Introduction to Cognitive Psychology

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Lecture – 13
Long Term Memory: Elephants Remember for lifetime

Hello welcome back. So, in today's lecture we are going to study about long-term memory. This is a part of memory which has been discussed in that internship and model, and this is the kind of memory that people when they colloquially or when a layman talks about memory this is the kind of memory that they talk about. So, what we are going to do in today's lecture is will look into this kind of a memory.

So, basically mostly retrievals that you have any kind of information that you think of storing any kind of life event knowledge, any kind of facts, any kind of mathematical rule, or any other kind of information which you think is stored in your mind or brain is basically what is stored in the long-term memory. So, let us then look at what is long term memory, and in this particular section we look into basic processes of long term memory as in how it is formed and what are the basic processes and kind of retrieval and all and the upcoming couple of lectures we look into different kinds of long term memory.

Now, continuing from what we saw in the last class, I discussed about something called Atkinson and Shiffrin's model. So, Atkinson and Shiffrin model or the information processing model talks about a system which has 3 parts into it a 3-part system.

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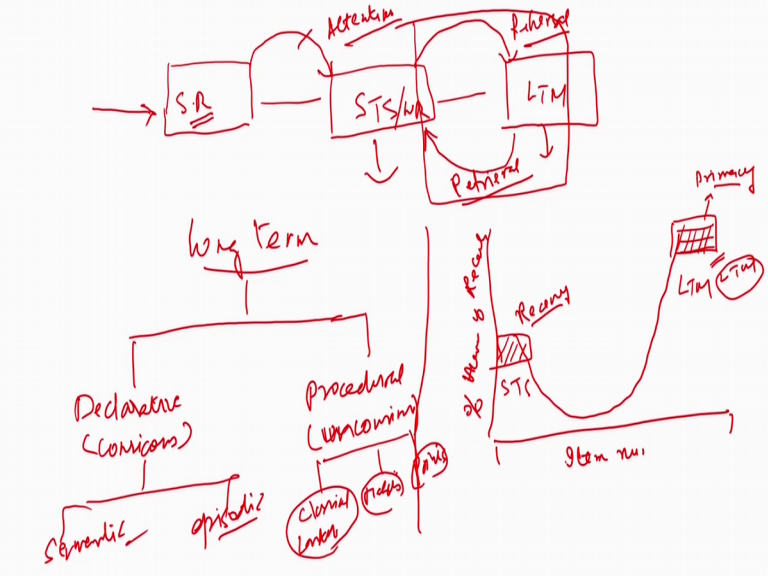

So, what we have is a setup like this. And this is called the sensory register. In the last series of last lectures, we saw what is sense a register and how does it work, and what are the various properties of the sensory register. So, basically any information which comes out, or which comes in or gets processed through the perceptual an notational processes, basically arrive at the sensitive register.

And it is a huge capacity very short duration of time. And then we have something called the short-term store, this is another thing that we talked about in our last lecture. This is the kind of system which those information from brief periods of time not very brief, but brief periods of time, but it can hold only limited information. And we saw an extension of this concept called the working memory in our last class.

So, working memory is basically an improvement of the short-term store, because it talks about the system; which has more capacity then as was discussed in the Atkinson and Shiffrin's model. And obviously, the last thing that we did not discuss, the last part we did not discuss was the LTM or the long-term memory this is the store which holds most of the information.

Even the working memory as we saw the capacity working memory executed systems which basically make decisions for the working memory system they through the episodic buffer connect to this long-term store. So, this long-term store then holds the most of the information. Now the Atkinson and Shiffrin model just does not talk about

this kind of a box and arrow structure, but they also talk about processes. And so, these processes are the ones which actually go ahead and transfer information. So, here the process here is the attentional processes.

So, I will write attention a location here. So, that is the process which takes an information from the sensor register and moves it to the short-term store. And once information is in the short-term store, it is basically the rehearsal process which moves information from the short-term store to the long-term store. So, the number of rehearsals that we do a number of repetitions, that you do of an information number of times you use an information. It basically goes to something called a long-term store it gets stored here.

Now, the long-term store is not an active store as we discussed in terms of the short-term store. We saw the working memory concept describe the short-term store is an active store set it can do a lot of stuff, it can move around a lot of stuff it can do a lot of activity. But the long-term store does not do any activity. It is just like a kind of storehouse which is there. So, information are there a number of information is stored here it is stored in a highly organized and categorized format. But there is no action as such which basically means that things cannot be acted upon.

If a particular rule or if a particular information needs some action on it some kind of action has to be done on this information it has to come back to the short term store the working memory store and the process which moves information from the long-term store to back to the short-term store is basically called the retrieval process. So, basically then we will look into this part, this whole part in this lecture.

Now the question is what is the existence or evidence for existence of this long-term store. But again, let us look quickly look into the idea of serial position curve. Now what was the experiment for looking at the serial position curve? The experiment was that a list is given to people to actually go ahead and read and once you read this list you asked to retrieve it back. And as you retrieve it back what tends to happen is a curve like this is shown in terms of retrieval.

So, if I look at percentage accuracy of recall which is on this side, and this is the item numbers on the list what I tend to see is, that item which are recent tend to be retrieve more, and items which are at the beginning of the list tends to be the retrieve more.

Whereas, item in a middle of the list are not retrieve. And so, this effect was called this was called the primacy effect, and this is called the recency effect. And very popular theory we have discussed this before.

Now this base basically experiment shows that and that there are there has to be 2 systems of memory, there has to be 2 stores of memory. The reason why is that in the items which have been learned at the beginning of the list they receive a number of repetitions. And so, they had retrieve back better is because this goes to a LTM store. A store which stores information a kind of structure in the brain which stores information for longer durations of time and the experiments are done where it was found out that the primacy effect items which show primacy effect they were remembered for longer duration of time.

Why because it was processed think of you doing the list what happens is the first item comes in. So, second item pops in. So, we repeat the first item and the second item, third item pops in; you repeat the first item, the second item, the third item. And so, the number of repetitions that the first item actually goes through or it receives is n factorial times it is a kind of the list items is there and make a factorial of that and that is the kind of repetitions at receive.

So, with more number of repetitions you are prone to more number of more processing. And so, shifting to a store. So, this basically here this diagram here shows you that there are 2 different kind of stores and this is the short-term store and this is the long-term store.

Now another interesting thing is that as we saw that the short-term store which is basically then improve into the work in memory store that is divided into it is central executive the phonological loop the vco, spatial, sketchpad and the episodic memory similarly the long-term store has or the long-term memory has several subdivisions. So, we look into the subdivision in the and as we move progress through this and each of the subdivision we are going to look at or we are going to study one by one. So, in the upcoming lectures we look into all of these stores. So, basically there are 2 subdivisions of it one is called the declarative part and the other is called the procedural part.

So, basically the long-term store and itself is divided into 2 stores. There is a lot of debate we will also look at the debate of what are the declarative and procedural parties,

but basically the difference is declarative is that part or if declarative is that type of long term memory which you when you retrieve that you are conscious about it. So, a task like thinking about your first birthday I am pretty sure that you cannot remember your first birthday that, but let us say your twelfth-class farewell or things like that.

Now another interesting thing why you cannot remember your first birthday is up because there is something called childhood amnesia. We will talk about amnesia at the end of this section, but right now that is the reason that is I am just giving you the reason. So, basically conscious things which you are aware of when you are thinking about it or when you are retrieving it is what is the declarative knowledge, and procedural knowledge is those knowledge which are unconscious. So, you are basically unconscious or you do not know that you are retrieve here for example, mostly I give this example in my classes riding a bicycle. So, how do you teach someone to ride a bicycle.

So, even if I ask you to give me how do you ride a bicycle it is very difficult for you to show how do you ride a bicycle and so, there are 2 different parts. Now within this declarative and procedural part you have within the declarative part you have something called the semantic type and the episodic type of memory. We look into these 2 types of memory semantic stores world knowledge. So, basically facts rules truths and those kind of thing and episodic is that kind of knowledge which is basically related to episode which is basically related to some kind of event in your life.

Procedural basically there are 4 subdivisions, but will not look in detail into the procedural part of memory. So, I will just give you a brief overview of what can come here. So, you have basically things which are learned from classical conditioning things like habits right? And so, this kind of structure is there and also priming is another thing which comes under procedural memory.

So, things priming is basically a instance or it is basically a phenomena in which if you want to if you want to identify or if you if you are given the task of perceiving an object just before perception of an object some information, some very brief information is given to you and that brief information leads you to basically remember or basically recognize that our object that is called priming. So, basically, I think of it in this way.

So, when you going to meet someone before you meet someone somebody gives you some kind of information about that person and that makes you quickly identify that

person now this information which has been given to you is basically called priming and similarly there are 2 type of priming one is called semantic priming the other is called perceptual priming, but will come to that when we come to that particular exercise, but right now this is what it is.

So, let us then start the usual things let us start looking into the usual thing of long term memory. So, what we have done up till now is we have established that there is something called long term memory and we have us also establish that this long-term memory has some kind of set up which is there which we look into the upcoming lectures.

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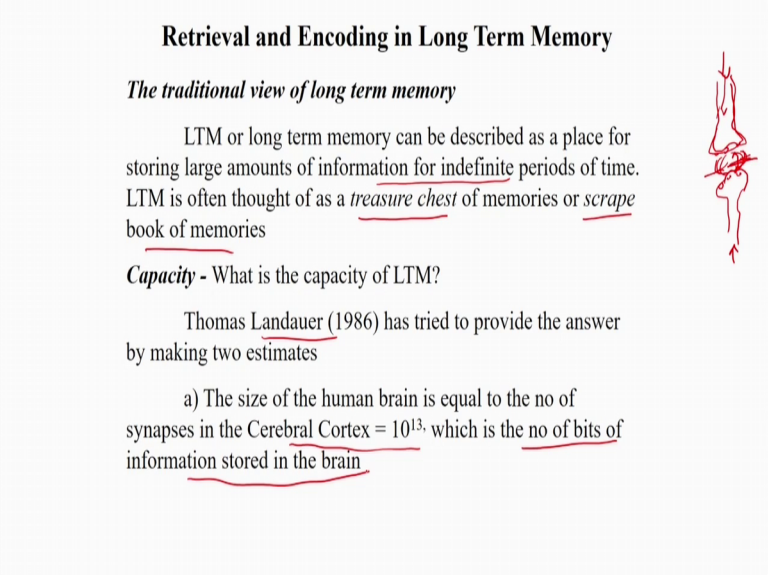

So, basically then in this particular lecture we look into the retrieval and encodings on long term memories basically long-term memory it is basically described as a place for storage on large amount of information and as you know from philosophical viewpoints this has been quoted as a scrape book of memories or a treasure chest. So, basically it as an thought of a place like a box or a chest which can store a large amount of information. So, that is what the conceptualization of long term memory is these are all philosophically conceptualization.

Now, the question arises what is the capacity of LTM. So, there have been several experiments which have been done. And so, generally speaking the long-term memory has a huge it is it has sometimes it is called that it has infinite capacity, why because

whatever you know up till now whatever you have learned up till now in your life and till the point you die it will all be stored in long term memory.

So, basically meaning that most information that you know in your life is in non-term memory, again that the evidence here is that long term memory has an infinite storage. So, basically, but there have been some attempts to find out what is the capacity of this long-term storage. So, look a let us look at this evidence.

So, Thomas landauer he try to provide an answer by making 2 basic estimate one estimate is the cerebral cortex has 10 to the power 13synapses. And so, what synapse are if you look at a neuron and in neuron which is there and these neurons they connect to each other through an empty space. So, basically this is the neuron this is the dendrite of a neuron dendrites are those portions of a neuron which help in communicating. So, these are 2 dendrites which communicate with each other and they communicate through both an electric and electrical messenger and a chemical messenger. So, chemical messengers are stored here.

But this is something which comes into the biology of memory. And so, let us not get into that particular framework, but then this synapse is the space between these 2 dendrites which are there. And so, basically this space allows chemical messengers are basically substances which are called neurotransmitters to basically move from one neuron to another. So, if this is the neuron which is transmitting and this is the neuron which is receiving information is passed through the synapse.

So, synapse is there that particular space avoid which is there and it is very important in looking at how memory is form. So, there is a whole idea of how memory is stored what is the way it is stored and biological basis of memory says that there is something called phenomenas called long term potentiation and long-term depression, which is how memories are stored, but we will not discuss on to that we will quickly look into this. So, this empty voids or spaces are what are called synapses.

And so, Thomas landauer he found out that there were 10 to the power 13 synapses in the in cerebral cortex and which is the number of information which is stored in the brain. So, he basically equated in that one particular synapse is trained for only one kind of information. And so, if it is 10 to power 13 then it is 10 to power 13 bits of information which is stored huge number.

Now another estimate was made as that there are 10 to power 20 bits of information which is the number of neural transmission made by an average human lifetime. And so, this particular deduction is made on the basis of the fact that the there is the life of human beings in the life of a neuron and based on the life of the neuron and life of the human being it is estimated through computational calculations which show that 10 to the power 20 bits of information pass on from one neuron to the another or that is the number of connections and neuron actually a number of neurons which are there they make. And so, this is the kind of information or this is the kind of capacity of LTM.

But then both of them are generically in a an estimate of it and as I said in generic speaking it has infinite capacity, now the question is how does it account for this infinite capacity. So, basically think of the archiving program that you have in your computer. So, you have either a winrar or you have something likesome other I do not know the names of a lot of those archiving system, but then you have these systems or you have these programs which help you to compress file now similar system helps is there in long term memory what it does is it compresses file, but then it uses certain features which already advanced feature.

So, what it does is first it selects what is information has to be stored and based on that it also compresses information and then it provides the key to this compression. So, let us look at how information is stored and how information is retrieved the duration and all those things in the next fewslides.

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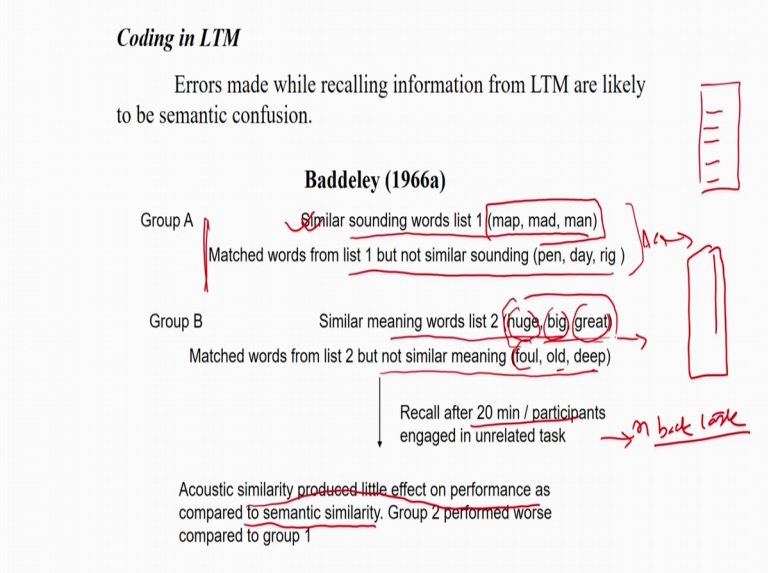

So, basically another question is we saw that the coding that happens the way information is stored in short term memory was a caustic in nature. And so, there was a very good experiment which was there which was done by Bradley. And so, Bradley showed that if a caustic words were used, if 2 different kind of information was fed into short term memory and both for a caustic in nature, in the sense that either they had the same phonology which basically means the same speech sound and another ones which did not have the same speech sound the confusion was more for those words which had the same speech sound.

So, p and d we are confuse more pde confused more than p and k kind of a thing. And so, basically that experiment showed us or basically told us that the kind of storage that happens in long term memory is basically costing. Now what is the format in which it is stored in long term memory. So, basically this is in terms of again Bradley did not experiment and found out that this is in terms of semantic nature.

So, what was the experiment. So, what Alan Bradley did was he gave 2 groups first he selected 2 groups of people for one group he gave similar sounding word for example, map made and men 2 people for remembering and then he gave another words from the same place. So, he gave people 2 group for people 2 different leads layer lists to remember, now there are 2 versions of the list in one version of the list what happened is people were given similar sounding words to a remember for example, hen had hair kind

of a thing or map madman as he are written here and in the other list you had my words from the same list the presentation list, but then these words were not similar sounding. So, you have things like pandering because they do not sound similar and this was to create a caustic confusion and in the group b people were given same meaning words. So, you see here what happened is you have the huge word the big word and the great word all of them have the same meaning so it is like a synonyms.

So, synonyms generally more synonymous are given and then another list was created where people were given words which did not have similar meaning. So, it had different meaning for example, foul old and deep here and recall was done after 20 minutes participants engage and related tasks for the task while basically n back counting. So, an n back counting task was used now what is n back counting tasks we showed you in the lastlecture in the brown peters and task n back counting is basically a task in which you count back n units.

So, one thousand and if you have to count 3 units back it will be 997, 994 kind of a thing. And so, this is n back you have to keep on counting back and this is has to what the n back task is all about. And so, people did this kind of a task this was given so that they should this kind of task should take up all their available attentional resources so that the rehearsal is not allowed or rehearsal is not given.

So, over 20-minute wait was done and after that when experiment has a or the subjects were asked to retrieve back the caustic similarity produce very little effect on performance as well as semantic similarity. So, when words which were similar we were represented or they were shown to people 20 minutes is enough time for any item to get process. So, when this kind of retrieval was done it was found out that in these people in group a there was no difference.

So, there was no difference between people who were given map and man to remember, but then more confusions were seen on people who were given similar meaning word. And so, this experiment basically demonstrates the fact that these words which had similar meaning that was what was creating confusion and this experiment also shows that the kind of manner or the manner in which information is stored in long term memory is basically in terms of semantics or in terms of meaning.

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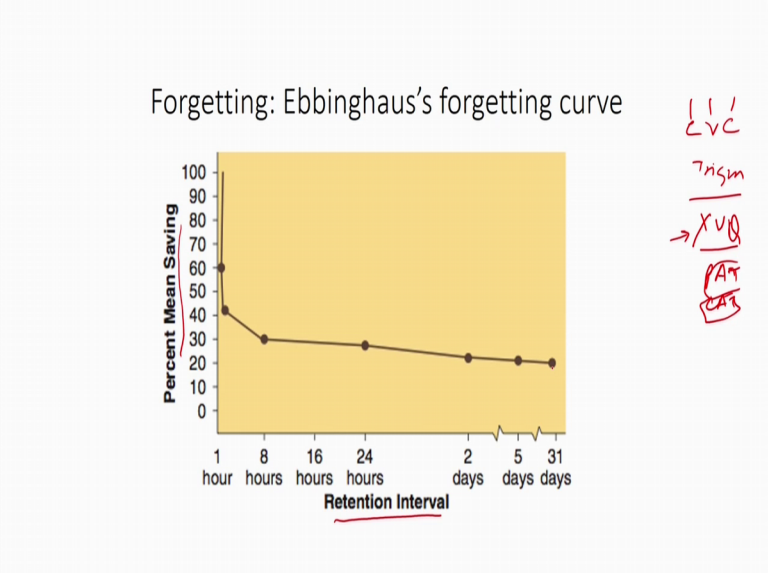

Another reason or another thing for the existence of semantic evidence I would say for the existing semantic memory is basically this is called Ebbinghaus's forgetting curve. So, what is Ebbinghaus's forgetting curve and how did it arrive. So, I explained to you in earlier lecture that Ebbinghaus's was a German psychologist and he was testing his limits to memory of how much thing he can remember how much items he can remember and for how longer time, but if he if tried to remember words from a list then there would be some a long-term memory or there will be some bias into it.

So, what he did was he created CVC a consonant vowel consonant kind of a trigram we called this as a trigramso this trigram was. So, let us say X V and Q now XVQ does not mean anything, but PAT would mean something or PAT or CAT would be cat. So, these have meaning words and these as a trigram. So, this kind of a trigram was then he took a lot of trigram he remembered them and he then retrieved the these back over periods of time this is the very simple demonstration a very simple thing very simple result from is experiment what he saw that the percentages of mean saving and versus the retention interval what happened is the as inputted arrived on 31 days after 31 days people still remember this 20 percent of items from the list.

So, even when he did experiments he found out that from the list that he remembered 20 percent of item were still with him he was able to retrieve this 20 percent of item even after 30 days or 31 days and which kept on going for a number of more days, basically

meaning that there is a store which allows you to store this information for longer duration of time and that also this idea that you do not get forgetting or do not forget after this long duration is basically another evidence for the existence of a store which stores information for longer duration time with more rehearsal. So, what happens is as time passes the you do not tend to forget more and this is an evidence for long term memory.

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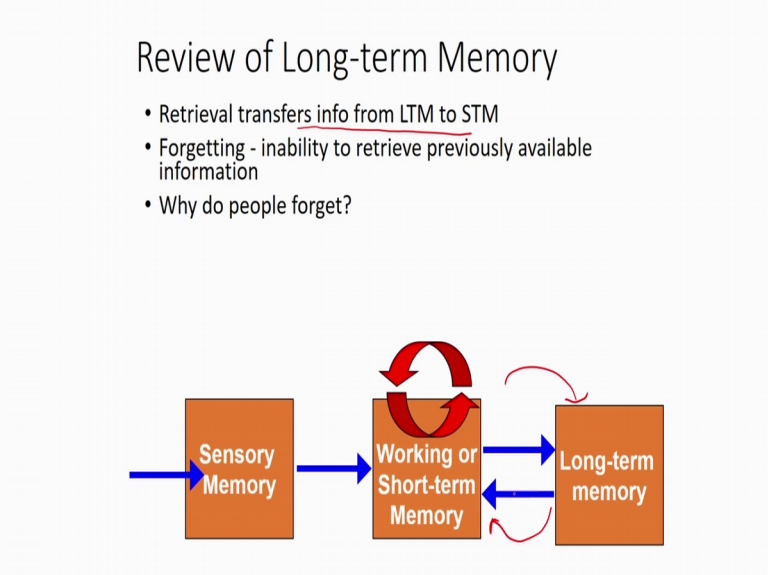

So, let us do a quick review of a long-term memory. So, basically the question here is retrieval transfer the information from long term to short term memory as I showed to you, and forgetting is a inability to basically retrieve information from memory. And so, we people often talked about forgetting. Now forgetting from short term memory is very obvious because items get store for 20 second and so, we cannot think of forgetting as a forgetting here and there again we looked at how does this forgetting happen.

So, in the last class we looked at the brown Peterson tasks and the Waugh and Norman task and both of them said that there is a decay kind of a thing and interference kind of a phenomena which basically leads to forgetting from short term memory. So, let us look at why do we people forget from long term memory how do we forget things from long term memory. So, is there something called forgetting from long term memory or if something is encoded into long term memory does it stay there forever.

So, let us look at that quickly. So, basically this is how it works so this is the sensory memory this is the working or short-term memory information is rehearsed here and then it is passed to long term memory from the long-term memory it is retrieve back as and when it is wanted back to long term memory.

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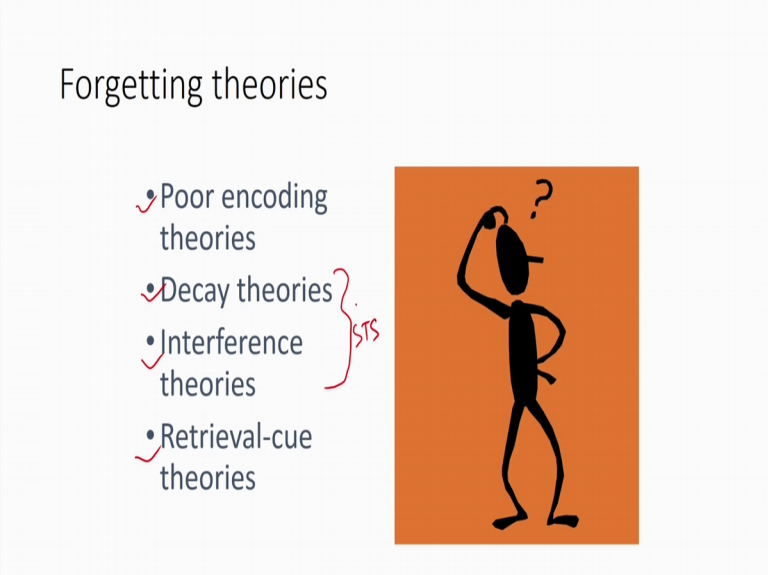

So, why do people forget there are several forgetting theories which have been proposed for long term memory and let us look at some of these theories. So, some of the theories which have been proposed for forgetting from long term memory is something called the poor encoding theory the decay theory the interference theory and the retrieval cue theory. So, some of these theories are what you find. So, basically the reclaim and interference theory is what also applies to the short-term store, but then for the long-term store you have to additional theory. So, let us look at these theories one by one.

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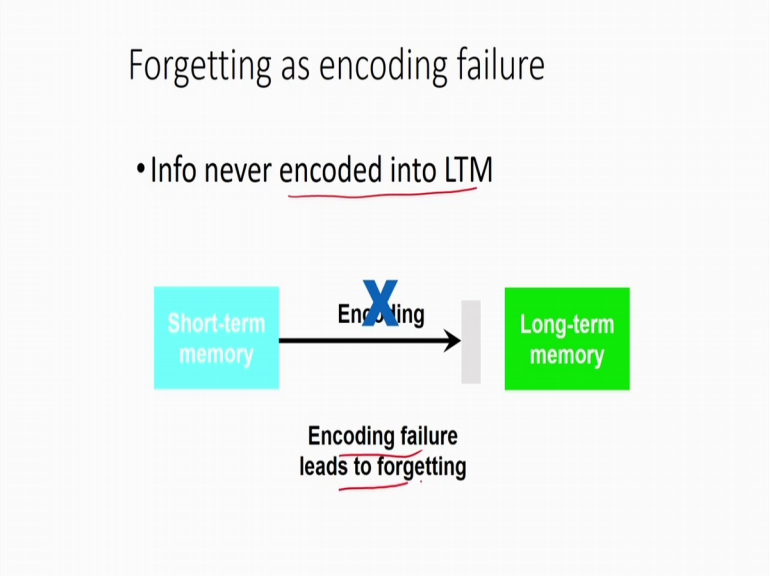

So, let us look at the first theory. First theory says that forgetting happens from long term memory because people never encoded that. So, it could have happened that a piece of information was given to you and you never encoded that information and that could be one of the reason why forgetting happened, and that could be one of the fact by forgetting happened it could be that you will never know for example, if I ask this the question where is the tilde key in your computer keyboard.

So, people who have not used the tilde key they have no never encoded where the tilde key is or where is the function key. So, people who type some people never use the function key they will never know because they never encoded it that is called the encoding failure theory. So, information which is never encoded into LTM is called the reason for it there is a short-term memory information never pass from the short-term memory into the long-term memory. So, no encoding and that is the reason for encoding failure here.

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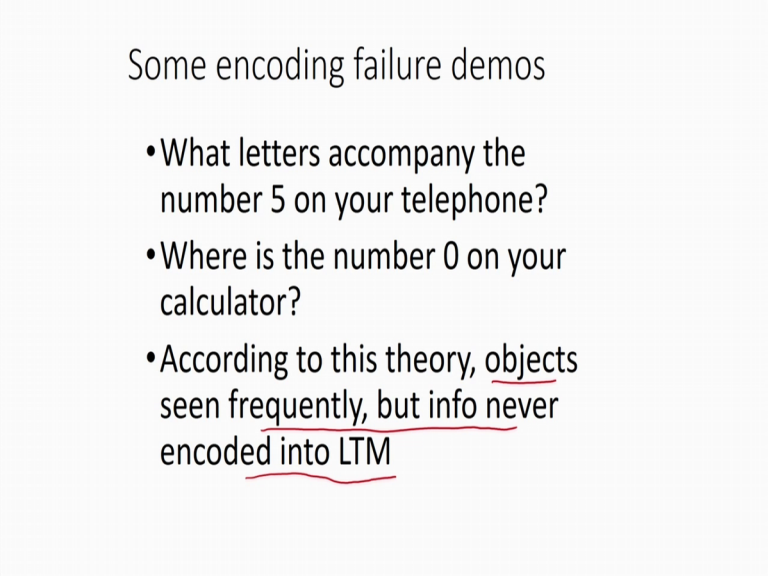

So, some examples are what let us a accompany the number 5 on your telephone if that is what is given to you. So, most of you I mean these days you have these newer smartphones we do not have these numbers with it, but the push button phones that were that were there it had to be had a number of number written 3 digits or 3 letters which were written after every digit.

So, if that is the question most people would not have ever thought about that right. And so, you do not tend to remember or where is the number 0 on your calculator if this question is asked most people do use it. And so, it is become. So, procedural or so automatic as we saw in attentional theories at the thing become so automatic the pressing 0 becomes so automatic the it is very difficult for you to know where it is or so according to this theory objects seen frequently, but never, but information was never encoded into LTM and that is one reason for forgetting from LTM.

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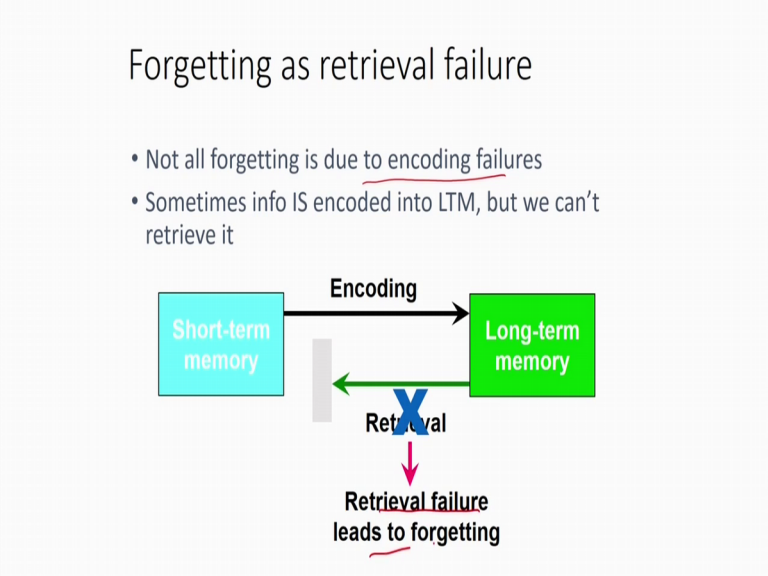

Another reason why people tend to forget another theory which proposes forgetting from long term store is called the retrieval the failure theory. So, what does this theory say it says that not all forgetting is due to encoding failure some of the forgetting is due to retrieval failure also. So, on one poor encoding theory the first theory says that it was not encoded, but in the next 3 theories talk about retrieval failure something happens at the time of the retrieval getting information back from long term store and that must be the reason why this kind of a forgetting really happens.

So, let us look at those theory. So, sometimes information is encoded in LTM, but it does not come back. And so, you see this is short term memory encoding is done, but it does not come back this is called the retrieval failure leading to forgetting.

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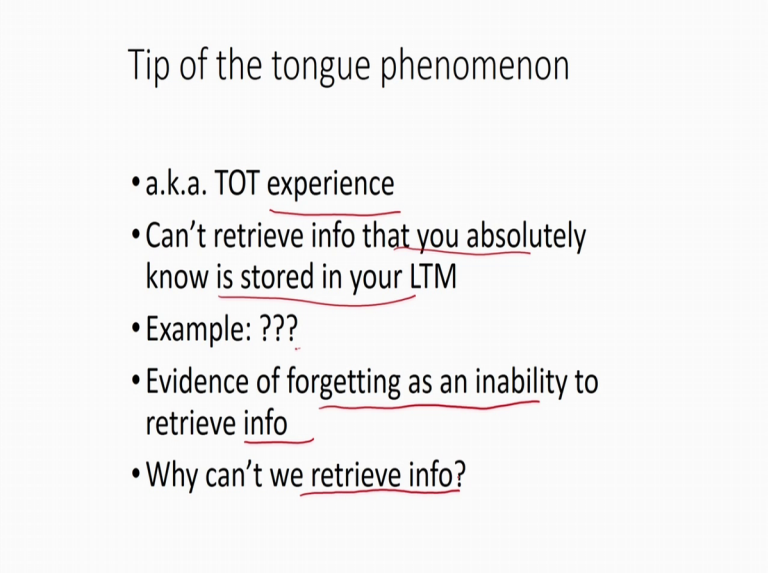

So, what are the theory is there or what are the some common examples there one common example is Tip of Tongue phenomenon. The TOT phenomena is called Tip Of Tongue, now there are times in your life when you know that you know information for example, movie song is coming up and so, you are there looking at it you know the actresses name you know that which letter it starts now you know which heroes she has worked with when which movie she has work with, but suddenly there is a freeze and the name does not come your mouth and this is called that tip port tongue phenomena.

What happens is that you are not able to retrieve that and that is called retrieval failure also cannot retrieve information that you absolutely know is stored in your memory because you know to the first thing of this actors you know whom she work with a lot of information will basically mean that there is somewhere also the name stored, but you are not able to retrieve it an example I have given. So, evidence of forgetting as an inability to retrieve information why we cannot retrieve information that is what we are going to see.

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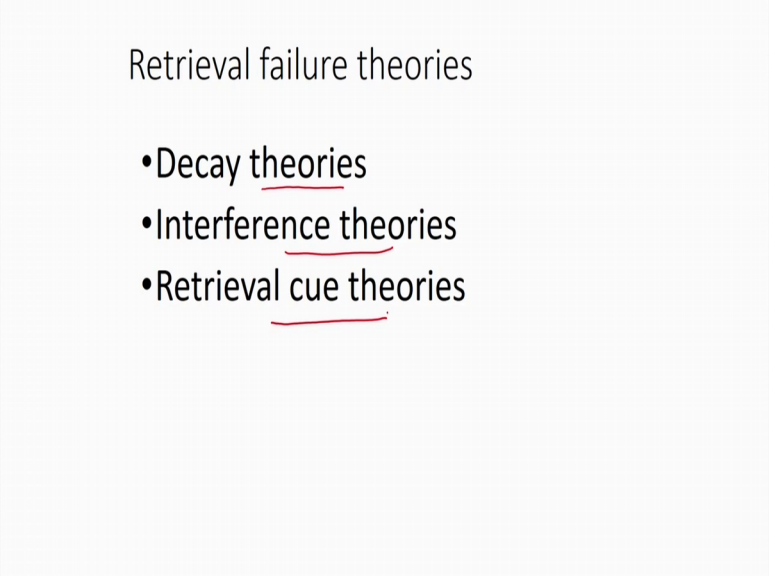

So, 3 theory from the retrieval failure section one is a decay theory the interference theory and the retrieval cue theory.

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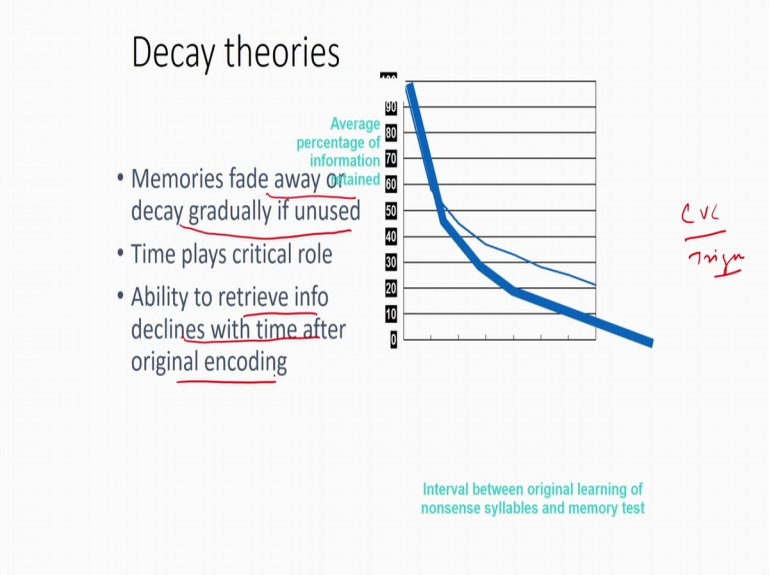

So, let us start with the decay theory first. And so, what does the decay theory actually says, the decay theory this is basically the average percentage of information retrieved and this is the interval between original learning of nonsense syllables and memory tests which is basically some something like a (Refer Time: 29:54) CVC kind of a paradigm. So, we looked at trigrams and this is the in curve which is that. So, basically the key

theory says that memories fade away or decay gradually if unused. So, if some memory is not used for a period of time it decays and there is a biological explanation to that also we will come to the biological explanation in a while, but that is what it is.

So, if you do not use information which is stored in your memory then there would be a problem and this is something which we are seeing nowadays what has happened is the Google has taken up so much of her information Google has taken up so much of her life that we do not try to retrieve information even if we need some bits of information what we tend to do is we tend to look into Google we type that and we get any information and voila it is there. So, basically that is a problem. So, we do not use it. And so, I always keep on telling this to my students that please use information if you do not use information it will decay out, and one of the fact is the time how much time is spent between learning and retrieving the information that is one of the reasons of how this particular theory works.

So, time plays a critical role now ability to retrieve info are the clients with time after original encoding. So, as more and more time happens and you are not receiving this information the k will decay will lead to forgetting. So, let us say at some point of time when you learn something.

So, there is bit of knowledge that you learn are Sanskrit for example, if you learn Sanskrit in your in your earlier classes in class 78 I am not used it because you did not follow it you tend to forget some as or things like some other grammar or Sanskrit you do not tend to remember how the is made that is basically conjugation of sentences how it is done in Sanskrit. So, basically that is what happened as time passes on information is never used. And so, you tend to forget it so, basically this is what the decay theory is.

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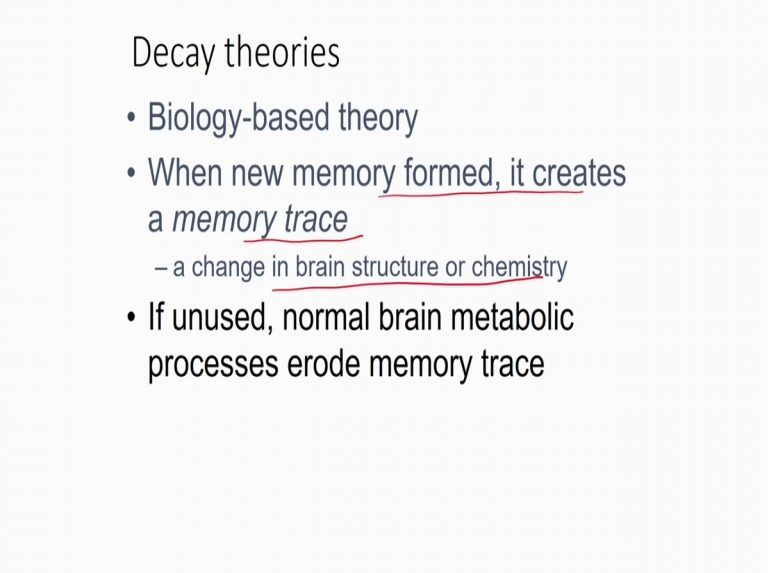

So, basically decay theory is a biological based theory. And so, it gives a reason why decay really happens and what is the reason the reason which has been provided is that when new memories are formed it creates a memory trace a change in the structure of the brain chemistry. As a new memory is formed from the neurobiology of memory you will come to know that as a new memories form what happens is new connections are developed.

And so, when new connections are developed what happens is there are number the new dendrites get attached to each other and information passes or one neuron gets connected to multiple neutrons, but what happens is if you do not use this connections it will be there away the brain chemistry will take it away. So, if unused normal brain metabolic activities will erode these connections these connections which have been formed between 2 neuronal junctions or 2 dendrites these connections will erode away because they are not talking to each other.

So, 2 neuron should be talking to each other only then a connection is there, but if this talking stops somehow the neurotransmitter if it stops passing between 2 junctions the receptor 2 receptor neurons what will happen is or some change in metabolic activity within the synapse happens this leads to forgetting.

For example, one of the interesting thing is known is which is evident is dopamine deficiencies or dopamine deficiencies in d1 d3 d5 kind of a structure. So, these are 3

receptor types on a particular on particular neurons. And so, when lack of dopamine happens here then people show tendencies which are very similar to neurotic people and so this kind of thing happens. So, if you do not use any connection for a longer period of time it will be there way.

Think of it in terms of railway store a railway warehouse. So, in the olden days people there is these railway warehouse used to be somewhere and so you would see railway lines basically passing through roads, but then as time has progressed nobody uses those railway lines or old stations or old junctions which are there.

And so, it withers out nobody remembers it and there is nobody cares about it for example, there New York central station below that there is another station which is there it is a popular thing which is there. And so, there is a whole network out there, but nobody uses it anymore. And so, it decays and similarly the brain also decays the information from the brain also decays by not bit getting you. So, theory not widely favored today in today's world we know your follow this theory because there are certain brain chemistries which say that this kind of degeneration does not happen in the brain.

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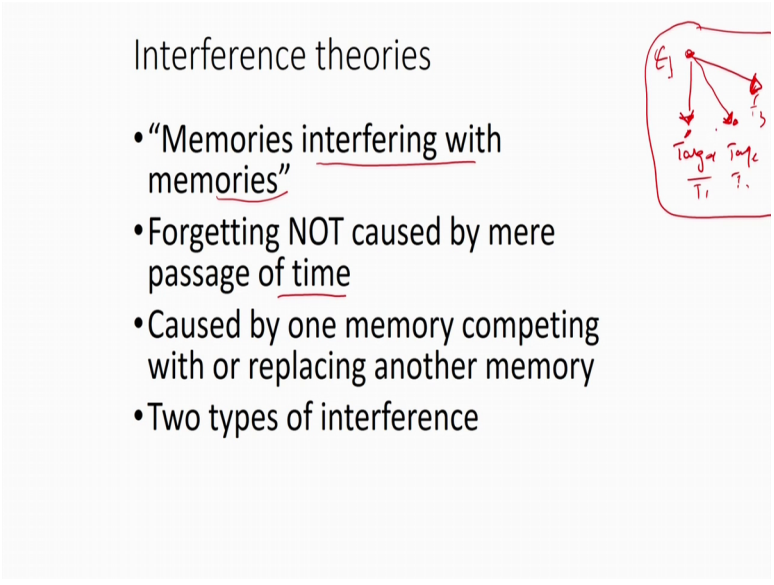

Then we have the print appearance theories and what is the interference theories say. So, memories interfering with another memories is the reason for forgetting. So, why do we forget we forget because one kind of memory interfere with another kind of memory now we looked at what is interference and we looked at how does it happen. So, what

happens is that if 2 items which are very similar fairly similar together are brought to their brought in close proximity to each other one will interfere with the other or one will compete with the other.

So, there is something there is something calla fan effect which has been explained by understand for this kind of a interference. So, Edison and Nele 1996 they did this work on how interference really works. So, they what they looked at is that any retrieval cue points to a particular target this is how they looked at. So, if this is a retrieval cue or this is how you retrieve something it points to a target, but then assuming that another target is added to it which is similar in nature this retrieval cue then is shared between these 2 targets. And so, if more number of competitions are generated what will happen is an interference will happen because this retrieval cue c one is now cueing these targets T 1 T 2 and T 3. And so, what will happen is when C 1 is activated one neuron is activated or one junction is activated.

Now, they are not uniquely connected what will happen is all of these targets will get activated and they will interfere with the processing of 1. Now forgetting not caused by mere passage of time, this theory basically says that forgetting is not basically due to passage of time is caused by one or more competing with or replacing other memory. So, the definition the thing that I showed you what will happen is multiple targets with compete with each other.

So, as soon as this cue is activated this targets will compete with each other the more similar they are the more chances that they will not be retrieved because similarity is one way of how information is retrieved. So, if let us say there are how is the conceptualization of working memory there are different bean bags or think of it in the there are different kind of structures out there. And so, structures which have similar kind of structures which have similar kind of features are put into this bean bag. We look into that when we talk about semantic memory. And so, what will happen if it is informations which are of similar type they compete with each other what will happen is that they will not be processed. So, it is caused by one more competing with or replacing another memory. So, if similar items are there they will compete with each other.

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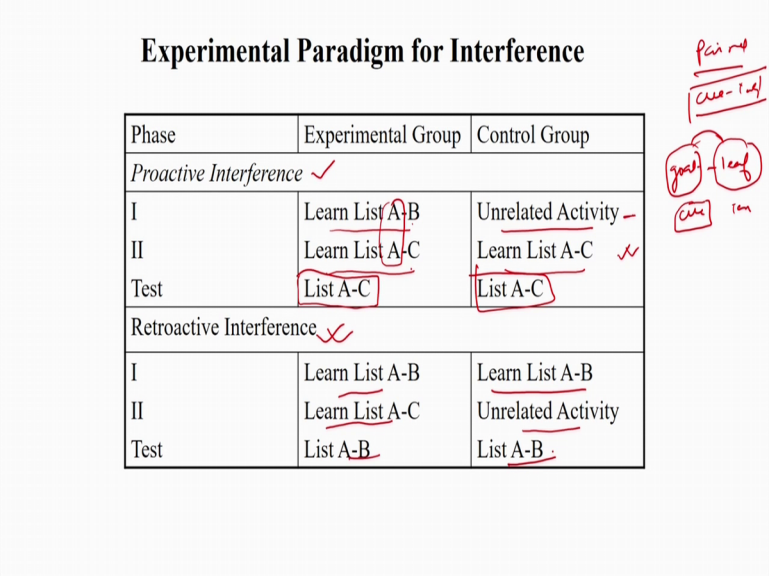

And. So, they will not be able to retrieve it there are 2 types of interference to look at. One is called the proactive interference and the other is called the Retroactive interference, and a very simple paradigm explains it. So, let us assume that an experimental group a group is given to learn a list A B and a and while they are doing that a control group is given an unrelated activity to do after a while the same group both the groups are now given a list A C to learn.

So, A B is a list basically A B is a pair associate list. So, you have how what is a pair associate list in a pair associate list you have something called a Q target kind of a set up in Q target what you have is so, let us say if we have goat and we have leaf here. The goat is what is presented to you the leaf is what you have to remember and this is called the pair associate. So, a pairing between goat and leaf is done and this is called the Q and this is called the target.

So, in the while learning you will learn goat leaf, but while retrieving I will show you goat and you have to learn leaf now we have done this earlier on a attentional theory and in perception those are part of perception also where we showed, basically in perception of automaticity of perception where we showed how automaticity really works. So, basically in this paradigm then what happens is at a later period of time you are given to Learn List A C now when that happens to control group shows no interference, but then since list A B and list A C has a in common. So, this will interfere with each other. And

so, the learning of a the running of A C after A B creates. So, this kind of interference and this is called proactive interference.

So, here since no list was done the learning of A B creates interference with learning of A B and that is what the proactive interference is all about in Retroactive interference paradigm what you have is both groups Learn List A B and A B, but group 2 learn A C and group the control group does not learn anything. And so, what happens here is this A C list the learning of this particular list it interferes with the learning of the earlier list and that is what attractive and proactive interferences. Let us quickly look into what these really mean.

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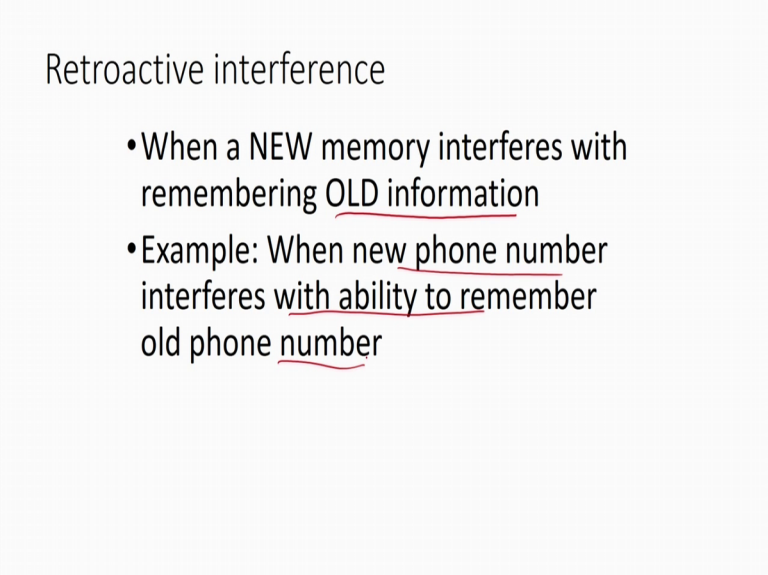

So, when a new memory interferes with remembering of old information this is called Retroactive interference, example is when a new phone number interferes with the ability to remember your old number.

So, let us say you have you have change your sim card you have change your number and when some degrees from the old number the new number interferes with remembering of the old number this is basically what is call your Retroactive interference.

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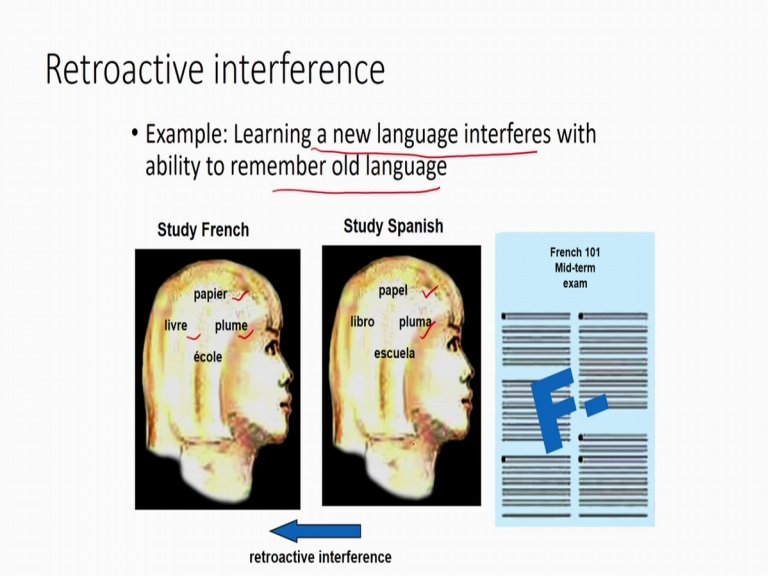

So, quick paradigm example learning a new language interferes with ability to remember a old language. So, this person here she knows French and these are the French words that she knows. And so, what happens is after that she learns Spanish now papier and papel both are for paper liver and or pluma and plume both of flower and so, this kind of things are there which are very similar in the 2 languages. And so, what happens is if she learns French first studies Spanish second and Spanish interferes with the learning of French that is why she gets an f in her exam and this is what is called Retroactive interference.

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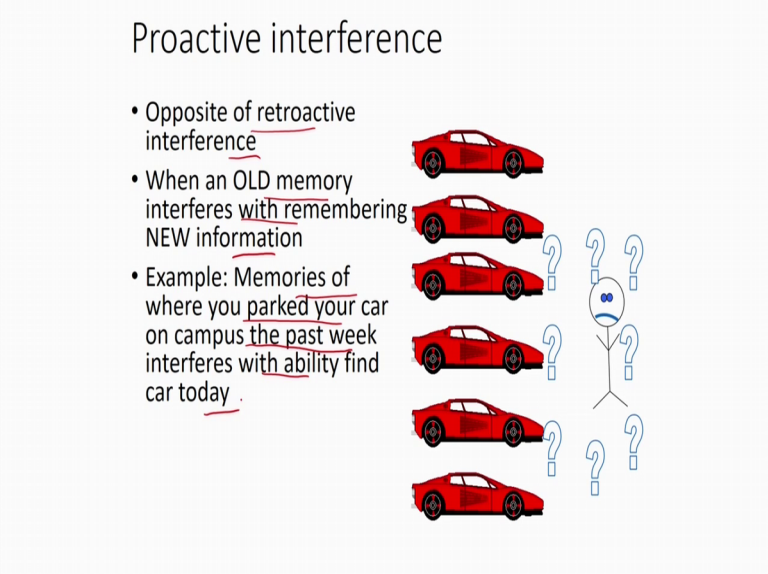

In proactive interference what happens is opposite of Retroactive interference. So, when old memory interferes with new memory. So, in Retroactive new memory interferes with old memory as I saw as we saw that Spanish interferes with French, I mean proactive interference is the opposite the old memory keeps on interfering with new memory that is called the proactive interference. And so, in proactive interference what happens is memories off where you parked your car on campus the past week interferes the ability to park car today. So, what happens is since you have parked this car your cars how many time near your past parked a bicycle in wherever you are leading your department.

So, many time at so many places where that interferes with the fact that where you park today this is what is called proactive interferences, this is if. So, old knowledge hampers because you tend to park at some place and because that was not available you part someone else. And so, the ability to go back or the automaticity which makes you go back into the place where you used to park and not finding a bicycle is what is called proactive interference.

So, all knowledge basically interfere or completes with new knowledge. Now basically as you saw what happens here is that most both the information are similar type because it is a parking situation in both the cases. And so, similarity is there another theory which talks about the failure or which talks about how retrieval failure happens is called the retrieval cue theory of forgetting.

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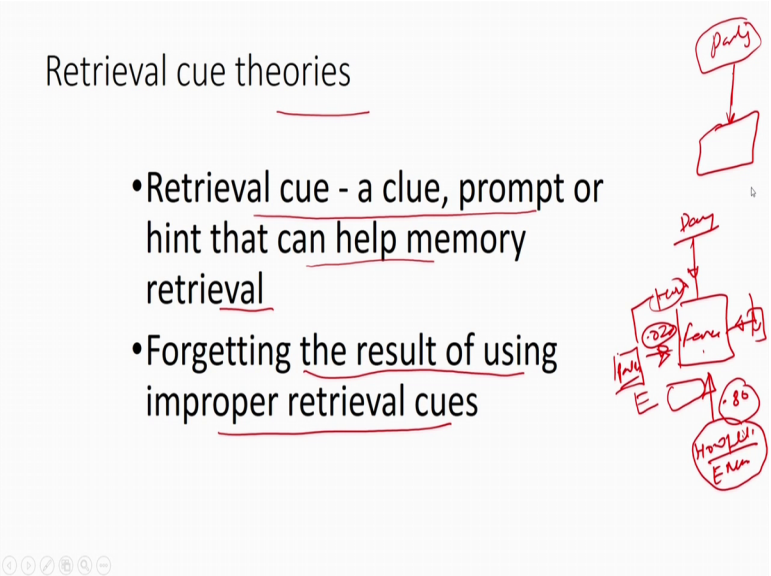

And. So, what is the retrieval cue theory the retrieval cue theory says a clue prompt or hint that can help memory to retrieve. So, basically when any long-term memory is formed as I said it is a cue target kind of any kind of a memory is a cue target kind of a system.

So, memory is generally has something call a key lock kind of a system. So, basically when a memory stored somewhere in the in the long term store a cue or a key is provided to it and this key fits with this lock the memory and it opens it. So, this cue clue cue is the clue or the law the key for the memory and the memory is called the lock or that is the store which is there.

And so, retrieval cue is very important because if you use the wrong retrieval cue you may not be able to retrieve, also another feature that you have to know what retrieval cue is that, sometimes one memory can have multiple retrieval cues what do I mean by that if you want to remember your let us say farewell that is class farewell now that is what you want to remember there are several ways of remembering it one is the kind of importance you were given their another is the kind of feeling that you have on that day may be embarrass so that embarrassment, which could make you remember that day or maybe it was other kind of words people said to you or the kind of feeling that you have that day the kind of shock that you got the kind of emotionality which was generated.

And so, several events or several events can link to that memory and can bring for that memory. And so, multiple cues can link to that memory and each of these cue has a certain weight to it the most weighted I mean to say the most potent cue will have the highest weight.

So, basically if my memory that I am talking about is let us say remembering an event and the event is my farewell, and there are 4 cues which can make it remember for example, the day in terms of what day it was how I felt that day that is another. So, my feeling my emotion is one way of remembering it or it could be an let us say party and after party which is making it remember or some other event at home which makes me remember it.

Now let us say this emotionality is whenever I think about whenever I become emotional I remember this farewell. So, it has the highest weight, here right? And so, these have another and so each one of them can think can make you think about this farewell

situation, but what would happen is that this is the one which will make you the think more and this is the highest rate. So, basically what is there and similar situation can also occur where one cue can retrieve so many memories. So, there are all ways all type of things of that let us look at this theory.

So, retrieval cue is in this, this is what of cue looks like. So, forgetting the result of using improper retrieval cue if you think about a party and if that is what is retrieving the farewell and what could happen is there you would have so many parties in your life. So, it could be the farewell party it could be your home party which is there it could be some other party with your friends which is unrelated to the farewell and so on and so forth.

So, if party is the fact or party is the cue that you are using to try to get retrieval this has the lowest weight, right? Because you may have so many parties, but how you felt that day has the highest weight. And so, that is the most potent thing. And so, if using improper cue if thinking of retrieval in some other way in which it was not encoded if that is what you are trying to retrieve then that is not possible and so that might not be a good idea of retrieving.

So, retrieval forgetting can be basically happening because people do not have the right retrieval cue.

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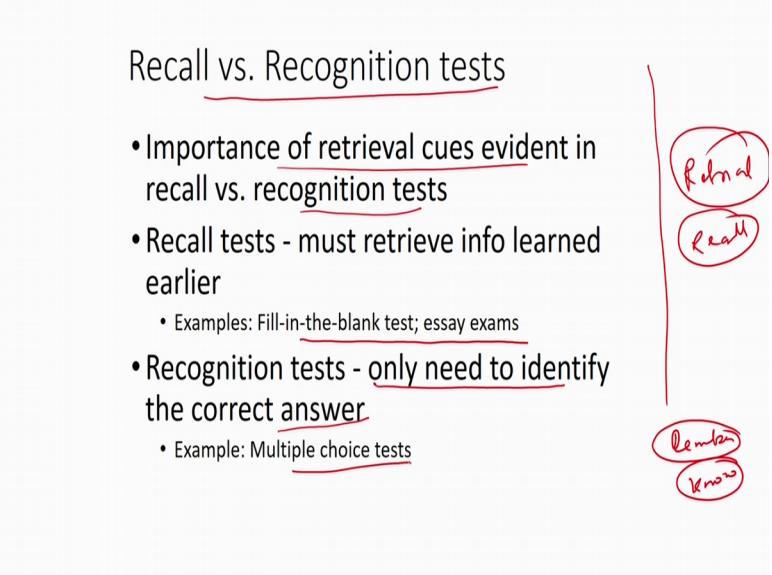

Now, with retrieval cue there are 2 things to look at one is called the recall and the other is called the recognition. There are 2 retrieval types from long term memory. We will discuss this retrieval and an recall in detail in the upcoming lectures, but for now let us look into it. So, importance of retrieval cue is evident from recall versus recognition and what is the difference. So, recall test must retrieve information which is learned earlier for example; fill in the blank type of test. So, those tests which ask you to remember something from memory right and as demonstrated you are filling the blank type of questions are mostly retrieval or recall kind of a retrieval system.

So, here you have to retrieve the actual information which is stored, and in the Recognition test what happens is it is like in answers in front of you, but then you have to basically go ahead and match them. And so, as you will see that recognition has recalled in building to it because only if you recall something if you are able to recall something and then you will be able to match it. So, basically remember versus no kind of a thing remember versus no kind of a system. So, I remember something versus I know something.

So, for knowing something you have to have this remember for remembering something you have to have the knowing kind of a thing. And so, multiple choice tests are something called Recognition test.

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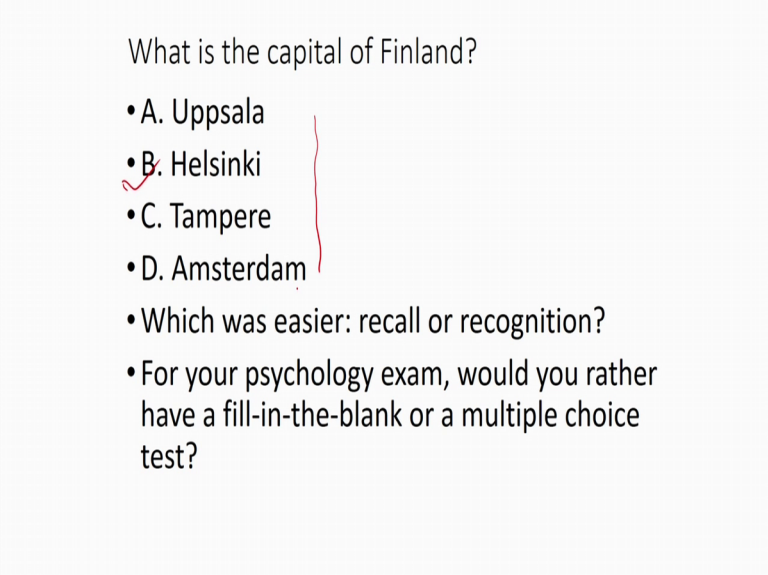

So, for example, look at this question what is the capital of Finland. Now the no answer is there. And so, whenever you try to give an answer if you have a given answer to that it happens. So, recall because when you search a memory for it and look at these the 4 answers which are given I am pretty sure that you know the answer. The answer is as Helsinki. And so, the fin what is the capital of Finland there are 4 answers. Now when you are recalling you are doing a free recall.

So, you are searching your memory for any information, but in recognition you have to have recall also because you have to recall where does these things fit. And so, recall basically is a part of recognition. And so, this is what a Recognition test looks like and so, you will put in to fill Helsinki because all of them now have a probability of 0.25 one 4th probability of being remembering.

So, which was easier recall and recognition psychological exam would rather have filling the blanks or multiple choice and it is best that you have recognition item is basically multiple-choice questions have what is on which what I have been used nowadays everywhere. And so, this is the most important kind of examination which has been used. And so, this is the most prominent kind of a recall that has been or kind of a recall system which is used everywhere nowadays. So, in this lecture will looked into some of the what is how long-term memory is designed, what is the way in, which it is encoded and what is forgetting, how it is stored and what is the forgetting from long term memory or how does this long-term memory store information.

Thank you.