Memory
Prof. Manish Kumar Asthana
Department of Psychology
Indian Institute of Technology Roorkee

Lecture - 4
Methods of Studying Memory - II

Hello everyone, I welcome you again in the lecture series of memory. Today we are going to start lecture number 4. As we studied in previous lecture about the measures of memory, recall and recognition, along with the different type of approaches in memory research, here we are going to start with the differences. What is the difference between the recall versus recognition? Many a time, researchers always ask this question, how recall is different from recognition?

Is it same? Because as we know that these both are the memory measures, so they may be using the similar mechanism or maybe having the identical neural mechanism. The answer to this question is that these two memory measures may be sharing the similar mechanism, but they are not identical in nature. They are very distinct from each other at behavioral level and anything which is distinct at behavioral level is going to be distinct at neural level. So, if two individuals are performing differently, and having different memory performance, then you can understand their ability to acquire at neural level will be very very distinct from each other and as per their responses.

So here when we talk about the recall, we talk about the generation of memory where individuals generate the information. Here the individual generate information based on the consolidated information or experience which he or she has acquired in his lifetime. But when we talk about the recognition, then we are talking about the matching of the provided choices with the existing knowledge or the consolidated knowledge an individual is having. So here what we say, what we can see, if you ask an individual about a car, recall a car, then the car can be blue in color., the car can be green in color, the car can be yellow in color, white, orange or even red. Now, when we talk about, when we bring specificity here, when we talk about, please recognize a blue color car which you have seen crossing your house in the morning.

Then this matching has to be related with this car. The individual is not going to recognize that this is a blue car because this is going to be a wrong answer. We know the distinction between the two colors. So to have a matching with the provided choices is something which we call as recognition. So here when we are talking about the recognition of the blue car, then the answer to this is this.

But when we talk about the recall, a car or recall any car then anything can be recalled here. Now even here in the recognition one could even ask 4 seater car, 6 seater car, 7 seater car or a lorry which is only going to carry the objects from here from one place to the other place. So, the difference between recall and recognition is very simple; in recall we are generating the memory and in recognition we are matching the choices with the consolidated information which one has acquired. In both cases recall and recognition, people are going to have some consolidated knowledge based on their experience and based on their insight. Now moving further down the line, it is very important for us to understand how this implicit learning how this implicit memory how associative learning occurs. Why is it important for us?

Because for any form of recall or recognition when we are talking about, in recognition also we are matching, and for matching we have trying to associate one information with the another information. So, this in this classical experiment done by Ivan Pavlov the great scientist. He accidentally came across the associative learning and which later turned out to be an implicit learning and then conditioning model and conditioning paradigm he gave. Why did I say that accidentally he came across this model? Because

he was trying to understand the gustatory process of human beings and while studying the gustatory process he used the animal model and in the animal model he used the animal dog.

So, he was training the dog to eat the food and after the dog has taken the food, he was trying to understand how much time an animal takes to digest the food. While understanding these processes, he observed one unique characteristic in the animal. The animal was given the food and he was eagerly waiting for the food to come. The indication that the animal was waiting for the food, the animal was wobbling his tail. What he observed is that after few trials of giving animal the food, the animal started not only to wobble the tail, but also to salivate.

The salivation was the measure which Pavlov was taking into consideration to study the digestive system. But what he observed is that when the food was also not there, then also dog was salivating and the reason for his salivation was that the food bowl which was being present in the environment and this food bowl was empty. But now the food bowl which was kept in the store wardrobe, or hidden was now visible to the dog. So dog assumed that the food is going to be provided to him, as a result the dog started to salivate. Pavlov observed this behavior of the animal and started to wonder why the

animal is behaving in such a way. Similarly, dog also started to salivate when every time dog was seeing the Pavlov or the other experimenter nearby.

Pavlov was little confused why the animal is salivating when the food is absent in the environment. Seeing the bowl, seeing the experimenter doesn't make any sense. Even when the animal was brought back to the chamber, the chamber, the context, the room is the context. So when the animal is being brought in that same context, what Pavlov observed, that animal was salivating as well. This was a very distinct behavior reflected and shown by the dog.

So, Pavlov was wondering that what is happening here? That when the experimenter is there, when the room is there, when the bowl is there, animal is salivating and even when the food smell is there, before the food is being brought to the dog, the smell also made dog salivate, and when the association with the bell. All these made animal salivate which indicates that the animal has learned to salivate indirectly, implicitly about the food is going to be given to him. This type of association Pavlov gave called it as conditioning. So, this associative learning was the standard procedure and conditioning became the very well-known established paradigm in the discipline of learning and memory.

Till date researchers are using the paradigm of conditioning extensively. We will be discussing about this paradigm in detail. The point to discuss the associative learning here is to reflect upon the implicit measures, implicit learning which animal is doing here. So, moving further, another type of measure, another type of assessment of memory performance is implicit memory test. Like memory recall, memory recognition, implicit memory test is also one such paradigm.

So, implicit memory test draw on the non-conscious aspect of memory. When an individual is not conscious, not aware what is happening, just like the dog, I explained it to you minute ago. There is no food, but still unconsciously dog is expecting, anticipating, assuming the food is going to be given to him. And in the presence of experimenter, in the presence of the room, in the presence of the bowl, they start to salivate. Many a time, human implicitly perform the similar way, like you are driving a car and you stop when you see a crowded road ahead of you.

When you approach to grab a coffee from a coffee machine, you are unconsciously careful to grab a coffee, make a proper distance so that you should not burn yourself, neither the people around you. So, a very traditional experiment performed by Eich in 1984, he presented two streams of stimuli, auditory stimuli to the participants in both of their ears. In one ear, they presented a sentence, "The men took photographs of the grizzly bear". And then, in another ear, "The fencers flashed their swords of cold steel at each other". Now, when these two sentences were being presented to the participant, then the participant has to do a spelling test.

They were being exposed to these two sentences and then a list of words were being shown to them. What were these list of words? Bare, bear, steal and steel. Now, what is common in this? They sound alike.

The words are sound-alike. Bare and bear. Steal and steel. But the meaning, semanticity of these two words are very different from each other. What was seen, that the participant who were being exposed to these two sentences before the spelling test, participant responded equally to these sentences.

The experimental group responded equally to both the words. Because they were being exposed to these words and unconsciously because they were being exposed to these two sentences that affected their performance in spelling test versus the control group where the participants were not being exposed to these two sentences they clearly spelled out the word bear b-e-a-r or the steel s-t-e-e-l. So what we understood here that the exposure alters the participants memory performance implicitly and that is why this is implicit memory test is there to test the interference effect to test how the prior exposure of the information alters your memory performance. So if you are familiar with the word, if you are, if the word is highly dominant to you, if you are frequently using a word, then frequency, familiarity, dominance may affect your spelling test. That is why the context also plays a major role.

In some context, some colours hold more cultural values than the other. And these colours influence and implicitly affect the individual's performance. Now, another measure to this is the reaction time measure. In reaction time measure when we are

talking about it is measured as the amount of time required to perform a particular task. Generally, in reaction time, the individual in this task has been asked a question, yes or no.

Observe the differences between the two. Identify the anomalies. And in doing so, an individual has to reply or respond as quick as possible. As I was telling you earlier, the reaction time and accuracy is a common measure in the cognitive psychology domain and discipline. So these two methods reaction time and accuracy seems to be the highly used memory measures in the discipline of memory research.

So, here a particular task is given to an individual and it is expected from the participant to respond as quickly as possible. For instance, arithmetic problem, how quickly an individual can solve an arithmetic problem. Now, reaction time, the same reaction time plays a major role at the time of IIT-JEE entrance. Individuals whose reaction time is quick, fast, they tend to solve more number of problems in the exam. However, reaction time alone is not going to decide the performance of an individual. Reaction time, along with accuracy is going to decide the memory performance of the individual. so the individuals who are responding quickly along with accuracy are going to have a better chances to get admitted and selected in IIT-JEE screening examination. Longer the reaction time is usually reflects more internal cognitive processing.

When we talk about the more internal cognitive processing, one has to be clear that memory alone doesn't take place at any single time point. Along with memory processing, attentional resources are there, perceptual processing is happening, decision making is happening, reasoning is happening, working memory is undergoing a lot of processing, long term retrieval, long term memory information access is there. Collectively, these processing are happening at the same time. So, longer the reaction time indicate that the problem might be ambiguous in nature, a problem might be complex in nature, a problem requires multiple cognitive processes. As a result, the response time the reaction time increases by default. Longer the reaction time is in a cricket game people may lose the game. Similarly, in such kind of thing, we have seen smaller the reaction time usually reflect less internal cognitive processing.

So, if an individual is taking less reaction time, this means that individuals are doing the processing is very easy and simpler in nature. But the nature of the cognitive task may vary from individual to individual. Some individuals may feel or like the arithmetic problem than the others. As a result, these reaction time may vary. So, it is instructed to the researchers beforehand that when they are conducting a study, they have to ensure that the person should not be familiar with the task.

If you are familiar with the task, your reaction time get better and better. And what we have seen in memory literature is that, when initial phase of the experiment, participants are little slow, less responsive, less reactive and less accurate. But as the task progresses, their accuracy, their reaction time gets better and better. One should also ensure that such reaction time measures which is being acquired in a closed room in a controlled environment is very different than the reaction time which individuals encounter in the real and open environment. Your reaction time crossing a highway or reaction time crossing a heavy traffic road will be very different than when you are conducting the study in a closed environment.

How long it takes to decide whether or not word had appeared in the experiment earlier? That is also reaction time in memory literature. People have been doing it. A list of words is given just like earlier I was telling you the recognition test where old and new is there. So, a list of words are given to you, and then your reaction time is being asked if the word appeared in the list or not.

So, for example, sun, wind, shoe, blood, bear, bare. And when this list of words are being shown to you, it is being shown to you less than 500 milliseconds, sometimes less than 50 milliseconds. And then in the test phase, it is being asked, shoe was being presented to you or not? So you have to quickly respond. Yes, I have seen this list of words.

So, series of presentation in the randomized fashion is being done, shoe is being presented, bear is presented, wind is presented. Let us say if I present you apple and ask you, apple is presented to you or not? So, reaction time should be no, but how quickly you are responding it is going to decide your memory performance. What has seen is that reaction time is less for the high frequency reaction familiarity and dominance of the

word so which means that your response time is very fast because you are familiar with the word you are frequently using a word and those words are highly dominant so if the words are being taken from your state from your city which then you are familiar with those words

So, your response time towards those words will be very high. If you are coming from a Hindi speaking state, then your response towards the Hindi word will be very fast. If you are coming from Telugu speaking state, then the words used from Telugu will be, you will be responding it to, will be very fast. Tamil words, similarly Tamil words, Punjabi words. So, this familiarity, frequency, dominance plays a major role in your reaction time.

Moreover, reaction time is less for the rare and emotional word. Rare and emotional word, which means that the words which are very, very rare in nature, you will respond to them very fast. The words which have high emotional value, high emotional value, blood, cut, knife, kill, death, these are all emotional words, negative emotional words. People tend to respond faster. Similarly, marriage, happy birthday, these are positive emotional words.

But their reaction time will be higher than the negative emotional word. Because negative emotional word grab attention faster, and we respond to more in relation to the positive word. So, this rare emotional words, high frequency familiarity dominance alters your reaction time. In some studies, we have seen the effect of age also in reaction time. So, what we have studied in this lecture? In this lecture, we studied about the recall versus recognition, how recall and recognition are different from each other. Recall is generation of memory from your consolidated memory or from your experience memory the moment i say apple you know what apple is.

If I ask you to write an essay on cow, you know what cow is. Two-legged animal with a horn, white color, domestic animal. So, you generate the memory. In contrary, recognition, where you are having several options available to you and you are doing a matching to it. You match the words.

You match the letters together. You match the images, you match the stimuli. And in the case example which I showed you, if you have to recognize a thief, then you recognize

the features, facial features, facial expression, body languages to that available choices to you. Then we also discussed about the associative memory where we discussed about the, where we discussed briefly about the conditioning and Pavlov, Ivan Pavlov's conditioning experiment where dog's salivation is an indicator that how the dog is implicitly learning about the context and associating this context with the food. How dog is associating a smell with the food?

How dog is associating experimenter with the food? How dog is associating empty bowl with the food? And this implicit learning, this associative memory, which we get an insight from the Pavlov's experiment. We have been using this conditioning model till date to understand the underlying neural mechanism of associative and implicit fear learning memory. Along with fear learning memory, we are using conditioning model to study different types of memory.

And the nature of memory, how these associations are forming, how the dissociation is forming, what type of neurons are assembling together and helping in the association of this information and the underlying neural mechanism. Then we talked about the implicit memory test, how this implicit memory test is being conducted and how it is being tested and it becomes an indicator of the memory performance. Such an insight gives an understanding to us that how quickly people form a memory and, how the frequency, familiarity and dominance of such information alters your memory performance. We even understood that the rare words, emotional words play a major role. One should be noting here is that the emotional word and rare word have better preferences or evolutionary, ecologically in all types of memory measures.

So in recall, recognition, implicit, reaction time, they have benefit over the other types of words, positive, neutral words. And then we discussed about the reaction time. Reaction time we understood. Complex the task is, high demanding the task is, reaction time will be more. Easier the task is, less demanding the task is, less reaction time will be there.

Reaction time is faster and quicker, lesser, sorry, reaction time is lesser for the rare and emotional words. Reaction time is lesser for familiarity, highly familiar, highly frequent, highly dominant word. Reaction time is higher for the less frequent, less familiar, less

dominant word. With this, I will end this lecture today here and in next lecture series, we are going to study the new topic. Thank you all for your kind attention.