

**Memory**  
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**Lecture - 37**  
**Metamemory- II**

Hello, I welcome you all to the lecture series on memory. Today, we are going to extend our discussion on metamemory. Earlier, we discussed metamemory, the processes, and how monitoring and control contribute individually to the acquisition, retention, and retrieval process. We even discussed the multifunctions, along with the flexibility of the system itself. On one hand, when monitoring provides a lot of flexibility, functionality, and functions to metamemory and towards encoding, retention, and retrieval, at the same time, the control processes are less flexible, trying to be more specific towards acquisition, retention, and retrieval.

We even discussed The feeling of knowing and tip-of-the-tongue, and in some aspects, we also discussed the judgment of learning. Now, the judgments of learning we are going to discuss in detail in today's lecture. In addition to that, the feeling of knowing. The types of judgments we are discussing with respect to memory.

One such phenomenon is the tip-of-the-tongue state. Tip-of-the-tongue states we have been discussing, and we know we have learned earlier that something you know and is there with you, yet the complete retrieval is not there. Why is this complete retrieval not there? Why does this failure in accuracy or retrieval happen? Is this failure permanent?

Though we understood from empirical evidence that the tip-of-the-tongue phenomenon is a temporary inaccessibility. However, in some instances, we still know that sometimes it could prolong. When we talk about the tip-of-the-tongue states, there are three parameters which we have to address. And these are considered the core characteristics of the tip-of-the-tongue states. What are these core characteristics?

Inaccessibility, where an item is stored in our memory, however, available in the memory system but cannot be retrieved at present. So, here we are not talking about storage. The information is stored. The information has been encoded and stored. If encoding and storage are not there, then we cannot talk about retrieval.

Something which is not present in the system cannot be accessed. So here, when we are talking about accessibility, we are knowing that the information is encoded and is there in the system itself. So inaccessibility means that the item is stored or available in the memory but cannot be retrieved at the present moment. The item is stored or available in the memory but cannot be retrieved at the present moment. The second characteristic is availability.

So all the information is stored in the memory should be available to the individual or should not be. If all information is available to the person then too much accessibility, too much access to the information may result into other complications and other chaos. It may even bring lot of cognitive load to the individual to understand, to select, to decide which information is relevant to the task and which information is not relevant to the task. So complete accessibility

may not be a good solution and complete accessibility to all the information which is stored may even not be possible ecologically. So some sort of inhibitory control is always there which ensures that the individual can execute the task without of much complication. And that is what exactly we have studied at the time of working memory. Where the buffers were being installed and naturally these buffers ensures that not all the auditory memory, not all the visual memory just rush in to the central executive system. The third characteristic is the accessibility.

So the information that is currently retrievable. what we can retrieve it, what information we have access to. And if you remember, earlier we had discussed that whatever the information an individual is acquiring, he or she tries to categorize them and organize them. So when we have categorized them and organized them, then the access of the information, at the time of access, if the specific information can be provided which may help the individual to select the category from the organized categories.

This makes the individual to retrieve information accurately and precisely without having any sort of interference, distortion, disruption in the human memory. Now, hence an item is accessible, but eventually it has to be recoverable. Because you may access to the information, but then the point is, can we recover that? So feeling is a subjective state where I know I do have a feeling that I know. and feeling that I do know this information, must be having a reference.

The reference that we are considering here is that whenever we are storing the information, we are storing the information in association. Such association makes,

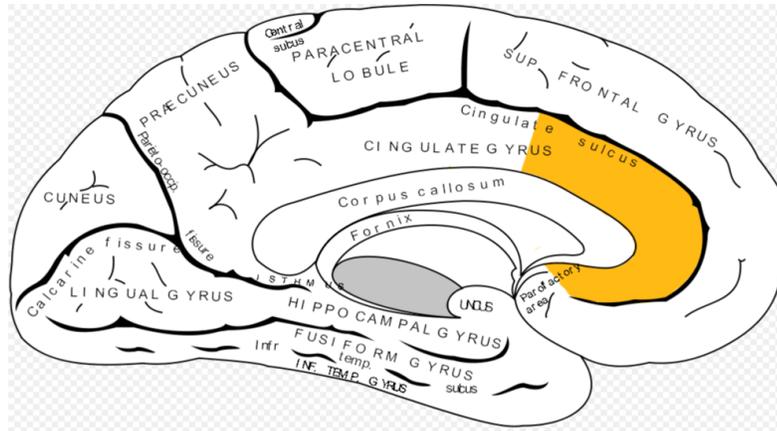
provide easiness and provide aid to the individual who is storing the information for future retrieval. The important concern for us in this whole scenario of tip of the tongue is that the information is available, information can be accessible or information which is not inaccessible. But the interesting part here is which part of the brain is responsible for that? Which part of the brain is ensuring that the information at the time of need should be accessed without an effort.

should be accessed without an effort. The system which has to ensure that the information should be available all the time to the individual so that a smooth and proper execution can be done by an individual. Now we know when we were discussing in the memory disorder We discussed briefly that what is happening in Alzheimer's on dementia or any sort of amnesia. The loss of information is there.

Maybe the information is there but people are not able to access it. Maybe the information is there but at the time of availability it has not been, cannot be accessed. So here similarly we have been discussing the important amnesias and here also The similar bony structures seem to be playing a role in the tip of the tongue states. What are these bony structures?

The prefrontal lobe. The prefrontal lobe is the same as the central executive system. And this prefrontal lobe is there for the meta memory. which is a memory of memory. This memory of memory is ensuring and keeping a monitoring on the system.

Any brain region which is doing the monitoring of the incoming information and the present information that is the frontal cortex. And within the frontal cortex has been divided into two parts. We discussed this earlier also. That is DLPFC, dorsolateral prefrontal cortex, ventromedial prefrontal cortex, orbitofrontal cortex. The coordination of all these three brain structures within the frontal cortex, even the left and right side of PFC, both side. So, left DLPFC, right DLPFC, left VMPFC, right VMPFC, left OFC and right OFC. The coordination of these three brain regions within frontal cortex on each side of the brain is important towards the tip of the tongue states. More importantly, if you see this frontal cortex, this region, underneath this cortex is the region which is this cingulate cortex, particularly anterior cingulate cortex. If you see this frontal cortex, this region, underneath this cortex is the region which is this cingulate cortex, particularly anterior cingulate cortex.



Source: <https://web.archive.org/web/20131020185717/http://www2.fiu.edu/~schwartz/mellearnTOT.pdf>

This anterior cingulate cortex which you are seeing on your screen is also being considered as the reward region. and punishment system. So, from fMRI studies, it is very clear that the reward system, which is the anterior cingulate cortex, shows a heightened activation. So, towards the tip of the tongue is state, but the feeling of knowing the answer, the correct, the accuracy is going to be there And once the answer is there, the anticipation of reward, the prize, the being the winner, activates this circuit altogether.

So the trip of the tongue state is showing a heightened activation in the anterior cingulate cortex, dorsolateral prefrontal cortex or the frontal area. Now feeling of knowing when we are talking about it. Prediction about the future retrievability of the particular item. It predicts if we are going to retrieve the information in future related to a particular item. National Animal of India.

The national bird of India. The national flower of India. All these questions. All these questions. Retrieval of information is required.

One of these questions is a related question. People may have a feeling of knowing the answer. However, it cannot be retrieved completely. So here, Bill Withers conducted a very simple study and demonstrated. He recorded the artist who sang the song 'Ain't No Sunshine,' recognizing this name among a list of other artists who have performed this song.

They just have to tell. Similarly, some questions can be asked, such as, who landed on the moon first? We may know the answer; we may not. If we do not know the answer, then assistance can be provided. Some more information can be given, which may assist us, helping us in coming up with an answer. So when we talk about this aspect, the feeling of knowing judgment,

which can be seen as metamemory investigation. Metamemory. So metamemory investigation. Two methods researchers have adopted. First method was being proposed and used by Joseph Hart,

In 1965, another method was the game show paradigm by Lynn Rader in 1987. Joseph Hart proposed recall judgment recognition procedure, RJR. Recall the judgment and then you have to recognize it. What is this? Participants have to recall the target of a Q target pair.

Now the Q target pair, if we talk about silver, gold, police, kitchen, fork, napkin, petrol, drink. What are these? These are the pairs. One of those could be a target or vice versa and then the cue will be gold or kitchen or napkin or drink. Any one of these cue will be given and the target should be retrieved.

If they are unsuccessful in retrieving the information, then more information can be provided to them so that they can answer it. Now, another point here is the game show paradigm. When we talk about the game show paradigm, a participant is given a question and must indicate two things. That he knows the answer, indicate the—sorry—two things. First, you indicate the answer.

What is the answer? If the answer is given as A, B, C, D, or E, you have to indicate which one of these is the answer. For instance, A. And then, even if you try to indicate it, then he can also simply tell us that he knows the answer. And this he has to do as quickly as possible.

As fast as possible, he has to report it. That he knows the answer or indicates that that is the answer. People made knowing responses faster than they could retrieve the name. So what people made was that okay feeling of knowing can easily be estimated. The feeling of knowing can easily be evaluated or assessed when people say, 'I know it,' rather than retrieving it.

Because retrieval cannot be so soon. Retrieval cannot be, the time cannot be defined when the person is going to retrieve it. But once they are saying that they know it, then

we can estimate that how much they know about the answer. So, there are these two paradigms which people have used.

Now, when we are talking about the feeling of knowing that I know the answer, when the question arises, this feeling of knowing can be understood with the cue familiarity. In explaining the underlying mechanism of feeling of knowing, people discussed and talked about the cue familiarity. Are they familiar with the cue? But then the question arises, what is cue? So cue familiarity refers to general information question or sense of familiarity which an individual is having.

The kind of fossil fuel which we use in the car or the kind of fossil fuel we use in the kitchen. LPG we use in the kitchen. CNG we use in the cars. The sense of familiarity. General information question.

Familiarity also means if a Q target pair elicits a sense of familiarity. What does this mean? Man on the moon question. Here, the familiarity is high. Anyone who has studied in school or has an interest in planets and the planetary system, astronomy, will easily come up with an answer, Neelam song.

Even Neelam They don't have to be familiar. If you have attended school, then you may have been exposed to such questions. This says the two target pairs elicit a sense of familiarity. What does this mean?

I said police, kitchen. Now we know police cannot be in the kitchen. So this is a very peculiar example. Where the sense of familiarity suggests they are not too similar, while if I say silver and gold, the sense of familiarity is that both are metals, both are expensive, and both are used as jewelry in an Indian context. The familiarity can be high or low.

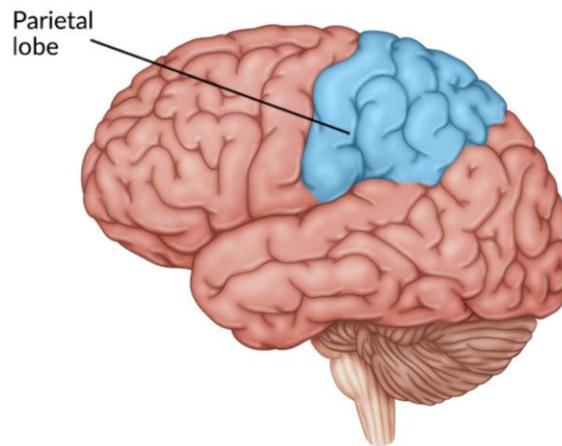
In the study, Denver Coyot in 2001, they showed when a 2 of 2 target pair is made arbitrarily more familiar, the feeling of knowing, judgment are higher for that item. If we talk about silver and gold, Or if we talk about police and kitchen, they may have high familiarity. If I say jet spray and swimming pool, now both of these do not have so familiar with each other. This pairing

Jet spray is used in bathroom inside. Swimming pool outside. Inside the house, outside the house. So the familiarity. Some of us may not be familiar even what jet spray is.

Jet spray is most of us may be familiar with swimming pool is. Most of us may be familiar with swimming pool is. So the familiarity here seems to be less. But when we talk about silver and gold, Fire and fire brigade.

Doctor and nurse. Teacher and student. Here, the familiarity and the two-target pairing are very high. The interesting question that arises here is: what are the underlying neural mechanisms for the feeling of a name? Just like the tip of the tongue is straight.

Now here, the interesting brain region that emerges indicates that there is a feeling of knowing. I know the answer. I know. And that 'I know' is coming from the parietal lobe. Now, the parietal lobe—if we understand from the visual area—if the region is going to this side, the word system, this is the word system.



Source: <https://www.flintrehab.com/parietal-lobe-stroke/>

The visual area to the parietal area is known as what system? What is this? But when we talk about the visual area to the temporal area, then we are talking about the 'where' system or 'where' pathway. So decide the 'where' pathway. So the question, 'I know the answer,' is actually getting activated or triggered in this brain region.

Importantly, the left hemisphere is showing heightened activation versus right hemisphere. So this cerebral asymmetry is being seen here that the left parietal lobe is showing an activation at the time of feeling of knowing. Now an additional brain region which is coming into this light is the inferior frontal gyrus. So the frontal area also when we are talking about so this frontal region inferior side of it is playing a similar role.

Now we know that any sort of feeling of knowing is a sort of monitoring and monitoring region definitely has to do some association with the frontal area. The moment we say

that we are monitoring, the moment we say we are controlling, the moment we say we are eliminating frontal cortex seems to come into light. Of course, the frontal cortex is further being divided into left, right, sorry, dorsolateral prefrontal cortex, ventromedial prefrontal cortex and orbitofrontal prefrontal cortex, left and right separately. What we have seen when people's reported feeling of non-judgment

Inferior central cortex showed an activation. This area is not getting activated during the tip of the tongue state. At the tip of the tongue state, anterior prefrontal cortex was getting activated. Anterior, anterior cingulate cortex was getting activated. And dorsolateral prefrontal cortex was getting activated.

Now the idea altogether is the idea altogether is judgment of learnings are made during a study a prediction of future memory performance. So when a Q target word pairing is given such as the cat, fork, You may have to make a judgment as to whether you may, you will recall the fork or not. When you have been given a word cat in a subsequent test, or will you be able to recall the words which you are familiar with easily? So the key word, will it be retrieved?

Will it be recalled easily? Now the importance of judgment of learning, if we talk about why is it so important for us? For two reasons. One, that it provides an understanding towards the metamemory theory. And secondly, the practical use of it.

The practical use of judgments of learning. How judgments of learning can be used and its evaluation can indicate the understanding of our metamemory. So judgment of learning, it offers an advantage over feeling of knowing judgment. So what basically it is doing? Feeling of knowing judgment and tip of the tongue states.

and this can be made on all the items. It is allowing the precise experimental control over the items where we are providing the judgment. People indirectly make judgment of learning But it directly affects their choices. For instance, when they decide and when they sit to think how they are going to learn or prepare for the exam.

Once they decide that, then the outcome seems to be aligned with their line of thought as well. So these judgments of learning is important and reflect upon the metamemory processes, how people are going to retrieve the information, what they have to learn, how the recall will be going to happen, is the retrieval will be easier or difficult to make. People use this judgment of learning to guide their study to know whether they are accurate and whether that accuracy can be improved. We discussed this earlier also when

we were talking about the feeling of knowing, judgment of knowing, judgment of learning that the monitoring was doing a progress monitoring.

This progress monitoring is ensuring whatever we are acquiring, how accurately we are acquiring it and can its accuracy be improved. The judgment of learning in Q target is an important aspect for the researchers because here the participant is being provided with Q and target both and he is being asked to predict whether he or she will recall that item later when presented with only the Q. So when the cue target is given to the individual, the retriever of it can provide an answer and suggest the practical application of it. So here, he or she will recall the item later when presented only the cue.

The cue could be gold, the cue could be black, cat, CMG, puppy. And can they retrieve the target word? Now, in this cue-target judgment of learning, the underlying neural mechanism—we discuss the feeling of the main neural mechanism—we discuss the tip of the tongue. The neural mechanism—it's time for us to understand when people are making the judgments of learning, which part of the brain is coming into light. Now, such a decision—when the cue is given and the target has to be identified—such a system can only be governed by the central executive system.

What is the central executive system? Prefrontal cortex. And exactly this is what we have seen in the imaging studies, fMRI studies, where the prefrontal lobe shows activation once the judgment of learning is present, indicating that the judgment of learning resides in the prefrontal lobe of the cerebral cortex. Judgment can be the same as decision-making also.

So, this decision-making area could be the prefrontal lobe as well. Areas of the brain unique to the verbal judgment of learning were located in the ventromedial prefrontal cortex, lateral prefrontal cortex, and also the medial prefrontal cortex. Now, these brain regions seem to be major contributors in the judgments of learning. Let us summarize what we have studied in this lecture.

We studied the tip-of-the-tongue states. We even tried to understand that the anterior cingulate cortex and dorsal medial prefrontal cortex are getting activated during the tip-of-the-tongue state. The feeling-of-knowing judgment is showing activation in the left dorsolateral prefrontal cortex. Inferior parietal cortex, inferior prefrontal cortex, parietal cortex, and furthermore, we even discussed the importance of judgments of learning—why it is important to understand the theory of metamemory and its practical use. We will try to understand what the underlying neural mechanisms for judgment of learning are.

These brain regions, which we studied today, indicate that three important brain regions collectively play an important role in metamemory. First, the parietal cortex, prefrontal area, and anterior cingulate cortex. The anterior cingulate cortex has projections to the frontal cortex and also to the parietal area. But in the tip-of-the-tongue phenomenon, the anterior cingulate cortex plays an important role, along with the parietal cortex. When we discussed the feeling of knowing, we understood that the parietal area shows activation rather than the tip-of-the-tongue state.

is showing activation rather than the tip-of-the-tongue state. Such understanding gives us insight into metamemory, and we even discussed the tasks people have used to investigate and study metamemory. I will end this lecture here, and in the next lecture, we will continue discussing aspects of memory, particularly mnemonic tools. The tools that could be used for encoding and storage. Thank you.