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

Lecture – 13
Memory

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We are now in our third week, till now what we have done, we have looked at how information is brought to the brain, how the brain assigns a meaning to it, based on our experience that come to us, how do we learn certain things. Now we are moving to the next step that is, once the information comes to us and we realize that there is a need for us to store it for a little longer time for future usage okay.

Future usage could be same, couple of seconds from now or it could be know even in the lifetime sometime. So future is no quite broad in that sense, so when you realize that I need to store this information for little longer, I can use it in maybe a couple of seconds, couple of minutes from now or I might need this information much later in my life which is valuable to me. Then we try to store it, and if we have successfully stored it, then whenever needed we will like to retrieve it okay.

If the process of storage works well, if we succeed, you know retrieving it from the storage this is what is called as memory. And in this third week, we would be exclusively focusing on the concept that has to do with human memory processes okay. Now memory is basically studied in terms of mental processes that are involved in storing and retrieving information. Now remember before memory we have talked about learning, the distinction between the two is, that learning basically emphasizes on acquisition.

Whereas memory basically focuses on the retention and the retrieval of the information. So if you acquire information that is what learning looks at, if you are more interested in terms of

retaining the information and retrieving it wherever you need it, then this is the part of the memory. So storage, retrieval these are two important constructs that we would be looking at. Now memory system it stores information acquired through our sense modalities. How the sense modalities they help our brain in terms of an perceiving things, that we have already discussed in the first week.

Now these informations which come to the brain might qualify to be stored for relatively longer time, and therefore memory consists of many systems ranging from storage duration and before storage which primarily will take the information to the long-term storage okay. So depending on the fraction of second to lifetime duration of storage, we will further classify memory into different subtypes, that takes a side we will continue doing till the end.

Therefore memory basically is our cognitive system which is used for a storing and retrieving the information okay. With this basic information about memory, let us understand what actually we are going to do is part of this very discussion, deliberation for this full week. We would be trying to understand what memory is, we would be looking at some of the dominant theories which tries to explain how human story system works, how the retrieval process works.

Then we would be trying to understand, that why is it important for human beings to memorize information, why memory plays that important role, and given the fact that memory plays no such important role, how many types of a retrieval and storage processes are there, one is of course based on the time line whether you know, store the information for few seconds, little longer or much more longer okay.

Or depending on how you truncate it, you have the information which runs for certain duration of time. And then depending on certain qualities you truncate it, so this would lead to know all types of storage of information okay, the strategies that we use. And then we will come to the reverse of memory, reverse of memory would basically be the process called forgetting.

If you commit an error no, in terms of a story information or you have stored the information, but then you commit an error in terms of retrieving it, think of something like this, you are now

searching for a paper that you have filed in your cabinet okay, your filing cabinet has that specific paper that he was searching for – that you are very sure about. But when you search for it, you have all types of problems okay.

Maybe that people -- some people give proper file names, where they will put such type of documents. So they would only look for those file names, once they find the file name they will turn the pages and identify the paper, this could be one. The other situation could be, that you make a random search and even in memory we will see that random search actually does not work okay.

Some people might even go for ordering things no, putting things in certain orders, in certain hierarchy that also works very well then you also might know file the document based on its relevance whether you will need in the coming days you whether you would know need no in longer duration papers which you think are redundant you will never need it depending on your classification scheme you will put the paper accordingly.

Same is the story with the memory processes also life experiences all the information that comes to you depending on several, several, several parameters we try to give it a code we try to store it and the coding is needed because the brain understands a particular type of a language storage again you need to store it for longer time and also you need to give it a proper file name so that when you want to retrieve this information you can just search for that specific file name and get the information.

So from that perspective if you look at the memory process memory has three distingue processes encoding.

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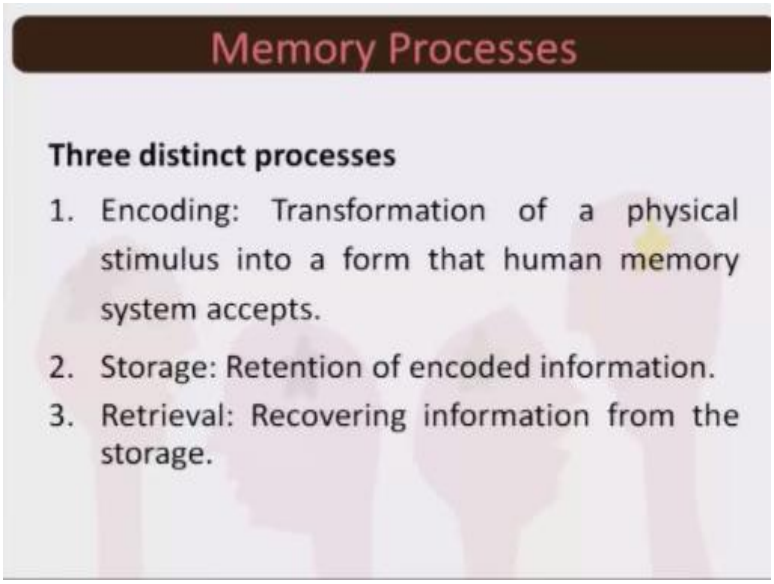

Storage and retrieval now encoding basically is the process of transformation of physical stimulus in a form that human memory accepts now if I am looking at the camera right now okay there is no certain form okay and I perhaps have some idea of what type of function this form a performs and based on this utility are based on this form I create an impression okay I know that if I see an object like this what this should be called I know that if I want a function like this to be performed.

What is the instrument that I would need okay so this is in the process of recording storage off course is the process of retention the encoded information has reached the.

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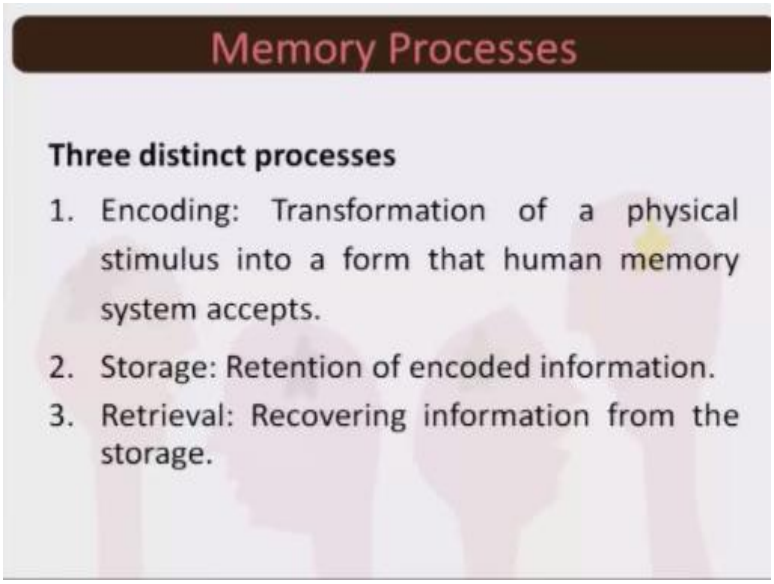

Brian and now that encoded piece of information the brain will retain itself remember the storage would require a specific file name it is just like we save files in our computers okay say for instance if I have to deliver a lecture on memory and if I make a PowerPoint presentation okay I might no love to give it a name the file name memory because this will help me a lot in terms of no us making search for where exactly is my PPT presentation that I have to use today.

If I have say 106 Power Point presentations with me making random search will make my life help so how you encode the information and how precisely how nicely how customized the file name you provide to the information that you have stored that place are very crucial role and this crucial role comes into play when you try to recover the information that you have a stored.

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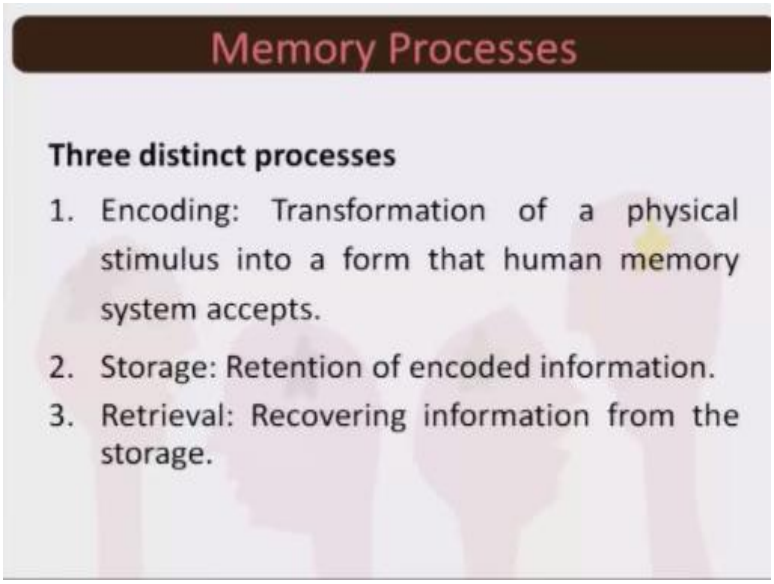

Okay so encoding a storage and retrieval are three distinct processes which are of extreme relevance to memory processes two models we would discuss 1 that Atkinson Shiffrin's model that was proposed in.

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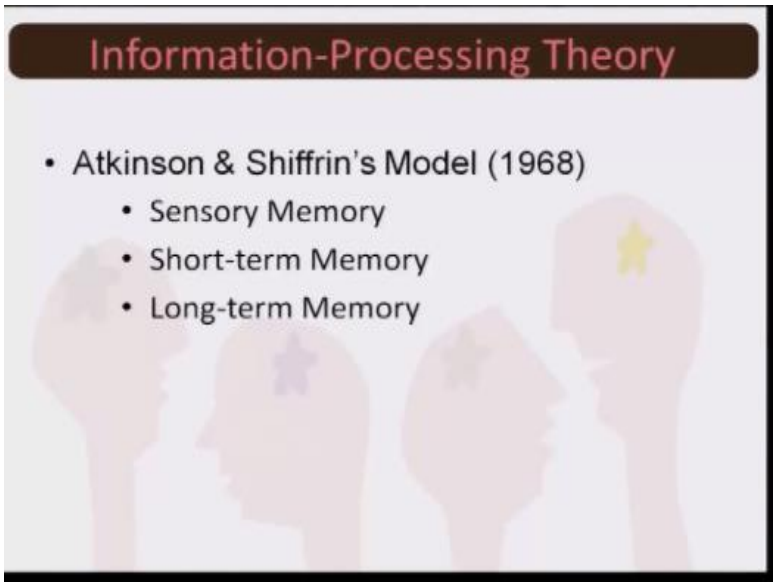

1968 which tried to now explain memory in trifurcated format saying that we have sensory memory short-term memory and long-term memory.

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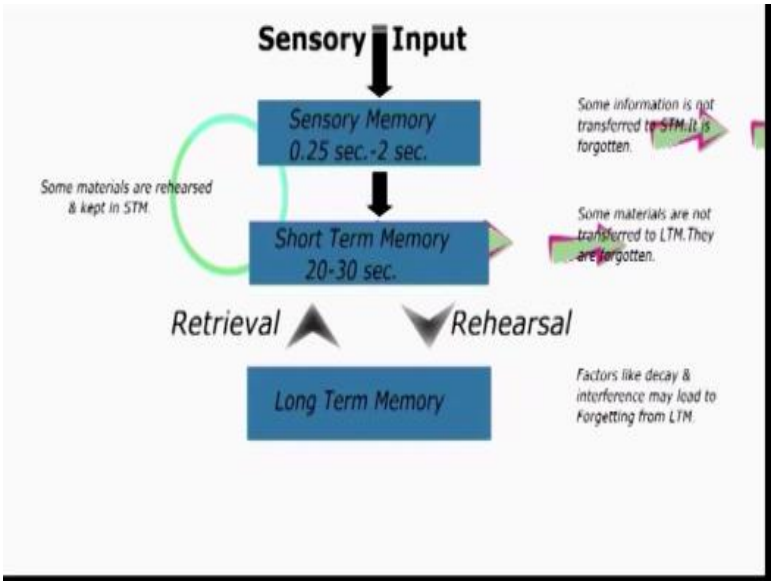

Memory starts with sensory input received from the environment this input is retained for a very brief time ranging from 0.25 seconds to 2 seconds, some of these inputs are attended and rehearsed such input pass on to short-term memory the unattended inputs are not transferred to short-term memory and are forgotten the inputs can be held in the short term memory for twenty to thirty seconds if they are further rehearse the pass onto long-term memory.

The unrehearsed ones are forgotten the inputs moving to the long-term memory as organized into categories they may remain here for days, months or even lifelong and can be retrieved as and when needed decay and interference are some of the factors that lead to loss of information from a long-term storage because there are contingent an Shiffrin's model they talked about that trifurcated structure of a memory okay.

Just looking at it from a temporal point of view okay sensory short-term and long-term another theory was proposed by Craik and Lockhart in 1972.

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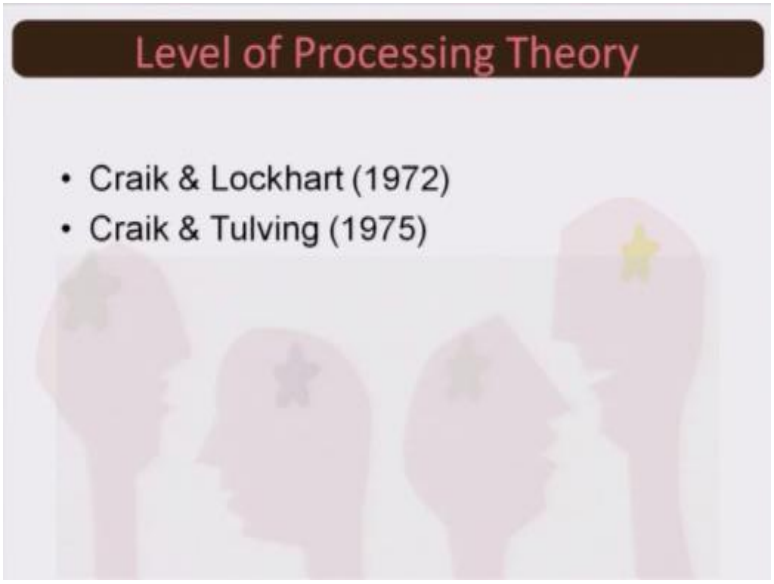

Which further got revised by betel wing and Craik and Tulving came forward with a revised version in 1975.

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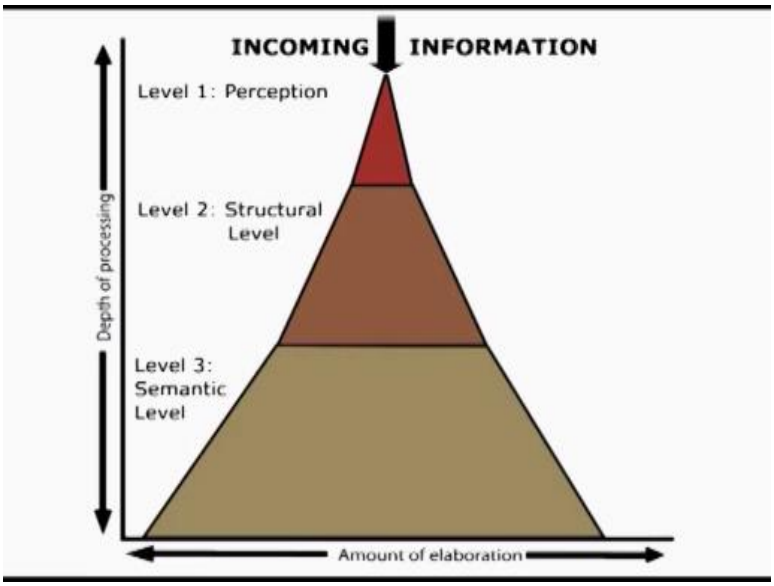

According to this model the incoming information can be processed at three different levels perceptual level, structural level and semantic level at perceptual one becomes aware of the immediate environment the structural level is somewhat deeper compared to the perceptual level here one emphasizes the structural features of the information the deepest level of processing is the semantic level here one derives profound meaning of the information this model explicate that deeper the processing more is the elaboration in other words deeper and meaningful analysis leads to do durable memory of the information.

Higher the elaboration more are the chances that the newly derived meaning integrates with existing memories now you have seen the difference between the two models the first model which tried to look at memory in terms of the three types of structures based on it is temporal programming the second model which was more looking in terms of the elaboration process okay whether you look at the information only from a perception point of view or whether you look at the information from a structural point of view or whether you go for an extensive elaboration okay there by suggesting that the more and more elaborate perhaps you understand things better and if you have more if you have more of no symmetric meaningfulness driven type of a memory okay you will store it better.

The third a perspective on memory is what is call as the neural network perspective now neural network basically now talks about the groups of modules so it says that there are various modules which form a group, okay. And these modules basically they help perform simultaneous functions. Memory is nothing according to the neutral network perspective but it is formation or strengthening of these interconnections.

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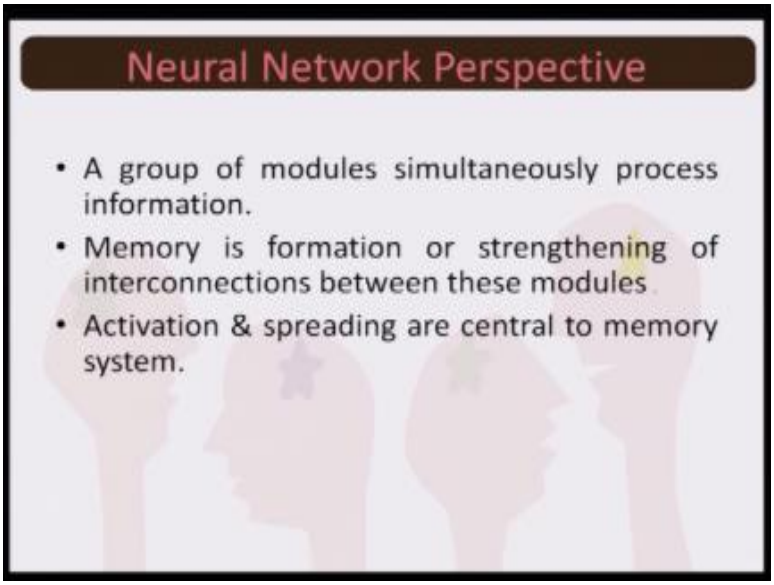

Which gets formed between different modules, okay. Now the activation and the spreading they are the two central components from the neural network perspective related to memory. So what happens you get the information from the external environment, you encode the information, okay. You have modules which would be entertaining those encoded information and once the traces are formed.

When you repeated the second time it gets strengthened, okay. Now two or more modules they get interconnected and this formation if it is repeated it gets strengthen when you activate it, okay. You are able to stored the information, okay. Now more and more is the no formation of the module more and more is the connectivity between different, different modules, the more

spreading takes place, okay. You have better memory. So there is a spread of this is strengthened associations the stronger the Association, the more wider the network, okay. Better would be the memory and when you activate it this is how the memory system gets operationalized, this is the neural network perspective.

Now that we have discussed three important concepts no, the model given by a Atkinson and Shiffrin, the model given by Creak and Law cord which further got revised in collaboration with Delving and the neural network perspective if we combine all these information and try to evolve a comprehensive model of memory. So what is memory all about? How does our memory function? Okay. This is how we would explain it.

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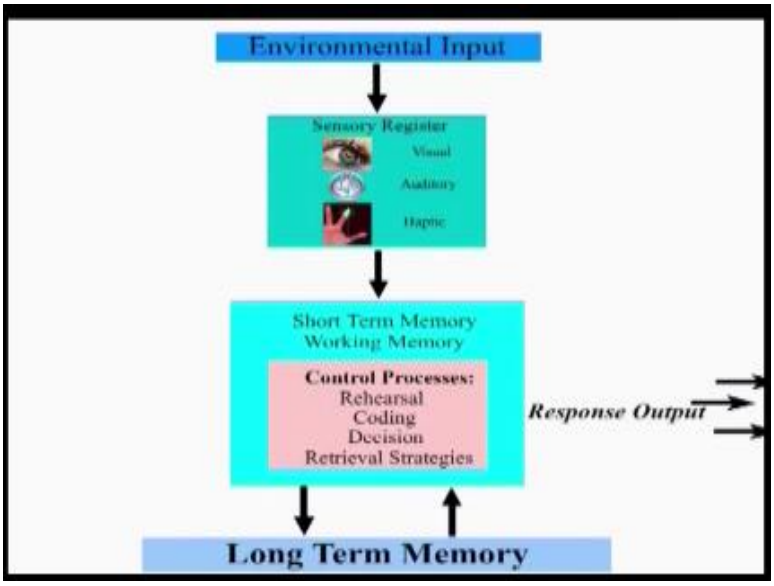

This is what you get, if you summarize the existing knowledge on memory system then our centralized register mostly gets information from the visual auditory in the haptic senses, the rehears information then moves to the short term memory system those encoded and rehearsed for their move to the long-term memory system depending on our decision to respond to the environment.

We use certain retrieval strategies to get the desired information from the long-term storage, the response outputs are mediated by our working memory. Now let us go back to our first view, what we discussed there was, that visual kinesthetic, somesthetic, vestibular, auditory, olfactory, okay. All these channels they are basically meant to provide information to the brain. Given the fact that the brain receives stimulus from all these sensations, okay.

One can think that if memory is guided by the information that comes to the brain then ideally it should store all type of information. Now let me give you an example. Say if your mother for instance, okay. Just comes and no keeps a palm on your shoulder, without hesitation within fractions you would arrive at a conclusion that it is my mother, okay. This recollection you have not looked at her mother it is only the touch of the mother which made you identify make a correct identification that it is your mother.

Whereas if somebody else touches you, you are not able to provide the correct meaning to it, why? And this gives you a feel that fine a touch-based memory could also exist, okay. Previously I was telling you that if I look at a camera and I know this is called camera, okay. The structure , the form, the function both. So next time if I see this structure I know this is camera and if I needed something to be recorded I know which is two mean can perform this function.

And then I will say I need the camera, okay. So it is the visual part, it is the understanding of the mechanism and now imagine another situation, you are somewhere no close to a railway track you are not able to see a train but you hear the sound of a moving train, just with the help of these auditory input you can sense, okay. The fine the source of this very sound is a moving train, which perhaps is no at certain distance from me, okay.

Now one sound, how does it make you understand that this comes from the train? Again there must be something that the brain has restored based on the auditory process. Say somebody gives you something to taste, you put it on the tip of your tongue as Oh! I remember there is something else also which resembles to this taste or this taste is equivalent to something that no you and the person with whom you are sharing this experience also is aware of.

Then you realize that there could be a taste based memory also okay. So what I am basically trying to tell you is, that because the brain receives input from all sense modalities, you can assume situations and you can very easily identified cases from the real world situation, where your own experience will tell you that this part of my memory is basically guided by the input which has come from a given since modality.

Having said this, let me confides that research in psychology has largely been conducted by only using two sense modalities, the visual processes and the auditory processes. So eye and the ear these are the only two sense modalities through which know, how the information is captured how it is process, how it is stored okay, whole lot of research is going to it. And the third set research which is not as comparable as the usually or auditory guided a research, in a memory is the touch based memory.

Rest of the sense modalities, they have not been examined as thoroughly as the first two and then the third one. Therefore, we will for our understanding of sensory memory will focus on only three types of memories so, the sensory memory which has to do with vision that is the iconic memory, sensory memory that has to do with auditory process.

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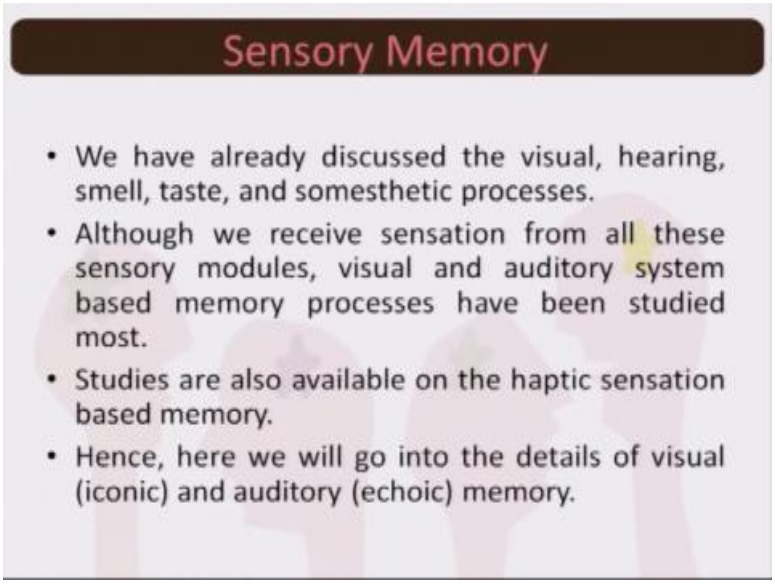

That is the echoic memory and the sensory memory that has to do with haptic sensation, the touched based sensation. But because largely research has been guided by the iconic memory and the echoic memory, so for this very module obtain are brief module we would be know, talking exclusively with respect to the iconic and the echoic memory, iconic and echoic memory.

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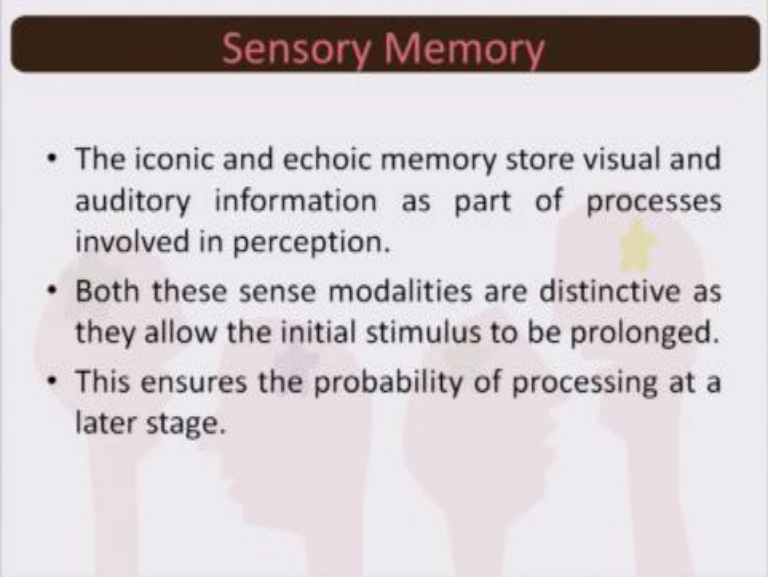

Basically know they store visual and auditory information as part of the process involved in perception okay. So eye and ears both are responsible for the process of perception they are the first source the biological entity in our body which receives the signal from the external wall, now both these sense modalities.

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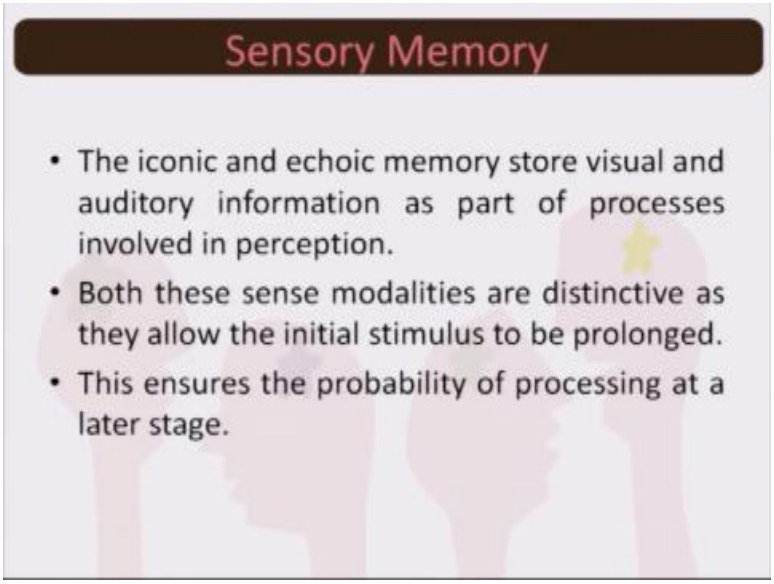

Are distinctive because they allow the initial stimulus to be prolonged okay, this means that when the eyes they get activated because the light falls on the retina you remember in perception we had said, that the sees as state converts into the trance state and again gets back to the sesar state, because it has to be ready enough to receive the second set of signal. Now this very transformation okay, the at the level of retina the rod cells in the consoles the light falls and the SIS configuration becomes in the trance state. The time that it will take to get itself back to the SIS state is the time, which basically the eye gives to itself to retain the information for certain period of time.

So the visual information although it has crossed to the optic track okay, till this know information, till this chemical configuration realigns the information is stored at the level of eyes, this is iconic memory. Now recollect what we had discussed about the auditory mechanism, what we discussed was that the sound wave it in turns to the middle ear it goes to the inner ear, where in the cochlear we have the flute and the wall of the cochlear which has the hair follicles this flute starts shaking and thereby making movement in the hair follicle. These hair follicles in turn triggers current in the nervous circuit okay. This neural circuit finally is pursued by the brain, assigned a meaning and thereby, we hear meaningful things in the world. But, reconnect your

other experience of throwing a piece of a story in a Still water okay, or if you do not have that experience recollect the experience of know, collecting water in a bucket that falls from the tape. You close the tape and one or two drops still falls in the bucket and you realize that the rebels create in the water, it takes certain time for the rebel to settle down okay.

Now convert this to the working mechanism of the ears, the cochlear has the flute, the flute shakes so once the shaking has begin it will take time to slow down and then gradually get a stabilized. So that would mean, that till the flute in the cochlear no moves, the hair follicles will also move and till the hair follicle moves ear is capable of retaining the auditory information okay, and this is the source of echoic memory. So what happens, eyes and ears both are now capable of storing the information for a shorter period of time to ensure or to allow you the probability of processing this information at a little later distinction okay.

And these are the biological foundation of sensory memory, especially remember we are talking only with reference to iconic and echoic memory. Now iconic memory, it has to do with the eyes can hold information for up to 1-2 seconds okay.

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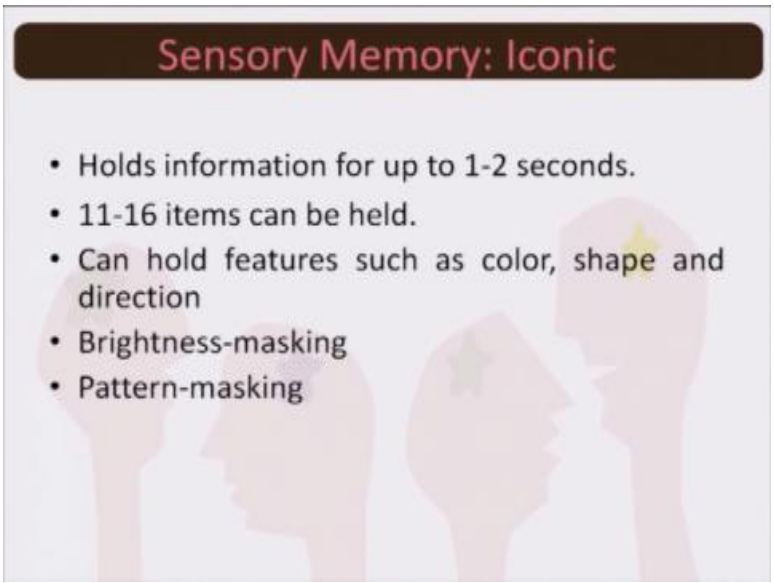

Remember when we will come to the echoic memory we would realize that ears are able to store information for a little longer period of time compared to eyes, why that question we will take up when we come to echoic memory. Now what happens in the case of iconic memory, shorter period of time just 1-2 seconds? But then you have a longer piece of information11 to 16 items can be heard right at the level of.

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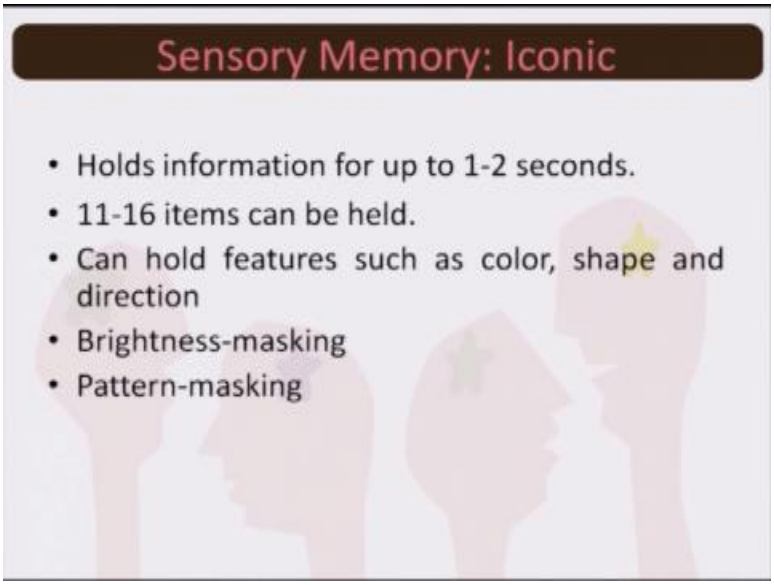

Eye far 1-2 seconds you can imagine the capacity of iconic memory. Further what is far more interesting is to understand the fact that features which are extremely important for us to perceive the world such as color, such as shape such as direction okay you remember Muller- Lyer illusion the example that we took it had arrow added line feather line so directions was there different lines and different colors entire this dull principle to bubbles that you is to come as examples all of them where colored so the shape color the direction all these features can be in store okay.

And 11 such information 11 to 16 such information can be stored right at the level of 5 what would this mean this would mean that when you saw examples whether it was a line whether it was horizontal whether it was vertical whether it was a babol whether it expand whether now it

moved it in the vertical , vertical direction diagonally, horizontally okay everything you could store right at the level of the eyes on multiple information up to two seconds this is what happens at the level of eyes and this is called iconic memory.

However our iconic memory has two limitations first if you vary the brightness level okay , once you now change the brightness then you realize that some degree of masking has taken place okay so right now the level of brightness was this much you add one more glowing light are you switch off one more light and you realize that the brown brightness pattern is changed because in perception also we have discuss this based on the now balance between white, grey and black the perceptual quality changes okay therefore 2 information can get massed okay it can interfere so this is called brightness masking.

Similarly we can have pattern masking more than one partner if it is superimposes 1 gets over lid over the other and you get a combined image of the 2 this is this we will called as pattern masking so in terms of efficiency we know 11 to 16 items color, shape direction all such important features for up to 2 seconds that is the capability of the iconic memory limitation it no highs it is limitations when you are tempered the brightness level and if you vary the pattern then also it has certain limitations okay with respect to iconic memory let us also discuss one of the interesting experiments done by sporadic.

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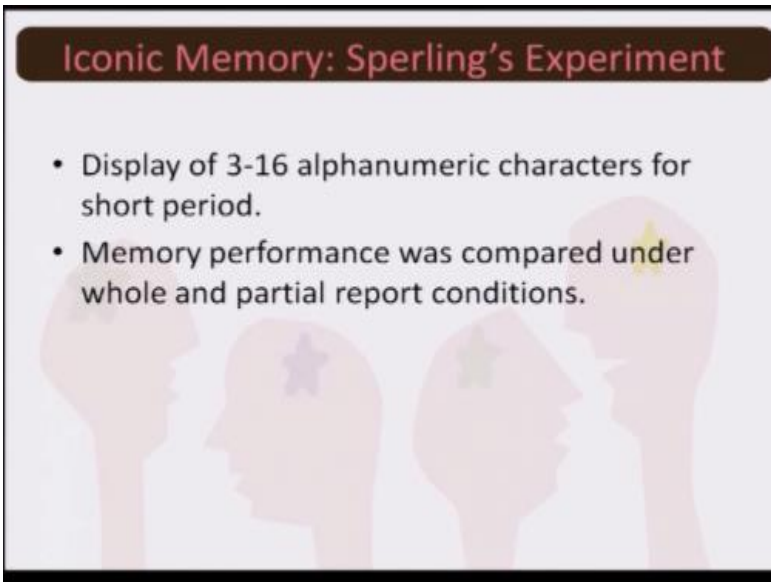

Now 3 to 16 alpha numeric characters were displayed for a shorter period of time okay and performance in terms of memory was compared under two conditions the whole report condition and the part report condition.

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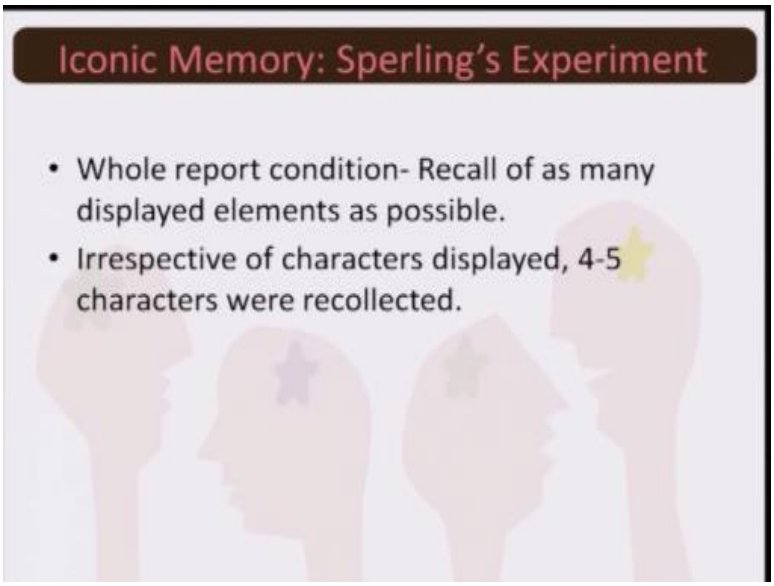

Now in the whole report condition recall was basically supposed to be done okay with respect to as we need information as many elements of information that was initially presented okay how was the participant is able to recollect now irrespective of the characters.

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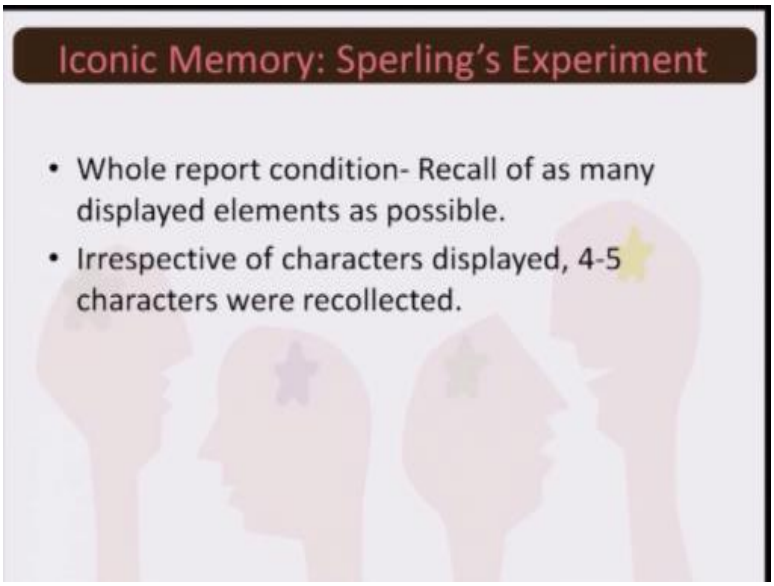

Displayed it was realized that only 4 to 5 characters we are in collected okay this was the whole report condition where the recall was supposed to be off maximum possible number of elements what happened in the case of partial reporting condition in the partial reporting condition.

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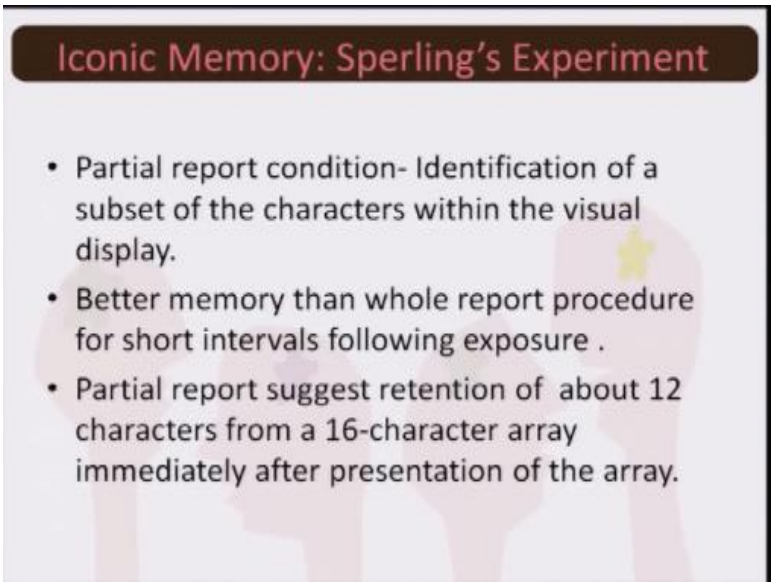

The participant was basically supposed to identify the subset of the character within the visual display and it was realized that memory was better in this case so better memory compared to whole the report procedure okay and partial report also suggested that retention is possible for about 12 characters from a 16 character away so if this alpha numeric character there was 16 alpha numeric characters 12 at least could be a recollected in the partial report condition suggesting that if you are allowed this freedom to go for a partial recall this is a better condition compared to the whole recall condition.

Another interesting information of a research not so very old conducted 2010 which tried to now modify Sperling's partial report parade in technique and try to find out if iconic memory works in the case of inference also because whatever we were discussing what to do with the adults now in fans this very study phone that even for human children over just six months old.

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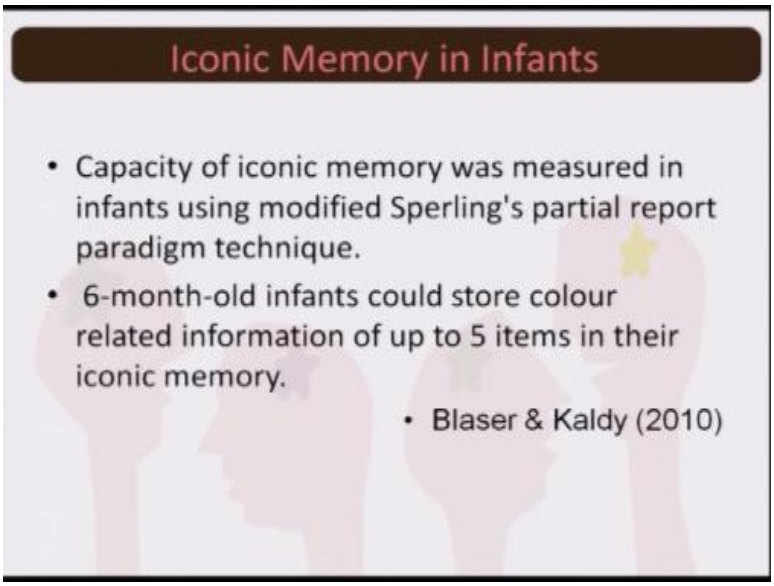

They could also a store color related information okay and up to 5 items were now stored at the level of iconic memory so you can visualize that write from a very early stage in our life iconic memory vision based memory which basically serves us for a very brief period of time not more than two seconds time okay plays an important role when we meet tomorrow we would be talking about echoic memory.

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