It was also thought that repeated pairings are necessary for conditioning to emerge, but many CRs can be learned with a single trial, especially in fear conditioning and taste aversion learning.

Forward conditioning

Learning is fastest in forward conditioning. During forward conditioning, the onset of the CS precedes the onset of the US in order to signal that the US will follow. Two common forms of forward conditioning are delay and trace conditioning.

- **Delay conditioning**: In delay conditioning the CS is presented and is overlapped by the presentation of the US.
- **Trace conditioning**: During trace conditioning the CS and US do not overlap. Instead, the CS begins and ends before the US is presented. The stimulus-free period is called the trace interval. It may also be called the conditioning interval. For example: If you sound a buzzer for 5 seconds and then, a second later, puff air into a person's eye, the person will blink. After several pairings of the buzzer and puff the person will blink at the sound of the buzzer alone.

The difference between trace conditioning and delay conditioning is that in the delayed procedure the CS and US overlap.
Simultaneous conditioning

During simultaneous conditioning, the CS and US are presented and terminated at the same time.

For example: If you ring a bell and blow a puff of air into a person’s eye at the same moment, you have accomplished to coincide the CS and US.

Second-order and higher-order conditioning

This form of conditioning follows a two-step procedure. First a neutral stimulus ("CS1") comes to signal a US through forward conditioning. Then a second neutral stimulus ("CS2") is paired with the first (CS1) and comes to yield its own conditioned response.

For example: a bell might be paired with food until the bell elicits salivation. If a light is then paired with the bell, then the light may come to elicit salivation as well. The bell is the CS1 and the food is the US. The light becomes the CS2 once it is paired with the CS1.

Backward conditioning

Backward conditioning occurs when a CS immediately follows a US. Unlike the usual conditioning procedure, in which the CS precedes the US, the conditioned response given to the CS tends to be inhibitory. This presumably happens because the CS serves as a signal that the US has ended, rather than as a signal that the US is about to appear.

For example, a puff of air directed at a person's eye could be followed by the sound of a buzzer.

Temporal conditioning
In temporal conditioning a US is presented at regular intervals, for instance every 10 minutes. Conditioning is said to have occurred when the CR tends to occur shortly before each US. This suggests that animals have a biological clock that can serve as a CS. This method has also been used to study timing ability in animals.

**Zero contingency procedure**

In this procedure, the CS is paired with the US, but the US also occurs at other times. If this occurs, it is predicted that the US is likely to happen in the absence of the CS. In other words, the CS does not "predict" the US. In this case, conditioning fails and the CS does not come to elicit a CR. This finding – that prediction rather than CS-US pairing is the key to conditioning – greatly influenced subsequent conditioning research and theory.

**Extinction**

In the extinction procedure, the CS is presented repeatedly in the absence of a US. This is done after a CS has been conditioned by one of the methods above. When this is done the CR frequency eventually returns to pre-training levels. However, spontaneous recovery show that extinction does not completely eliminate the effects of the prior conditioning. Spontaneous recovery is when there is a sudden appearance of the (CR) after extinction occurs. These phenomena can be explained by postulating accumulation of inhibition when a weak stimulus is presented.

**PHENOMENA OBSERVED**

**Acquisition**

During acquisition the CS and US are paired as described above. The extent of conditioning may be tracked by test trials. In these test trials, the CS is presented alone and the CR is measured. A single CS-US pairing may suffice to yield a CR on a test, but usually a number of pairings are necessary. This repeated number of trials increases the strength and/or frequency of the CR gradually. The speed of conditioning depends on a number of factors, such as the nature and strength of both the CS and the US, previous experience and the animal's motivational state. Acquisition may occur with a single pairing of the CS and US, but usually, there is a gradual increase in the conditioned response to the CS. This slows down the process as it nears completion.

**Extinction**
In order to make a learned behavior disappear, the experimenter must present a CS alone, without the presence of the US. Once this process is repeated continuously, eventually, the CS will stop eliciting a CR. This means that the CR has been "extinguished".

![Diagram of learning and behavior](image)

**External inhibition**

External inhibition may be observed if a strong or unfamiliar stimulus is presented just before, or at the same time as, the CS. This causes a reduction in the conditioned response to the CS.

**Recovery from extinction**

Several procedures lead to the recovery of an extinguished CR. The following examples assume that the CS has first been conditioned and that this has been followed by extinction of the CR as described above. These procedures illustrate that the extinction procedure does not completely eliminate the effect of conditioning.

- **Reacquisition:**

  If the CS is again paired with the US, a CR is again acquired, but this second acquisition usually happens much faster than the first one.

- **Spontaneous recovery:**

  Spontaneous recovery is defined as the reappearance of the conditioned response after a rest period. That is, if the CS is tested at a later time (for example an hour or a day) after conditioning it will again elicit a CR. This renewed CR is usually much weaker than the CR observed prior to extinction.

- **Disinhibition:**

  If the CS is tested just after extinction and an intense but associatively neutral stimulus has occurred, there may be a temporary recovery of the conditioned response to the CS

- **Reinstatement:**

  If the US used in conditioning is presented to a subject in the same place where conditioning and extinction occurred, but without the CS being present, the CS often elicits a response when it is tested later.

- **Renewal:**
Renewal is a reemergence of a conditioned response following extinction when an animal is returned to the environment in which the conditioned response was acquired.

**Stimulus generalization**

Stimulus generalization is said to occur if, after a particular CS has come to elicit a CR, another similar stimulus will elicit the same CR. Usually the more similar are the CS and the test stimulus the stronger is the CR to the test stimulus. The more the test stimulus differs from the CS the weaker the CR will be or the more it will differ from that previously observed.

**Stimulus discrimination**

One observes stimulus discrimination when one stimulus ("CS1") elicits one CR and another stimulus ("CS2") elicits either another CR or no CR at all. This can be brought about by, for example, pairing CS1 with an effective US and presenting CS2 with no US.

**Latent inhibition**

Latent inhibition refers to the observation that it takes longer for a familiar stimulus to become a CS than it does for a novel stimulus to become a CS, when the stimulus is subsequently paired with an effective US.[2]

**Conditioned suppression**

This is one of the most common ways to measure the strength of learning in classical conditioning. A typical example of this procedure is as follows: a rat first learns to press a lever through operant conditioning. Then, in a series of trials, the rat is exposed to a CS, a light or a noise, followed by the US, a mild electric shock. An association between the CS and US develops, and the rat slows or stops its lever pressing when the CS comes on. The rate of pressing during the CS measures the strength of classical conditioning; that is, the slower the rat presses, the stronger the association of the CS and the US. (Slow pressing indicates a "fear" conditioned response, and it is an example of a conditioned emotional response, see section below.)

**Conditioned inhibition**

Three phases of conditioning are typically used:

**Phase 1**

A CS (CS+) is paired with a US until asymptotic CR levels are reached.
Phase 2

CS+/US trials are continued, but these are interspersed with trials on which the CS+ is paired with a second CS, (the CS-) but not with the US (i.e. CS+/CS- trials). Typically, organisms show CRs on CS+/US trials, but stop responding on CS+/CS− trials.

Phase 3

- Summation test for conditioned inhibition: The CS- from phase 2 is presented together with a new CS+ that was conditioned as in phase 1. Conditioned inhibition is found if the response is less to the CS+/CS- pair than it is to the CS+ alone.
- Retardation test for conditioned inhibition: The CS- from phase 2 is paired with the US. If conditioned inhibition has occurred, the rate of acquisition to the previous CS− should be less than the rate of acquisition that would be found without the phase 2 treatment.

Blocking

This form of classical conditioning involves two phases.

Phase 1

A CS (CS1) is paired with a US.

Phase 2

A compound CS (CS1+CS2) is paired with a US.

Test

A separate test for each CS (CS1 and CS2) is performed. The blocking effect is observed in a lack of conditional response to CS2, suggesting that the first phase of training blocked the acquisition of the second CS.

RECENT DEVELOPMENTS

⇒ CS pre exposure effect

Lubow and Moore (1959) found that conditioning was retarded if the CS had been presented by itself previous to the reinforced trials.

❖ Latent inhibition: Pre-exposure to a CS followed by CS-US pairings retard the generation of the CR.
❖ **Context pre-exposure:** Pre-exposure to a context facilitates the acquisition of fear conditioning.

❖ **US–Pre-exposure effect:** Presentation of the US in a training context prior to CS-US pairings retards production of the CR.

❖ **Learned irrelevance:** Random exposure to the CS and the US retards conditioning even more than combined latent inhibition and US pre-exposure.

⇒ **The over expectation effect**

Wagner et al. (1968) showed that conditioning to a CS depended, not on the number of CS-US presentations, but on its quality as a predictor of the US compared to other CS present at the time of conditioning. Kamin (1968) discovered that conditioning of one CS would block conditioning to a second CS trained simultaneously with the first CS.

- **Blocking Effect:** In classical conditioning, the finding that little or no conditioning occurs to a new stimulus if it is combined with a previously conditioned stimulus during conditioning trials. Suggests that information or surprise value is important in conditioning. i.e., Conditioning to CS1-CS2 following conditioning to CS1 results in a weaker conditioning to CS2 than that attained with CS2-US pairings.

- **Over Expectation:** In classical conditioning, the finding that two conditional stimuli that have been separately paired with an unconditional stimulus may actually lose some of their potential to elicit conditional responding if they are combined and the compound is paired with the same unconditional stimulus. i.e., Reinforced CS1-CS2 presentations following independent reinforced CS1 and CS2 presentations result in a decrement in their initial associative strength.

- **Overshadowing:** In classical conditioning, the finding that there is less conditioning to a weak conditional stimulus if it is combined with a more salient conditional stimulus, during conditioning trials. i.e., Conditioning to CS1-CS2 results in a weaker conditioning to CS2 than that attained with CS2-US pairings.

⇒ **Sensory pre conditioning**

Brogden (1939) demonstrated sensory preconditioning. Sensory preconditioning is a classical conditioning procedure in which two neutral stimuli are first paired with each other, and then one of them is paired with an unconditional stimulus. When the other neutral stimulus is tested, it evokes a conditional response, even though it was never paired with the unconditional stimulus itself. i.e., when CS1-CS2 pairings are followed by CS1-US pairings, presentation of CS2 generates a CR.

**BIOLOGICAL CONSTRAINTS ON CLASSICAL CONDITIONING**

In classical conditioning, humans and other animals learn when to “expect” (cognition) a US, and their awareness of the link between stimuli and responses can weaken associations. Biological constraints predispose organisms to learn associations that are naturally
adaptive. Training that attempts to override these tendencies will probably not endure because the animals will revert to their biologically predisposed patterns.

Research indicates that, for many animals, cognitive appraisals are important for learning. For example, animals appear capable of learning when to expect an unconditioned stimulus (US). Conditioning occurs best when the CS and the UCS have just the sort of relationship that would lead a scientist to conclude that the CS causes the UCS.

The behaviorists’ optimism that learning principles would generalize from one response to another and from one species to another has been tempered. Conditioning principles are constrained by the biological predispositions of each species. For example, rats are biologically prepared to learn associations between the taste of a particular food and the onset of illness, but not between a loud noise and an illness.

APPLICATIONS

Pavlov’s work laid a foundation for John Watson’s emerging belief that, to be an objective science, psychology should study only overt behavior, without considering unobservable mental activity. Pavlov taught us that principles of learning apply across species, that significant psychological phenomena can be studied objectively, and that conditioning principles have important applications.

Classical conditioning principles provide important insights into drug abuse and how it may be overcome. Classical conditioning works on the body's disease-fighting immune system. For example, when a particular taste accompanies a drug that influences immune responses, the taste by itself may come to produce those immune responses. Watson's "Little Albert" study demonstrated how classical conditioning may underlie specific fears. Today, psychologists use extinction procedures to control our less adaptive emotions and condition new responses to emotion-arousing stimuli.

Classical conditioning is used not only in therapeutic interventions, but in everyday life as well. Advertising executives, for example, are adept at applying the principles of associative learning. Think about the car commercials you have seen on television: many of them feature an attractive model. By associating the model with the car being advertised, you come to see the car as being desirable (Cialdini, 2008). You may be asking yourself, does this advertising technique actually work? According to Cialdini (2008), men who viewed a car commercial that included an attractive model later rated the car as being faster, more appealing, and better designed than did men who viewed an advertisement for the same car without the model.
MODULE 3:

OPERANT CONDITIONING

Operant conditioning is a theory of behaviorism that focuses on changes in an individual's observable behaviors. In operant conditioning, new or continued behaviors are impacted by new or continued consequences. Research regarding this principle of learning was first conducted by Edward L. Thorndike in the late 1800s, then brought to popularity by B. F. Skinner in the mid-1900s. Much of this research informs current practices in human behavior and interaction.

Thorndike's law of effect

Operant conditioning, sometimes called instrumental learning, was first extensively studied by Edward L. Thorndike (1874–1949), who observed the behavior of cats trying to escape from home-made puzzle boxes. A cat could escape from the box by a simple response such as pulling a cord or pushing a pole, but when first constrained the cats took a long time to

Diagram of Operant Conditioning
get out. With repeated trials ineffective responses occurred less frequently and successful responses occurred more frequently, so the cats escaped more and more quickly. Thorndike generalized this finding in his law of effect, which states that behaviors followed by satisfying consequences tend to be repeated and those that produce unpleasant consequences are less likely to be repeated. In short, some consequences strengthen behavior and some consequences weaken behavior. By plotting escape time against trial number Thorndike produced the first known animal learning curve through this procedure.

Humans appear to learn many simple behaviors through the sort of process studied by Thorndike, now called operant conditioning. That is, responses are retained when they lead to a successful outcome and discarded when they do not, or when they produce aversive effects. This usually happens without being planned by any "teacher", but operant conditioning has been used by parents in teaching their children for thousands of years.

**Skinner**

B.F. Skinner (1904–1990) is often referred to as the father of operant conditioning, and his work is frequently cited in connection with this topic. His book "The Behavior of Organisms", published in 1938, initiated his lifelong study of operant conditioning and its application to human and animal behavior. Following the ideas of Ernst Mach, Skinner rejected Thorndike's reference to unobservable mental states such as satisfaction, building his analysis on observable behavior and its equally observable consequences.

To implement his empirical approach, Skinner invented the operant conditioning chamber, or "Skinner Box," in which subjects such as pigeons and rats were isolated and could be exposed to carefully controlled stimuli. Unlike Thorndike's puzzle box, this arrangement allowed the subject to make one or two simple, repeatable responses, and the rate of such responses became Skinner's primary behavioral measure. Another invention, the cumulative recorder, produced a graphical record from which these response rates could be estimated. These records were the primary data that Skinner and his colleagues used to explore the effects on response rate of various reinforcement schedules. A reinforcement schedule may be defined as "any procedure that delivers reinforcement to an organism according to some well-defined rule". The effects of schedules became, in turn, the basic findings from which Skinner developed his account of operant conditioning. He also drew on many less formal observations of human and animal behavior.

**CONCEPTS AND PROCEDURES**

**Origins of operant behavior: operant variability**

Operant behavior is said to be "emitted"; that is, initially it is not elicited by any particular stimulus. Thus one may ask why it happens in the first place. The answer to this question is like Darwin's answer to the question of the origin of a "new" bodily structure, namely, variation and selection. Similarly, the behavior of an individual varies from moment to moment, in such aspects as the specific motions involved, the amount of force applied, or the timing of the response. Variations that lead to reinforcement are strengthened, and if
reinforcement is consistent, the behavior tends to remain stable. However, behavioral variability can itself be altered through the manipulation of certain variables.

**Modifying operant behavior: reinforcement and shaping**
Reinforcement and punishment are the core tools through which operant behavior is modified. These terms are defined by their effect on behavior. Either may be positive or negative, as described below.

1. **Positive Reinforcement and Negative Reinforcement** increase the probability of a behavior while **Positive Punishment and Negative Punishment** reduce the probability of a behavior that it follows.

There is an additional procedure

1. **Extinction** occurs when a previously reinforced behavior is no longer reinforced with either positive or negative reinforcement. During extinction the behavior becomes less probable.

Thus there are a total of five basic consequences -

1. **Positive reinforcement** (reinforcement): This occurs when a behavior (response) is rewarding or the behavior is followed by another stimulus that is rewarding, increasing the frequency of that behavior. For example, if a rat in a Skinner box gets food when it presses a lever, its rate of pressing will go up. This procedure is usually called simply reinforcement.

2. **Negative reinforcement** (escape): This occurs when a behavior (response) is followed by the removal of an aversive stimulus, thereby increasing that behavior's frequency. In the Skinner box experiment, the aversive stimulus might be a loud noise continuously sounding inside the box; negative reinforcement would happen when the rat presses a lever, turning off the noise.

3. **Positive punishment**: (also referred to as "punishment by contingent stimulation") This occurs when a behavior (response) is followed by an aversive stimulus, such as pain from a spanking, which results in a decrease in that behavior. **Positive punishment** is a rather confusing term, and usually the procedure is simply called "punishment."

4. **Negative punishment** (penalty) (also called "Punishment by contingent withdrawal"): Occurs when a behavior (response) is followed by the removal of a stimulus, such as taking away a child's toy following an undesired behavior, resulting in a decrease in that behavior.

5. **Extinction**: This occurs when a behavior (response) that had previously been reinforced is no longer effective. For example, a rat is first given food many times for lever presses. Then, in "extinction", no food is given. Typically the rat continues to press more and more slowly and eventually stops, at which time lever pressing is said to be "extinguished."

It is important to note that actors (e.g. rat) are not spoken of as being reinforced, punished, or extinguished; it is the actions (e.g. lever press) that are reinforced, punished, or extinguished. Also, reinforcement, punishment, and extinction are not terms whose use is restricted to the laboratory. Naturally occurring consequences can also reinforce, punish, or extinguish behavior and are not always planned or delivered by people.
Factors that alter the effectiveness of reinforcement and punishment

The effectiveness of reinforcement and punishment can be changed in various ways.

1. Satiation/Deprivation: The effectiveness of a positive or "appetitive" stimulus will be reduced if the individual has received enough of that stimulus to satisfy its appetite. The opposite effect will occur if the individual becomes deprived of that stimulus: the effectiveness of a consequence will then increase. If someone is not hungry, food will not be an effective reinforcer for behavior.

2. Immediacy: An immediate consequence is more effective than a delayed consequence. If one gives a dog a treat for "sitting" right away, the dog will learn faster than if the treat is given later.

3. Contingency: To be most effective, reinforcement should occur consistently after responses and not at other times. Learning may be slower if reinforcement is intermittent, that is, following only some instances of the same response, but responses reinforced intermittently are usually much slower to extinguish than are responses that have always been reinforced.

4. Size: The size, or amount, of a stimulus often affects its potency as a reinforcer. Humans and animals engage in a sort of "cost-benefit" analysis. A tiny amount of food may not "be worth" an effortful lever press for a rat. A pile of quarters from a slot machine may keep a gambler pulling the lever longer than a single quarter.

Most of these factors serve biological functions. For example, the process of satiation helps the organism maintain a stable internal environment (homeostasis). When an organism has been deprived of sugar, for example, the taste of sugar is a highly effective reinforcer. However, when the organism's blood sugar reaches or exceeds an optimum level the taste of sugar becomes less effective, perhaps even aversive.

Shaping

Shaping is a conditioning method much used in animal training and in teaching non-verbal humans. It depends on operant variability and reinforcement, as described above. The trainer starts by identifying the desired final (or "target") behavior. Next, the trainer chooses a behavior that the animal or person already emits with some probability. The form of this behavior is then gradually changed across successive trials by reinforcing behaviors that approximate the target behavior more and more closely. When the target behavior is finally emitted, it may be strengthened and maintained by the use of a schedule of reinforcement.

Stimulus control of operant behavior

Though initially operant behavior is emitted without reference to a particular stimulus, during operant conditioning operants come under the control of stimuli that are present when behavior is reinforced. Such stimuli are called "discriminative stimuli." A so-called "three-term contingency" is the result. That is, discriminative stimuli set the occasion for responses that produce reward or punishment. Thus, a rat may be trained to press a lever only when a light comes on; a dog rushes to the kitchen when it hears the rattle of its food bag; a child reaches for candy when she sees it on a table.
Behavioral sequences: conditioned reinforcement and chaining

Most behavior cannot easily be described in terms of individual responses reinforced one by one. The scope of operant analysis is expanded through the idea of behavioral chains, which are sequences of responses bound together by the three-term contingencies defined above. Chaining is based on the fact, experimentally demonstrated, that a discriminative stimulus not only sets the occasion for subsequent behavior, but it can also reinforce a behavior that precedes it. That is, a discriminative stimulus is also a "conditioned reinforcer". For example, the light that sets the occasion for lever pressing may be used to reinforce "turning around" in the presence of a noise. This results in the sequence "noise - turn-around - light - press lever - food". Much longer chains can be built by adding more stimuli and responses.

Escape and Avoidance

In escape learning, a behavior terminates an (aversive) stimulus. For example, shielding one's eyes from sunlight terminates the (aversive) stimulation of bright light in one's eyes. (This is an example of negative reinforcement, defined above.) Behavior that is maintained by preventing a stimulus is called "avoidance," as, for example, putting on sun glasses before going outdoors. Avoidance behavior raises the so-called "avoidance paradox", for, it may be asked, how can the non-occurrence of a stimulus serve as a reinforcer? This question is addressed by several theories of avoidance.

Two kinds of experimental settings are commonly used: discriminated and free-operant avoidance learning.

**Discriminated avoidance learning**

A discriminated avoidance experiment involves a series of trials in which a neutral stimulus such as a light is followed by an aversive stimulus such as a shock. After the neutral stimulus appears an operant response such as a lever press prevents or terminate the aversive stimulus. In early trials the subject does not make the response until the aversive stimulus has come on, so these early trials are called "escape" trials. As learning progresses, the subject begins to respond during the neutral stimulus and thus prevents the aversive stimulus from occurring. Such trials are called "avoidance trials." This experiment is said to involve classical conditioning, because a neutral CS is paired with an aversive US; this idea underlies the two-factor theory of avoidance learning described below.

**Free-operant avoidance learning**

In free-operant avoidance a subject periodically receives an aversive stimulus (often an electric shock) unless an operant response is made; the response delays the onset of the shock. In this situation, unlike discriminated avoidance, no prior stimulus signals the shock. Two crucial time intervals determine the rate of avoidance learning. This first is the S-S (shock-shock) interval. This is time between successive shocks in the absence of a response. The second interval is the R-S (response-shock) interval. This specifies the time by which an operant response delays the onset of the next shock. Note that each time the subject performs the operant response, the R-S interval without shock begins anew.
**Two-process theory of avoidance**

This theory was originally proposed in order to explain discriminated avoidance learning, in which an organism learns to avoid an aversive stimulus by escaping from a signal for that stimulus. Two processes are involved: classical conditioning of the signal followed by operant conditioning of the escape response:

1. **Classical conditioning of fear.** Initially the organism experiences the pairing of a CS (conditioned stimulus) with an aversive US (unconditioned stimulus). The theory assumes that this pairing creates an association between the CS and the US through classical conditioning and, because of the aversive nature of the US, the CS comes to elicit a conditioned emotional reaction (CER) – "fear."

2. **Reinforcement of the operant response by fear-reduction.** As a result of the first process, the CS now signals fear; this unpleasant emotional reaction serves to motivate operant responses, and responses that terminate the CS are reinforced by fear termination. Note that the theory does not say that the organism "avoids" the US in the sense of anticipating it, but rather that the organism "escapes" an aversive internal state that is caused by the CS. Several experimental findings seem to run counter to two-factor theory.

   *For example, avoidance behavior often extinguishes very slowly even when the initial CS-US pairing never occurs again, so the fear response might be expected to extinguish. Further, animals that have learned to avoid often show little evidence of fear, suggesting that escape from fear is not necessary to maintain avoidance behavior.*

**Operant or "one-factor" theory**

Some theorists suggest that avoidance behavior may simply be a special case of operant behavior maintained by its consequences. In this view the idea of "consequences" is expanded to include sensitivity to a pattern of events. Thus, in avoidance, the consequence of a response is a reduction in the rate of aversive stimulation. Indeed, experimental evidence suggests that a "missed shock" is detected as a stimulus, and can act as a reinforcer.[22] Cognitive theories of avoidance take this idea a step farther. For example, a rat comes to "expect" shock if it fails to press a lever and to "expect no shock" if it presses it, and avoidance behavior is strengthened if these expectancies are confirmed. [23] [24]

**Some other terms and procedures**

**Non-contingent reinforcement**

Non-contingent reinforcement is the delivery of reinforcing stimuli regardless of the organism's behavior. Non-contingent reinforcement may be used in an attempt to reduce an undesired target behavior by reinforcing multiple alternative responses while extinguishing the target response. As no measured behavior is identified as being strengthened, there is controversy surrounding the use of the term non-contingent "reinforcement".
Schedules of reinforcement

Schedules of reinforcement are rules that control the delivery of reinforcement. The rules specify either the time that reinforcement is to be made available, or the number of responses to be made, or both. Many rules are possible, but the following are the most basic and commonly used:

- **Fixed interval schedule**: Reinforcement occurs following the first response after a fixed time has elapsed after the previous reinforcement.
- **Variable interval schedule**: Reinforcement occurs following the first response after a variable time has elapsed from the previous reinforcement.
- **Fixed ratio schedule**: Reinforcement occurs after a fixed number of responses have been emitted since the previous reinforcement.
- **Variable ratio schedule**: Reinforcement occurs after a variable number of responses have been emitted since the previous reinforcement.
- **Continuous reinforcement**: Reinforcement occurs after each response.

**Discrimination, generalization & context**

Most behavior is under stimulus control. Several aspects of this may be distinguished:

- "Discrimination" typically occurs when a response is reinforced only in the presence of a specific stimulus. For example, a pigeon might be fed for pecking at a red light and not at a green light; in consequence, it pecks at red and stops pecking at green. Many complex combinations of stimuli and other conditions have been studied; for example an organism might be reinforced on an interval schedule in the presence of one stimulus and on a ratio schedule in the presence of another.
- "Generalization" is the tendency to respond to stimuli that are similar to a previously trained discriminative stimulus. For example, having been trained to peck at "red" a pigeon might also peck at "pink", though usually less strongly.
- "Context" refers to stimuli that are continuously present in a situation, like the walls, tables, chairs, etc. in a room, or the interior of an operant conditioning chamber. Context stimuli may come to control behavior as do discriminative stimuli, though usually more weakly. Behaviors learned in one context may be absent, or altered, in another. This may cause difficulties for behavioral therapy, because behaviors learned in the therapeutic setting may fail to occur elsewhere.

**Operant hoarding**

Operant hoarding refers to the observation that rats reinforced in a certain way may allow food pellets to accumulate in a food tray instead of retrieving those pellets. In this procedure, retrieval of the pellets always instituted a one-minute period of extinction during which no additional food pellets were available but those that had been accumulated earlier could be consumed. This finding appears to contradict the usual finding that rats behave impulsively in
situations in which there is a choice between a smaller food object right away and a larger food object after some delay.

NEUROBIOLOGICAL CORRELATES OF OPERANT CONDITIONING

The first scientific studies identifying neurons that responded in ways that suggested they encode for conditioned stimuli came from work by Mahlon deLong and by R.T. Richardson. They showed that nucleus basalis neurons, which release acetylcholine broadly throughout the cerebral cortex, are activated shortly after a conditioned stimulus, or after a primary reward if no conditioned stimulus exists. These neurons are equally active for positive and negative reinforcers, and have been shown to be related to neuroplasticity in many cortical regions. Evidence also exists that dopamine is activated at similar times.

There is considerable evidence that dopamine participates in both reinforcement and aversive learning. Dopamine pathways project much more densely onto frontal cortex regions. Cholinergic projections, in contrast, are dense even in the posterior cortical regions like the primary visual cortex. A study of patients with Parkinson's disease, a condition attributed to the insufficient action of dopamine, further illustrates the role of dopamine in positive reinforcement. It showed that while off their medication, patients learned more readily with aversive consequences than with positive reinforcement. Patients who were on their medication showed the opposite to be the case, positive reinforcement proving to be the more effective form of learning when dopamine activity is high.

A neurochemical process involving dopamine has been suggested to underlie reinforcement. When an organism experiences a reinforcing stimulus, dopamine pathways in the brain are activated. This network of pathways "releases a short pulse of dopamine onto many dendrites, thus broadcasting a rather global reinforcement signal to postsynaptic neurons." This allows recently activated synapses to increase their sensitivity to efferent (conducting outward) signals, thus increasing the probability of occurrence for the recent responses that preceded the reinforcement. These responses are, statistically, the most likely to have been the behavior responsible for successfully achieving reinforcement. But when the application of reinforcement is either less immediate or less contingent (less consistent), the ability of dopamine to act upon the appropriate synapses is reduced.

APPLICATIONS

Operant conditioning to change human behavior

Applied behavior analysis is the discipline initiated by B. F. Skinner that applies the principles of conditioning to the modification of socially significant human behavior. It uses the basic concepts of conditioning theory, including conditioned stimulus (S$^C$), discriminative stimulus (S$^d$), response (R), and reinforcing stimulus (S$^{rein}$ or S$^r$ for reinforcers, sometimes S$^{ave}$ for aversive stimuli). A conditioned stimulus controls behaviors developed through
respondent (classical) conditioning, such as emotional reactions. The other three terms combine to form Skinner's "three-term contingency": a discriminative stimulus sets the occasion for responses that lead to reinforcement. Researchers have found the following protocol to be effective when they use the tools of operant conditioning to modify human behavior:

1. **State goal:** Clarify exactly what changes are to be brought about. For example, "reduce weight by 30 pounds."

2. **Monitor behavior:** Keep track of behavior so that one can see whether the desired effects are occurring. For example, keep a chart of daily weights.

3. **Reinforce desired behavior:** For example, congratulate the individual on weight losses. With humans, a record of behavior may serve as a reinforcement. For example, when a participant sees a pattern of weight loss, this may reinforce continuance in a behavioral weight-loss program. A more general plan is the token economy, an exchange system in which tokens are given as rewards for desired behaviors. Tokens may later be exchanged for a desired prize or rewards such as power, prestige, goods or services.

4. **Reduce incentives to perform undesirable behavior:** For example, remove candy and fatty snacks from kitchen shelves.

**In Educational Set-up:** 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 behavior 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 behaviors, 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).

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 behavior 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.
MODULE 4:

COGNITIVE THEORIES

Cognitive learning theories hold a unique place in history - they explore the captivating depths of the mind from the perspective of process. According to these theories, one’s ability to learn stems from the way one perceives, organizes, stores, and retrieves information. Cognitive approaches can be applied to any discipline. Primary emphases involve problem-solving and the facilitation of storage and retrieval of information for application. The ongoing study and enhancement of these processes can only benefit our ability to learn more efficiently and effectively.

KOHLER - INSIGHT LEARNING

Insight learning was first researched by Wolfgang Kohler (1887–1967). This theory of learning differs from the trial-and-error ideas that were proposed before it. The key aspect of insight learning is that it is achieved through cognitive processes, rather than interactions with the outside world. There is no gradual shaping or trial and error involved; instead, internal organizational processes cause new behavior.

Sultan the Chimpanzee and Insight Learning

Kohler’s most famous study on insight learning involved Sultan the chimpanzee. Sultan was in a cage and was presented with a stick, which he could use to pull a piece of fruit close enough to the cage so that he could pick it up. After Sultan had learned to use the stick to reach the fruit, Kohler moved the fruit out of range of the short stick. He then placed a longer stick within reach of the short stick. Initially, Sultan tried to reach the fruit with the short stick and failed. Eventually, however, Sultan learned to use the short stick to reach the long stick, and then use the long stick to reach the fruit. Sultan was never conditioned to use one stick to reach another; instead, it seemed as if Sultan had an epiphany. The internal process that lead Sultan to use the sticks in this way is a basic example of insight.

Insight Learning versus Other Learning Theories

A basic assumption of strict behaviorism is that only behavior that can be seen may be studied, and that human behavior is determined by conditioning. Insight learning suggests that we learn not only by conditioning, but also by cognitive processes that cannot be directly observed. Insight learning is a form of learning because, like other forms, it involves a change in behavior; however, it differs from other forms because the process is not observable. It can be hard to define because it is not behavioral, a characteristic that distinguishes it from most theories of learning throughout the history of psychology.

Initially, it was thought that learning was the result of reproductive thinking. This means that an organism reproduces a response to a given problem from past experience. Insight
Learning, however, does not directly involve using past experiences to solve a problem. While past experiences may help the process, an insight or novel idea is necessary to solve the problem. Prior knowledge is of limited help in these situations.

In humans, insight learning occurs whenever we suddenly see a problem in a new way, connect the problem to another relevant problem/solution, release past experiences that are blocking the solution, or see the problem in a larger, more coherent context. When we solve a problem through insight, we often have a so-called aha or eureka moment. The solution suddenly appears, even if previously no progress was being made. Famous examples of this type of learning include Archimedes's discovery of a method to determine the density of an object ("Eureka!") and Isaac Newton's realization that a falling apple and the orbiting moon are both pulled by the same force.

**Insight versus Heuristics**

Insight should not be confused with heuristics. A heuristic is a mental shortcut that allows us to filter out overwhelming information and stimuli in order to make a judgement or decision. Heuristics help us to reduce the cognitive burden of the decision-making process by examining a smaller percentage of the information. While both insight and heuristics can be used for problem solving and information processing, a heuristic is a simplistic rule of thumb; it is habitual automatic thinking that frees us from complete and systematic processing of information.

Insight is not a mental shortcut, but instead is a way to arrive at a novel idea through cognitive means. Rather than being habitual or automatic, insight involves coming up with a new idea that does not result from past experience to solve a problem. While heuristics are gradually shaped by experience, insight is not. Instead, internal processes lead to new behavior.

**TOLMAN- SIGN LEARNING & LATENT LEARNING**

Tolman's theorizing has been called purposive behaviorism and is often considered the bridge between behaviorism and cognitive theory. According to Tolman's theory of sign learning, an organism learns by pursuing signs to a goal, i.e., learning is acquired through meaningful behavior. Tolman emphasized the organized aspect of learning: "The stimuli which are allowed in are not connected by just simple one-to-one switches to the outgoing responses. Rather the incoming impulses are usually worked over and elaborated in the central control room into a tentative cognitive-like map of the environment. And it is this tentative map, indicating routes and paths and environmental relationships, which finally determines what responses, if any, the animal will finally make." (Tolman, 1948)

Tolman (1932) proposed five types of learning: (1) approach learning, (2) escape learning, (3) avoidance learning, (4) choice-point learning, and (5) latent learning. All forms of
learning depend upon means-end readiness, i.e., goal-oriented behavior, mediated by expectations, perceptions, representations, and other internal or environmental variables.

Tolman's version of behaviorism emphasized the relationships between stimuli rather than stimulus-response (Tolman, 1922). According to Tolman, a new stimulus (the sign) becomes associated with already meaningful stimuli (the significant) through a series of pairings; there was no need for reinforcement in order to establish learning. For this reason, Tolman's theory was closer to the connectionist framework of Thorndike than the drive reduction theory of Hull or other behaviorists.

Tolman coined the term cognitive map, which is an internal representation (or image) of external environmental feature or landmark. He thought that individuals acquire large numbers of cues (i.e. signals) from the environment and could use these to build a mental image of an environment (i.e. a cognitive map). By using this internal representation of a physical space they could get to the goal by knowing where it is in a complex of environmental features. Short cuts and changeable routes are possible with this model.

Tolman also worked on latent learning, defined as learning which is not apparent in the learner's behavior at the time of learning, but which manifests later when a suitable motivation and circumstances appear. The idea of latent learning was not original to Tolman, but he developed it further.

Application

Although Tolman intended his theory to apply to human learning, almost all of his research was done with rats and mazes. Tolman (1942) examines motivation towards war, but this work is not directly related to his learning theory.

Example

Much of Tolman's research was done in the context of place learning. In the most famous experiments, one group of rats was placed at random starting locations in a maze but the food was always in the same location. Another group of rats had the food placed in different locations which always required exactly the same pattern of turns from their starting location. The group that had the food in the same location performed much better than the other group, supposedly demonstrating that they had learned the location rather than a specific sequence of turns.
Principles

1. Learning is always purposive and goal-directed.
2. Learning often involves the use of environmental factors to achieve a goal (e.g., means-ends-analysis)
3. Organisms will select the shortest or easiest path to achieve a goal.

**ALBERT BANDURA - SOCIAL LEARNING THEORY**

The social learning theory of Bandura emphasizes the importance of observing and modeling the behaviors, attitudes, and emotional reactions of others. Bandura (1977) states: "Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is learned observationally through modeling: from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action."

Social learning theory explains human behavior in terms of continuous reciprocal interaction between cognitive, behavioral, and environmental influences. The component processes underlying observational learning are: (1) Attention, including modeled events (distinctiveness, affective valence, complexity, prevalence, functional value) and observer characteristics (sensory capacities, arousal level, perceptual set, past reinforcement), (2) Retention, including symbolic coding, cognitive organization, symbolic rehearsal, motor rehearsal), (3) Motor Reproduction, including physical capabilities, self-observation of reproduction, accuracy of feedback, and (4) Motivation, including external, vicarious and self reinforcement. Because it encompasses attention, memory and motivation, social learning theory spans both cognitive and behavioral frameworks.

In social learning theory Albert Bandura (1977) agrees with the behaviourist learning theories of classical conditioning and operant conditioning. However, he adds two important ideas:

1. Mediating processes occur between stimuli & responses.
2. Behavior is learned from the environment through the process of observational learning.

**Observational Learning**

Children observe the people around them behaving in various ways. This is illustrated during the famous Bobo doll experiment (Bandura, 1961).

Individuals that are observed are called models. In society, children are surrounded by many influential models, such as parents within the family, characters on children’s TV, friends
within their peer group and teachers at school. These models provide examples of behavior to observe and imitate, e.g. masculine and feminine, pro and anti-social etc.

Children pay attention to some of these people (models) and encode their behavior. At a later time they may imitate (i.e. copy) the behavior they have observed. They may do this regardless of whether the behavior is ‘gender appropriate’ or not, but there are a number of processes that make it more likely that a child will reproduce the behavior that its society deems appropriate for its sex.

- First, the child is more likely to attend to and imitate those people it perceives as similar to itself. Consequently, it is more likely to imitate behavior modeled by people of the same sex.
- Second, the people around the child will respond to the behavior it imitates with either reinforcement or punishment. If a child imitates a model’s behavior and the consequences are rewarding, the child is likely to continue performing the behavior. If parent sees a little girl consoling her teddy bear and says “what a kind girl you are”, this is rewarding for the child and makes it more likely that she will repeat the behavior. Her behavior has been reinforced (i.e. strengthened).

Reinforcement can be external or internal and can be positive or negative. If a child wants approval from parents or peers, this approval is an external reinforcement, but feeling happy about being approved of is an internal reinforcement. A child will behave in a way which it believes will earn approval because it desires approval.

Positive (or negative) reinforcement will have little impact if the reinforcement offered externally does not match with an individual's needs. Reinforcement can be positive or negative, but the important factor is that it will usually lead to a change in a person's behavior.

- Third, the child will also take into account of what happens to other people when deciding whether or not to copy someone’s actions. A person learns by observing the consequences of another person’s (i.e. models) behaviour e.g. a younger sister observing an older sister being rewarded for a particular behaviour is more likely to repeat that behaviour herself. This is known as vicarious reinforcement.

This relates to attachment to specific models that possess qualities seen as rewarding. Children will have a number of models with whom they identify. These may be people in their immediate world, such as parents or older siblings, or could be fantasy characters or people in the media. The motivation to identify with a particular model is that they have a quality which the individual would like to possess.

Identification occurs with another person (the model) and involves taking on (or adopting) observed behaviors, values, beliefs and attitudes of the person with whom you are identifying.
The term identification as used by Social Learning Theory is similar to the Freudian term related to the Oedipus complex. For example, they both involve internalizing or adopting another person’s behavior. However, during the Oedipus complex the child can only identify with the same sex parent, whereas with Social Learning Theory the person (child or adult) can potentially identify with any other person.

Identification is different to imitation as it may involve a number of behaviors being adopted, whereas imitation usually involves copying a single behavior.

**Mediational Processes**

SLT is often described as the ‘bridge’ between traditional learning theory (i.e. behaviourism) and the cognitive approach. This is because it focuses on how mental (cognitive) factors are involved in learning.

Unlike Skinner, Bandura (1977) believes that humans are active information processors and think about the relationship between their behavior and its consequences. Observational learning could not occur unless cognitive processes were at work. These mental factors mediate (i.e. intervene) in the learning process to determine whether a new response is acquired.

Therefore, individuals do not automatically observe the behaviour of a model and imitate it. There is some thought prior to imitation and this consideration is called mediational processes. This occurs between observing the behaviour (stimulus) and imitating it or not (response)

There are four mediational processes proposed by Bandura:

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**Behaviourist Model** (only study observable / external behaviour)

- **Stimulus** in the environment
- **Black Box** can’t be studied
- **Response** behavior

**Cognitive Model** (can scientifically study internal behavior)

- **Input** in the environment
- **Mediation Process** mental event
- **Output** behavior

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1. **Attention**: The extent to which we are exposed/notice the behaviour. For a behaviour to be imitated it has to grab our attention. We observe many behaviours on a daily basis and many of these are not noteworthy. Attention is therefore extremely important in whether a behaviour has an influence in others imitating it.

2. **Retention**: How well the behaviour is remembered. The behaviour may be noticed, but is it not always remembered which obviously prevents imitation. It is important therefore that a memory of the behaviour is formed to be performed later by the observer.

   Much of social learning is not immediate so this process is especially vital in those cases. Even if the behaviour is reproduced shortly after seeing it, there needs to be a memory to refer to.

3. **Reproduction**: This is the ability to perform the behavior that the model has just demonstrated. We see much behaviour on a daily basis that we would like to be able to imitate but that this not always possible. We are limited by our physical ability and for that reason, even if we wish to reproduce the behaviour, we cannot.

   This influences our decisions whether to try and imitate it or not. Imagine the scenario of a 90-year-old-lady who struggles to walk watching Dancing on Ice. She may appreciate that the skill is a desirable one, but she will not attempt to imitate it because she physically cannot do it.

4. **Motivation**: The will to perform the behaviour. The rewards and punishment that follow a behaviour will be considered by the observer. If the perceived rewards outweighs the perceived costs (if there are any) then the behaviour will be more likely to be imitated by the observer. If the vicarious reinforcement is not seen to be important enough to the observer then they will not imitate the behaviour.

**Principles**

1. The highest level of observational learning is achieved by first organizing and rehearsing the modeled behavior symbolically and then enacting it overtly. Coding modeled behavior into words, labels or images results in better retention than simply observing.

2. Individuals are more likely to adopt a modeled behavior if it results in outcomes they value.

3. Individuals are more likely to adopt a modeled behavior if the model is similar to the observer and has admired status and the behavior has functional value

**Application**

Social learning theory has been applied extensively to the understanding of aggression (Bandura, 1973) and psychological disorders, particularly in the context of behavior modification (Bandura, 1969). It is also the theoretical foundation for the technique of behavior modeling which is widely used in training programs. In recent years, Bandura has focused his work on the concept of self-efficacy in a variety of contexts (e.g., Bandura, 1997).