The Nature of Psychology
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Lecture – 10
Memory – II

Friends welcome back to this lecture on Human Behaviour. This is lecture number 10 in this series. And if you remember from the last lecture we were dealing with human memory. So, what we will try and do in this lecture we will complete human memory. Now a disclaimer to start with for all the lectures I am doing in this series especially on human cognition can also be referred back to my other lecture which would be running that is on course on cognitive psychology.

So, what we are doing in this lecture on human behaviour is just introducing the concept. And if you want a little bit more or if you want to understand the concepts little bit more you can always refer back to my lecture on cognitive psychology which is on the internet, which is also a course a MOOC's course on cognitive psychology which is call the interaction to cognitive psychology. So, before we go any further let us do a quick recap as we keep on doing in the other lectures of what we have been done up till now.

So, we started off by dedicating two lectures to introducing the concept of what is human behaviour and what do we do in the study of human behaviour. And there we introduced the concept of psychology, what is psychology and what are it is basic historical routes from where it comes and why should we study human behaviour for all matters. Then we looked at the two branches or two sciences from which psychology evolved. And I showed to you how psychology has it is roots not only in philosophy, but on physiology as well.

And so these are the two main branches from which psychology has evolved. Then we will looked at some primary schools of psychology not limiting to structuralism and functionalism which are the old schools, but also extending to the idea of psychoanalysis and behaviourism and guessed autism and so and so forth. And for that what we looked at neural schools of psychology towards then this lecture. We looked at experimentations of how studies that are in psychology which is basically using the experimental method or the observation method or the correlation method and so and so forth.

Lecture number 3 and 4 were dedicated to understanding sensation which is the process of grabbing, the physical stimulus and converting into psychological medium or into the psychological framework. And there we looked at the process of sensation and what are the parameters of any sensory system. So, we looked at two parameters; one being the sensitivity and the other being the sensory coding. And we not only looked at these parameters in detail, but we also took a model of sensory organ which is a human eye and try to interpret.

All we had learn about sensory organs or the process of sensation and how the eye functions on those parameters or how the eye fits into that whole idea of how sensory systems work. Then we moved on to the concept of perception which is making meaning to sensations. And we looked at the primary definition of sense perception, we looked at perception from two viewpoints; one was the global view point the other was the local view point.

So, global view point the or we looked at perception from the ecological point of view from the idea that perception is equivalent to anything or all information which is falling on to the retina or the eye. So, we do not need any kind of other information the retina of the eye is in terms of visual perception or the eardrum in terms of auditory perception my information falling on to it is enough to create the world or make meaning of the physical stimulus.

And then we looked at the global view which says that perception is not something like this, it is a five six step process. So, we moved on to looking at perception as a six part process or five part process rather starting off by looking at attention which is the first process in perception then moving onto something a localization and then to recognition further to obstruction and constancy. We moved onto the section on learning which is basically what is done to all those perceptual organisation through perceptual material.

Basically, once you perceive something these materials are learned and then they are stored. So, the next two chapters on learning and memory where is how human beings deal with physical stimulus which have been perceived or which have been interpreted. So, learning way we looked at theories of learning, in the chapter on learning we looked at non associative and associative forms of learning and within the non associate we look

at sensitization and habituation. And within the associative forms we dealt in detail the classical instrumental and a observation part of it.

This was the whole idea of what we did in learning. We moved on to the idea of memory which is basically storing the learning. So, once we perceive something and we learn something about it or we collect knowledge about whatever has been perceived it has to be stored somewhere and that is the process which we call memory. And so the next section dealt in chapter number 9, or section number 9 was one memory. So, we started off by explaining what is memory is basic processes in terms of encoding, storage and retrieval.

So, we did a detailed analysis of what is encoding, what is storage and what is a retrieval and how these properties or how these processes rather they combine together to form the concept of memory. Further to that we also looked at two influential views or two models of human memory. One model being the Atkinson and Shiffrin model which says that human memory has three parts; one is a sensory register, the other is a short term memory and the third one is a long term memory.

And then we added on or we introduce another concept of memory which is called the network model of memory and we will looked at how this network model or multiple processing model of memory, how defined by rumble heart. And how this model of memory differs from the idea of Atkinson and Shiffrin and towards the end of the last lecture we looked at what kind of information's are stored into memory.

So, we continue on in today's lecture from where we left off in the last class. So, we were looking at what are the kind of information which is stored in memory. Now Atkinson and Shiffrin defined human memory as a three part system. The first part being the sensory register where all kind of information come in and they stay for very very few seconds or within partial seconds, but the amount, the register is used so it can take a lot of information.

And here the information that is gathered, the knowledge that is gathered is basically in the very wrong form and that is why had, we had the eco and the icon which is the format in which the knowledge or external information is grapsed. Then we talked about something call the short term store. The short term store or the short time memory as

described in the Atkinson and Shiffrin model is a store. So, information stays here for less than 30 seconds until unless it is rehearsed.

And this rehearsals are of two type; if we do maintenance rehearsal which is passively repeating the information again and again. Then what happens is the information is remembered for more than 30 seconds for whatever period of time that we want. But if we do something call elaborate rehearsal which is making meaning or assigning meaning to the kind of information which is in the short term store then it passes on to something called long term memory. So, this idea or this conceptualization of short term store or short term memory was what was done by Atkinson and Shiffrin.

Now, Atkinson and Shiffrin believe that the short term store is a passive store, it cannot do anything on it is own which basically means that information just stores on the short term store and nothing happens after that. But we are all aware of the fact that elaborate rehearsals happen. Now how does the elaborate rehearsal happen? For example, the concept that we took in explaining Atkinson and Shiffrin model we looked at storing a phone number.

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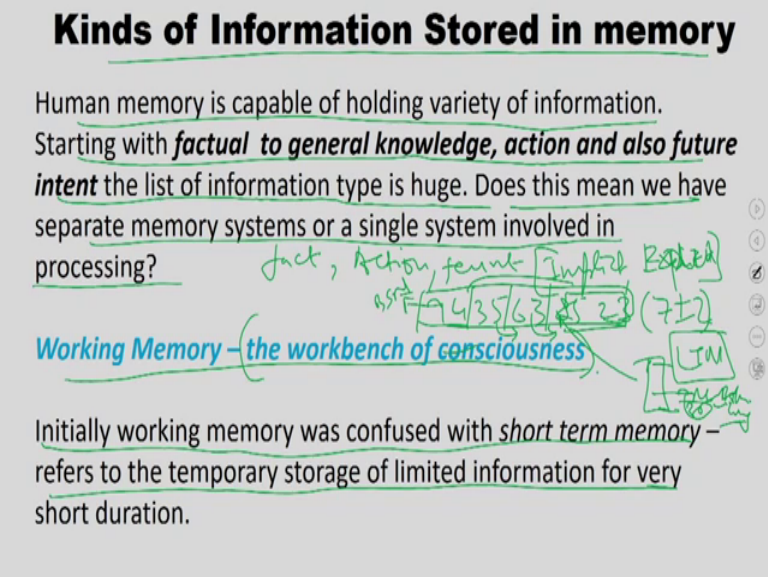

So, let us say this is the phone number and what Atkinson and Shiffrin says is that; 7 plus or minus 2 chunks of item is will be what is stored on a short term store or short term memory. Now if we do elaborate rehearsals ,suppose this is a number which is very dear

to us, so, we will do an elaborate rehearsal. So, we will chunk the numbers together. How do we chunk the number? 94 is for BSNL, 3 5 is some state code this is some city code.

And this is the number 8 5 2 3 is a number of the person who are whom you are calling. So, basically this type of rehearsal or this type of elaborate rehearsal or assigning meaning requires you to borrow certain rules and certain concepts from long term memory. Now the idea that 94 is related to BSNL or the fact that 3 5 is relate to a particular state let us say it is Gujarat for any purpose, now the idea that 3 5 relates to Gujarat is 6 3 2 Vadodara in Gujarat, I am just giving a definition.

And these ideas or these facts are storing something called long term memory. So, according to the concept of what Atkinson and Shiffrin said that short term store is a store where information is stored passively the concept do not fit which basically means that the short term store was doing more than storing information; it was able to access long term memory at the run time which basically means that whenever information was processed for elaborate rehearsal or elaborate rehearsal was happening on short term memory.

The short term memory was doing more than just passively storing information and there in came the concept of working memory which was proposed by someone called Alan Baddeley. So, the new conceptualization of short term store that is called the working memory was what was conceptualized and this working memory was known as a workbench of consciousness. So, let us look at what is working memory. So, initially working memory was confused with short term memory and refers to the temporary storage of limited information for very short duration of time as I explained to you.

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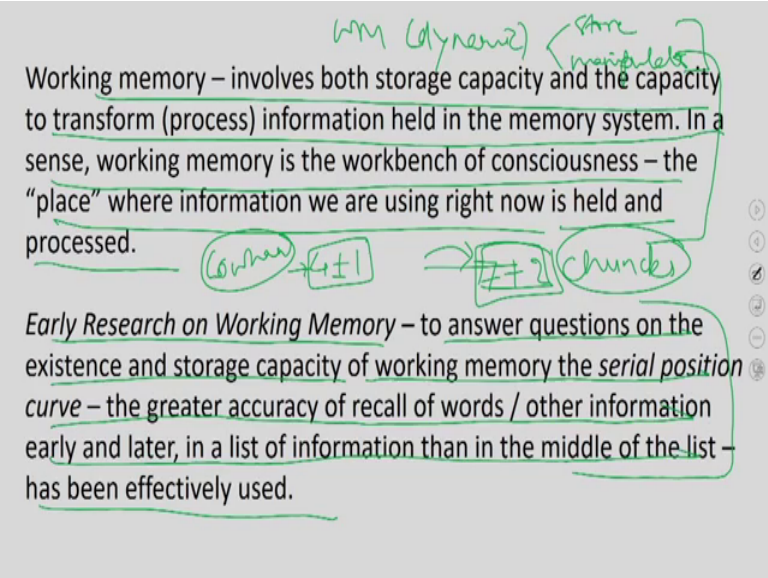

Now, working memory involves both storage capacity and the capacity to transform processes information held in memory systems. Now as I said working memory is a dynamic store, the idea is that working memory is a dynamic store. And how it is a dynamic store because it can both store information as well as manipulate information or transform information. So, there are two things at the short term store or the working memory can do.

But the short term store was not able to do that and that is why the conceptualization of working memory was actually thought of. Now in a sense working memory is the workbench of consciousness, the place where information we are using right now is held in process. And that is what the definition of working memory is all about. And so not only numbers any kind of information which is assigned some kind of a meaning goes through the working memory as the working memories are is able to pull rules from the long term memory.

Now the very act that it can pull rules or it can actually refer to long term memory in terms of what certain stimulus mean or what kind certain kind of packets of information mean provides in the dynamicity that we are talking about. And so it was different from the idea of short term store. Now early research is on working memory. Now to answer questions on the existence or storage capacity of working memory the serial position

curve, the greater accuracy of recall of words and other information early and later a list of information than in the middle of the list has been effectively used.

Now the question was my short term store could store 7 plus or minus 2 chunks of item. Now as I define, what is chunks? Chunk is basically information of same type which are organized together. So, for example, if I have a list of animals and a list of birds and list of food items, a list of furniture's and if there are 10 items in each list, if I give you one item or if I give these four list for you to remember what you will do? You will chunk them together; you will organize items which are similar together. For example, rat, hen, cat, dog will you put into animals. And similarly pizzas, burgers, fast food, fries will you put into food. So, this is basically what is called chunk.

And so what Atkinson and Shiffrin believe that there are 7 plus or minus 2 chunks of items is what we can maximally store into the short term store. Now reason researcher say that we can only store 4 plus or minus 1 item or the magical number 4 at is called so there is a work by Connan, another psychologist working with the area of memory, a very recent paper of his suggest that whether only 4 chunks of items that we can store in long term but that is a whole other ball game. So, the question was how many items are stored in working memory? And for that the serial position the idea of serial position curve was actually introduced.

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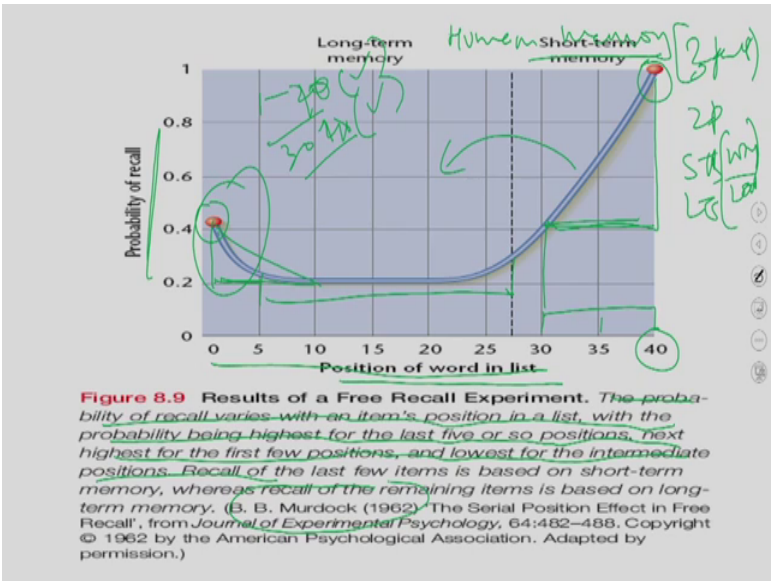

Figure 8.9 Results of a Free Recall Experiment. *The probability of recall varies with an item's position in a list, with the probability being highest for the last five or so positions, next highest for the first few positions, and lowest for the intermediate positions. Recall of the last few items is based on short-term memory, whereas recall of the remaining items is based on long-term memory.* (B. B. Murdock (1962) 'The Serial Position Effect in Free Recall', from *Journal of Experimental Psychology*, 64:482–488. Copyright © 1962 by the American Psychological Association. Adapted by permission.)

Now what is the serial position curve? Now given the fact that and the serial position curve has also been established or it is the experiment which explain that there are two types of memory stores. So, how do psychologist, how did psychologist find out that human memory is a 2 or 3 parts store or basically two part store which consisted of the short term store and the long term store or in our definitions the working memory and the long term memory, so how was this thing decided?

Now, for that the answer comes from the study of something called the serial position curve. What happens in the serial position curve? So, let us say that I give you some 40 or 50 items; say 40 or 50 items in a list for you to learn. And once you learn this list I will give you some break. And after that you are to recall that list back or you have to provide me the list member at the time of retrieval. So, at later point of time, first I make you learn the list and at later point of time I ask you to retrieve the list back.

So, if that is what my thing is or that is what my experiment is this is what has been found. Now, the probability of recall versus the position of words in the list follows a curve like this. And so if you look at the curve what happens is items at the beginning of the list are this is 40. And these are items at the top of the list right. So, as you can see items which are at the very beginning of the list they are remembered with a higher frequency and items which are at the this end of the list or the towards the item number 39, 40; so, if you look at from item number 30 onwards to 40 they are remembered with a higher; if you look at the curve here the slope of the curve which is very high. And if you look at the slope of the curve here for item number 1 to 5, so we have taken 20 items. So, let us take a 20 item curve and so slope of the curve something like this. If you look at the slope is generally higher. But look at the items which are in the middle of the list. Now if you look at the items which are the middle of the list, the chances of them for being recalled is very low.

So, what is happening now? Why is it that at items in the beginning of the list, so example item 1 to 20 and then items number 30 to 40, 1 to 10 and 30 to 40 they have a higher recall? Of course, 30 to 40 is the highest record and 1 to 10 has the lowest record. What is the reason for it? And the answer that was given as there are two stores. Now what is happening is item number 30 to 40 are still in the short term store and stores they are still being repeated.

Now since the items are been just encountered with when you are learning the list the items that you are just encountered with when you are still repeating it, what will happen is they will stay current in the store. And so they will stay current in terms of repetition and the chances are that you will remember them more. What is the answer to the fact that items number 1 to 10 are required with higher accuracy or relatively higher accuracy? Now answer to this lies in the fact that item number 1 to 10 has passed on from something called the short term store to long term store.

They have been already processed and some meaning has been attached to it. And that is why they have moved from the short term store to long term store. And that is why the chances are the accuracy of them being recalled is very high. And this is the experiment the idea of serial position curve is the experiment which gives you the fact that there are two stores or there are human memories divided into two stores. So, as you can see the probability of recall varies with items position in the list with the probability being highest for last 5 or so positions.

Now next highest are the first few positions and lowest for the intermediate position. So, that is what basically this and this experiment was done by someone called B. B. Murdock. Now again if you want to look at the more details about serial position curve or the experiment by Murdock refer to my course on cognitive psychology we have discussed in detail this kind of a concept.

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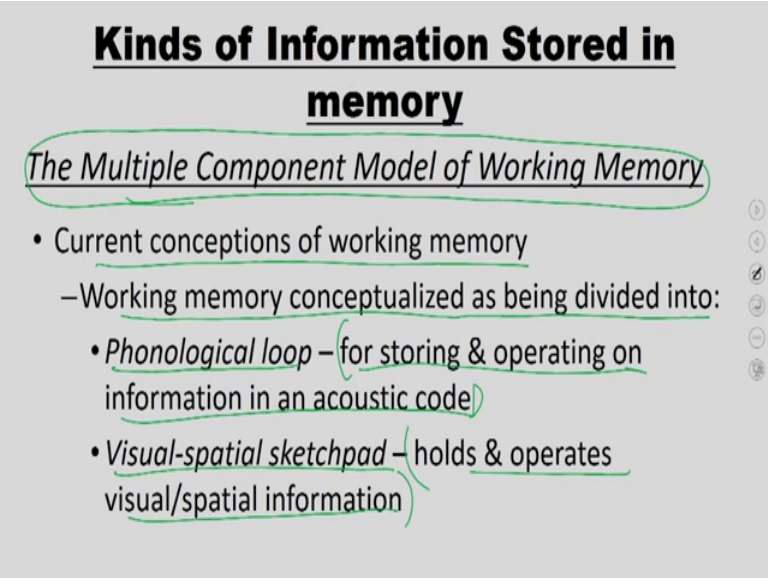

So, that is basically what how the existence of working memory or the existence of how dual system, dual store existing memory came about. Now, what are the kind of information which is stored in the working memory? The multiple component model of working memory; so, how is the working vary first of all design? Now if you look into the short term store, the short term store has different representation. It has the icon for visual information, the eco for the auditory information.

And similarly other stores or other kind of encoding methods or other kind of encoding types for different kind of information from different sensors. Now how does the short term store tackle with this kind of information? Atkinson and Shiffrin model believe that all information once it is enter the short term store they are stored in just one basic format which is called the phonological format which is called the auditory format.

But that is where Alan Baddeley and the concept of working memory differs. They believe that items which are stored in short term memory items which enter the short term memory they are not in the phonological code there are different codes of it. And that is how the conceptualization of working memory came in. And working memory was called the multiple component model. Now current conceptions of working memory believe that working memory is conceptualized as being divided into something called the phonological loop and something called the visual spatial sketchpad.

And what is the phonological loop? For storing and operating on information in an acoustic code and visual spatial sketchpad holds and operate information which is visual and spatial in nature. And so what this says is that the idea of working memory the concept of working memory works in this way that information which is coming from the short term store and which is in the form of a eco or the icon, these information's say in the same format and that gets stored into two different operating systems or two different processes within the working memory.

There is something call the phonological store which stores only information in the phonological codes, auditory information. And there is something was the visual spatial sketchpad which basically stores information in the visual and spatial nature. And so there are two different stores which are existing in the concept of working memory.

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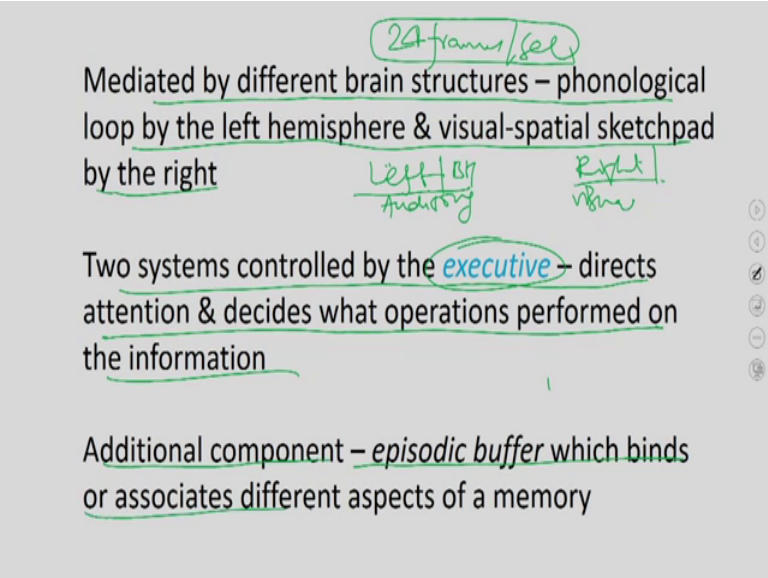

Mediated by different brain structures, phonological loop by the left hemisphere and visual spatial sketchpad by the right hemisphere and so if you look at not only the stores are different. So, the audio information or auditory information or phonological information is governed by the left brain hemisphere and the visual information is governed by the right hemisphere. This use different brain regions or different brain areas are responsible for the two stores; which now says that when you actually go storing information into working memory, it is not to one area of the brain which is responsible for storing information but different brain areas and different processes store information in working memory.

And now it actually is more believable; why I will tell you? When we go to the movies all of us know that pictures are faster, so you have 24 frames. And when whenever you go to a movie you have mostly 25, 24 frames per second which is what the rate of pictures actually move. But if you look at auditory information, the dialogue which comes in it is much lower. So, how is the brain able to contemplate or match these two things together? The human eye can scan perceive images at the rate of 24 frames per second. And the human ear is a single channel system, so it is very slow in hearing information.

So, how does it maintain, how does the human brain deal with this kind of delays which are there and answer is in terms of working memory. There is a phonological loop which

takes in information from the auditory sensors and it keeps on repeating this information over and over again. Now information in the phonological loop or information which is passed on the phonological loop is stripped off of it is a various grammars. And only the basic grammar or the basic information is what is stored. For example in verb, the noun, the verb, the object these are the what is the information which is basically been processed. And on the other hand we are something called the visual spatial sketchpad which actually looks at or takes in 24 frames and stores it one by one and delays it.

So, what it does is, it processes and reprocesses that it creates a little bit of delay. So, this is how the central executive which is the top body or the working memory it keeps track of this audio and video. And so you have the image and the video acting or working at the same time and it gives the kind of pleasure that you go to see movies. Now two subsystems controlled by the executive directs attention and decides what operation would be performed on the information. So, as I said the idea of working memory is that it is two system, two subsystems, the phonological loop and the visual spatial sketchpad these two stores different kind of information in them.

But then how or who decides which in which kind of information should be picked up right now for making meaning or which kind of information should be delayed that is done by a central system which is called the central executive. Central executive sits right on the top and decide what kind of information should be processed and what kind of information should not be processed. Now additional components, episodic buffer is also been put as a new component which binds information or associations or different aspects from the memory.

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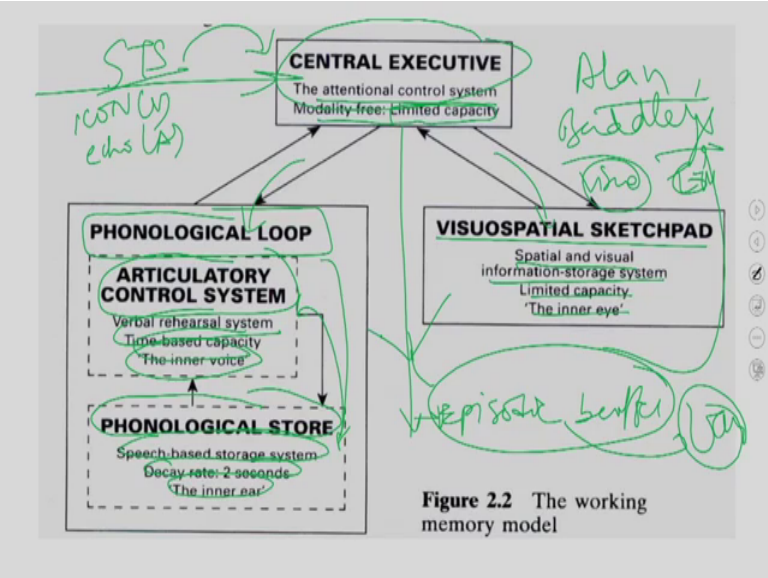

So, basically then this is what my idea or this is what Alan Baddley's idea of working memories. And so how does it work? There is a central executive which gathers information from the short term store. So, my short term store has both icon for visual and eco for auditory information. And so this information this raw inputs is fed on to something called the central executive. What was central executive do? The attentional control system, modality which is modality free and limited capacity.

So, it takes in this information and then pushes this information to two sub stores which are there. One sub store is called the phonological loop. What are the phonological loop do? It has an articulatory control system. So, verbal rehearsal system, time based capacity and the inner voice. We have dealt again I will say that we have dealt with this working memory system or working memory in my lecture on cognitive psychology please refer that. If you want more details, but basic information I am going to give here. And then there is something called a phonological store.

The phonological store is speech based storage system, decay rate is 2 second and there it lies in the inner ear. So, the information which is in the auditory nature which is echoic information is pushed onto the phonological store. And what the phonological store does is take this information and keeps on rehearsing it or repeating it through a phonological loop. Information which is or the visual nature is pushed onto something called the

spatial sketchpad which has spatial and visual information storage system, have limited capacity and is it in the inner eye.

Now in relation to this there is also a store which is called the episodic buffer. And what is the episodic buffer actually doing? The episodic buffer not only combines information from these two store but also talks to the long term memory for; so there is a long term storage assuming that this is my long term store. The episodic buffer takes in information from these two store takes in commands from the central executive and talks to the long term memory for pulling out the rules or pulling out any kind of explanations which is needed for interpreting incoming information from the short term store. So, this is working conceptualization of working memory is.

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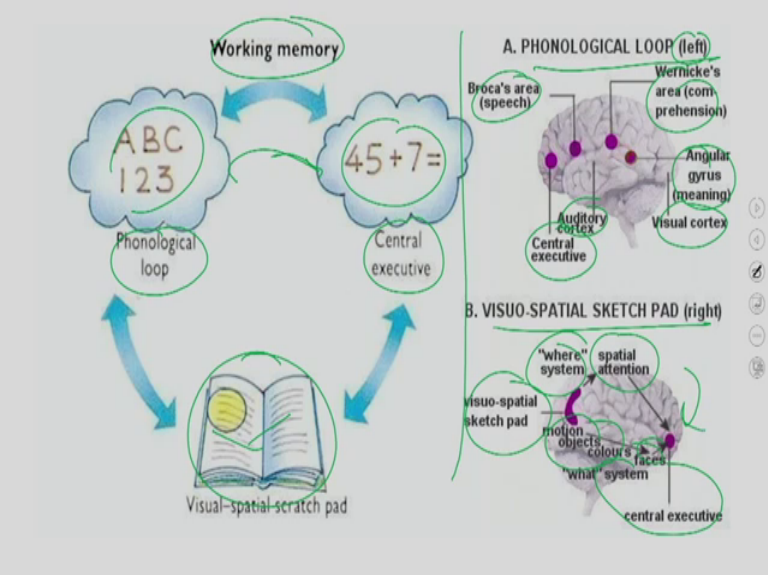

And so if you look at working memory, so, ABC 123 this is the phonological loop. Then 45 plus 7 equals to these are the central executive it is what is it doing. So, this is phonological loop, this is the visual sketch sketchpad; so all visual and spatial relation and if you look at the brain areas the phonological loop which is in the left hemisphere.

So, Broca's area; speech area, Wernicke's area, angular gyrus and visual cortex or auditory cortex and central executive; these are the areas. For the visual spatial sketchpad is a right hemisphere, the where system, the spatial information, visual spatial information, motion object, colour, faces all these systems composed of the visual spatial sketchpad.

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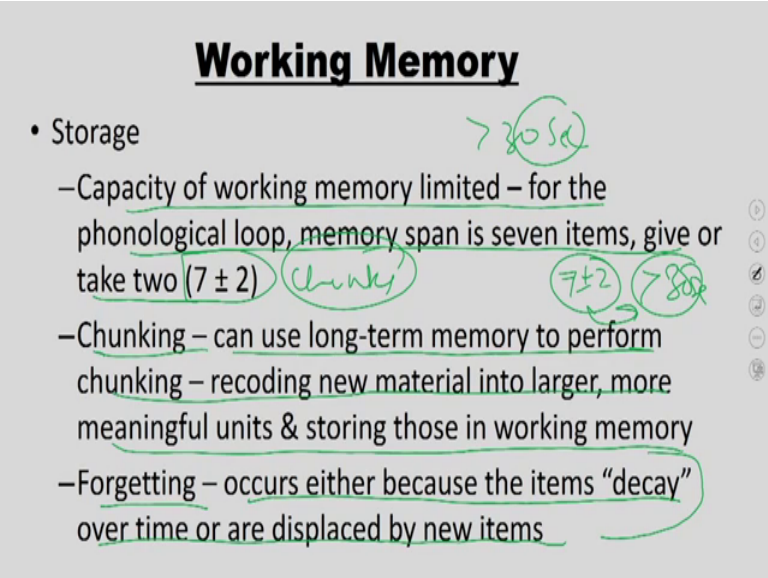

Working memory; so what is the capacity of working memory? The capacity of working memory is limited for the phonological loop, memory span is a seven items, given or taken 7 plus or minus 2. Again it is 7 plus or minus 2 chunks of item which the phonological loop can actually store. What is chunking? Can help us long term memory to perform chunking,-recording new materials into large more meaningful units and storing those into working memory.

So, chunking is the process where we organize information, which are similar or which appear similar into holes. And then how is forgetting happening? Occurs either because items decay overtime and are displaced by new items. So, how does items forget from working memory? What happens is if you do not repeat an item, do not use an item for longer periods of time for less than 30 seconds, if you do not use an item what will happen is it will decay it will move out of working memory or it is displaced by new incoming information because the storage capacity is less. So, if 7 plus or minus 2 is my storage capacity and if you are not using this information for say less than 30 seconds, what will happen is; new information always throws away old information.

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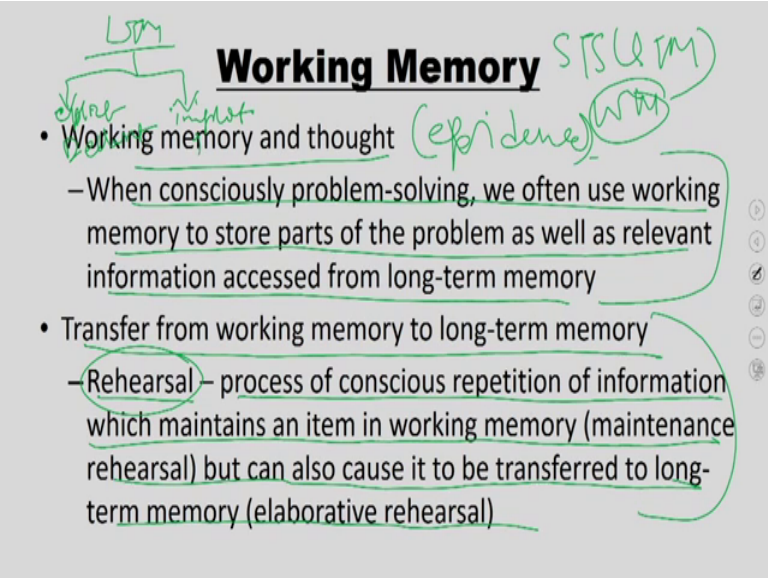

Working memory, working memory and thought; when conscious problem solving we often use working memory to store parts of the problem as well as relevant information accessed from long term memory. So, what is the evidence of working memory? These are the evidence; when we are doing some kind of problem solving, when we are doing some kind of problem identification and problem solving questions then what we do is we solve part of the question and keep it in working memory.

And then try solving some other part of the question and integrating them together and that is the evidence for the idea of working memory. Transfer from working memory to long term memory. How does information transfers from working memory to long term memory? Through something called rehearsal. Process of conscious repetition of information which maintains an item in working memory maintenance rehearsal but, can also cause it to be transferred to long term memory by elaborative rehearsal.

So, the same processes that happen in the short term store or short term memory is true for what happens in working memory or the concept of working memory. Although the recent versions of concepts of working memory or how working memory looks or what are the ways in which working memory functions is a new dynamic idea. So, we will not going to the details of what is the current conceptualization working memory because now they talk of something called a single store system and so information lies at different depths.

So, now, memory is thought of a single system where there are different depths and information goes into different depths to the processes. So, depending on what process you are using or what kind of rehearsal you are doing information will either be stored at something called long term memory or working memory. And the depth of that the kind of rehearsal will decide where the information is going. And so that is the concept present conceptualization, but we are not here for discussing that.

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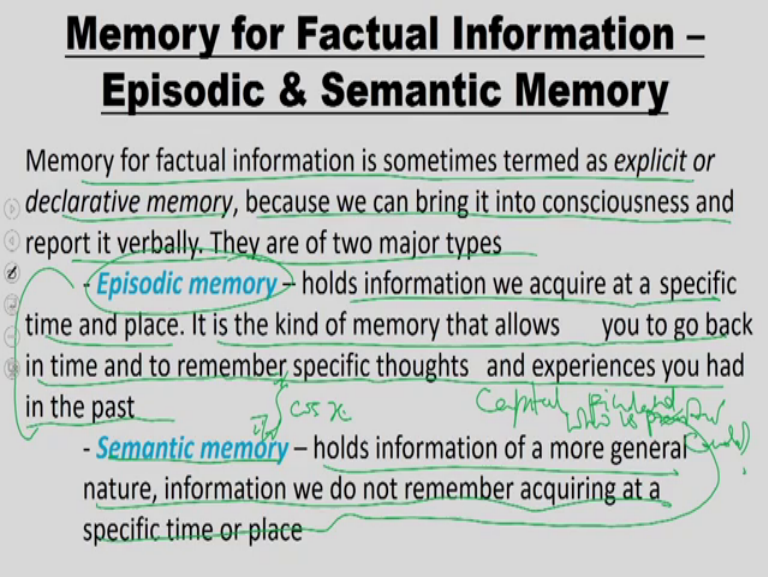

Now memory for factual information which is episodic and semantic memory. Now we look at the conceptualization of how long term memory functions. Now, the long term memory that we talk about is divided into two parts. We have the conscious part and we have the unconscious part. So, we have something called explicit memory and implicit memory right. Explicit memory is called explicit long term memory is called declarative and implicit long term memory is called the procedural.

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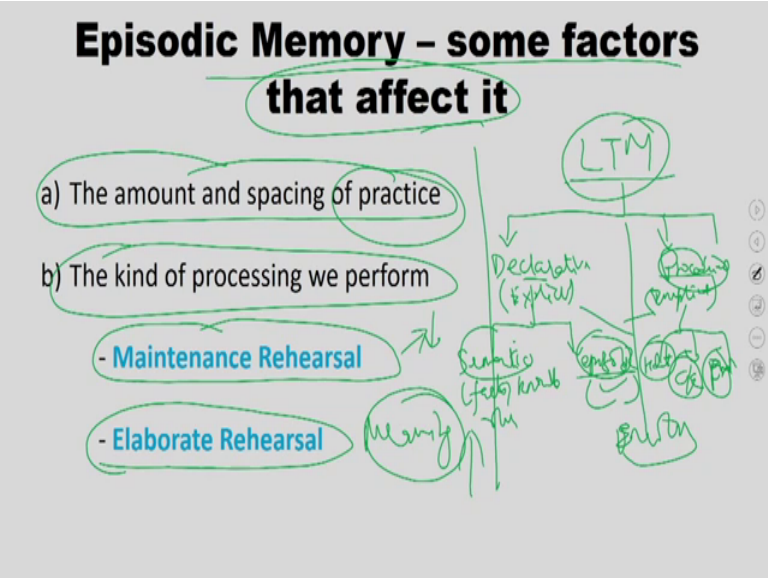

So, just I will just draw it here; my long term memory up till now we have been looking at the sensory store and the short term memory of the working memory. Now we will deal with what is long term memory. So, long term memory is basically divided into two parts. We have something called the declarative store and something called the procedural store. Now declarative is the explicit form of memory which we are aware of and procedural is a part of memory which is implicit.

Let me give an example to make you understand what is explicit and implicit. What is declarative memory? It is explicit in nature. For example, if I ask you what is the capital of United States, questions like where is East from your current position, questions like how many cents make a dollar, questions like what is the colour of the Norwegian flag or who is the prime minister of some country or questions like what did you do in your second birthday or third birthday or first day in school; these questions comprise of information which is explicit in nature and they are tackling with or they are dealing with the declarative memories. Or information which you are aware of and you can access.

There are other information which lies on the procedural memory which are implicit in nature. For example, questions like how do you ride a bicycle. Now, no matter how hard you try it is very difficult to explain how do you ride a bicycle because it is motor memory. Or how do you play guitar.

Now if I if I try writing a 21 day book in riding a bicycle or playing a guitar is very difficult to explain someone how to ride a bicycle you can do it and so they are implicit in nature; so, two forms of memory. Now within the declarative type I have two main types; one is called the semantic memory; which is semantic which is facts, knowledge, rules and so on and so forth.

And the other end I have episodic store which are composed of episodes; for example, first day in school, first day in college, first case, first birthday, not first just anything experience at the mall and so and so forth which has which is an episode which is kind of a event in your life and so that is stored in the episodic store. Within the procedural generally there are three systems; one is called the habit formation.

So, habits are procedural memory, we have classical conditioning another kind of procedural memory. Emotional memory is another kind of procedural memory and so there are other types of procedural memory as well. And within them lie something called emotional memory which is sitting right between these two type of memory types. So, this is how my long term store is organized when long term in memory store has declarative and procedural parts.

And within the declarative part I have semantic and episodic within the procedural part I have something called habit formation, classical conditioning and priming and so many other kind of memory stores which are there. So, since we are not dealing in detail the procedural memory type let us look at the two different declarative memory types. It is very difficult to study the procedural type of memory because it requires you special technique for developing; what is priming, semantic and conceptual priming and so on and so forth.

Let us just confine our self with what kind of information are stored in the long term memory. So, memory for factual information; episodic and semantic. Now memory for factual information is sometimes termed as explicit or declarative memory because we can bring into consciousness and report it verbally. They are of two types; one is called the episodic memory. What is it? It holds in information that we acquire at specific time and place. So, it has something called autonoetic consciousness which basically means it it has a certain place.

And certain time these memories can actually we plotted on a place time axis and a space time axis and so these are episodic in nature. And these memories always unfold in a timely manner. For example if you think about your first day at whatever college you are studying in then the memory which unfolds happens in a timely manner; which means that the first day will start with morning and then it will tell you all the events that happened one by one in a time sequence and a space sequence and that is what is the idea of autonoetic consciousness.

Now it is a kind of memory that allows you to go back in time and to remember specific thoughts and experiences you had in the past. And so it is also called time travelling memory right. So, who says the time travel is not possible? It is possible, if you look at episodic memory what we actually doing is we are travelling back in time and going to a place or going to system where we can leave that particular memory and so we are doing time travelling.

Now, at the kind of memory which is the long term part or declarative long term part is semantic memory which holds information of more general nature. Information we do not remember or acquire at a specific place and time. For example, information who is what is the capital of Finland or questions like who is the president of Canada. These kind of information or information about how do we integrate pi by 2 to minus pi by 2 cos x this kind of information.

Then for integrations simple differentiations all those kind of rules are there; sin x plus cos x and so that kind of a thing. So, these are rules and they are not stuck to one place time but these are general thing is that you actually store. Episodic memory some factors that affect it; what are so some of the factors which affect. Episodic memories are one is the amount of spacing and practice? How much in spacing that you do? Or how much time has elapsed between you experiencing a particular event.

The more time that has elapsed, the more the better the memory will be. But if you club to remember the idea about spacing that we did in the first slide where we looked at how event goes? Did something called mass practice versus the space practice the same thing is there. So, the more time you provide or the lesser time you provide to particular kind of a episodic memory the better the it has been or how are the retrieval will be of those memory items also the kind of processing where they perform.

So, episodic memory is also dependent on the kind of processing that we do. So, if we do maintenance rehearsal remember what is maintenance rehearsal? It is repeating an information passively over and over again just for the sake of it that is called maintenance rehearsal. The kind of memory that will have is very low grade and it will be there for very less period of time.

But if you do a elaborate rehearsal if we make meaning or attached meaning to information which is which is presented to us then it is called elaborate rehearsal. And in this case is what will happen is the information will store will stay with you for longer period of time and a high grade information is what will be available with you.

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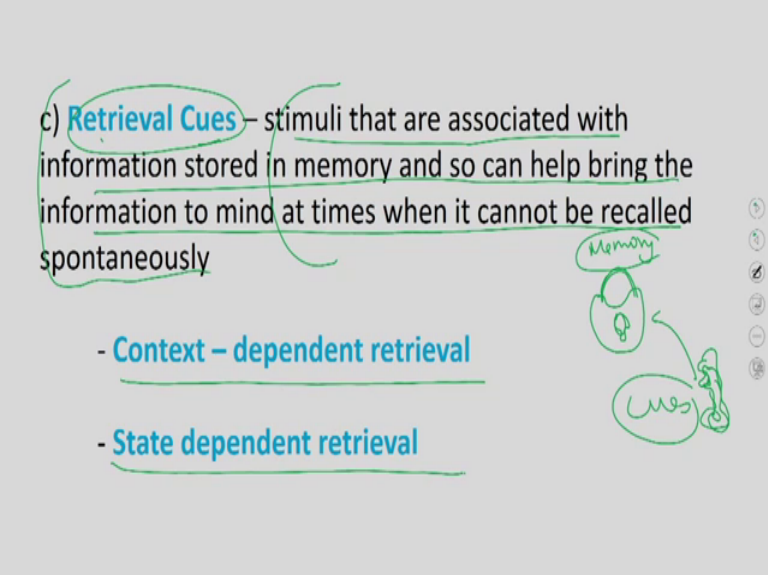

Also retrieval cues also decide what kind of information or the one of the factor which decides high episodic memory function. So, stimuli that are associated with information stored in memory and so can bring my information to mind at times when it can be recalled is what is called the retrieval cue. Now basically if you look at the memory any memory follows a lock and key kind of a paradigm.

So, think of this as a lock, this is my memory. Now any memory is actually a lock and cues are known to be the keys. So, then this is the key and cues are key and these key actually fits a lock. Now what happens in terms of memory is that there are many keys. A same memory can be extracted through a number of cues. Let us say that in your 12th

class farewell you had a bad experience right. So, you went into a fight and you got slapped by someone or something.

Now whenever how do you remember this event this 12th class farewell that can be several ways one is the fight; obviously, right. The other way is remembering the last day or twelfth class this these packets of information or these terms that I am telling you are the cues. You can also remember 12th class farewell by the nice smile that you got from your lady friend or any other reason. So, the same event can be extracted or can be pulled up from different cues. And so these cues are the keys that fit into the lock.

So, the memory is generally the lock and the key that opens it or the key the through which you can access it is called the cues. So, this cues which extract information or which bring information to the forefront. Or which help you remember information is responsible for how well a memory is stored into long term store. So, there are two type of cues; one is called the context dependent cue the other is called the state dependent retrieval or state dependent cue.

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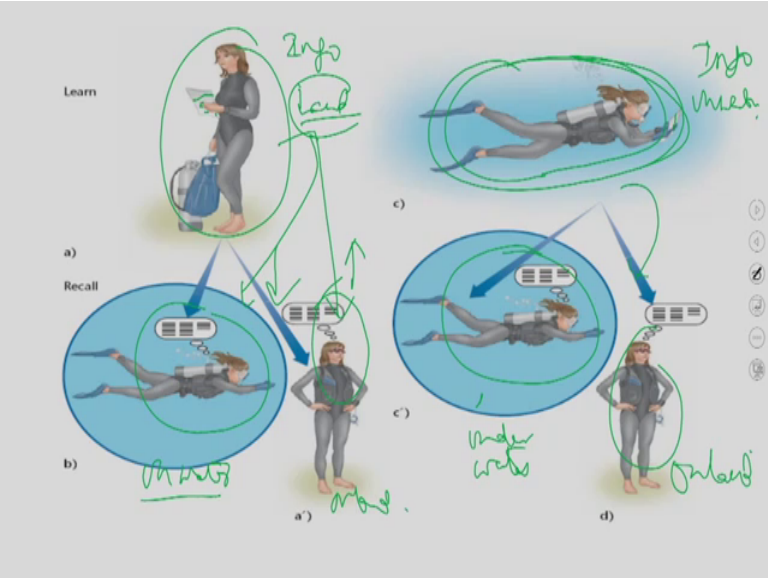

What is the context dependent? Now within the context dependent cue what happened is the context in which you learn information will decide how well you will remember if the contexts remain the same. What is the meaning of it? Now all of us when we give an exam and when we are giving the exam in the same room in which the lectures was held we remember it better than if we are giving the exam in some other school.

What happens is it has happened to all of us it has it will happen to you also. There are times when we actually try to remember and answer. And then we remember the context is basically means that we remember everything which was written on that page, but we do not remember what the answer was or how it was solved. We remember the flowers that we made on the notepad; we remember the lines that were there, the colour of the notebook which was there, the kind of pen that we use, the teacher who was teaching it we remember everything, but not the exact answer. And so this is called context depend effect.

So, basically where you learn an object where you learn a particular information. If it is tested in the same medium then the retrieval is better or the memory is better than when it is tested in some other medium. And a small experiment was done to test this. So, basically two type of people were used divers were used. And these divers were given some information to learn. So, this is a list of item that these divers are learning. Now there are two cases; one case is the diver learns the information.

So, information learn on in land and then later on the diver took a dive and underwater it try to recall the information. In the other case the driver learn a list of words underwater and then later on it was tested for these items under water and on land. So, two cases diver learned information on land diver learned information on underwater. And then the testing happened in two conditions this is underwater the words were remembered and on land the words were remembered.

This is underwater the words were remembered and on land the words were remembered. What do you think happened? If the information was learned on land the retrieval was better on. So, this is high retrieval and in this case the retrieval was very poor right. So, if you learn an information on land the chances of you retrieving this information on land is very high. But if you remember an information on land go underwater and try to retrieve that information the chances are very less that you will be able to retrieve. And similar happens when you learn information under water.

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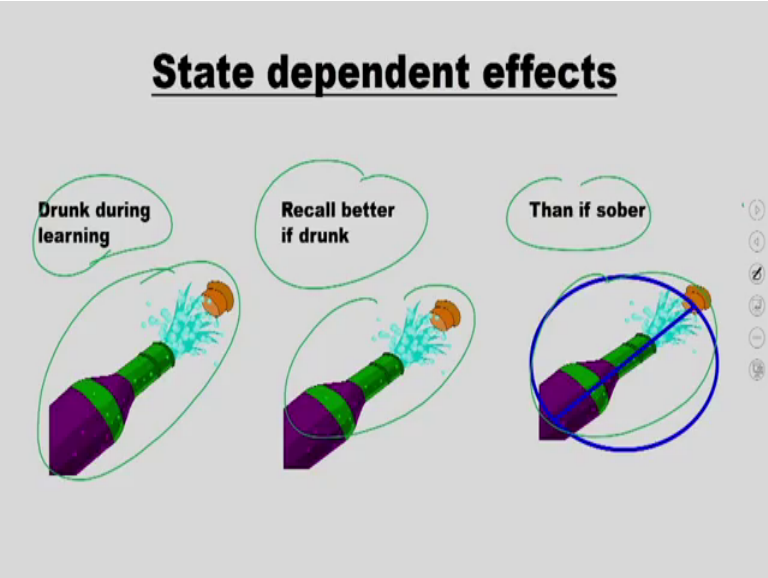

There are some state dependent effects also. Certain states or memory states are also responsible for you to learn information in a nice manner. And so nothing to explain you as I if you learn something when you are drunk you recall that when you are drunk better then when it is you are sober.

And a certain kind of information only comes to us when we are drunk you have might have friends of you who actually break when they are drunk. And they do not even remember what they keep on telling when they are drunk. So, basically some information's are remember better because they happened this kind of information were learned when they were when you are drunk and so certain body physiological states are responsible for coding this kind of information.

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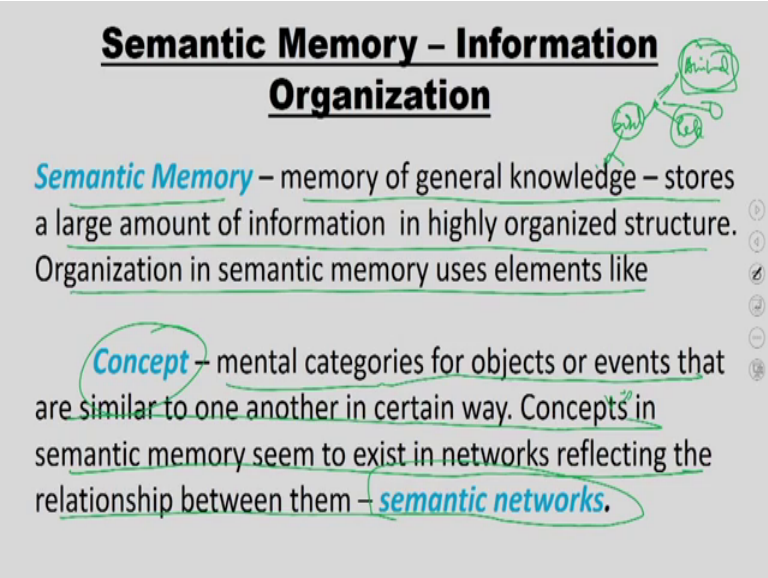

Now, semantic memory; information organization. Now what is semantic? Memory for general knowledge stores a large amount of information in highly organized structures organization in semantic memory uses elements like. So, basically if we looked at how information is stored in episodic memory. But in semantic memory information is stored in terms of a network right.

So, any information that happens in a semantic memory it is stored in kind of networks which is composed of nodes and sub nodes. For example, let us look at the information animal. So, animal is a concept and within the animal you will have birds and reptiles. And within the birds and reptiles you will have within the birds you will have information like that.

So, if you look into it is like a node the top node is the animal within that you have birds and reptiles and mammals. And within the birds will have different kind of birds with reptiles you have different kind of reptiles within the mammals you will have different kind of animals.

So, basically information is arrive in a highly organized structure. And the organization is using elements like something called concept. Now what is the concept? It is a mental category for object or event that are similar to one another in certain ways. Concepts in semantic memory seem to exist in networks reflecting the relationship between them

which is called the semantic network. And as I said within animals you will have birds and so all kind of birds will be structured here.

But within bird you will have you may have two different kind of bird. For example, talking birds non talking birds the birds which can be domesticated birds which cannot be domesticated birds which are non birds. For example, you have emu or ostrich which are birds, but or hen which are birds, but non birds and so on and so forth so that is the kind of things. So, here is the concept of animal and here is the concept of bird and here is the concept of different birds and so and so forth. And this is how it is stored, information is stored in semantic memory.

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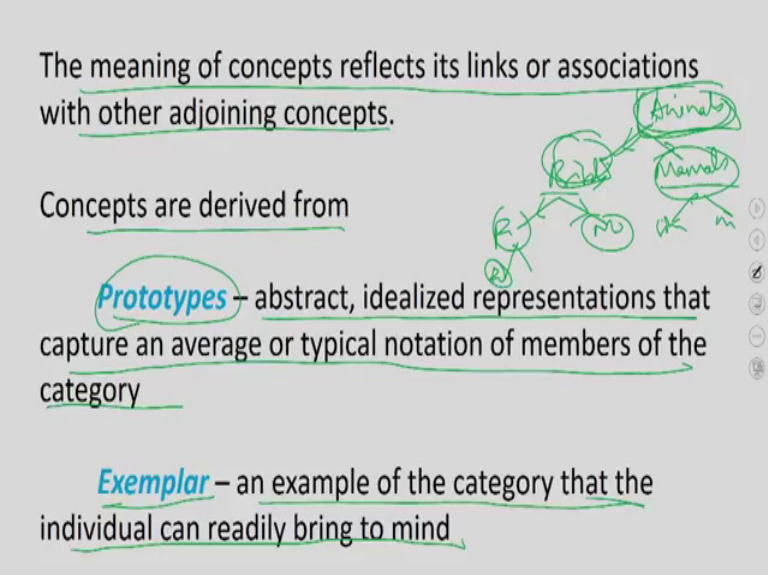

The meaning of concept reflects in links or association with adjoining concepts. For example, if I am looking at animals so animal is one concept. So, all four footed beings which can walk locomote make their own food are animals. And within the animals you will have let us say mammals first and birds so egg laying versus giving birth to babies. And within birds you will have let us say feathered and non feathered. As you can see this is a concept this is a concept this is a concept and so and so forth.

And these are so within the feathered you will have let us say parrot this is called an exemplar because this is a type of feathered bird right. And so these are the nodes which are there as you see information passes through this and this is the connector. So, this is how information is so meaning of concept reflects the link or a station with adjoining

concept. For example, how, so within mammals you will have simple mammals and complex mammals. You will have a chimpanzees versus bears and so and so forth that kind of a thing.

Now, our concepts derived how are these animals and birds like concepts derived? They are derived from something called prototypes; abstract, idealized, representation that capture an average of a typical information or member of the category. So, for example, how is the prototype of a animal describe? For say think of an animal and tell me what it looks like. What you do is, you think about an animal and the a list of animal.

So, you will take 4 or 5 animals, think about 4 or 5 animals and extract the commonality between them. So, what will have animal have? Most animals have 4 footed, and then they have semi develop brain, they locomote move from one place to another and they cannot make their own food. So, this is what definition of animal is and this is how a prototype is defined. Or prototype of a car; so car is a basically a vehicle which has 4 wheels runs on engine and used for transporting vehicles. So, this kind of a categorization conceptualization or abstraction is what is prototype.

Exemplars; exemplars are the examples from which the prototype are defined. So, an example of the category that the individual can readily bring into mind. For example, if I think about animal if I want to derive the prototype of a animal and I am thinking about let us say lion it is an exemplar right. Or similarly when I am thinking about Hyundai or BMW this is basically a exemplar.

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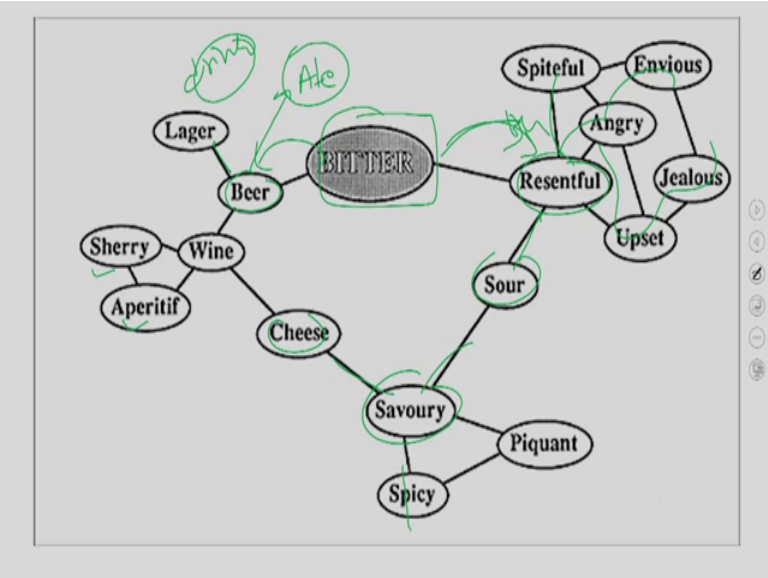

So, as you can see if bitter my concept, this bitter is actually related to two more concepts. One bitter is related to beer bitter is also related to resentful. On one end if you look at beer this is related to further concepts or further links into it. For example, beers are there are different kinds of beers you have lager, you have the ale, and so and so forth different kinds of beers are there. And within the beer it is again related to wine for example, the sherry wines, the aperitif wine, and wine is again related to cheese and so on and so forth.

But if you look at bitter it is related also to an emotion. So, this is a drink a food item, but bitter is also related to human emotion which is resentful. And resentful is then further related to spiteful, angry, envious, all of which are human emotions. And then bitter is related to sour, wine is rated to cheese, and both are savoury items which are spicy and frequent. So, that gives you a definition of how things are related in semantic memory or how they are organized in semantic memory.

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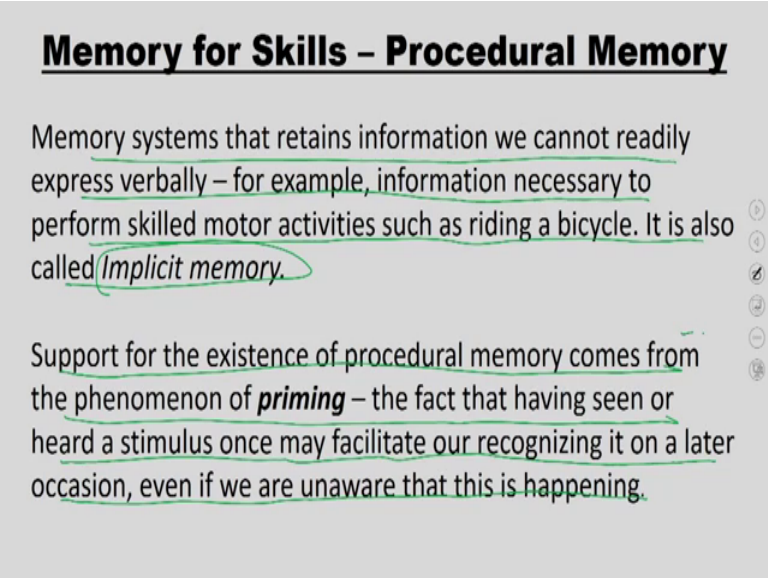

Again if you go back to my lecture on cognitive psychology; what I have done is I have looked at these details these memories in full chapters or full lectures so you can refer to those lectures, memory for skills which is procedural memory. So, memory system that written information we cannot readily express verbally. For example, information necessary to perform skill motor activities such as riding a bicycle is also called implicit in nature.

So, you no matter how hard you try you cannot explain how do you ride a bicycle and that is what is the memory for skill procedural memory. Now support for the existence of procedural memory comes from the phenomenon of priming the fact that having seen or how does stimuli once may facilitate you would recognizing it on a later occasion even if we are unaware that this is happening. So, priming is a situation when partial information is given to you.

For example, your some new friend of your comes in and new person comes in your hostel. And before you meet him somebody provide some partial information about this person. So, when meeting this person you will use this partial information in forming a impression of this person or forming and or designing a talk with this person. And that is what is called priming in priming.

What happens is partial information or some kind of very reduced information is given to you and this reduced information or this low grade information is used by you to make

meaning later on. Or at some point of time or help you in making meaning later point of time is what is priming. And so priming basically suppose the fact that procedural memory exist.

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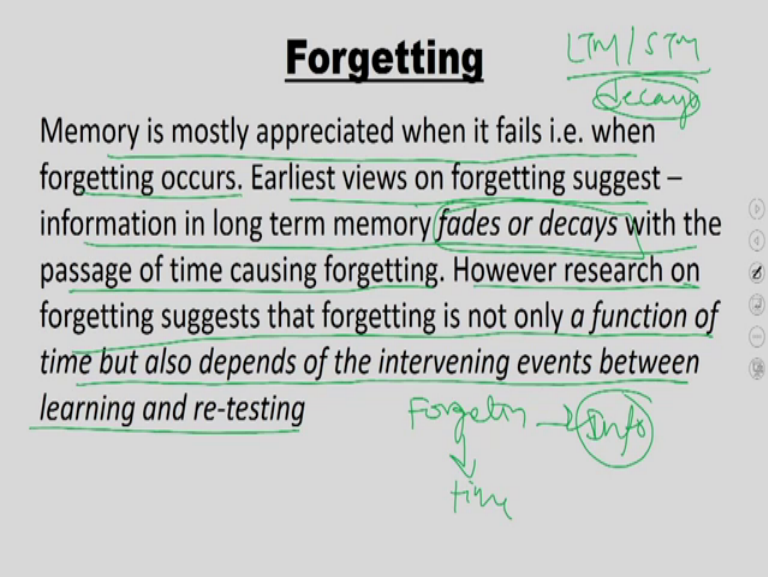

Forgetting; so memory is mostly appreciated when it fails that is when forgetting occur. Earliest we are forgetting suggest the information in long term memory fades or decays with the passage of time causing forgetting. So, the earlier views of memory believes that information actually is forgotten. So, any information from either the long term store or the short term store it. How do you forget it through decay or fading?

However, research on forgetting suggest that; forgetting is not only a function of time, but also depends on the intervening events between learning and retesting. So, forgetting is not only time dependent. Forgetting is not only depend on time it is also dependent on what kind of information is learn in between learning and testing of an information. And so that is what is called interference, the forgetting as a result of interference.

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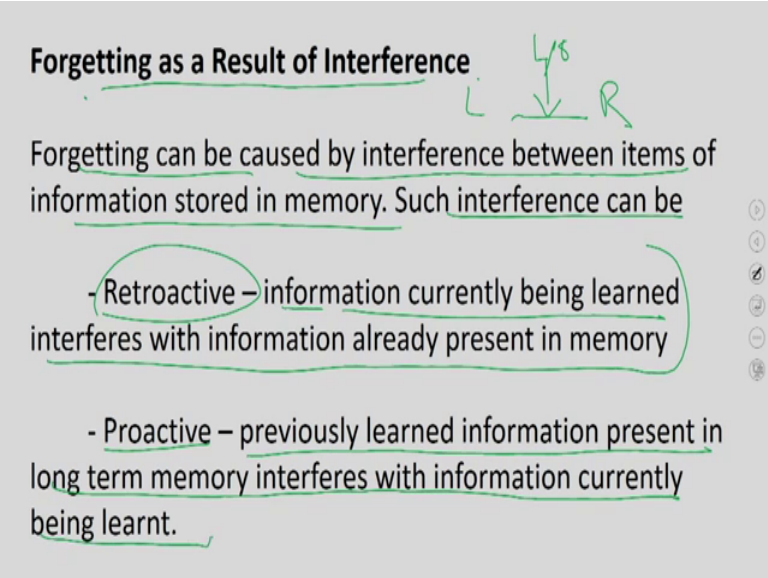

Forgetting can be caused by interference between items of information stored in memory. Such interference can be retroactive in nature. So, what kind of retroactive information? When learning and when learning and retrieving an information is between the learning and retrieving of an information is filled with learning or of another kind of information is what is interference.

So, if some information blocks your remembrance of some other information this is what is interference. So, what is retroactive interference? Information currently being learned interferes with information already presented in memory that is called retroactive. And what is proactive interference? Previously learned information presented in long term memory interferes with information currently being learnt and that is what is proactive.

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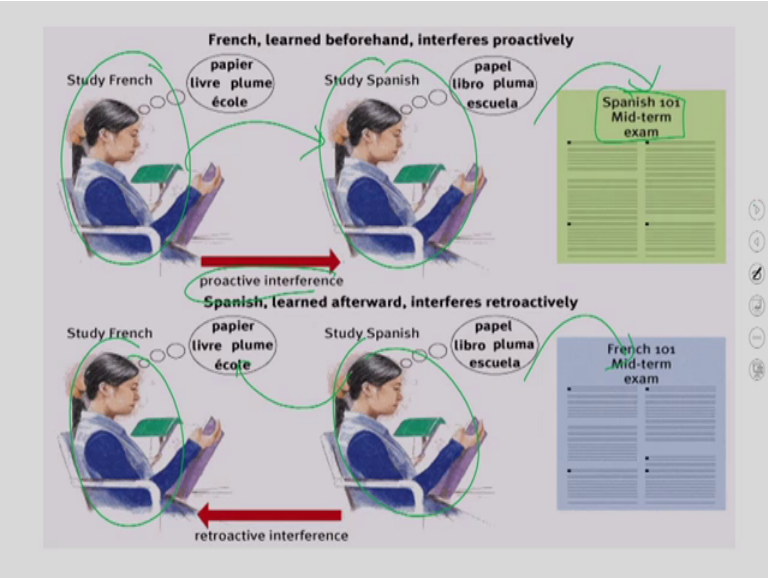

So, let us take a quick example for example, if you are studying French and then you study Spanish. And if I in the mid semester examination I take a test of Spanish. So, what will happen is words from French will interfere with words of Spanish. And this is basically called one kind of information which is proactive.

But then if you study French and then you study Spanish. And I take the examination of French. So, words from Spanish will interfere with the remembering a words from French that is called the retroactive interference.

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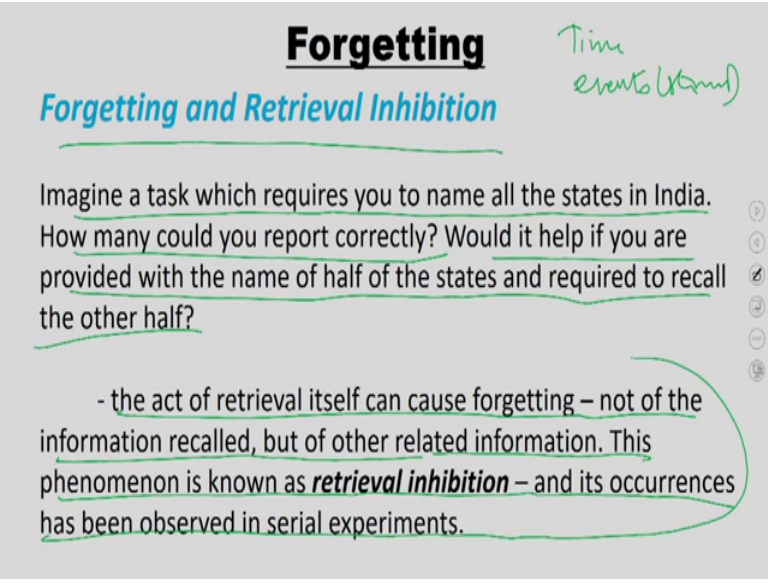

Now forgetting and retrieval inhibition. Forgetting does not only happen in terms of time based or event based or stimuli based forgetting. There is also forgetting happening from retrieval from the process of forgetting itself. How you forget or how you remember or how you actually retrieve an information that can also can cause forgetting. So, basically imagine a task which requires you to name all the states in India.

Now how many could you report correctly? Would it help you if you provide with the name of half of the states and required to recall the other half? No, it will be difficult because what will happen is you learned the states in a particular manner. But if I keep on giving you names of state what will happen is; you will go over the states again and again. And so there are two process one is remembering the other is matching and that can cause forgetting and that is called retrieval inhibition.

Now, the act of retrieval itself can cause forgetting not of the information recalled, but of other related information. Now this phenomena is known as retrieval inhibition and it occurrence has been observed in serial experiments. So, what happens here is that when I give you the task of remembering something the very act of remembering this information actually causes forgetting? And that type of forgetting or that type of feature through which forgetting happens is called retrieval induce or retrieval inhibition.

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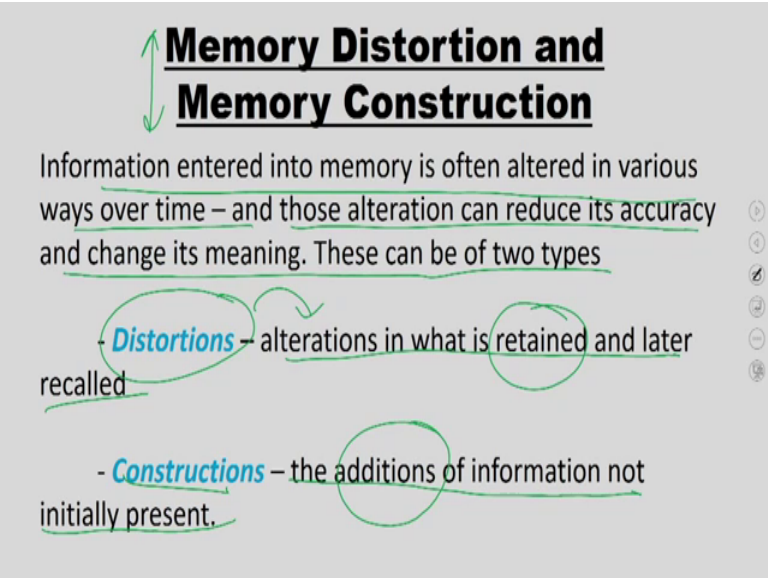

Now, memories I said is never accurate. The reason why memories are never accurate is because there is no way to look at how what memories are stored. Memories are

subjected to personal biases. People add their own bias. So, when I am looking at an incident any incident for that matter. If I look at car incident or car accident incident what will happen is my own bias my own interpretation will influence what I storage memory and so then never accurate.

So, memories are always open to distortions and constructions. So, information entered into memory is often altered in various ways over time. And those alterations can reduce it is accuracy and change it is meaning. Now this can be of two types one is called memory distortions alterations in what is retained and later recalled. And the second is called construction the addition of information into initially present information.

So, basically this memory accuracy is affected by distortions where alterations or in what is retained happens. And constructions where new information which is fitting the schema which is fitting the kind of information that is already have been stored can also lead to memory constructions.

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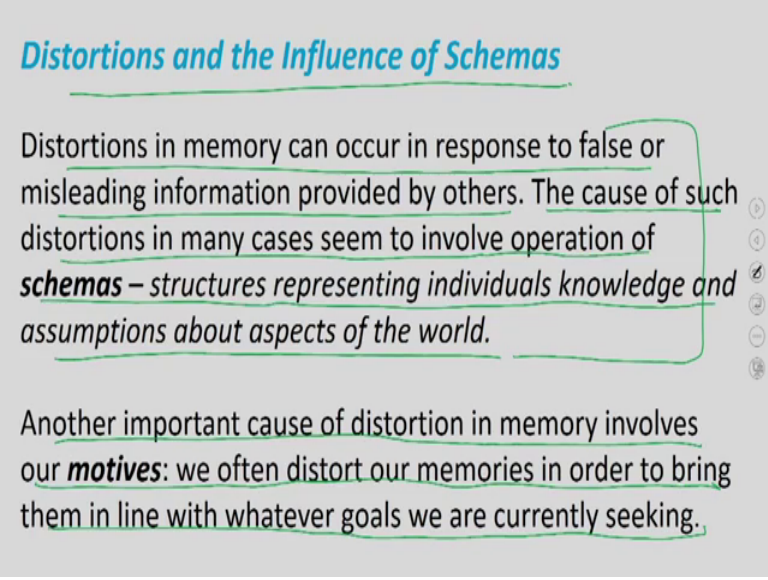

Distortions and the influence of schemas. Distortions in memory can occur in response to false or misleading information provided by others. Now the cause of such distortions in many cases seem to involve operations of schema structures representing individuals knowledge and assumptions about aspects of the world. Now for example, if I know that some information you have it in memory. For example, if I am cross checking someone in a eyewitness testimony case and I am cross checking someone.

And the eyewitness says that the person who committed the murder was actually wearing a dark coloured suit so and he insists on that it is blue. I can obviously play with a schema and make him believe that it was not a blue coloured suit, but it was a grey coloured suit. Because both of them are dark in colour and more or less steel grey is very equivalent to or very close to blue and so I can infuse schema like that. [you can] I can infuse false memory like that and that is what is playing around with the schema.

Now another important cause of distortions in memory involves are motives. We often distort our memories in order to bring them in line with whatever goals we are currently seeking. At times we save memory as I said dependent on what we want it to happen. If you want something good to happen no matter how does an incident was the way we encoded memory the way we encode memory is in terms of what we want.

So, suppose I got rejected by female friend, but I do not want this to be in this way. So, I will remember the memory in a entirely different way the way I want it to be. And so there will be two versions of the actual memory happening and that is called distortions of memory.

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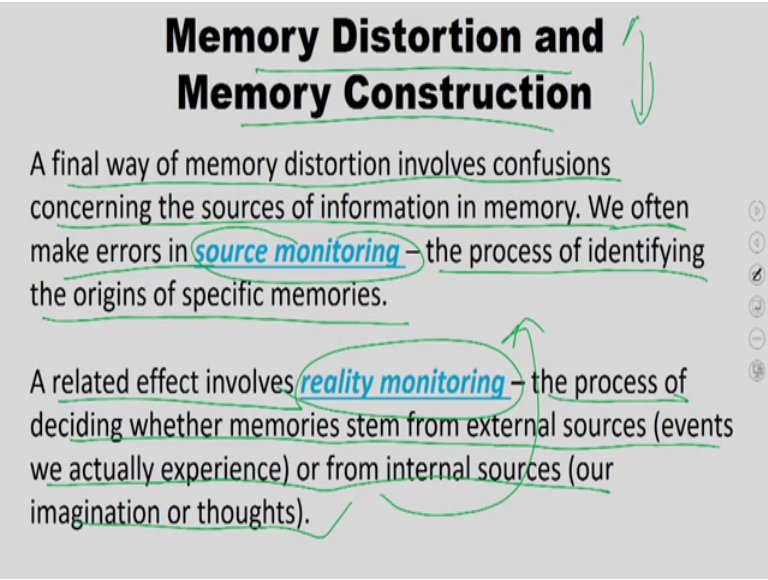

Memory distortions and memory construction; a final way of memory distortion involves confusions concerning the sources of information in memory. Sometimes what happens is you do not know where the memory came from or where it is stored or who actually said you. And those type of problems can also lead to memory distortions and

constructions and that is called the source monitoring error. Now we are often make errors in source monitoring the process of identifying the origins of a specific kind of memory.

Now a related effect is called realty monitoring sometimes memory comes to us and we even do not know whether his memories are real or not. For example, certain people have remember certain events from their life where are they are very unsure of whether this evens actually happened to them or not. And that is they fault play to something called reality monitoring. Now the process of deciding whether memories stains from an external sources which is evens we accurately experience or from internal sources our imagination or thought and that is called the problems reality monitoring. And that can lead to distortions or a memory constructions.

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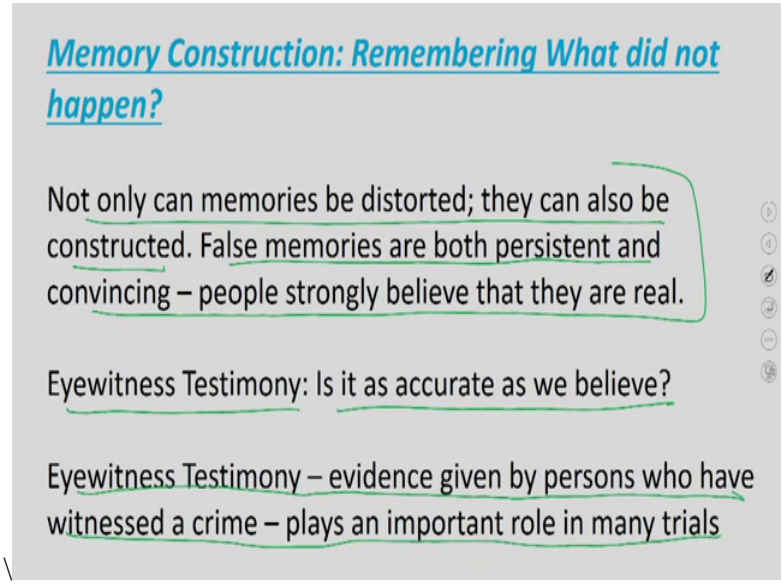

Memory construction remembering what is not happening. Not only can memories be distorted they can also be constructed. False memories are both persistent and convincing and people strongly believe that they actually happened. Eyewitness testimony is a good example is the accurate as we believe. Eyewitness testimony evidence is given by persons who having witness the crime plays an important role in many trials.

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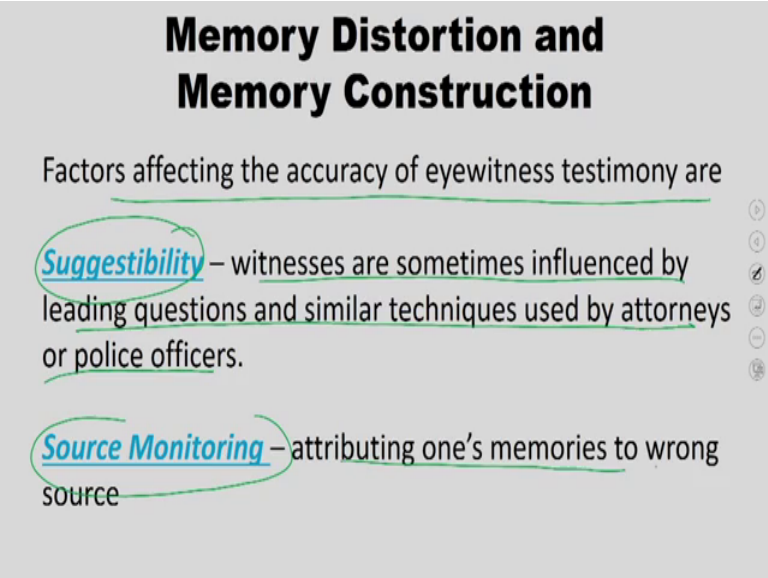

So, basically eyewitness testimony is affected by a lot of things that is beyond the control of the person who is actually giving the eyewitness testimony. So, factors affecting the accuracy of eyewitness testimony; one is suggestibility. Witnesses are sometimes influenced by leading questions and similar techniques used by attorneys or police officers. So, they are make you believe that certain thing is happen and you start believing them.

Also something called source monitoring; attributing ones memory to wrong sources. Sometimes the police tell you or the person who is questioning you in the court tells you a different story all together or gives you a different source from where the memory could have come. And that can lead to the throwing what are the eyewitness testimony.

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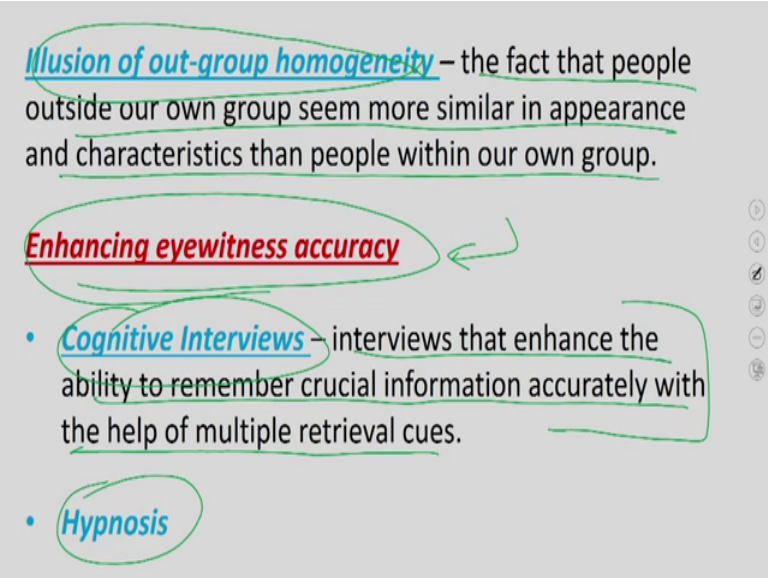

Illusions of out group homogeneity; another is an or another kind of memory distortion happens from the illusion of out group homogeneity; what is it? The fact that people outside our own group seem more similar in appearance and characteristics than people within our own group. So, for example, whites like to prefer to believe that all whites are good in blacks like to believe that all blacks are bad.

Or if you are in travelling in New York and you see a black immediately the idea that he is a thief comes to your mind. And that kind of a construction is there or that kind of a possibility is there. Enhancing eyewitness accuracy; so if these are the problems which can happen to eyewitness testimony. How do we increase the eye witness accuracy? One is called cognitive interview; interviews that enhance the ability to remember crucial information accurately when they happen at multiple retrieval cues. So, I can use something called cognitive interview.

In cognitive interview what we do is we go into the details of information. For example, somebody is telling me some information somebody is relating me some information nor some event. Now, I can keep on asking questions like; when did this happen, where did this happen, what was the time, what was the colour of the dress you are wearing, where you holding it to the right hand left hand? So, if I keep on doing this cognitive interviewing where I am looking at the details of the memory the it might increase the

eyewitness accuracy. Also hypnosis a process through which you can be thrown into a suggestible state can increase eye witness memory.

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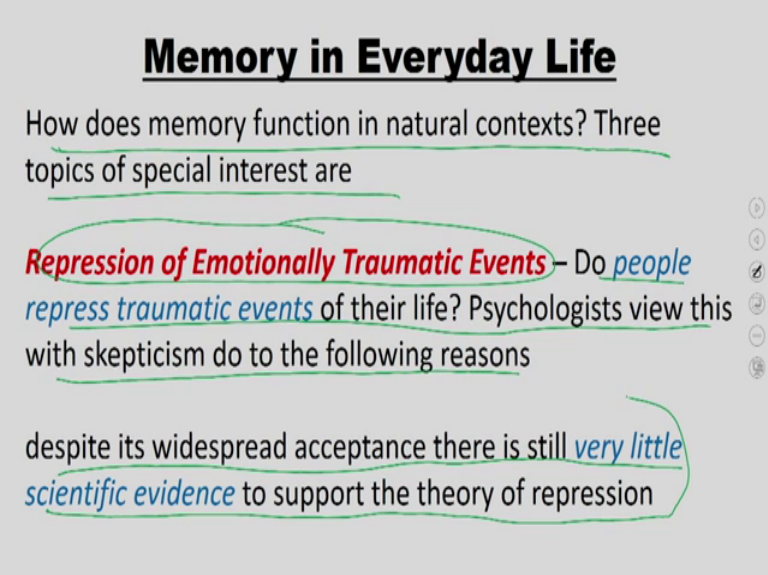

Memory in everyday life; so everyday memories. Now how does memory function in natural contexts three topics of separate interest are there. One is repression of traumatic events. Now, do people repress traumatic events of their life? Psychologist view that there is scepticism with the following reason.

Now despite it is widespread acceptance there is still very little scientific evidence to support the theory of repression. It is believed that psychologists believed that there are very less chance that people actually repress information from their everyday life or non traumatic information.

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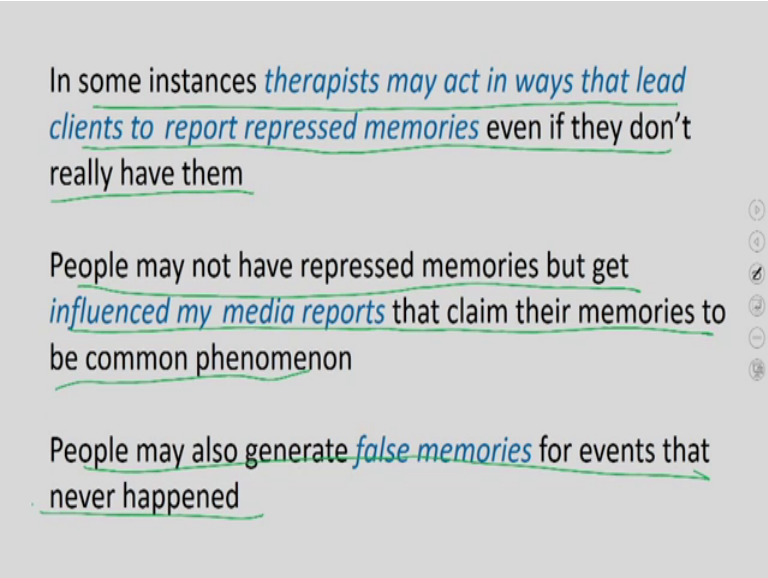

In some instances therapists may act as way to lead to clients to repress the memories even if they do not really have them. And the reasoning that has been provided is that psychologists believed that sometimes which is a therapists who actually gives the memory to people and they repress this memory later on and it is not their actual memory. What happens is when they go into therapy sessions the memories that they are trying to remember they trying to deal with is actually provided by the therapist.

Also people may have repressed memories, but may get influenced by the media report that claim that their memories are common phenomena. Sometimes media reports are such that peoples starts believing that something happened with them. Or this kind of information whatever the media is floating that happened with them also and they start believing that such kind of events happened with them. People may also generate false memories for events that never actually happened because of these reasons.

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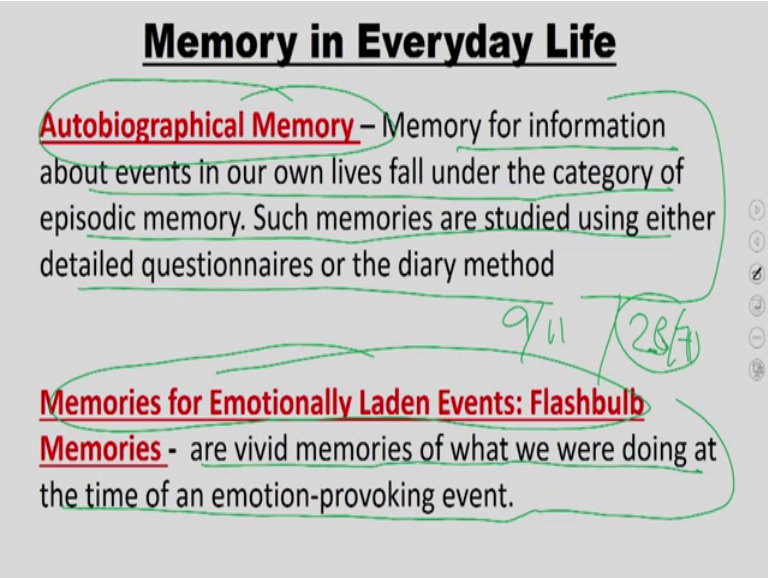

Memory in everyday life; there is something called another kind of memory which is called autobiographical memory. This is memory for information about events in our own lives which fall under the category of episodic memory. Such memories are studied using either detailed questionnaire or diary method. Now information from your personal life it is very difficult to study.

And so the only way to do it is through a diary method the correctness of this is very difficult to assess. So, this kind of memory is also there autobiographical memory your personal memory and so they are studied using the diary method. Now, there are also memories for emotionally laden events which are called flashbulb memories. And what are they? These are vivid memories of what we were doing at a time of an emotion provoking event.

For example, when the 9 11 happen or the 26\ 11 happened. Now all this time 26 7 I think, so whenever these events happened or when Rajiv Gandhi died or some other public favour some other event happened and now what you are doing around that period of time when you heard the news for the first time the memories for that is called the flashbulb memories.

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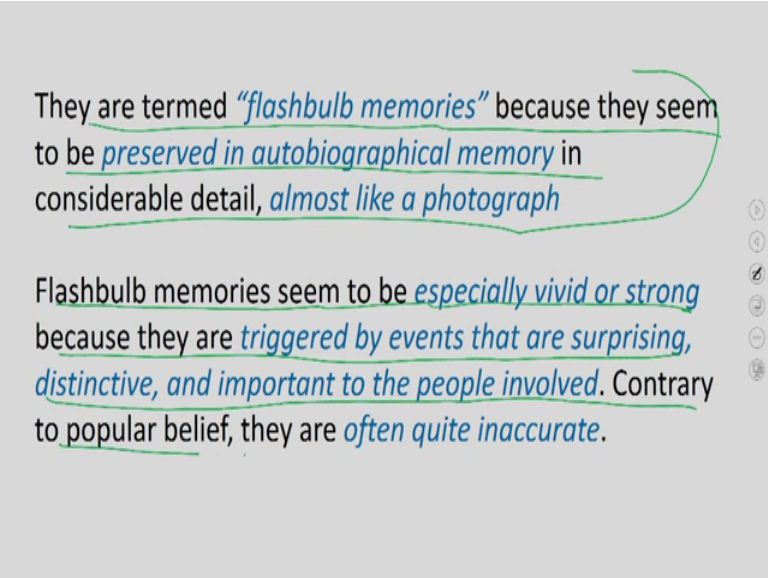

They are termed flashbulb memories because they seem to be preserved in autobiographical memory in considerable detail almost like a photograph, but this has been challenged. Now flashbulb memories seem to be especially vivid or strong because they are triggered by events that are surprising distinctive and important to the people involved. Contrary to popularly belief it is believed that they are often inaccurate.

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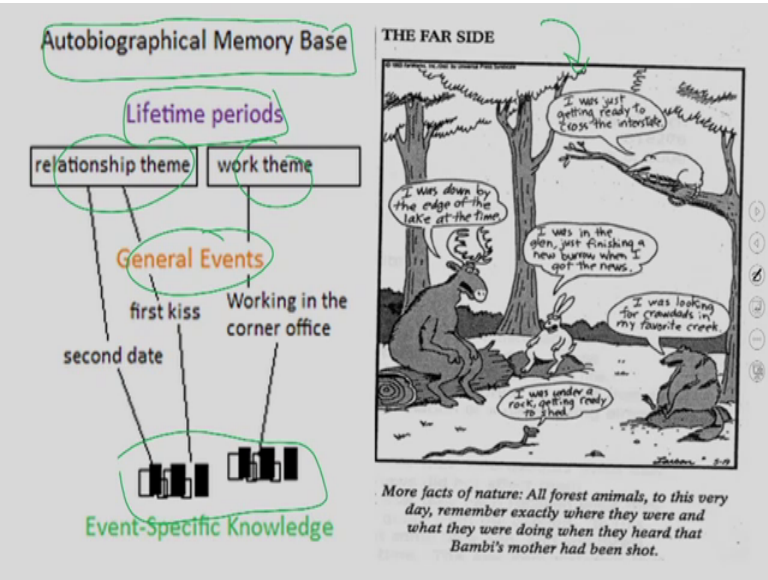

So, this is what my autobiography memory base looks like; if it is time periods event, relationship theme, work theme, general events, so event specific knowledge. And this is

the far side I will leave you with this particular graph or picture which actually tries to detail of the kind of memory that we have and how they interact with each other.

So what we did today, do a little recap of what we did today. What we did today was we moved on from where we left in the last section. So, in the last section what we did was we were dealing with two different influential views of memory and how recall and retrieval and the encoding retrieval and storage by three process and memory. What we build up today is what happens with memory.

So, what is the nature of working memory, how does it really work, what are the parts of working memory, and in further on took the discussions to the idea what is long term memory and what are the parts of it, what are the factors which influence long term memory, what are the other kinds of human memory which are there and how they function and what is semantic and an episodic memory, what is procedural memory and so on and so forth. So, we detailed on these things in this lecture and we moved ahead from where we started in the last lecture.

So, in total we did a complete capsule of what is memory and how it is related to the understanding of human behaviour. Now again I will tell you that if you want to study any of these human cognitive processes in detail you can refer back to my lecture on cognitive psychology where we deal with each of these memory types in detail in on those lectures. So, up till the next time when we meet and we deal another interesting topic in human behaviour is goodbye from here.

Thank you.