

Learning and Memory

UNIT-2



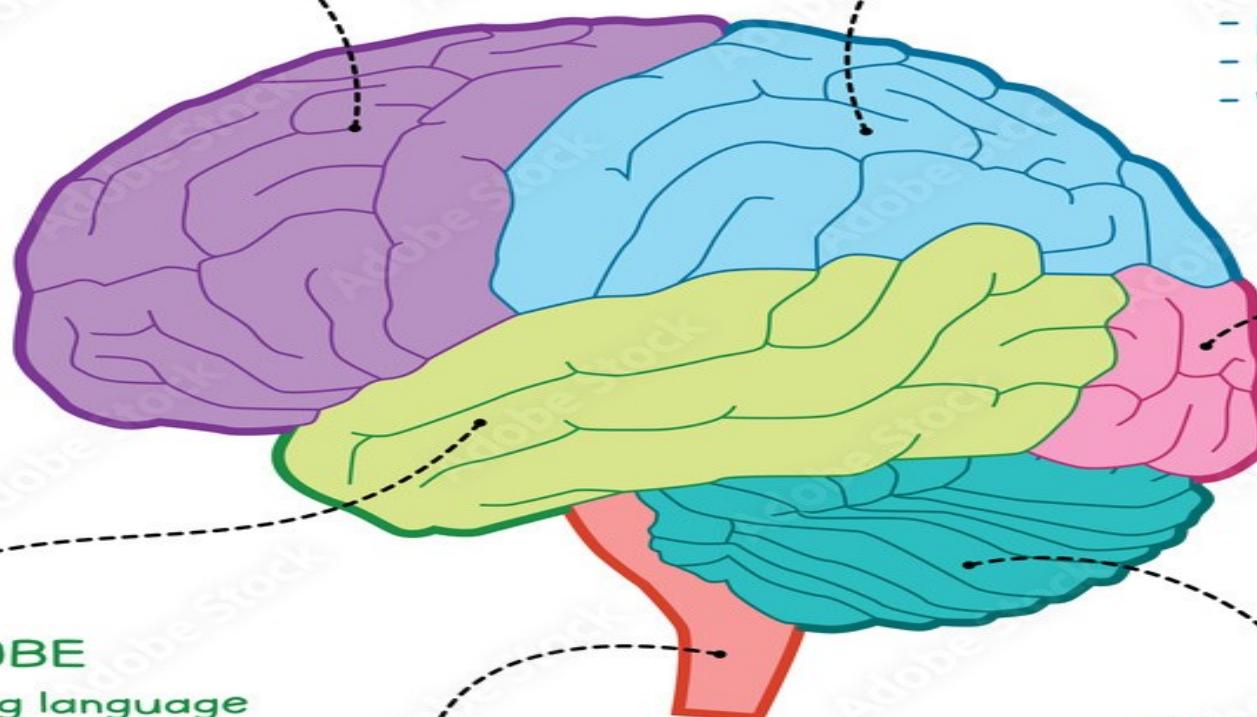
Learning is the acquisition of skill or knowledge, while memory is the expression of what you've acquired

- **Learning** is the process of acquiring new understanding, knowledge, behaviors, skills, values, attitudes, and preferences.
- The learning process Involves an interactive procedure with multiple different components Memory, attention, language, organization, processing, writing, and thinking at a higher order.



FRONTAL LOBE

- Problem solving
- Speech production
- Personality
- Emotional traits
- Judgment
- Motor control



PARIETAL LOBE

- Sense of touch, taste and smell
- Knowing right from left
- Body orientation
- Reading
- Writing

OCCIPITAL LOBE

- Vision
- Color Perception

TEMPORAL LOBE

- Understanding language
- Memory
- Hearing
- Learning
- Feelings

BRAIN STEM

- Sense of balance
- Breathing
- Body temperature
- Digestion
- Swallowing
- Alertness

CEREBELLUM

- Coordination
- Balance and equilibrium

- Memory is located in specific parts of the brain, and specific neurons can be recognized for their involvement in forming memories. The main parts of the brain involved with memory are the amygdala, the hippocampus, the cerebellum, and the prefrontal cortex

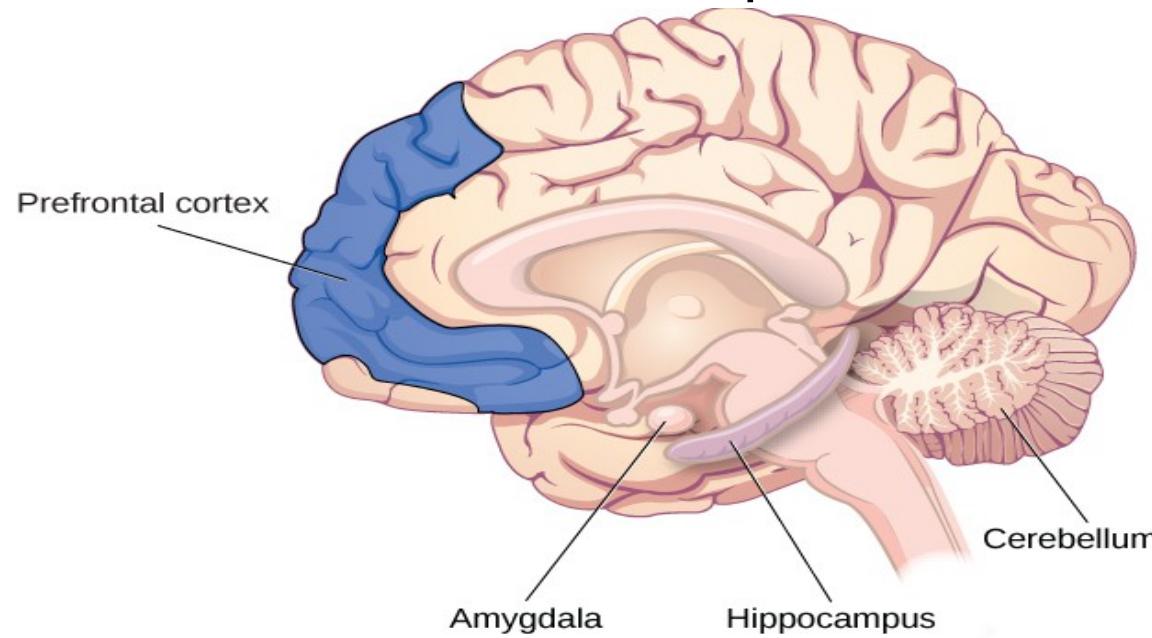
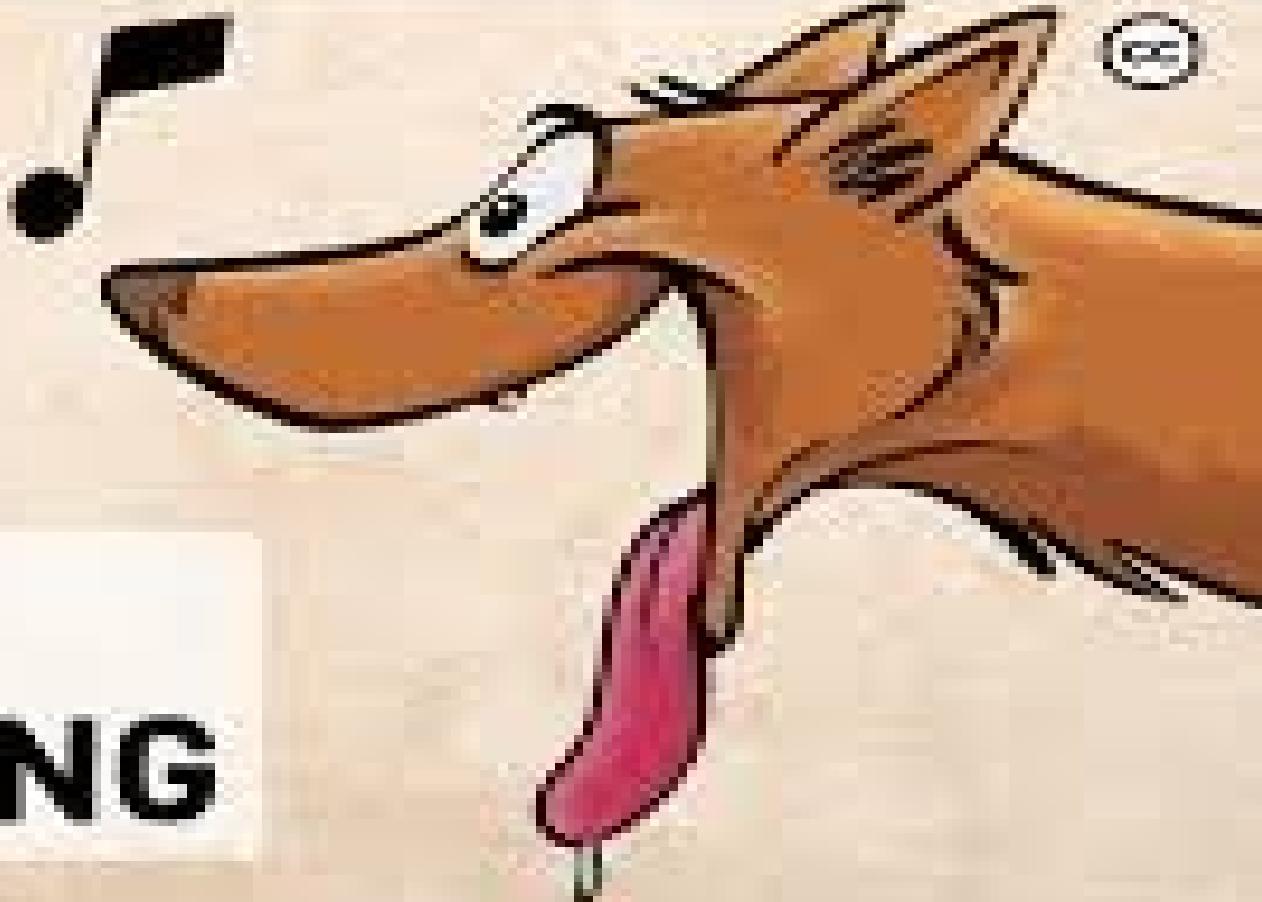


Figure 1. The amygdala is involved in fear and fear memories. The hippocampus is associated with declarative and episodic memory as well as recognition memory. The cerebellum plays a role in processing procedural memories, such as how to play the piano. The prefrontal cortex appears to be involved in remembering semantic tasks.

Theories of learning

- **Associative learning**
 - Classical Conditioning
 - Operant conditioning
 - Trial and error learning
- **Cognitive learning**
 - Insight learning
 - Observational learning

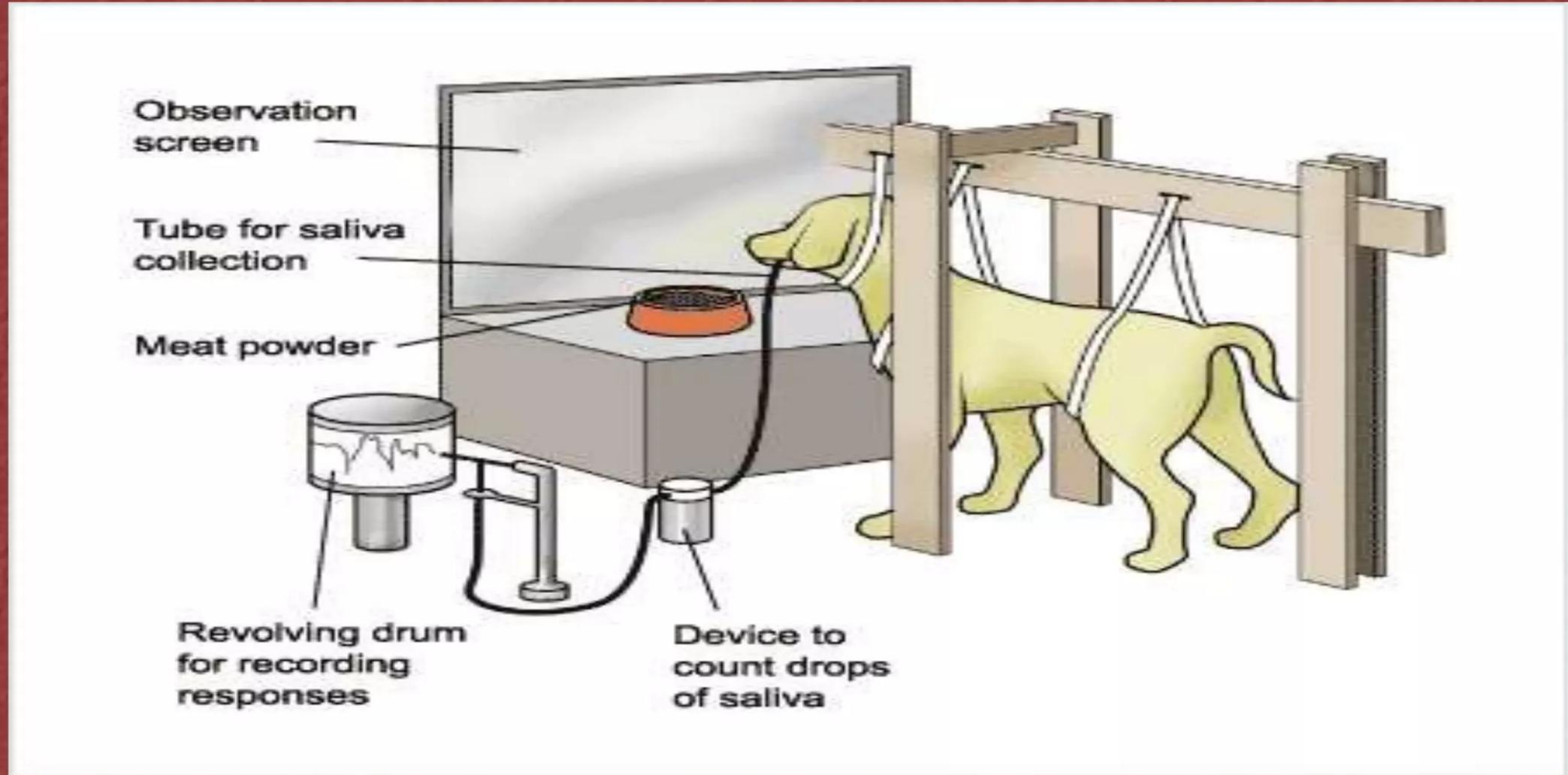


CLASSICAL CONDITIONING

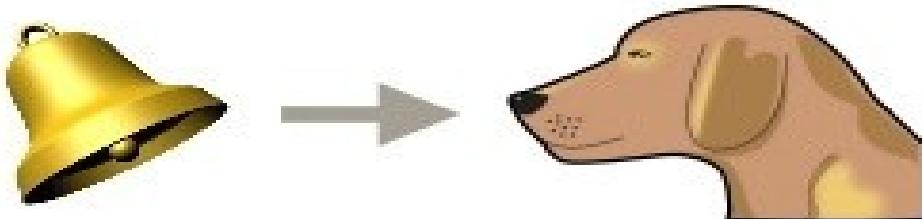
Learning Through Association

- Classical conditioning suggests that learning occurs when an association is formed between a previously neutral stimulus and a naturally occurring stimulus.
- In experiments conducted by Russian physiologist Ivan Pavlov, a natural stimulus (food) was paired with the sound of a bell.
- The dogs would naturally salivate in response to food, but after multiple associations, the dogs would salivate to the sound of the bell alone.
- Pavlov had identified a fundamental associative learning process called classical conditioning.
- **Classical conditioning refers to *learning that occurs when a neutral stimulus (e.g., a tone) becomes associated with a stimulus (e.g., food) that naturally produces a behaviour.***

Pavlov's Apparatus for Studying Classical Conditioning in Dogs



I. Before Conditioning



Neutral
Stimulus:
Bell rings

No notable
response.

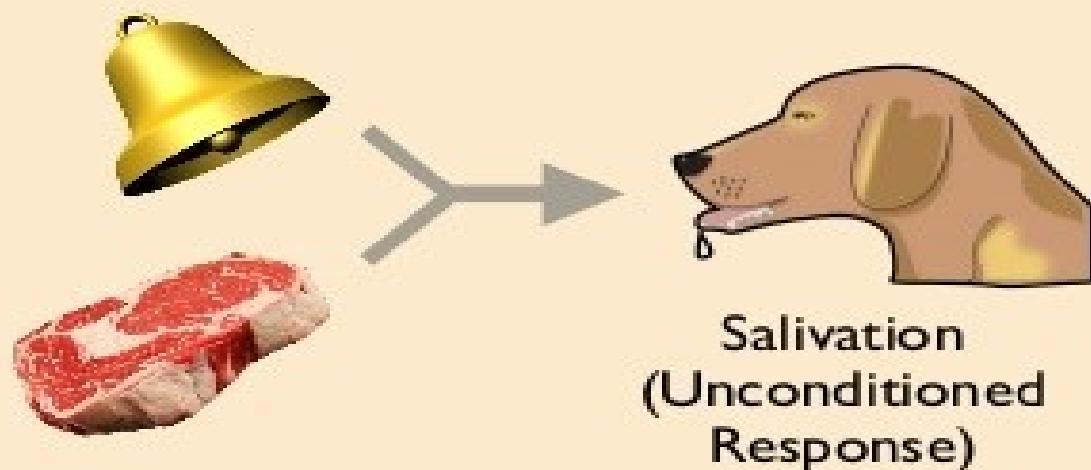
II. Before Conditioning



Unconditioned
Stimulus

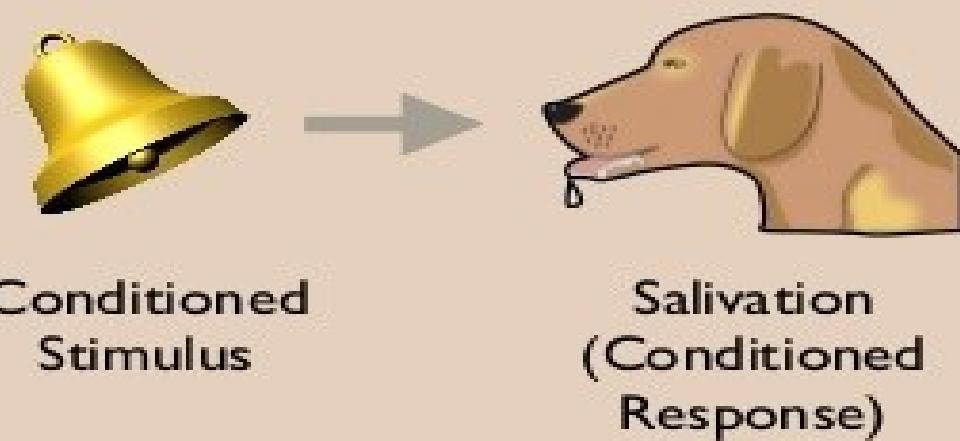
Salivation
(Unconditioned
Response)

III. During Conditioning



Salivation
(Unconditioned
Response)

IV. After Conditioning



Conditioned
Stimulus

Salivation
(Conditioned
Response)



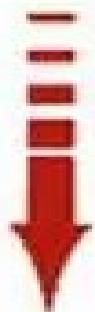
Neutral stimulus



No response



Unconditioned stimulus (US)



Unconditioned Response (UR)
Salivation



+
Several
Pairings



Salivation



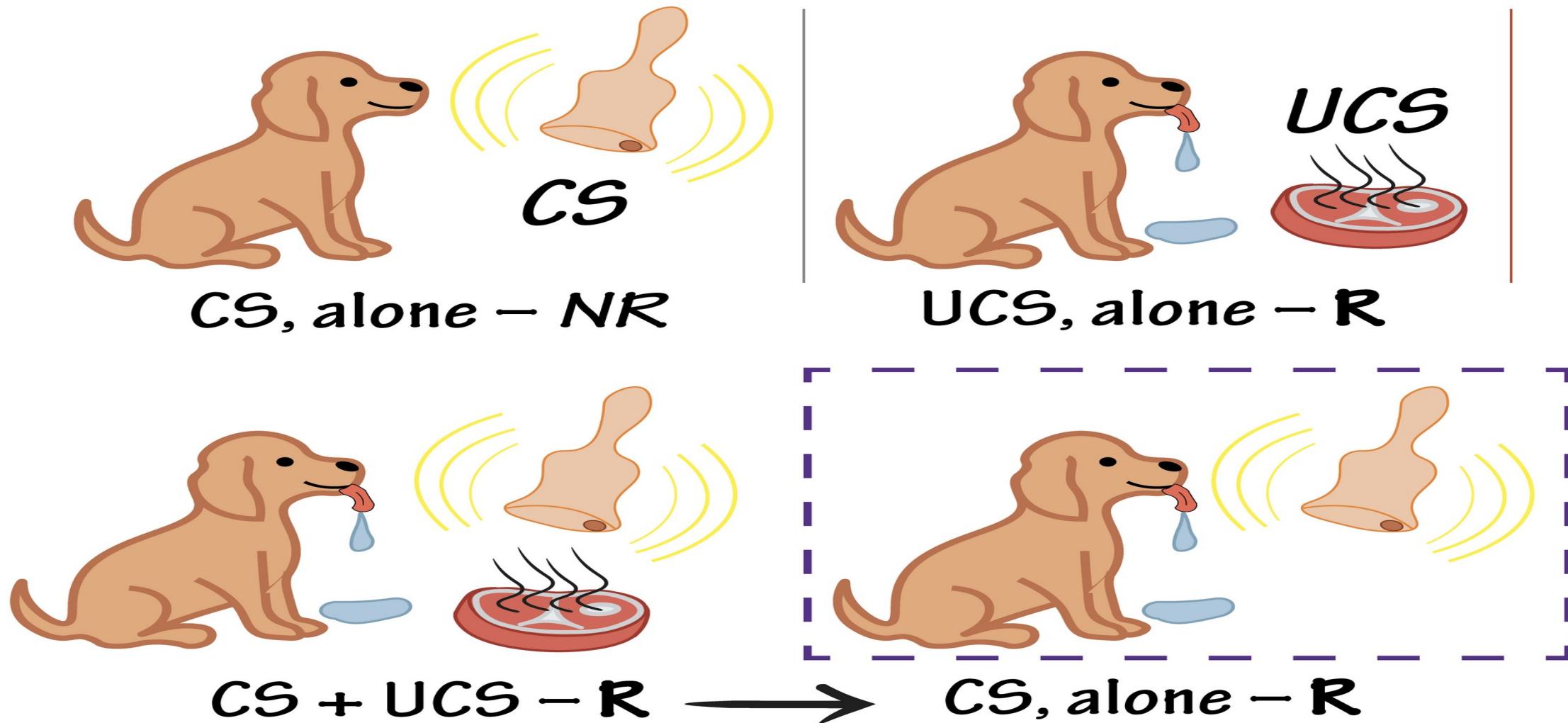
Conditioned stimulus (CS)



Conditioned Response (CR)
Salivation



CLASSICAL CONDITIONING (PAVLOV)



Laws/ Principles of classical conditioning

Acquisition

Acquisition refers to the initial stage of the learning or conditioning process. In this stage, particular response is being associated with a particular stimulus to the point where we can say the organism has "acquired" the response.

For example a parrot is taught to repeat the specific words each time the door bell rings. Whenever he will hear a bell he will repeat those words.



Extinction

Extinction is when the occurrences of a conditioned response decrease or disappear. In classical conditioning, this happens when a conditioned stimulus is no longer paired with an unconditioned stimulus.

For example: If door bell is replaced with knocking of the door, the parrot will forget talking in response to the door bell after 4-6 months of this change.



Spontaneous Recovery

Spontaneous_Recovery is the reappearance of the conditioned response after a rest period or period of lessened response.

For example The Door bell again starts ringing and the parrot is told to repeat the words each time the bell rings. It will again acquire this response.



Stimulus Generalization

Stimulus Generalization is the act or process of responding to a **stimulus** similar to but distinct from the conditioned **stimulus**.

For Example: If the mobile tone is similar to the sound of the door bell, the parrot will start talking whenever the mobile rings.



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Discrimination

Discrimination_is the ability to differentiate between a conditioned stimulus and other stimuli that have not been paired with an unconditioned stimulus.

For example: The parrot will not talk in response to the knocking of door or playing of music.



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B.F. Skinner's Operant Conditioning

REINFORCEMENT LEARNING

(OPERANT/INSTRUMENTAL CONDITIONING)

Behavioural Learning Theory

BASIC CONCEPTS



REWARD



PUNISHMENT

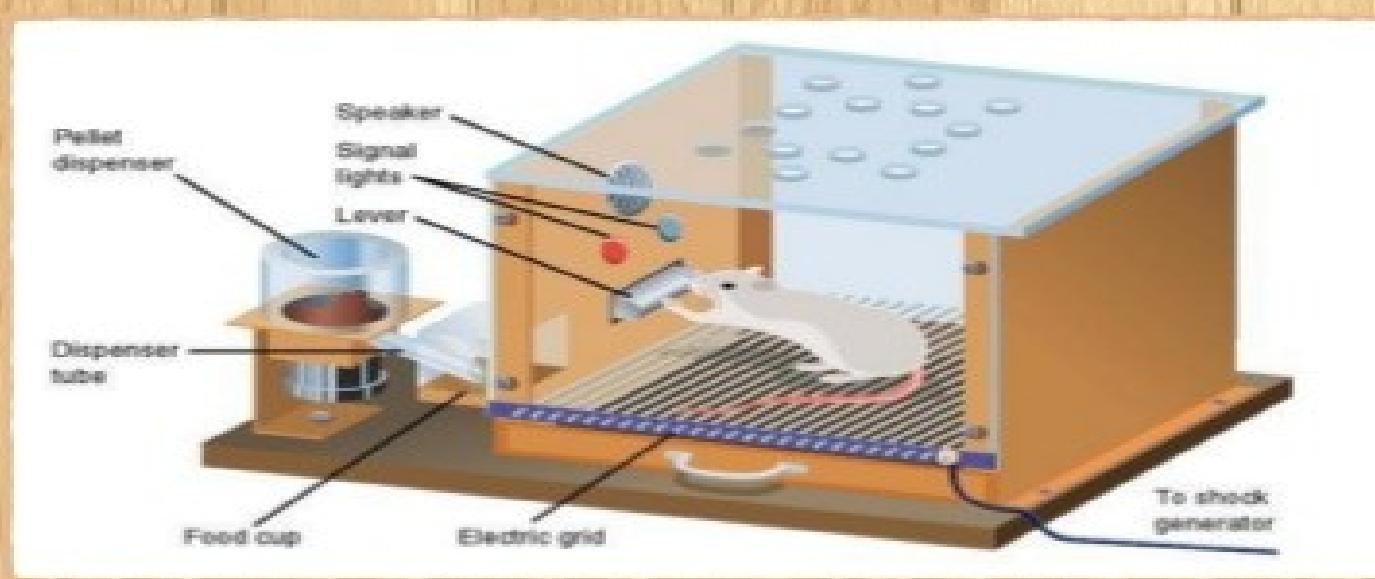


Operant Conditioning

- Operant conditioning was first described by behaviorist **B.F. Skinner**
- Skinner was more interested in how the *consequences* of people's actions influenced their behavior.
- **operant conditioning**- a mechanism of *learning* through which humans and animals come to perform or to *avoid* performing certain behaviors in response to the presence or absence of certain environmental stimuli
- Skinner used the term *operant* to refer to any "active behavior that operates upon the environment to generate consequences." Skinner's theory explained how we acquire the range of learned behaviors we exhibit every day.

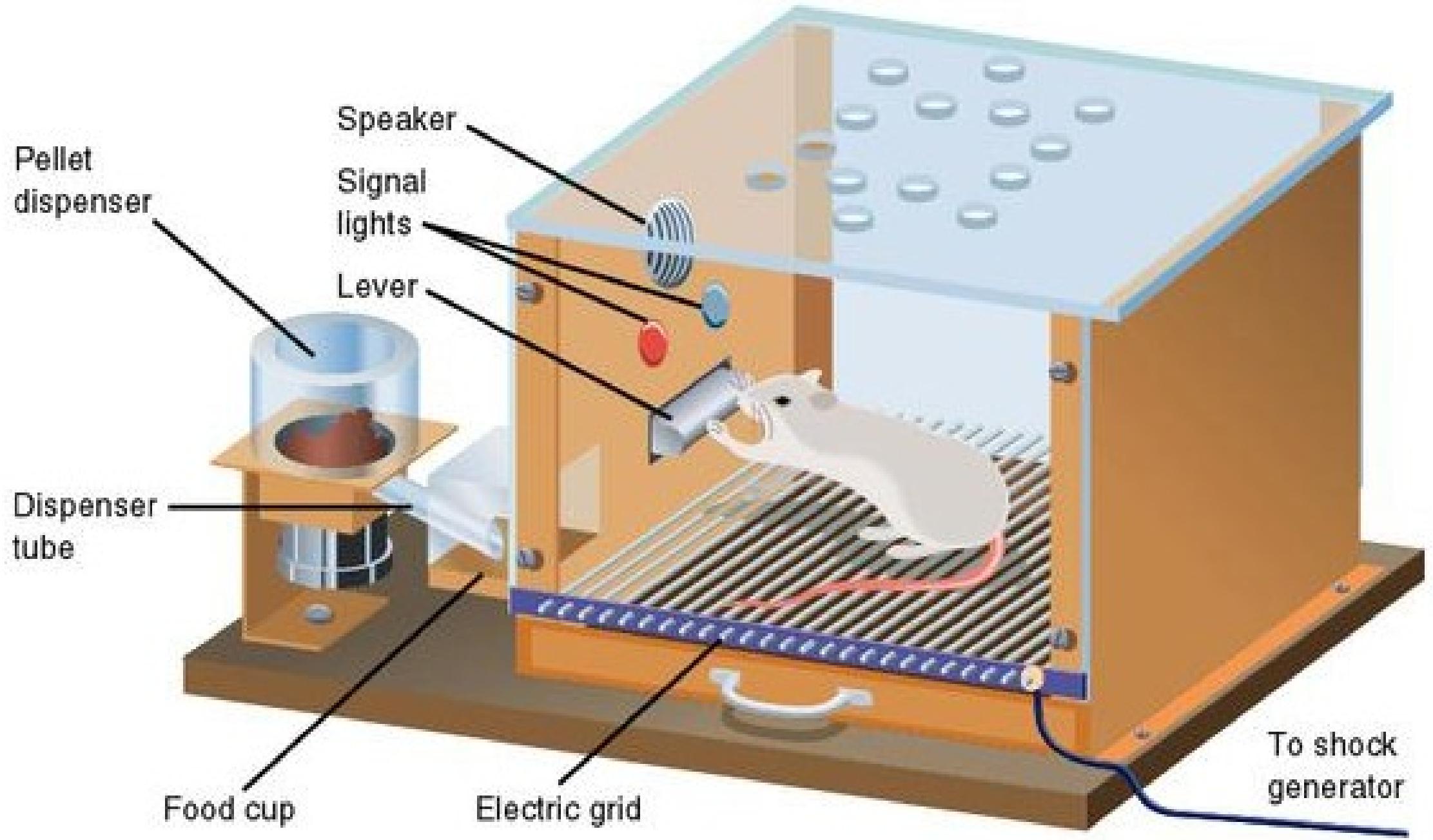
The Skinner Box

Skinner's operant conditioning chamber (also called a Skinner Box) was designed to teach rats how to push a lever. This behavior is not natural to rats, so operant conditioning with positive and negative reinforcement were performed in order to teach the behavior.



Positive Reinforcement:
A rat was awarded with food when he pressed the lever.

Negative Reinforcement:
A rat was able to turn off electric shocks produced by the floor by pressing the lever.



- ❖ Operant conditioning, sometimes referred to as instrumental conditioning, is a learning method that employs rewards and punishments for behavior.
- ❖ Through operant conditioning, an association is made between a behavior and a consequence (whether negative or positive) for that behavior
- ❖ For example, when lab rats press a lever when a green light is on, they receive a food pellet as a reward.
- ❖ When they press the lever when a red light is on, they receive a mild electric shock. As a result, they learn to press the lever when the green light is on and avoid the red light.

Operant Conditioning

Specific consequences are associated with a voluntary behavior

Rewards introduced to increase a behavior



Punishment introduced to decrease a behavior



- He created a device known as an operant conditioning chamber, often referred to today as a [Skinner box](#).
- The chamber could hold a small animal, such as a rat or pigeon. The box also contained a bar or key that the animal could press in order to receive a reward.
- In order to track responses, Skinner also developed a device known as a cumulative recorder. The device recorded responses as an upward movement of a line so that response rates could be read by looking at the slope of the line.

Reinforcement and punishment

- **Positive reinforcers:** the addition of a reward
- **Negative reinforcers:** the removal of a punishment
- **Positive punishers:** the addition of a punishment
- **Negative punishers:** the removal of a reward

Primary VS Secondary Reinforcement

- Something that is naturally reinforcing
- Examples: food, warmth, water, etc.
- The item is reinforcing in and of itself



- Something that a person has learned to value or finds rewarding because it is paired or associated with a primary reinforcer
- Money
- Grade
- Signs of respect & approval.



Punishment

- Anything that decreases a behavior
- Can be positive or negative
 - Positive doesn't mean good and negative doesn't mean bad!!!
 - Positive means adding a stimulus; negative removes a stimulus

Positive Punishment



You receive a speeding ticket (positive stimulus), which decreases your behavior of speeding (punishment).

Negative Punishment



Your driving privileges are taken away for a year because you were caught driving drunk (negative stimulus). This decreases your behavior of drinking and driving (punishment).

Schedules of Reinforcement

Ratio

Fixed

Variable

Interval

Reinforcement given
after action
completed a fixed
amount of times

Reinforcement given
after action
completed a varying
amount of times

Reinforcement given
after a fixed period
of time if action is
completed

Reinforcement given
after varying periods
of time if action is
completed

Schedule of reinforcement	<i>Example</i>
Fixed Ratio	A student receives a reward after a fixed number of times they perform a desired behaviour (e.g. a merit every time they attempt an extension question)
Variable Ratio	A student receives a reward after a variable number of times they perform a desired behaviour
Fixed Interval	A student receives a reward after a fixed period of time in which they perform the desired behaviour(e.g. a merit for working hard for 5 minutes)
Variable Interval	A student receives a reward after a variable period of time in which they perform the desired behaviour



**TRIAL & ERROR
THEORY OF
LEARNING:
E. L THORNDIKE**

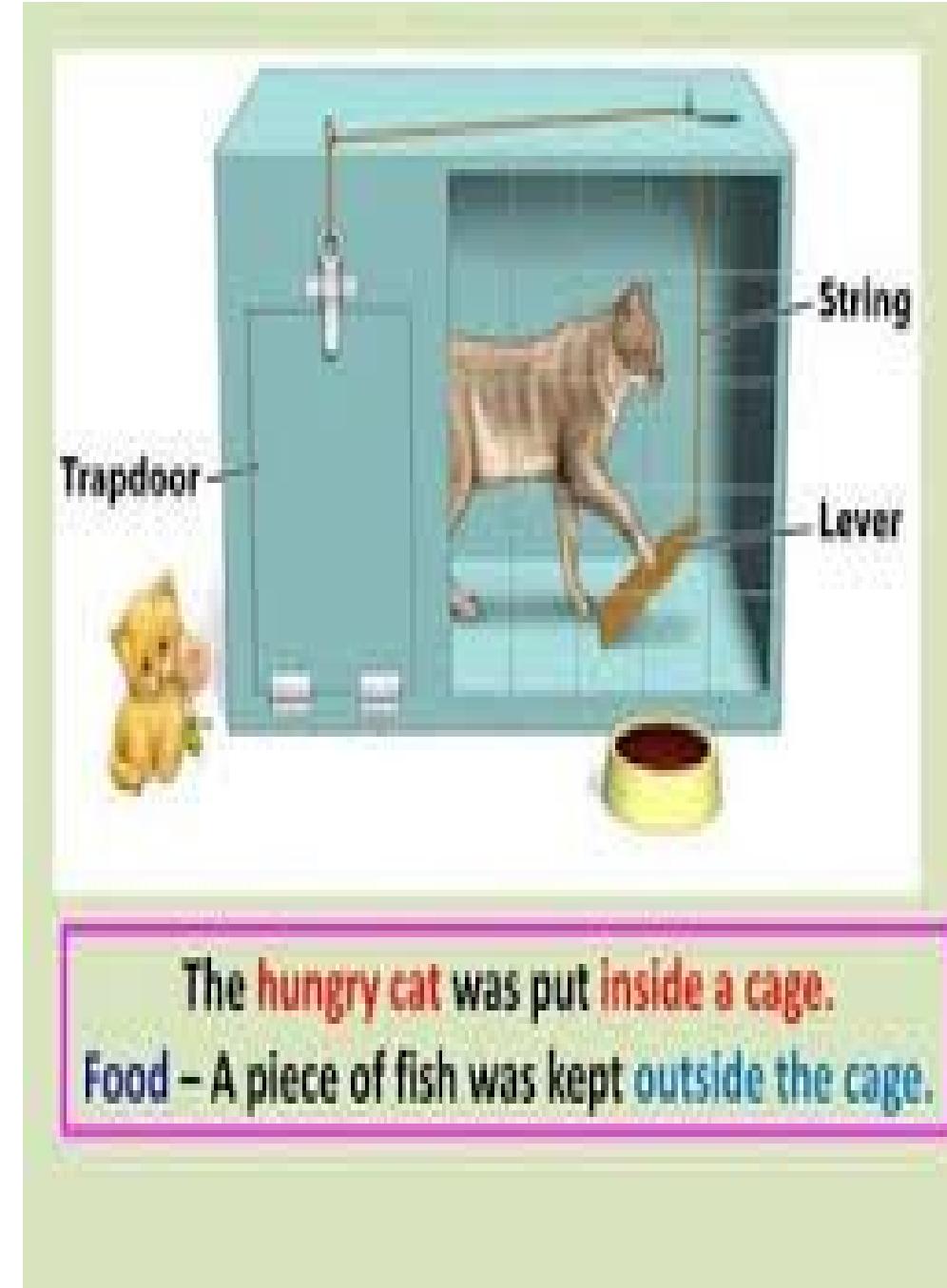
Trial and error learning

- E.L.Thorndike (1874-1949) was the chief exponent of the theory of connectionism or trial and error.

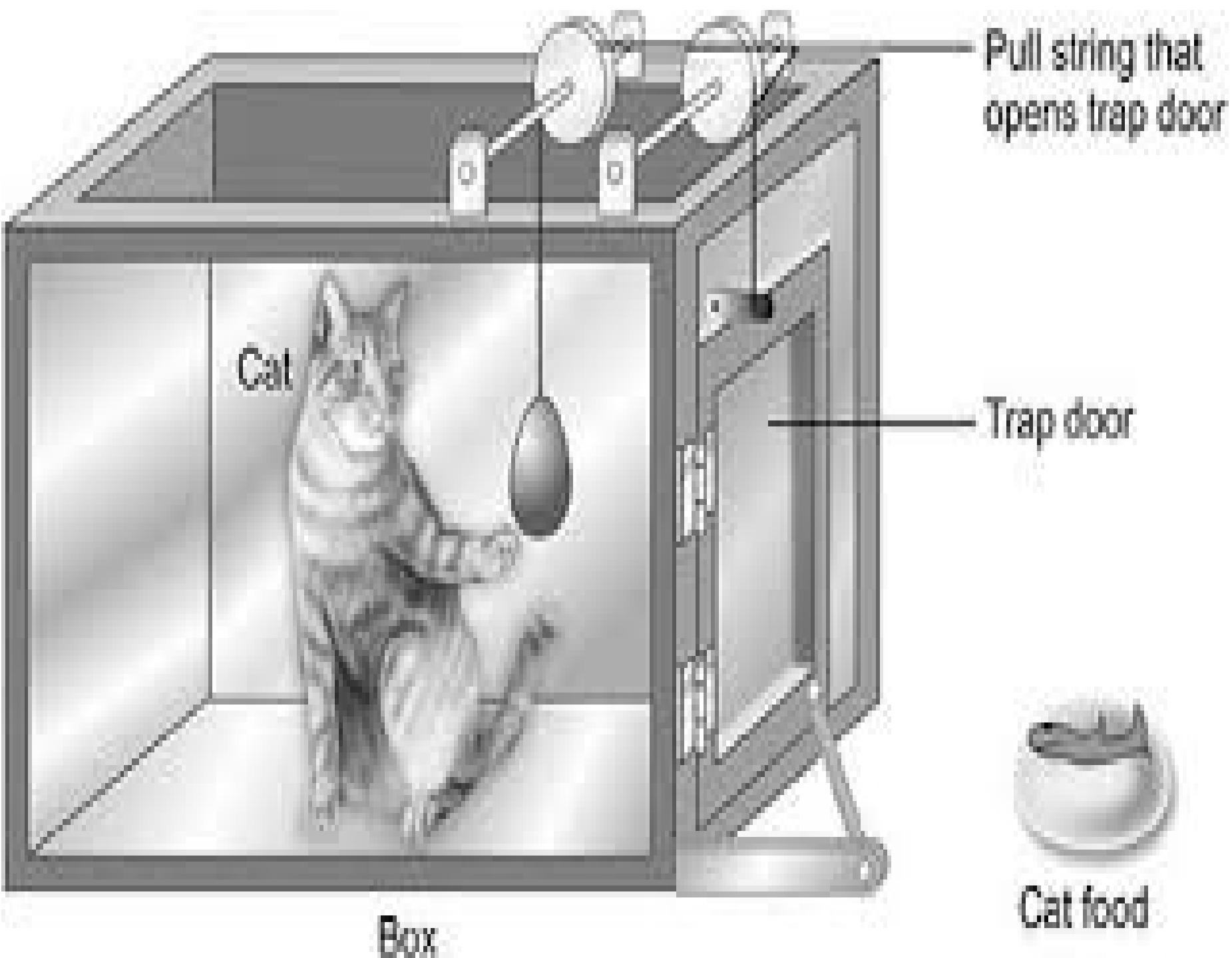
"Trial and error is a fundamental method of problem solving. It is characterised by repeated, varied attempts which are continued until success, or until the agent stops trying. ... Edward Thorndike showed how to manage a trial-and-error experiment in the laboratory."

Experiment

Thorndike formulated his theory, based on his experiments conducted on his cat in the puzzle box. The door of the box could be opened by pulling the strings inside the box. A fish was kept outside. The cat was tried to come out of the box by squeezing, jumping, biting etc. As the experiment was repeated for several times the wrong movements decreased and in the end the cat was able to open the door in a single trial.



The **hungry cat** was put **inside** a cage.
Food – A piece of fish was kept **outside** the cage.



Random movements of the cat



The Laws of Learning

On the basis of trial & error theory of learning, Thorndike formulated some laws of learning. There are three primary laws and five secondary laws of learning.

Primary Laws of Learning

- Law of Readiness
- Law of Exercise
- Law of Effect



Secondary Laws of Learning

- Law of Multiple Response
- Law of Mental Set / Attitude
- Law of Prepotency of Elements
- Law of Analogy
- Law of Associative Shifting

Law of Readiness

- the degree of preparedness and eagerness to learn
- Law of Action Tendency
- Individuals learn best when they are ready to learn, and they will not learn much if they see no reason for learning.

THE LAW OF READINESS

- The Law of Readiness implies a degree of concentration and eagerness.



LAW OF EXERCISE

This law explains the role of practice in learning.

According to this law:

“Learning becomes efficient through practice or exercise.”

This law is further split into two parts:

1-LAW OF USE: the learning are strengthened with repeated trial or practice.

2-LAW OF DISUSE: the learning are weakened when trial or practice are discontinue.



Law of exercise

1. Law of use:

With practice, the connection is strengthened.

2. Law of disuse:

When the practice is discontinued, connection is weakened.

Law of effect

The law stated that "any behavior that is followed by pleasant consequences is likely to be repeated, and any behavior followed by unpleasant consequences is likely to be stopped."



Law of effect

- Behaviour that is followed by a pleasant consequence is strengthened
 - more likely to occur again
- Behaviour that is followed by an unpleasant consequence is weakened
 - less likely to occur again

SECONDARY LAWS

1. Law of multiple response:

The law implies that confronted with a new situation, the organism response in a variety of ways before arriving at the correct response.

2. Law of attitude

Learning is guided by the attitude of the organism towards the task. The learner performs the task properly, if he has developed a healthy attitude towards the task.

3. Law of analogy:

An individual response to a new situation on the basis of the responses made by him in similar situation in the past, that is the organism makes responses by analogy.

4. Law of associative shifting:

The law states that "any response may elicited from the learner in associated with any situation to which he is sensitive."

Law of Prepotency of Elements

- The learner reacts selectively to the important or essential elements in the situation & neglects the other elements which may be irrelevant or non-essential.

THE ADDITIONAL THREE LAWS

- Law of primacy – learning should be done correctly for the first time since it is difficult to “unlearn” or change an incorrectly learned material.
- Law of recency – things that are most recently learned are often best remembered.
- Law of intensity – the more intense something is taught, the more likely it will be retained.

4. LAW OF PRIMACY

- Things learned first create a strong impression
- What is taught must be right the first time



5. LAW OF RECENCY



Things most recently learned are best remembered

6. LAW OF INTENSITY

- The more the intense the material taught, the more it is likely learned



Kohler Insight Theory of Learning



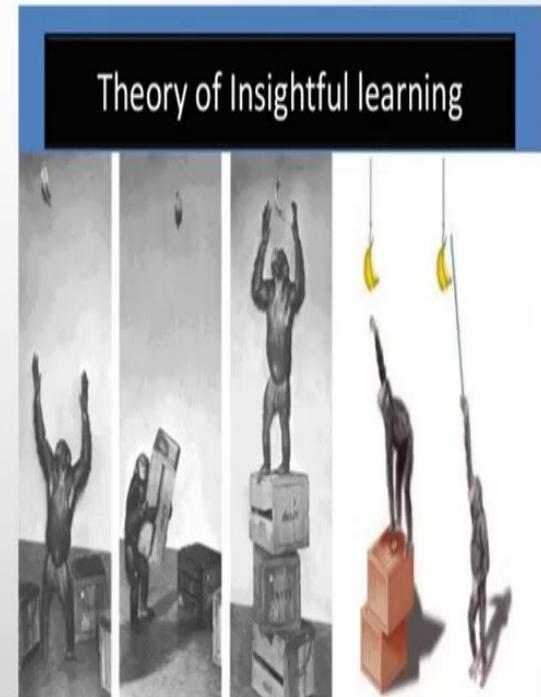
EXPERIMENTS OF INSIGHT LEARNING THEORY

KOHLER'S EXPERIMENTS ON SULTAN

(MENTALITY OF APES-1925)

1. EXPERIMENTS WITH BOX

2. EXPERIMENTS WITH STICKS



WHAT IS INSIGHT LEARNING?



• Insight learning is type of learning or problem solving that happens **all - of - a - sudden** through understanding the relationships of various parts of problem rather than through **trial and error**.

4-1-Insightful learning (Intellectual Learning)

- A cognitive form of learning involving the mental rearrangement or restructuring of the elements in a problem to achieve an understanding of the problem and arrive a solution .(Problem Solving)**
- Insightful learning was described by *Wolfgang Kohler* in 1920s,based on retrieve food and was offered as an alternative to learning based on conditioning.**



1887-1967

Insight learning - Kohler

- Insight learning refers to the sudden realisation of a solution of a problem
- After a period of mentally manipulation of aspects of a problem for a while
- Kohler experimented with Sultan the chimp who was caged with food strategically placed outside the cage.
- Some boxes and sticks were placed in the cage.
- Through some manipulation of these objects which got Sultan nowhere, he seemed to suddenly figure out that the sticks could be joined to get the food.
- He used Insight to solve similar problems



Theory of Insightful learning



Kohler's Experiment

- Kohler (1925) put a chimpanzee inside a cage. A bunch of bananas was hung from the roof of the cage. A box was placed inside the cage. The chimpanzee tried to get the bananas by jumping but could not get them due to height. The chimpanzee finally used the box placed below the hanging banana and climbed on the box and got the bananas.
- In another experiment, the chimpanzee required two or three boxes to reach the banana. The chimpanzee namely Sultan was able to learn placing of one box on the other and succeeded in getting the banana.
- In another experiment, a bunch of bananas was kept outside the cage. Two sticks were placed inside the cage. After several trials, the animal joined the two sticks and pulled the bananas in with a stick.

Characteristics of Insight Learning

- Insight is the sudden grasping of the solution to a problem.
- Insight alters the perception of the essential relationships in the total situation.
- Insight is facilitated by the previous experience.
- Insight is related to intellectual ability of the learner.
- Insight learning involves understanding and reasoning about the problem.
- Insight poses alternative mode of trial suddenly to solve the problem

Steps in Insight Learning

According to Kohler certain steps are involved in learning which are discussed below:

- ***Identifying the problem***- The motivated Teamer identifies the problems involved in attaining the goal.
- ***Initial efforts***- Initial efforts are in the form of simple trial and error mechanism.
- ***Incubation of ideas***-It involves a period of hesitation or pause' towards the problematic situation. During this period, the mind keeps the task alive.
- ***Insight development***- A flash of lightening comes in mind to solve the problematic situation.
- ***Repetition and Generalization***- After obtaining an insightful solution to the problem the individual applies it in another situation which requires a similar type of solution. The individual generalizes that similar problems require the same type of solution

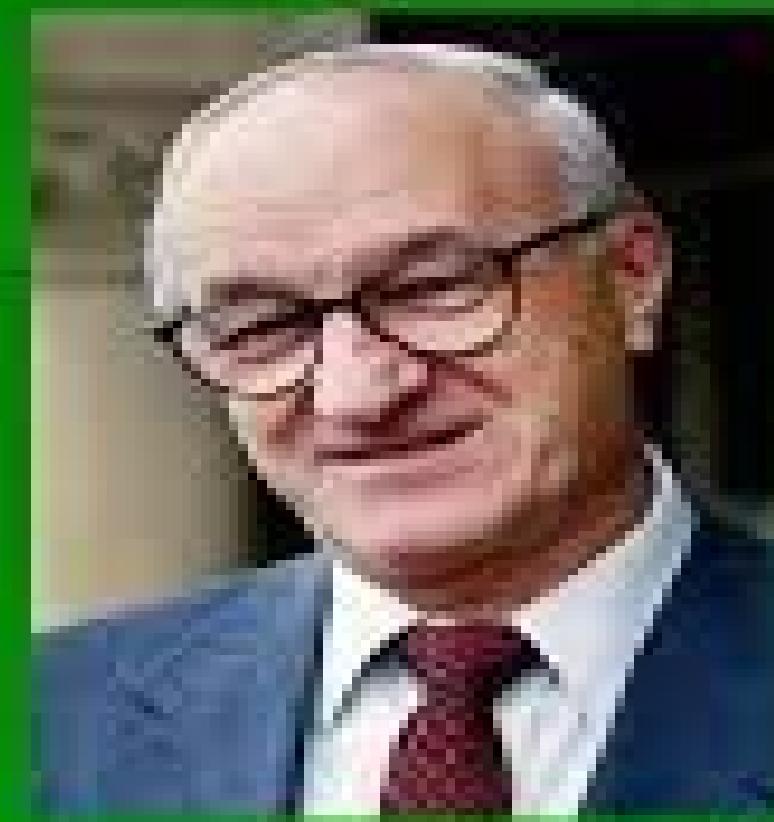
Insight Learning



Insight learning – Stages of Insight

- **Preparation** - Sultan tries to reach with his arms, tries to reach with one stick, all attempts fail
- **Incubation** - sits at the back of the cage and seems to have given up
- **Insightful experience** - realises he is holding both sticks and can join them together
- **Verification** - uses the double stick to reach the food.

Albert Bandura's Observational Learning Theory and Imitation



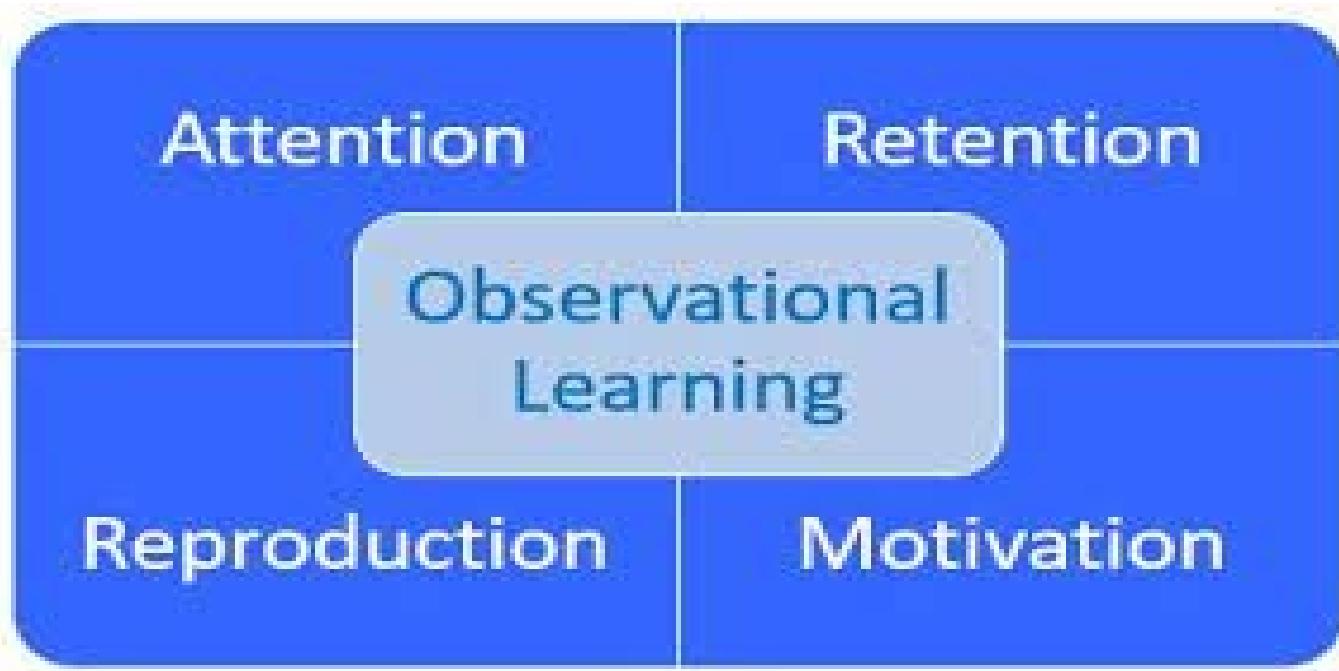
By: Lorraine Dighorn and Trudy Manganaro

Observational Learning

- **Observational learning**, method of **learning** that consists of observing and modeling another individual's behavior, attitudes, or emotional expressions
- **Albert Bandura**, was one of the first psychologists to recognize the phenomenon of observational learning
- **Observational learning (also known as vicarious learning, social learning, or modeling)** is a type of learning that occurs as a function of observing, retaining, and replicating novel behavior executed by others

- According to Bandura's research, there are four processes that influence observational learning:

- 1. Attention**
- 2. Retention**
- 3. Reproduction**
- 4. Motivation**

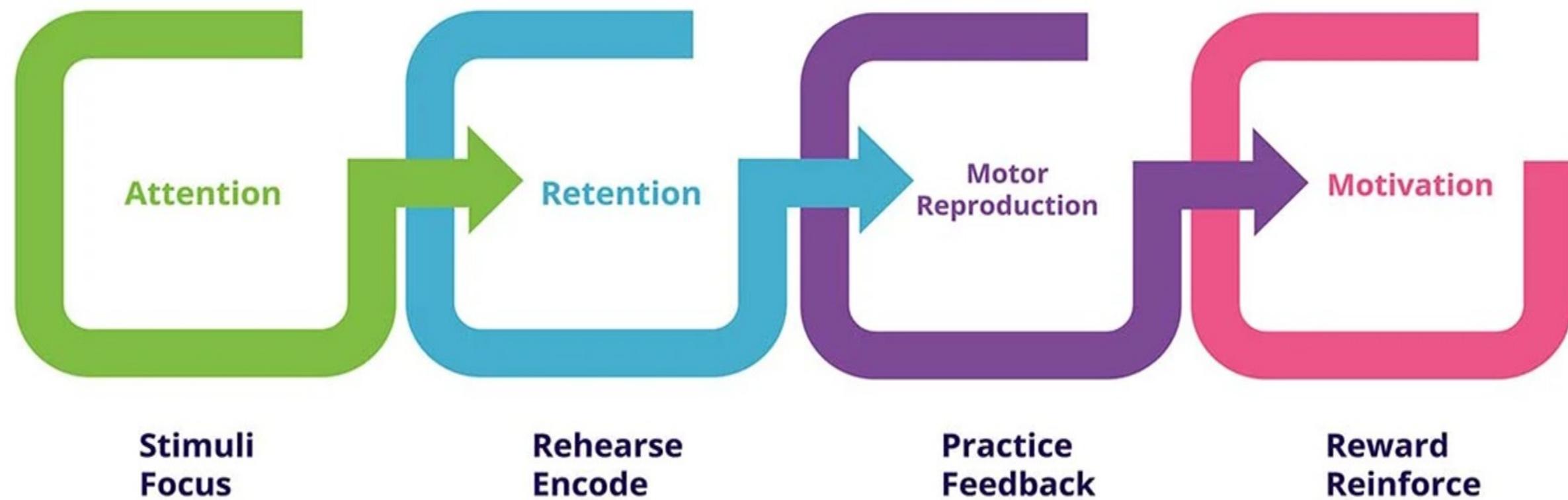


Attention

To learn, an observer must pay attention to something in the environment. They must notice the model and the behavior occurring.

Attention levels can vary based on the characteristics of the model and environment – including the model's degree of likeness, or the observer's current mood.

Social Learning Theory



Retention

- Simple attention is not enough to learn a new behavior. An observer must also retain, or remember, the behavior at a later time.
- To increase chances of retention, the observer must structure the information in an easy-to-remember format.

Reproduction

- Reproduction is the process where the observer must be able to physically perform the behavior in the real-world
- Often, producing a new behavior requires hours of practice to obtain the skills.

Motivation

- All learning requires some degree of personal motivation.

For observational learning, the observer must be motivated to produce the desired behavior.

- Sometimes this motivation is intrinsic to the observer. Other times, motivation can come in the form of external reinforcement – rewards and punishments.

Bobo doll experiment

- In the experiment, children were shown a video where a model would act aggressively toward an inflatable doll – hitting, punching, kicking, and verbally assaulting the doll. There were three different endings:
 1. The model was punished for their behavior
 2. The model was rewarded for their behavior
 3. There were no consequences
- After watching the model, children were given a Bobo doll, identical to that in the video. Their behaviors were observed.



- Researchers found that children were ***more likely to mimic violent behaviors*** when they observed the ***model receiving a reward, or when no consequences occurred***
- On the flip side – children that observed the **model being punished for violence** showed less actual violence toward the doll.