

**Indian Institute of Technology Kanpur**  
**National Programme on Technology Enhanced Learning (NPTEL)**  
**Course Title**  
**A Brief Introduction of Psychology**

**Lecture – 8**  
**Learning**

by  
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Now that we have seen how animals are trained by human beings and how we derive pleasure out of the way we see animals behaving around us let us come to the theories okay. We first come to the interesting theory, the first theory here in learning given by Russian physiologist Ivan Pavlov.

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**Classical Conditioning**



- Russian physiologist Ivan P. Pavlov
- Early 1900s: Mechanism of digestion
- Nobel Prize in 1904

What is called as classical conditioning, interestingly Pavlov's task was not to find out how many animals learn. He was not looking at classical conditioning at all, but he was basically designated by the Russian army of conducting a research on the mechanism of digestion.

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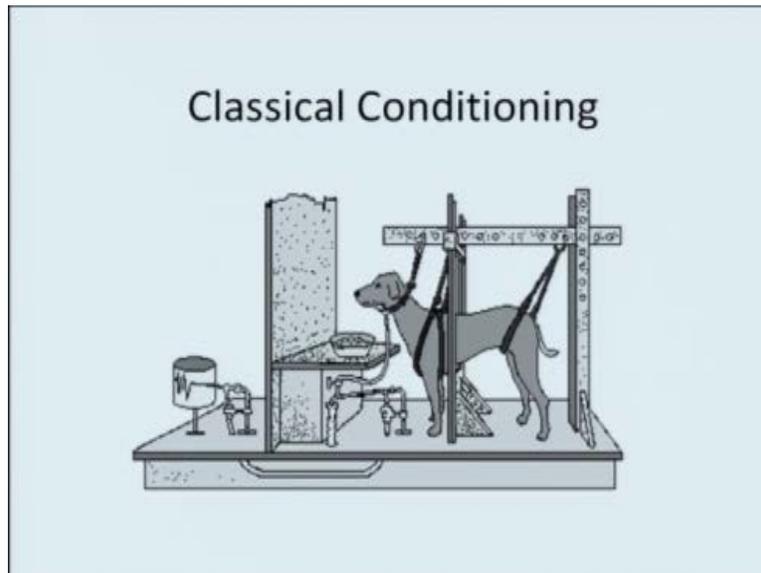
### Classical Conditioning



- Russian physiologist Ivan P. Pavlov
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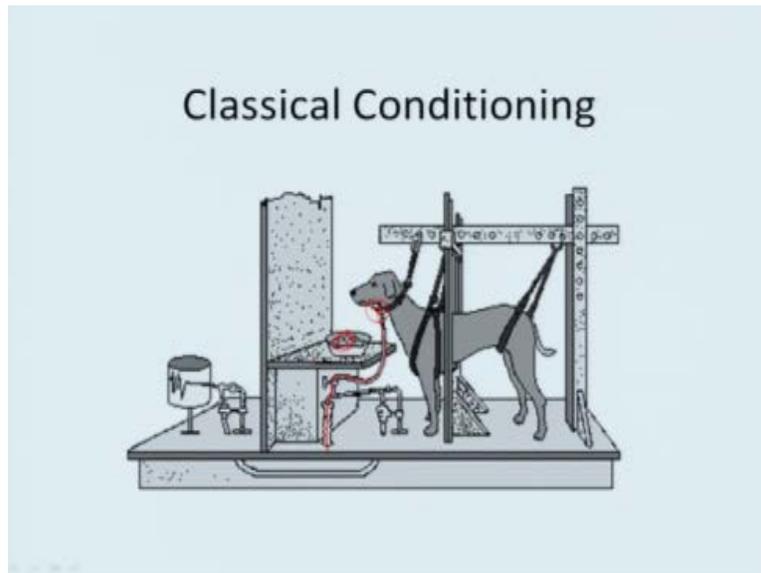
This was in early 1900s and for his noble work and the great theory that he came forward with Ivan Pavlov received Nobel Prize in 1904, now what actually wanted Pavlov had done.

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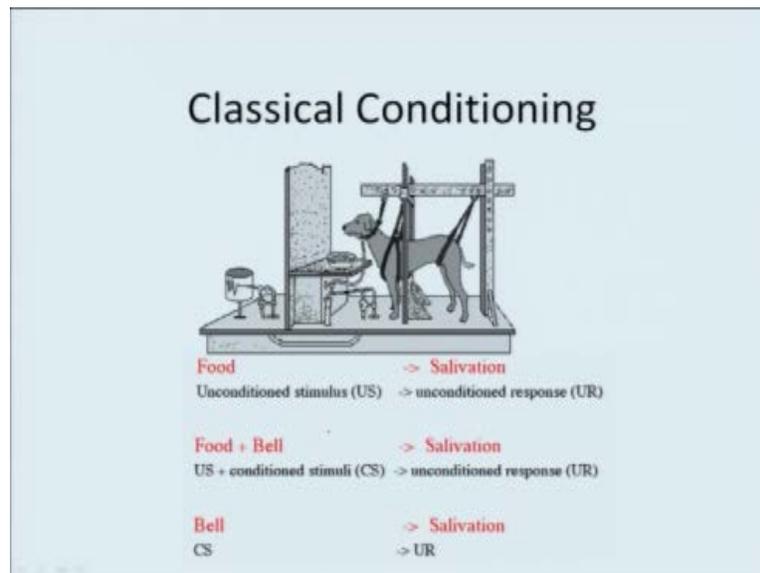
Was exactly what you see in this image. He took a dog the dog was fastened to two belts so that he could not make voluntary movements, his body remains stable and then a small surgery was performed such that the throat of the dog was connected to a tube and from that tube the saliva that was secreted by the dog would come and get collected in a beaker.

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Now you see this is the point where the surgery was performed and the actual intention was that whenever in this very plate, whenever the meat powder will be presented the dog would salivate. Once the dog salivates the saliva that gets collected here okay, will now travel from here and then get collected in the beaker there. So that was you know the basic experimentation that Pavlov had designed and what he did was that every time he would present the meat powder in the bowl there, the dog would salivate and every time the saliva would get collected in the beaker. This is what he, he adopted in order to understand the mechanism of digestion, but then something very interesting.

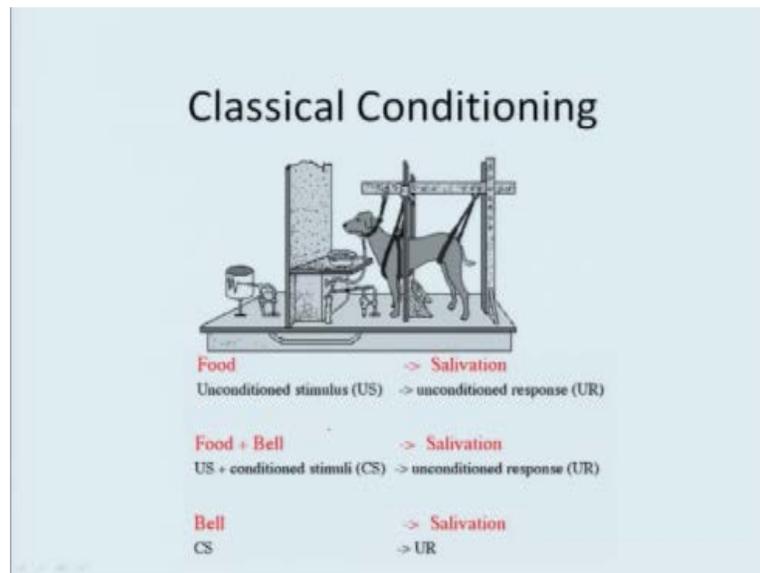
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Happened, in that very lab a bell was also being rung for some other purpose and what Pavlov observed was that initially the dog which was salivating on the presentation of the meat powder started salivating on the sound of the bell okay. So somehow although it was not part of the experimental protocol, although this was not the intention of the work that Pavlov was doing, what he realized was that the dog somehow had formed an association, the association was between the meat powder and the sound of the bell and these two things got associated okay.

So exactly what he found was that the food is presented, food is the unconditioned stimulus know, you are just presenting food and there is a biological mechanism okay, hunger is triggered by a biological mechanism there is a process of satisfaction that one derives out of having food okay, and salivation is again a biological process. So the urge for having food and salivation which was basically a biological mechanism got associated okay, with the sound of the bell. What actually happened okay, the food was presented, salivation took place.

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Food is the unconditioned stimulus, salivation is the unconditioned response because these are biological mechanisms. But then the dog what it started doing was that it associated the sound of the bell with the food, it thought that every time before the food is presented the bell is definitely rung, so sound of the bell got associated with the meat powder. Hence, next time onwards whenever the bell will be rung the dog used to anticipate that now definitely the food pallet will come okay, and this again led to salivation.

Now salivation which was basically a biological reflex okay, an unconditioned response again got conditioned to the association that was formed between the sound of the bell and the presentation of the meat powder, and then next step when the meat powder was not provided only bell was rung still the dog used to salivate anticipating that certainly the meat powder will get presented okay, and this is what Pavlov found.

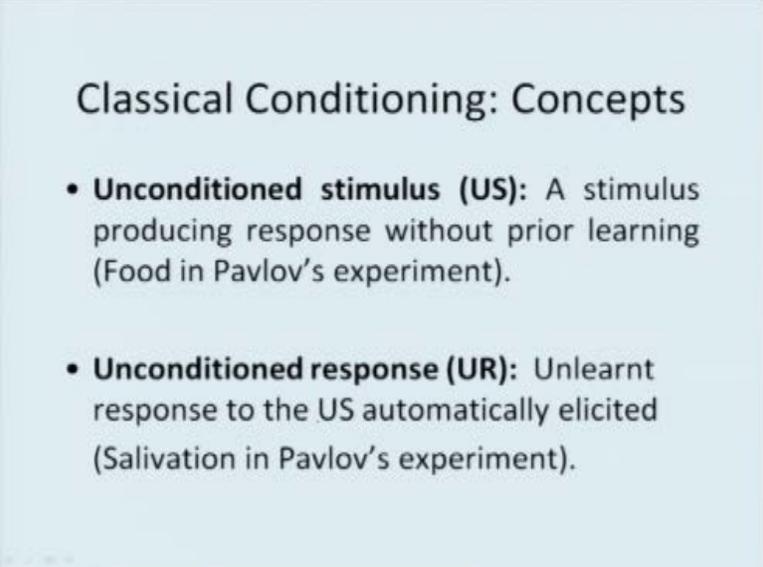
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## Classical Conditioning: Concepts

- **Unconditioned stimulus (US):** A stimulus producing response without prior learning (Food in Pavlov's experiment).
- **Unconditioned response (UR):** Unlearned response to the US automatically elicited (Salivation in Pavlov's experiment).

That the dog was classically conditioned, the natural response of the dog got associated with the sound of the bell which led to an anticipatory type of behavior. Now although we have used this word you understand the concept, let me repeat it again so that you remember it better. The major concepts in classical conditioning are unconditioned stimulus, unconditioned response.

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**Classical Conditioning: Concepts**

- **Unconditioned stimulus (US):** A stimulus producing response without prior learning (Food in Pavlov's experiment).
- **Unconditioned response (UR):** Unlearnt response to the US automatically elicited (Salivation in Pavlov's experiment).

Conditioned stimulus, conditioned response okay, rest all you understand. So a stimulus which produces response without prior learning okay, you have not learnt how to respond to that very stimulus, that the stimulus is unconditioned stimulus okay. Food in the, in this very experiment was unconditioned stimulus. The unconditioned response was.

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## Classical Conditioning: Concepts

- **Unconditioned stimulus (US):** A stimulus producing response without prior learning (Food in Pavlov's experiment).
- **Unconditioned response (UR):** Unlearned response to the US automatically elicited (Salivation in Pavlov's experiment).

Salivation okay, the dog had not learnt how to respond to the unconditioned stimulus, it was automatic process, it was a biological mechanism. So salivation was the unconditioned response, then the other two important concepts where you remove the un- and therefore it becomes.

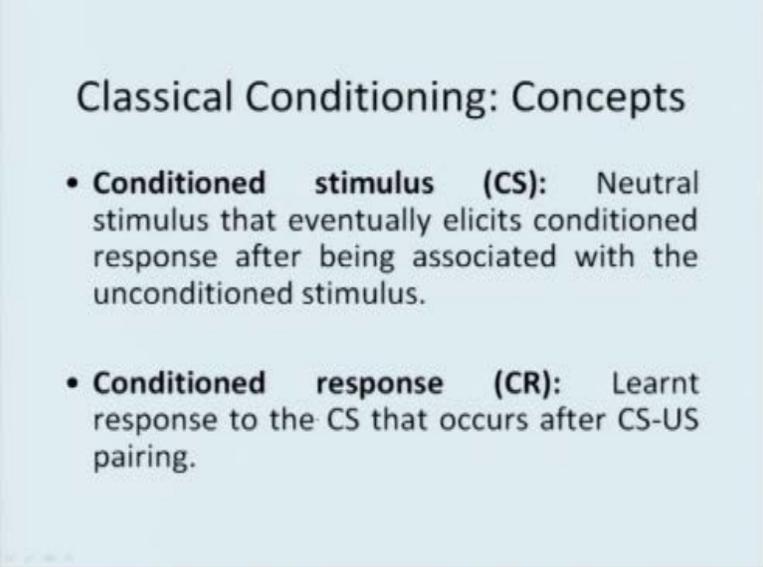
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## Classical Conditioning: Concepts

- **Conditioned stimulus (CS):** Neutral stimulus that eventually elicits conditioned response after being associated with the unconditioned stimulus.
- **Conditioned response (CR):** Learnt response to the CS that occurs after CS-US pairing.

Conditioned stimulus, conditioned response, what is a conditional stimulus? The neutral stimulus that eventually elicited conditioned response after being associated with the unconditioned stimulus so the sound of the bell and the meat powder both got associated okay, and conditioned response.

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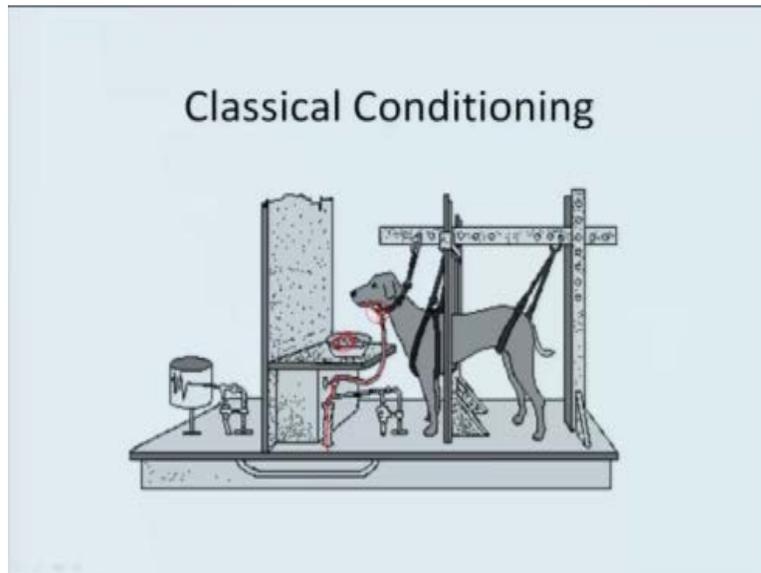


**Classical Conditioning: Concepts**

- **Conditioned stimulus (CS):** Neutral stimulus that eventually elicits conditioned response after being associated with the unconditioned stimulus.
- **Conditioned response (CR):** Learnt response to the CS that occurs after CS-US pairing.

Again remains the same but the learnt response here, what is called as conditioned response is basically that occurs after the CS-US pairing is taking place, the conditioned stimulus, the unconditioned stimulus that pairing is taken place. The unconditioned stimulus we discussed okay in the previous slide that.

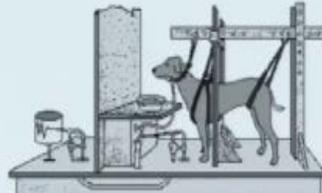
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The unconditioned stimulus was.

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## Classical Conditioning

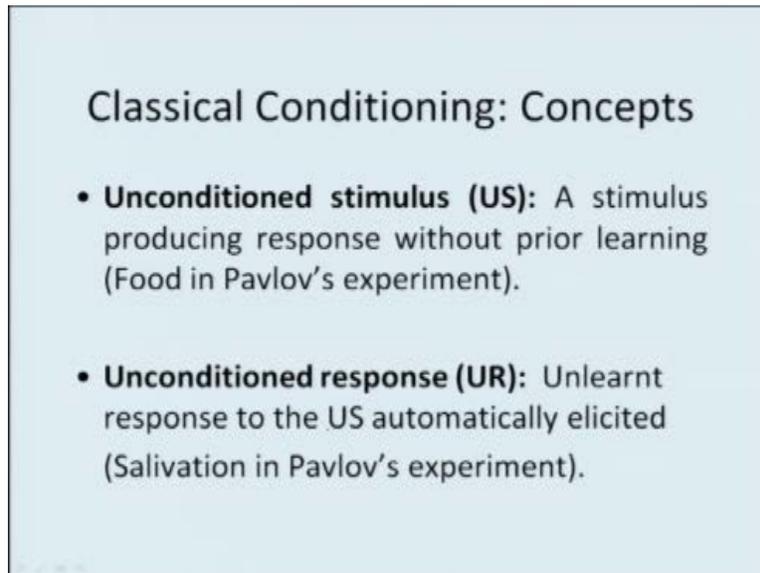


**Food** -> **Salivation**  
Unconditioned stimulus (US) -> unconditioned response (UR)

**Food + Bell** -> **Salivation**  
US + conditioned stimuli (CS) -> unconditioned response (UR)

**Bell** -> **Salivation**  
CS -> UR

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**Classical Conditioning: Concepts**

- **Unconditioned stimulus (US):** A stimulus producing response without prior learning (Food in Pavlov's experiment).
- **Unconditioned response (UR):** Unlearnt response to the US automatically elicited (Salivation in Pavlov's experiment).

The food okay, so the conditioned stimulus would be the sound of the bell.

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## Classical Conditioning: Concepts

- **Conditioned stimulus (CS):** Neutral stimulus that eventually elicits conditioned response after being associated with the unconditioned stimulus.
- **Conditioned response (CR):** Learnt response to the CS that occurs after CS-US pairing.

And because sound of the bell and the food both got associated and therefore the salivation which was actually initially in the first step was considered, considered as unconditioned response now becomes conditioned response. So what actually happens in classical conditioning?

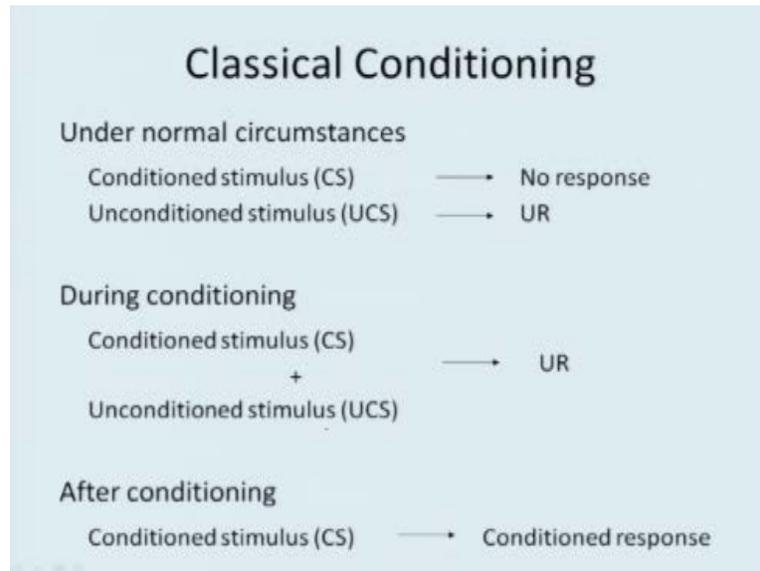
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## Classical Conditioning

- A neutral stimulus gets associated with a meaningful stimulus & acquires the capacity to elicit a similar response.
- It is a form of associative learning.
- It is the substitution & association of one stimulus for another.

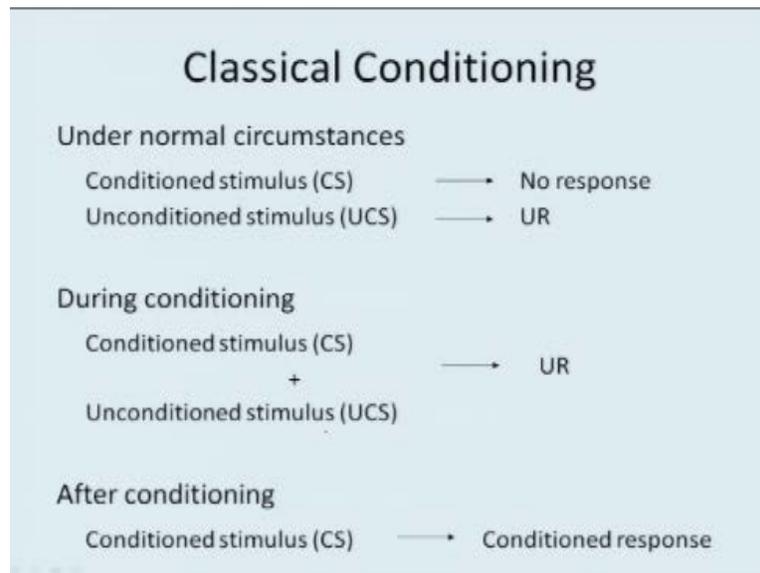
Basically a neutral stimulus gets associated with a meaningful stimulus and then it acquires the capacity to elicit a similar response okay. Again it is nothing but formation of association, so classical conditioning is also associated learning and it is the substitution and association of one stimulus for the other okay. So the sound of the bell replaces the meat powder, substitutes because it is associated okay. Now this is actually what happens no

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Under normal condition, conditioned stimulus leading to no response, unconditioned stimulus response leads to response okay, so when the dog was not classically conditioned even if the bell would be rung the dog will not salivate, no dog will not respond to sound of the bell okay. It has there is no association between the two, so initially sound of the bell is nothing but a conditioned stimulus but it leads to no response therefore it has no meaning for the dog. What has meaning for the dog? Food has the meaning for the dog. What is food in the normal condition? It is unconditioned stimulus.

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Okay, and therefore salivation was also an unconditioned response there, because it is biologically programmed to salivate. During conditioning what happened, the sound of the bell and the meat powder, the food both got associated and it was this combination that led to the unconditioned response, and after conditioning took place okay, now what was initially leading to no response. The sound of the bell, now stand alone sound of the bell can create salivation okay and hence salivation becomes a conditioned response okay. So this was what Pavlov now found, now the prerequisites.

(Refer Slide Time: 08:59)

## Classical Conditioning: Prerequisites

- **Contiguity** : Degree of association
- Conditioned responses develop when the interval between CS and US is very short.
- In many instances optimal spacing is a fraction of second.

For classical conditioning okay, you remember we discussed initially that contiguity, contrast, and similarity, these are the three primary facilitators of learning, this is these are the factors which know helps us form association. So, the prerequisites from classical conditioning.

(Refer Slide Time: 09:18)

## Classical Conditioning: Prerequisites

- **Contiguity** : Degree of association
- Conditioned responses develop when the interval between CS and US is very short.
- In many instances optimal spacing is a fraction of second.

Point of view would be again contiguity and contiguity will decide the degree of association. So the conditioned stimulus okay, will lead to a conditioned response which basically will develop when the interval between the.

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## Classical Conditioning: Prerequisites

- **Contiguity** : Degree of association
- Conditioned responses develop when the interval between CS and US is very short.
- In many instances optimal spacing is a fraction of second.

Conditioned stimulus and the unconditioned stimulus is very short, means the meat powder is being presented and simultaneously the bell is also rung. So temporally the difference between the two processes which are independent okay, the dog is not able to establish no it is so, so, so small. But had it been a little far off, you ring the bell and after a certain no elapse of time if the food was presented the degree of association would not have been stronger because the contiguity factors was not seen.

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## Classical Conditioning: Prerequisites

- **Contiguity** : Degree of association
- Conditioned responses develop when the interval between CS and US is very short.
- In many instances optimal spacing is a fraction of second.

So what happens the more and more is the, what you call lack of absence okay, so higher is the contiguity, shorter is the period between the conditioned and the unconditioned stimulus, stronger is the bond okay, the degree of association increases and there have been many studies which suggest that in certain types of learning the optimum no duration, the gap that you can afford is just fraction of seconds.

(Refer Slide Time: 10:41)

## Classical Conditioning: Prerequisites

- **Contiguity** : Degree of association
- Conditioned responses develop when the interval between CS and US is very short.
- In many instances optimal spacing is a fraction of second.

So you can understand okay, how important contiguity is.

(Refer Slide Time: 10:47)

## Classical Conditioning: Prerequisites

- **Contingency:** Predictability of the occurrence of one stimulus from the presence of another.

E.g.- Lightening followed by sound of thunder.

Light may make one put hands on the ears

The other prerequisite for classical conditioning is the contingency okay, contingency basically nothing but the predictability of the occurrence okay. So that once the bell is rung the dog would anticipate now definitely the meat powder will come, think of our own human experience. The fact we know that whenever there is a thunder storm we see the light first because it travels faster compared to the sound. But the moment you see no lightning you anticipate that you will now hear sound of the thunder okay. What is this, again this is contingency, this is predictability you know that this is how nature is designed.

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## Classical Conditioning: Prerequisites

- **Contingency:** Predictability of the occurrence of one stimulus from the presence of another.

E.g.- Lightening followed by sound of thunder.

Light may make one put hands on the ears

You know that all lighting will be followed by the sound of the thunder, reason being this is how it is programmed. Because these two things the light and the sound they travel at different speeds, so right from no, the space to our year it take little more time, the sound takes little more time compared to light. But because we know that this is by default going to happen, so therefore the moment we see the light we anticipate the sound okay, and anticipating the sound what we do, we close our ears.

Because we anticipate that the sound will be unbearable, it will be extremely loud. You have seen the light and you close your ears okay, this is how we respond and this is nothing but the importance of contingency. And the third important factor, that is the reflex okay.

(Refer Slide Time: 12:22)

## Classical Conditioning: Prerequisites

- **Reflexes:**  
Automatic stimulus-response connection

So reflex basically the automatic response and stimulus connection it is formed. A stimulus leading to response and how automated it becomes. The more and more automated it becomes the more faster it becomes okay, it becomes a part of your reflex. Because of contiguity okay, you know that if X has happened Y is by default arriving. You form a very strong bond, and this strong bond leads you to design a response which also is extremely fast okay. Imagine situations where you do things in a much more reflexive order.

For example now if you are riding okay, and you see no a smallest object coming from one side of your visual field. Suddenly you would try to have control over the break mechanism, because you anticipated something that is moving towards you is by default going to come very near to you and it might lead to accident okay. So the three prerequisites contiguity, the first important thing that we discussed contingency.

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## Classical Conditioning: Prerequisites

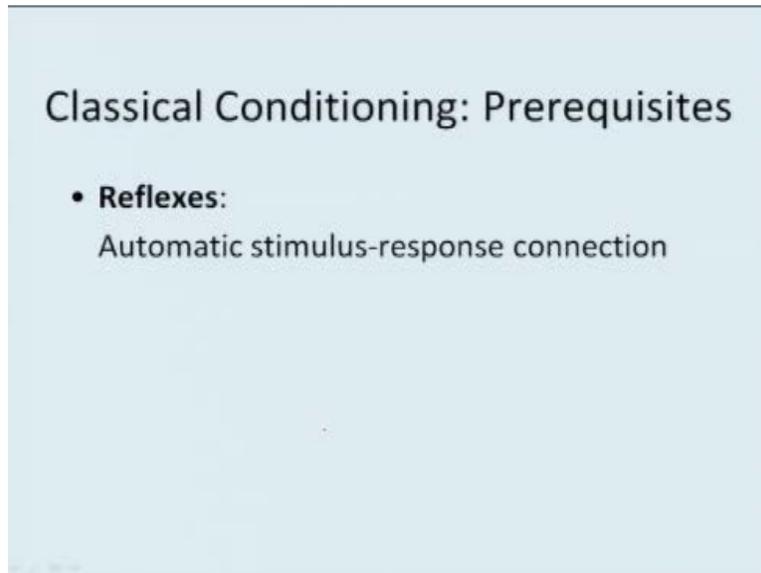
- **Contingency:** Predictability of the occurrence of one stimulus from the presence of another.

E.g.- Lightening followed by sound of thunder.

Light may make one put hands on the ears

The second important thing.

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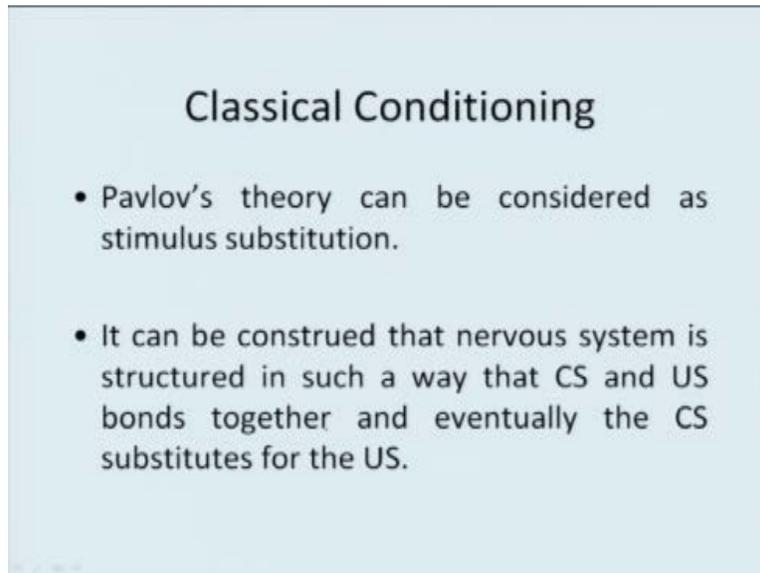


## Classical Conditioning: Prerequisites

- **Reflexes:**  
Automatic stimulus-response connection

And then reflex the third important thing, these three prerequisites are therefore classical conditioning to take place.

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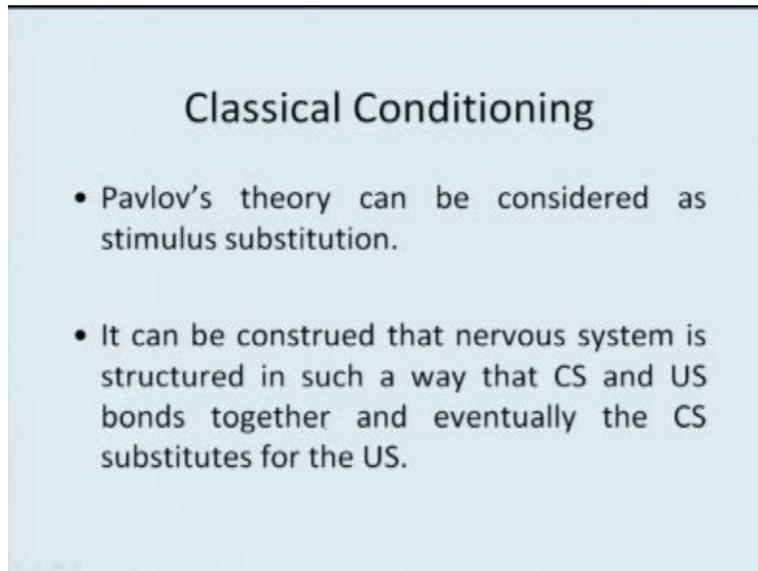


### Classical Conditioning

- Pavlov's theory can be considered as stimulus substitution.
- It can be construed that nervous system is structured in such a way that CS and US bonds together and eventually the CS substitutes for the US.

Now you can consider Pavlov's theory as a stimulus substitution theory okay, it can be construed.

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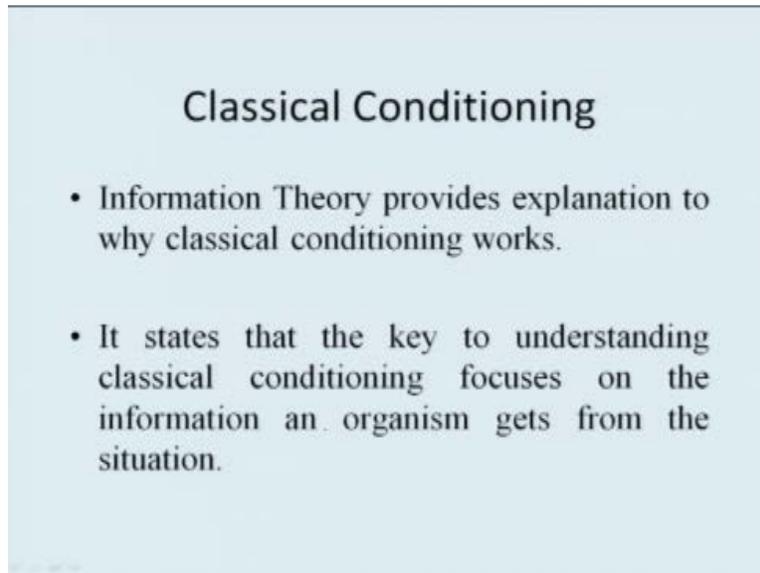


### Classical Conditioning

- Pavlov's theory can be considered as stimulus substitution.
- It can be construed that nervous system is structured in such a way that CS and US bonds together and eventually the CS substitutes for the US.

That nervous system is basically structured in such a way, that the conditioned stimulus and the unconditional stimulus, the bond between them okay, they get form and eventually the conditioned stimulus substitutes the unconditioned stimulus. So of course learning takes place in the brain there would be some chemical, neuro chemical signature of learning, this has taken place in the nervous system and then what happens CS, US bond is formed and eventually the CS will substitute the US okay. So that is the reason why Pavlov's theory can also be considered as stimulus substitution theory. Now the information theory provides explanation to.

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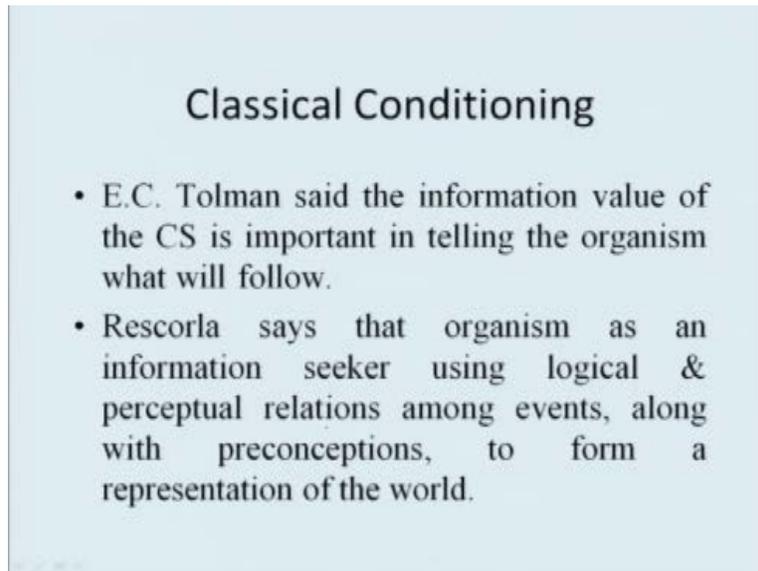


## Classical Conditioning

- Information Theory provides explanation to why classical conditioning works.
- It states that the key to understanding classical conditioning focuses on the information an organism gets from the situation.

The fact as to why is it that we get classically conditioned. It says that the key to understanding classical conditioning is that the information an organism gets from the situation okay.

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### Classical Conditioning

- E.C. Tolman said the information value of the CS is important in telling the organism what will follow.
- Rescorla says that organism as an information seeker using logical & perceptual relations among events, along with preconceptions, to form a representation of the world.

Two important people, their contribution is worth mentioning here, Tolman said that the information value of the conditioned stimulus is important in telling the organism okay, what has to be followed? And Rescorla said that the organism as an information seeker usually uses the logic and perceptual relation among the events okay, along with the preconceptions to form the representation of the world okay, and it is this information processing strategy that leads to, that results in classical conditioning.

Now let us look at one question, if the conditioned stimulus substitutes the unconditioned stimulus okay.

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**Classical Conditioning**

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

**Leon Kamin's Experiment (1968)**

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

The two stimuli should produce similar response or are they supposed to produce dissimilar responses. And in this context let us take the experiment done by Kamin. What Leon Kamin did was that a rat was conditioned by repeatedly pairing a tone of sound and electric shock, now tone of the sound is the conditioned stimulus and the electric shock is the unconditioned stimulus okay. And this pairing was done until the tone alone produced a stronger conditioned response okay, and here of course conditioned response will be fear. So just like Pavlov's experiment, where the sound of the bell will come and the food will be presented

Here the sound will be given and along with sound electric shock will also be given and the rat no will develop fear for it, it went to the extent that now even though electric shock was not given only the sound was generated the rat would produce fear. Now when you know Kamin started analyzing the results.

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## Classical Conditioning

### Leon Kamin's Experiment (1968)

- The tone continued to be paired with the shock, but the light (second CS) was turned on each time the tone was sounded.
- Even though the light & the shock were repeatedly paired, the rat showed no conditioning to light.

He found that the tone contributed to the, to be paired with the shock. But when he tried to pair this with the second conditioned stimulus that is light, he realized the light when it was turned each time the tone was sounded okay, basically this was again stimulus substitution, electric shock associated with the tone, now tone as well as light both are given to understand it, is it that if tone is replaced by light, will light also induce similar fear okay, and even though the light and the shock were repeatedly paired

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## Classical Conditioning

### Leon Kamin's Experiment (1968)

- The tone continued to be paired with the shock, but the light (second CS) was turned on each time the tone was sounded.
- Even though the light & the shock were repeatedly paired, the rat showed no conditioning to light.

It was realized that the rat did not show that conditioning to light okay.

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## Classical Conditioning

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

**Leon Kamin's Experiment (1968)**

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

So the question that we were asking was that is it if that conditioned stimulus substitutes the unconditioned stimulus, it is that two is different type of stimuli elicits similar response, and Kamin's experiment now shows that no that is not true.

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