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Lecture - 40
Memory - Failure Forgetting

Hello and welcome back to the final lecture of Week 8, in today's session we are going to talk about Forgetting and Memory Disorder. Now, memory is an important aspect of life, it helps us to frame our ideas to frame our opinions about people who understand people and get on with life. And it is also important when we are trying to take decisions based on our past experiences, based on our knowledge we try to apply it in our recent current event.

Now, forgetting has been noticed as a part of memory processes or rather I should say memory failure for times together for times at end and it has also been considerably studied. Earlier people studying forgetting processes thought that forgetting is a passive activity and it is more of a trace decay that when we do not rehearse something the network activity network connections they are likely to faint and gradually we it fades from our memory. Recent research in neuroscience suggests that forgetting is an active process and many a time we consciously try the brain consciously tries to remove certain things from the memory because it helps us to function more optimally.

And in today's session we are going to discuss both the memory disorders that has been that has occurred due to some physical discrepancy or some anatomical lesion or loss of connectivity and we will also look at the active processes of forgetting and this. So, we will be covering some of the theories that are known to you we will also check out some of the areas in the brain that are responsible for memory consolidation and lesions in which may cause or dysfunctions in which may cause forgetting.

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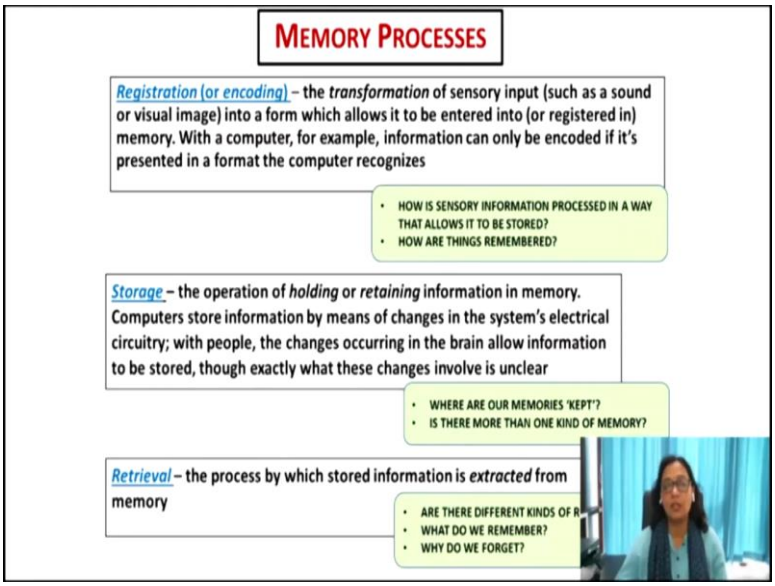

So, starting with this now if you look at the memory processes then there are we have already discussed about the registration memory processes being of three having three components, one registration or encoding where the sensory input be it in the form of a sound or a visual limit is registered into our system into our whole human system. So, it has to cross a certain threshold to register and only thereafter we can it is stored it is encoded and stored.

So, this registration process includes encoding of the information into signals that can be passed on through the from the sense organ through the nerve fibers to different areas of the brain for the storage process. For example, for visual information it will pass as signal from the optic nerve to the optic nerve to the primary visual cortex and thereafter to the other v 1 v 2 v 3 v 4 areas.

The next stage being storage and the operation storage is the operation of holding or retaining the information in memory. And if you just take the analogy of the computer then computers store information by means of changes in the system electrical circuitry; with humans also you will be studying about this more in the next classes.

The synaptic changes are responsible for storing the information and enhancement repetition of these of these networks the interrelationships the associations between the two neurons many more neurons and so on. This actually creates a increases the strength

of the network and this is how the storage happens. So, a trigger in a point in place will actually trigger the whole response.

So, just to give you an example the moment you think about say an animal you may be thinking about cat, dog, lion, tiger and the like but how many of us think about the penguin. So, it is actually the associations that are triggered the moment you say a cat or an animal similarly with school you may think of the name of your school. So, why is it that it is it triggers we discussed this in the previous classes and finally, the retrieval process the process which by which stored information is extracted from memory.

Now, if there is a problem with any of these three processes. So, the registration or encoding the storage or the retrieval they will be forgetting. So, for example, if when you were listening to some new information instead you were also paying attention to something else. So, if you were trying to do two things at the same time the registration of one information may not be very proper and when it is not done well, when it is not the encoding is not done effectively it may cause forgetting, why because there may be a problem with the registration, again the retrieval the associations that you have used to store it there if there may be some problem with that.

So, there may be a retrieval failure similarly if there is a the storage component interestingly requires a damage or some kind of lesion in the brain areas where the consolidation is done, after encoding if there is the consolidation process when it happens when we store information if there is a damage with the area functional networks that are responsible for the storage unit one may have a storage failure.

So, as I was just saying that when we talk of forgetting as an active process or even for that matter as a passive process these are the three areas where you know if it has not been done effectively if there has not been effective with encoding, storage or retrieval we may have a failure in memory or we may have forgetting.

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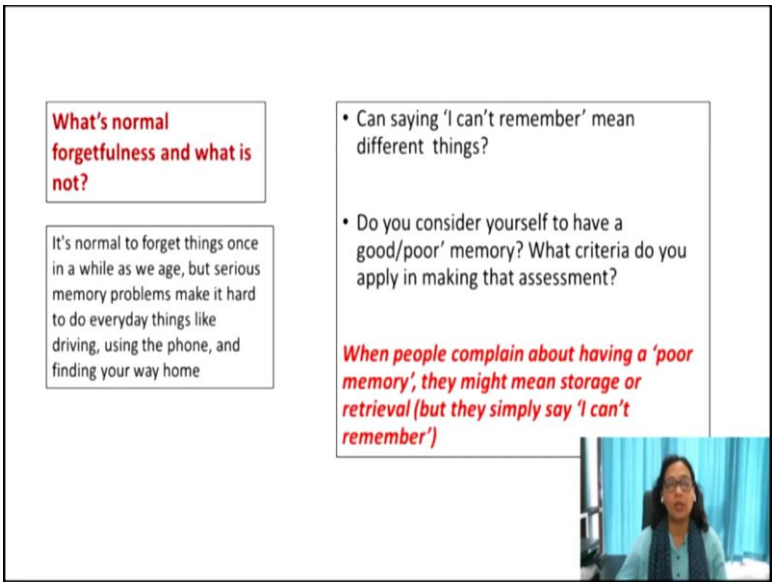

Now, let us look into it what is normal forgetfulness and what is not? So, it is normal to forget things once in a while as we age, also when newer information where more recent information where more important information is taking the place of past information that is irrelevant. But it is that is a normal that is normal forgetting that is usual, but if it is that we are not being able to remember things that we did yesterday or we have forgotten skills like driving or using the phone, finding the way home then definitely this is a memory problem.

Similar things you will often see the latter part that I said, you will often see in patients with dementia and specifically with Alzheimer's disease. So, they may have retrieval failure or you know even the associations failure. So, they might not first they may have a problem with encoding new information and storing it and retrieval failure as in things that they have known for a long time suddenly they lose they standing at a crossroad and have forgotten the way home, but if they are home they have they cannot remember where to where to go or you know what they have done.

So, even short term memory gets affected as to what they have eaten, what they have done last day more often than not people with memory problems especially at old age become very very suspicious of others. It is often confused with mental health, mental disorder you know with dilution, but again it can be without dilution for example, a person may be suspicious that he is he or she is losing money be it is because the person

has forgotten where he has stored the money, where he has kept the money, sometimes they forget that you know if we have told something to somebody or even if they forget to communicate the information, but have the feeling that they have and that is why their confusion suffer and they become very suspicious of the world around them.

So, we when we are talking of normal forgetting it is you know it is usual because our brain is made to forget, why, because so that we can take in more relevant information we can act on more relevant information. So, it is not important for me to remember what I was doing on June 21 2021, unless that was really an important event in my life. So, what I ate, what I did that day, if I had to store all that information along with that there would be more emotional information that would get stored and it would also disturb me.

Now, with time we need to forget certain things actively forget. So, when I say that 'I can't remember' it may mean different things, it may mean that I can't remember because of an encoding or retrieval failure or a storage failure when I have a storage failure most of the times we are not conscious that we cannot remember, we will say that oh no, I do remember he or she is not being right about it he or she has forgotten.

So, now when we ask yourself, do you have a good or a poor memory and how would you apply it for your assessment of good or poor memory? Are you forgetting the regular thing? Are you forgetting it as a student? Are you forgetting your academic? If you are forgetting it, is it because you have not stored it properly, if you have not or rather I should say if you have not encoded it properly, have you used the correct association to recall it. One of my friends would store everything in mnemonic, but later during retrieval he would have to ask people around as to what mnemonics stood for what. So, he wouldn't remember the association of the topic to the mnemonic.

So, now, have you when you are forgetting something, are you forgetting it because of a retrieval of because of an association failure that is why you are not being able to retrieve it or is it that when you were storing it you were doing multiple tasks at the same time or you did not use specific cognitive strategies to store the information properly.

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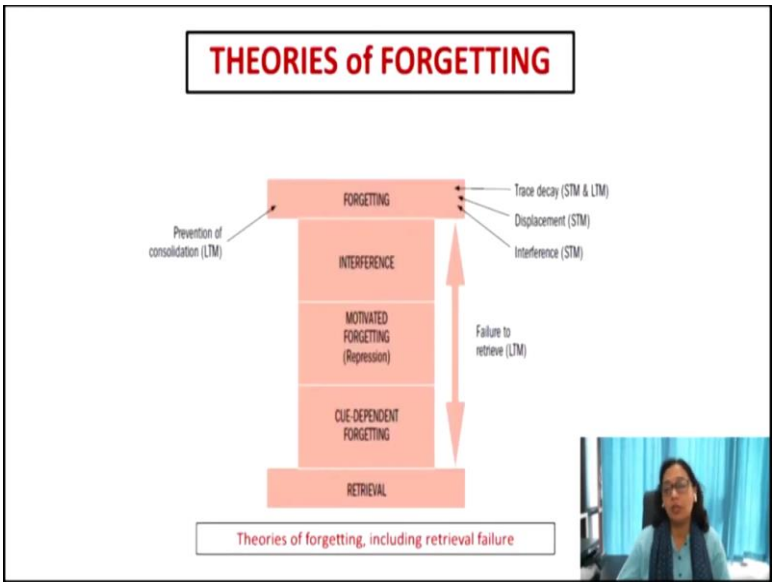

So, let us look at some of the theories of forgetting.

So, the primary theory was trace decay and trace decay theory as you as the name suggests is when you are when you are not using a certain a information a more often then the trace of that information gradually decays because of it is irrelevant now. So, here this theory implies that there is a time the temporal factor is very very important. Now, this gradually you know recent earlier this was the idea, but very soon researchers found out that it is not specifically the time that is important, but the activities that go between learning and recall that is more important.

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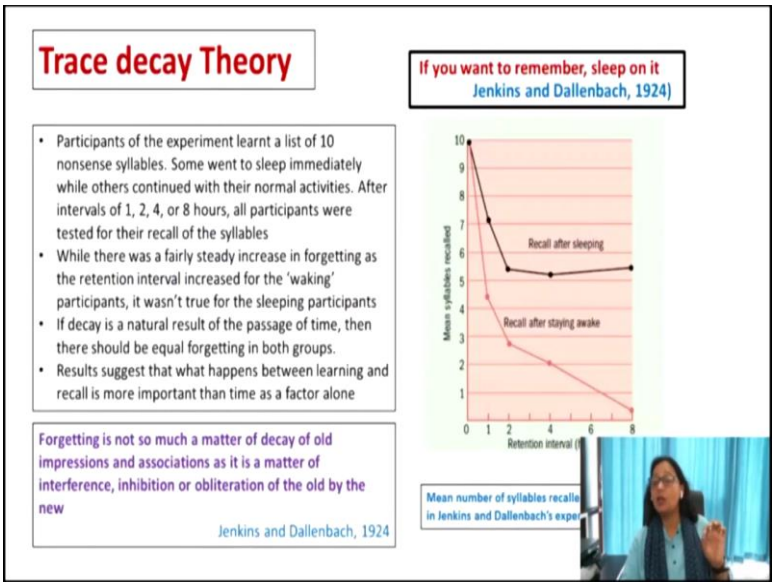

And a wonderful study so, that implies that forgetting is not a passive process, but forgetting is active because you are making other inputs take its place. So, Jenkins and Dallenbach, in 1924 they did this experiment to show that actually temporal difference is you know the not the most important part in trace decay so, in forgetting modern. So, what they did was they took they made participants learn a list of 10 nonsense syllables. We already know what are nonsense syllables that do not have nonsense syllables are syllables that do not have any past association.

So, some went to sleep immediately after learning the list while others they carried out with their normal activities and after intervals of 1, 2, 4 or 8 hours, groups were divided into such that they were tested after these stipulated time period, all participants were tested for the recall of the syllables. And while there was a fairly steady increase in forgetting as the retention interval increased in the 'waking group', it wasn't true that the sleeping for the sleeping participant. So, if time is a factor then they would be because of the natural passage of time both the group would lose information or rather I should say would have forgetting.

But there was more forgetting in the group that was away why do you think so? Is the reason being that these people actually got more opportunity to you know take in more information. So, the people who were awake they were exposed to more stimulus on the same modality. So, if this is nonsense syllables they had learned visually they are getting

to see more visual stimulus and those stimulus remain in the recent memory as compared to the people who are not getting any new stimulus that the group who is sleeping. So, the results suggest that what happens between learning and recall is more important than the time factor alone.

And what Jenkins and Dallenbach said is forgetting is not much not so much as a matter of decay of old impressions and association as it is a matter of interference, inhibition and obliteration of the old by the new. So, this brought about a new theory known as the displacement theory.

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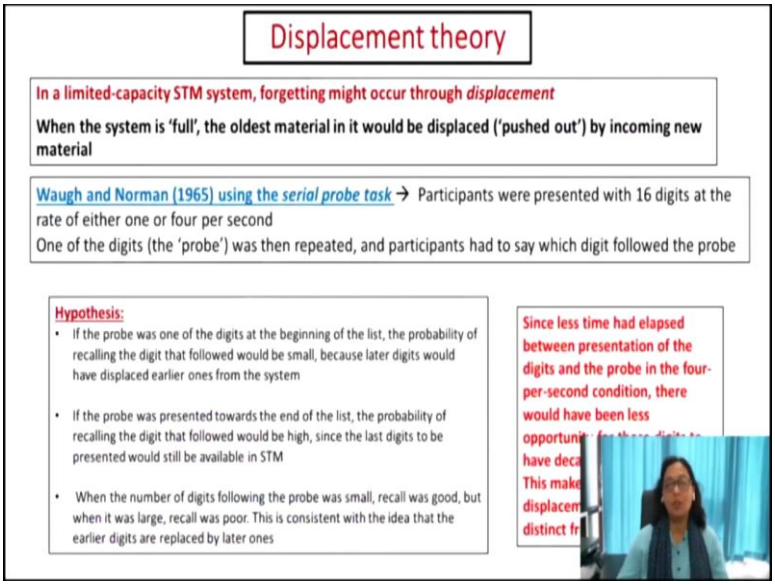

So, what does this say? So, that in when because we have a very very short limited capacity short term memory system or short term or a working memory system which is of a limited capacity, forgetting if necessary through displacement. So, what is displacement here?

So, it is an active process where the information in the short term memory that is irrelevant is removed to let newer information take its place, so that we can continuously process that information. So, this is you know when we are doing any work at this point in time when you are listening to me you are also looking at the slide and you are also processing whatever I am saying. So, if you process every word and if you process every word and keep it in your short term memory or you keep it in your working memory then

the because of it is limited space you will not be able to process the next set of information.

So, we miss out on that. So, what do we do? We you have understood the gist of it, you have understood what I am saying, you are making meaning of the language and in a continuous in a continuous affair. Once you have it is so dynamic once you have made meaning of say once you have made meaning once you have made meaning of these words these are removed because that part has been conceptualized.

And you are looking forward to the next set of words next set of information and you are as you are making meaning the words themselves specifically are not required and you move on see I ask you to pick up a pen, you pick up a pen and then I continue with some more things by sometimes this pick up a pen you will remember that instruction yes something she has said, but you might not remember the specific words.

Because your memory system is dynamic and you are using past information to match templates to understand what I am saying, you are comprehending the language that is how we do it, if I suddenly switch language and I start speaking in Hindi or German you will understand that well it is not the same language. So, you can discriminate if you understand German you will be able to switch it to German and make meaning of that language if not you know that there is a gap.

Now, so, it has to be a continuous dynamic processing, now for that you know there has to be displacement and this is what this theory was based on and this says that when the system is full the oldest material in it would be displaced or pushed out by incoming new material. So, this is recent information and this is what we actually check in immediate memory ok. So, how much of recent information do you can you store.

And Waugh and Norman in 1965 they use the serial probe task to see you know to or rather to prove this their hypothesis on of this place with theory. So, participants were presented with 16 digits at the rate of either one or four per second ok. And one of the digits was a ‘probe’. So, a probe is like a cube ok and it was then repeated and participants had to say which digit followed the probe. So, after they learn the digit one in one of those digits was actually a probe. So, when they were told that word that digit they were supposed to say the word that the digits that followed the probe.

If the probe was one of the digits at the beginning of the list, the probability of recalling the digits that followed was small, because the later digits would have displaced earlier one. So, if you are learning a list of 16. So, the first for example, 10 9 6 8 4 5 3 2 1 7 6 what are the last, what are what do you remember? You may remember 10 9 and then you will remember 1 7 6. So, this is that I said at the end.

Now, why is that, because these are recent so, these are replaced the one that we said before and these are the recent ones you remember. Now that is the function of the brain to be conscious and active at the present moment. So, that is why we remember what is here and now. And if the probe it was seen they showed in data that if the probe was at the towards the end of the list, then the probability of recalling the digits was high, since the last digits was still available in our working memory or short term memory.

And when the number of digits following the probe was small, recall was good, but when it was large, recall was poor. So, this is consistent with the idea that the earlier information is replaced by the latter ones. One of the criticisms of this theory is that because there is less time that has elapsed between the learning and the recall presentations of the digits and the probe in the four per second condition, there would be less opportunity for those digits to have decayed away. So, this is not very clear whether this is actually a trace decay theory or rather I should say whether the displacement process is any different from decay. So, it is quite similar.

So, this was one of the criticisms.

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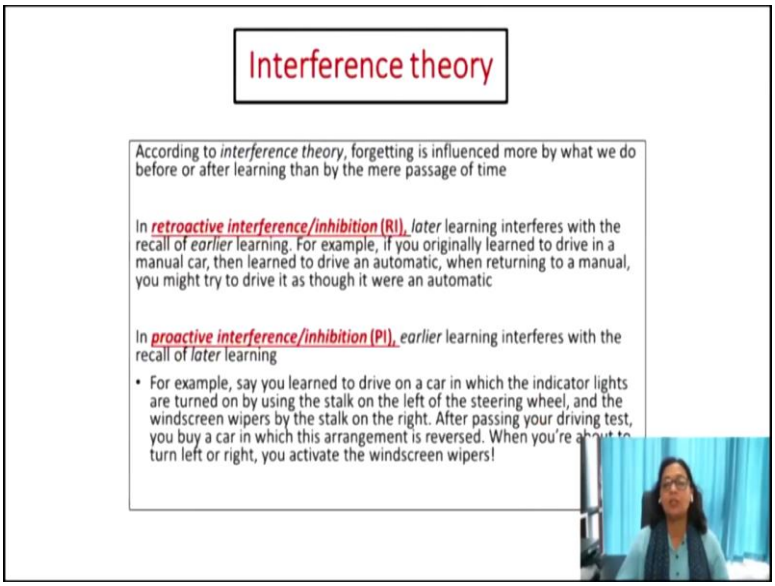

Let us get back to this again you will see that the third process which is very similar to displacement is in interference and now let us look at the interference theory ok. Before I go to interference theory there is ok just 15 a minute sorry the interference theory again is there are two kinds of interference. So, when you are when there is new information when there is information on one on the top of the other and the other and the other there is a lot of information that is coming in there can be two kinds of interference, interference as we know is something that jetting in and interfering with the process of storage in this case right.

So, what happens, there are the two kinds of interference are retroactive interference and proactive interference. Now, retroactive interference is that later learning interferes with the things that have been recalled earlier sorry have been learnt earlier. So, if you originally learn to drive a manual car or say if you learn to if you ride a bike ok and then after you shift to learning a car or you start driving a car, when to learn to drive a car the previous information the you know you keep going back to the manual of the bike. So, you go back to your previous ways of learning.

Now, this is so, new learning sorry old learning is affected because of the say in retroactive inhibition old learning is affected because of new learning, you shift to the car now going back to the bike may be a problem because the clutch and the brake are at different legs different feet that you use operations are different, when old learning now

again I repeat I was a little may not have been very clear. When old learning is affected by new learning that is retroactive innovation the it the there is an interference in the previous learning and proactive is when earlier learning what you have learnt affect your newer learning most of the time these occur together.

So, if you rode a bike earlier and then you start driving a car your riding the bike may be affected because your new learning that is recent learning has affected your previous learning. Similarly, learning to drive the car for a person who was driving the bike may be tough as compared to a novel an amateur who has not learnt to who does not know how to ride a bike, but just learning the car. So, he does not have any previous information that is affecting the new learning.

Let us do look at this through a list of syllables. So, when you are when you have learnt a first list of syllables say you have learnt list 1 and then you learn list 2 you see and then you recall list 1, you see that many words of list 1 is forgotten because the new words of list 2 have interfered with list 1 they have gone and mixed with list 1. So, previous learning is affected that is retroactive interference or retroactive inhibition. When your list 2 learning takes longer time after learning list 1 when you are learning list 2 if it takes longer time to learn then it is because of the previous learning that is affecting you your newer learning.

So, interference can happen in both directions ok and as you can well understand it is because newer information is taking you know it has to be remembered more. So, to learn that either you know the past has to be forgotten or the newer the learning takes a longer time. So, this is again another theory of forgetting.

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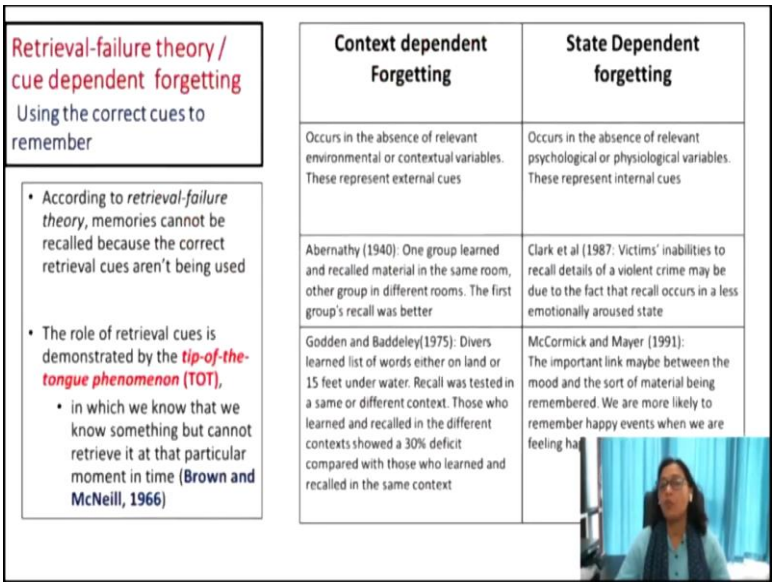

Next we come to retrieval failure, now retrieval failure or cue dependent forgetting implies that we use some kind of association, some kind of cues to remember things and memories cannot be correctly recalled without these cues why? So, see, so far we were talking of encoding and now we are talking of retrieval.

So, retrieval so, you have encoded it properly, but you encoded it as a contexts with a relevant context, the moment so the context may be used as a cue. For example, say if you are many a times when we sit for the exams we have a feeling that; well, I remember the answer, the answer was on the right side of the page with the box and over here, but I cannot actually remember the answer per say I know the position of the answer, but I do not remember the answer.

Many times it happens with the song that yes, I remember it was these two actors who were singing and there was a tree and a mountain and whatever, but you cannot remember the song ok. So, you may say the context of the song and everything, but you do not remember the song. So, it is at the tip of the tongue this is known as the tip of the tongue phenomena and a lot of experiments have been done on it and it has been seen that when we use contexts as cues or state many times we use context as cues as state as cues and most of the times we are quite unaware that we have used them.

So, context is an external cue while a state of an emotional state is an implicit cue and an internal cue and many times we are not even aware that we are using this cue to store

information I always give this classic example of state dependent forgetting. In an alcoholic state if somebody keeps the cycle keys when the person is in a normal state it is pretty tough to find out the where he where he has key the keys, unless he goes back to that in every state. So, that would be one a classic example of state dependent forgetting.

Now, there have been a lot of experiments on this and Abernathy in 1940 showed that he what he how he experimented is he trained made a group learn and recall material in the same room and another group learn the same material in one room and we call it in another room and as you can; obviously, understand many people use context to store that information. So, recall in the same room where the individuals had learned that for that group it was better. Many of us if you think many of us remember that when you know yes, I remember you told me this when we were turning the road you know on that day when we were coming down the stairs.

So, we use context to remember information, a similar experiment was done by Godden and Baddeley in 1975 they made a group of divers learn words either on land or 15 feet underwater and then recall was tested in both conditions and it was seen that if on the same condition if they had learned under water then recall under water was better if they were learned on land then we call our land was better. So, again they show that context is very important, when we talk of state dependent I gave you an example of hiding the keys in an alcoholic state or keeping the keys in alcoholic state.

Some other experiments were done Clark et al in 1987 they saw that victims inability to recall details of a violent crime is because when they are trying to recall it they are in a much lesser emotional state as compared to the condition of the violent crime. One classical example of this is you know previously people would do hypnosis to recall information and they would take the person to that state to recall information. Now, because I am not very well versed in hypnosis as a scientific technique I will not talk about it over here.

So, coming back to this again McCormick and Mayer in 1991 this show that there exists an important link between mood and the sort of material is being remembered. So, if you are in a happy mood you will remember happy things, if you are sad you will always remember more of negative things and this is what we try and address in the depression in therapy cognitive behavior therapy of depression.

So, when an individual is in a sad state it triggers more of the negative sad negative thought so, sad events in life and things like that. A classic example was given in the gift of the magi a story by O Henry where you know the when the girl she looks she is feeling sad and she is looking out of the window what she sees is a gray cat sitting on a gray fence on a grey back yard. So, it is everything is gray. So, it has an undertone of sadness. So, now, state dependent things we call state dependent memories, if you are in a sad state you will remember the sad thing. So, if you are trying to remember things in a different state then it may be a problem.

So, how we are storing the information here when I say storing I am saying encoding, how you are encoding the information with what cues with what association, if you have how when you are recalling that information what cues are you using that becomes very important.

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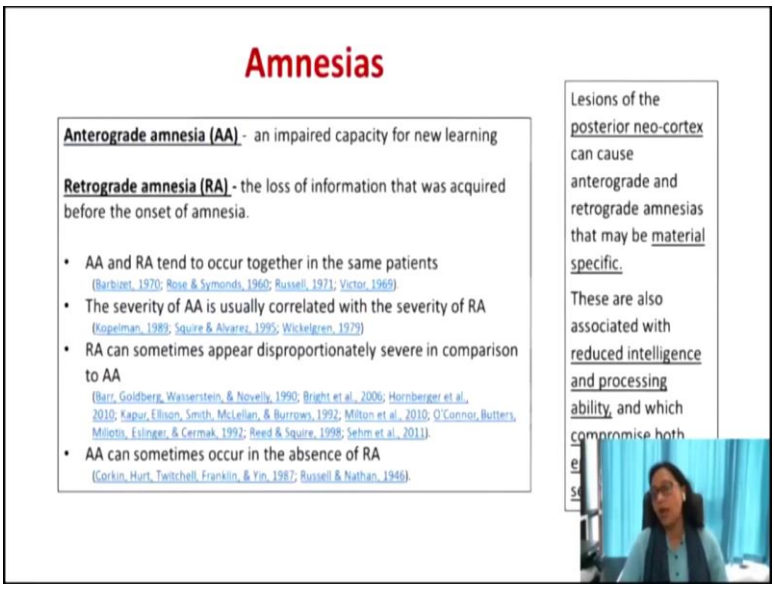

Now, we come to storage ok, so far we have discussed encoding and retrieval now we come to storage. Now, in storage difficulties when there are when there is forgetting or memory loss due to storage difficulties then we will look we will have to look for anatomical reasons for it or anatomical origins for it and a classic phenomena is amnesia.

Again there are two kinds of amnesias one is anterograde which is an impaired capacity for new learning and retrograde amnesia where there is a lot of information that was acquired before the onset of amnesia. So, if you consider that there is an individual who

had an accident today or whose had a head injury today or a surgery or a lesion ok after which there is a damage in certain areas of the brain we will come to those areas. So, when this damage occurs after that if he cannot store newer information. So, the newer short term memory you cannot store information in short term memory then that is anterograde amnesia henceforth newer information cannot be stored.

Retrograde amnesia is where the previous information is forgotten as we see in most of the movies; you will see that the person has after an injury after a head injury the person has forgotten who he was and who what he did and so on and so forth. So, now, this is retrograde amnesia after the impact after the trauma is in head injury after that the previous information has been deleted. Now, most of the times it has been seen that it is not a problem with the long term storage area only or the short term storage capacity, but the link between the long term and the short term.

So, people can store the information in the short term memory for a while do the function, but the pathway to long term memory may be lost that is why they have amnesia. And it has been seen that anterograde amnesia and retrograde amnesia tend to occur together in many patients the severity of anterograde amnesia is usually correlated with the severity of retrograde how much we have so from the incident how much have they forgotten in the past. So, it is like there is an accident have they forgotten the days events 2 days, 1 year, 5 years whole life. So, make on who [FL] kind of a phenomena ok I forgotten everything that happened before.

So, it progresses this way it will move for the injury the damage it depends on you know how much you have forgotten and similarly the anterograde amnesia that is after the incident how much you can store information or how much you forget that is dependent on the severity of the retrograde amnesia. So, how severe was the damage, how much has been forgotten and it can sometimes retrograde amnesia can sometimes appear disproportionately severe in comparison to anterograde. So, I can I have problems with storing new information, but I can still do it, but for I have completely forgotten who I was and whatever.

So, I have lost a lot more of retrograde as compared to anterograde ok and sometimes the anterograde amnesia can happen in the absence of retrograde. So, I can remember a classic case is of we will just discuss it I can remember everything that happened before,

but I cannot store in new information after the accident. And it has been seen that lesions in the posterior neocortex can cause anterograde and retrograde amnesia that may be material specific and this brings about a reduction in information processing ok. And this may also affect episodic and semantic memory; obviously, if you cannot remember. So, it affects language areas also of meaning and episode event related memory.

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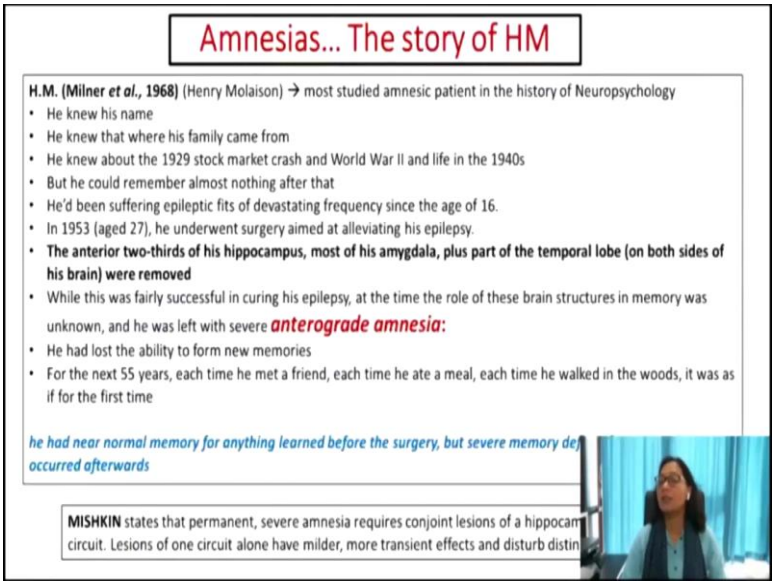

So, as I was just mentioning a classical case of a classic case of amnesia is that of Henry Molaison or agent and Milner and his associates they studied H.M in 1968. So, it is the most studied amnesic patient in neuro psychology. So, what happened to H.M? H.M had severe epilepsy and they had become devastating. So, his survival was at stake and in 1953 when he was 27 years old he underwent surgery to remove the epilepsy.

What happened after that? The anterior two-third of his hippocampus, which is again very very important for long term memory and specially episodic memory and amygdala which is responsible for emotion and parts of the temporal lobe on both sides of the brain had to be removed, he had temporal lobe epilepsy. So; obviously, you know once these temporal lobe areas and the hippocampus and amygdala these are subcortical structures in the brain and once these were removed he was the epilepsy had been cured. So, he did not have any further seizures, but what he developed was anterograde amnesia.

Now, what does that mean? As I said he remembers previous events. So, he knew his name, he knew where he was where his family came from, father mother came from,

where he was born, what school, everything he knew about 1929. So, in 53 he was 27 he knew about previous things before 53. So, he knew about world war, he knew about the stock market scrat and everything and, but after the event after the accident he remembered nothing he could not or rather I should say he could store nothing. So, we have lot the ability to form new memory and for the next 55 years that he lived each time he met a new friend he met a friend each time he ate a meal each time he walked in the woods it was as if it was for the first time.

There is a wonderful movie called '50 First Date' which has a similar storyline if you can do go through it and for a H.M he had a normal near normal memory for anything that happened before the surgery. So, his long term memory previous to the accident was intact. So, he couldn't store any new thing in the long term memory, but his previous memory of long term memory before the surgery was intact, but he had severe memory deficit for events that occurred afterwards. So, even the pathway to store information in long term memory was affected. So, he could not convert things to long term memory easily.

So, MISHKIN states that permanent and severe amnesia requires conjoint lesions at that time we got to know that he had you know temporal lobe lesions and hippocampus and amygdala lesions, but MISHKIN later shows that for severe amnesia it requires conjoint lesions of a hippocampal and amygdala circuit. So, that is as I said the pathway of storing long term memory and emotions together and lesions of one circuit alone have milder, more transient effects and disturb distinct aspects of memory.

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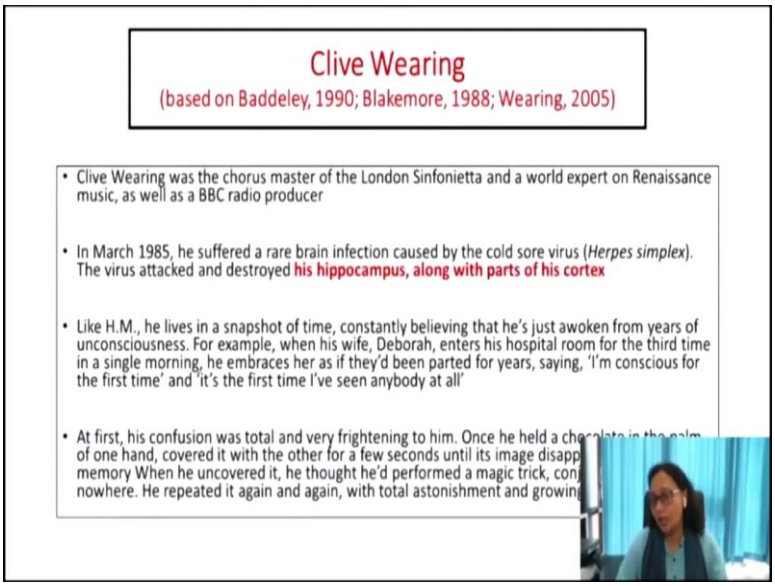

Another case let us look at another case which is widely studied in neuro psychology is that of Clive Wearing and Clive Wearing was a course master in the of London Sinfonietta and he was a world expert on Renaissance music, as well as a BBC radio producer. In 85, he suffered a rare brain infection by a virus and this destroyed his hippocampus, along with other parts of the cortex. So, the cortex is surface area of the brain of the cerebrum.

And like H.M, he remember he lives in snapshot of time. So, he he would believe that he suddenly had woke up and if he couldn't store new information ok and for him everything was new. So, he is he was as if he was conscious for the first time it is the first time he I have seen everybody at all.

So, initially the confusion was total and very frightening for him and just to give you an example that you know if he kept the chocolate in his hand and if he kept it for a longer while. So, that it faded from short term memory when he looked at it he thought it was like a magic trick. So, he it for him it was more of a new thing you know it is like an astonishment and fear for each time he discovered something new.

What is the difference between H.M and Clive Wearing?

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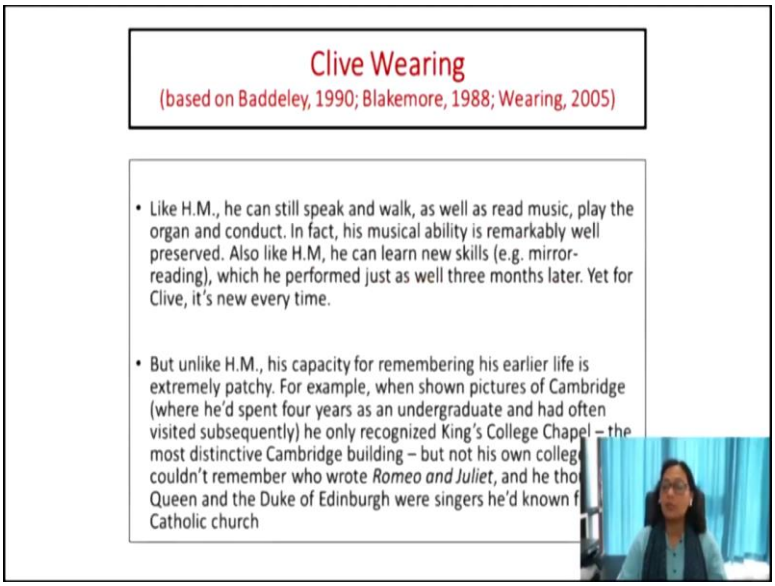

So, like H.M he can still speak and walk as well as read music, play organ and conduct. So, he can because these are things that he had learned earlier his musical ability is remarkably well preserved also like H.M he can learn new skills. So, you see skill learning is another area of the brain that is why it was not effected and if he learned the skill he could do it. So, it could be transferred to long term memory he could do it every time ok, but unlike H.M his capacity for remembering his earlier life was patchy. So, his long term memory of past events was also affected.

So, for H.M his long term memory before the accident before the surgery was intact, but for Clive Wearing even the long term memory so, before the accident was affected ok. And like he had studied at Cambridge, but when he was shown pictures of Cambridge he could only recognize King's College Chapel, but he could not recognize his college nor could he recognize the Queen or the Duke of Edinburgh. So, he had no see these are parts of long term learning right long term memory, but these were also affected.

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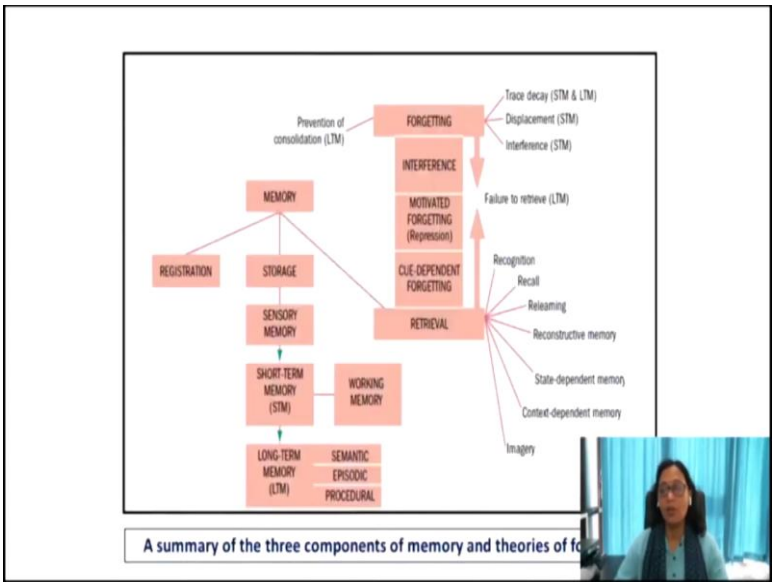

So, you see when we see each individual with memory problems they may be very very different and they may be due to you know different areas especially in storage circuits different areas being affected.

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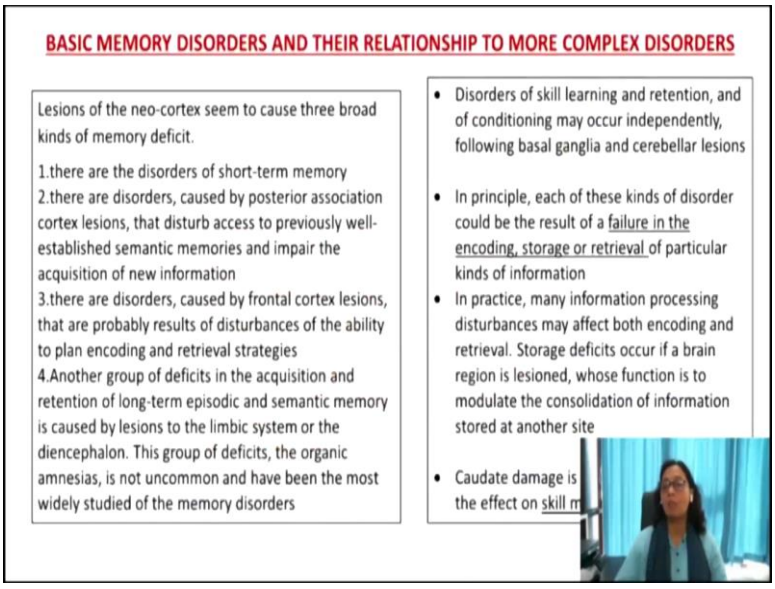

Now, let us look at the basic memory disorders and their relationship to more complex disorders. So, for if there is a there are lesions of the new-cortex they generally cause three broad kinds of memory deficit. 1, there are disorders of short term memory, 2 there are disorders caused by posterior association cortex patient. So, the association areas are

affected and this disturbs access to previously well-established semantic memory and impairs newer information. I was telling you that it is not only the short term memory structure getting damaged the areas for short term memory or the storage for long term memory, but also the association areas if we are impaired then it affects semantic memory and acquisition of new information.

Now, there are disorders that are caused by frontal cortex lesion, frontal cortex areas are the decision planning motor coordination these are controlled by the frontal cortex area. So, frontal cortex lesions may also cause memory disorders and these are probably because of the encoding strategies that one uses. So, the planning during encoding the cognitive strategies that one uses during encoding these will be affected if there is a frontal cortex lesion.

And the fourth group is the group of deficits in the acquisition and retention of long-term episodic and semantic memory and this is caused by lesions in the limbic system or the diencephalon. So, it is more of the subcortical areas and these group of deficits the organic amnesia is not common and is the most widely studied.

Now, disorders of skill learning and retention and conditioning may happen more this is not very well studied in humans, but most in animals, but in humans it can happen because of the basal ganglia and cerebellar lesion. So, this is for procedural learning for learning new skills because the basal ganglia and the cerebellum are very very important for body motor coordination and balance and that is why these even for motor memory. So, damage in these areas lesion in these areas may affect skill learning and retention.

And a in principle, each of these kinds of disorder could be the result of a failure of encoding storage or retrieval and in practice, many information processing disturbances may cause both encoding and retrieval disturbances, as I mentioned earlier storage disturbances are due to lesions or structural regions being affected. So, anatomical regions that are affected and when consolidation does not have proper does not happen properly.

Another very important area that is related to procedural learning or motor learning is caudate, caudate is again a subcortical area and is a part of the you know nervous system and damage in this area is responsible for the effect of skills memory.

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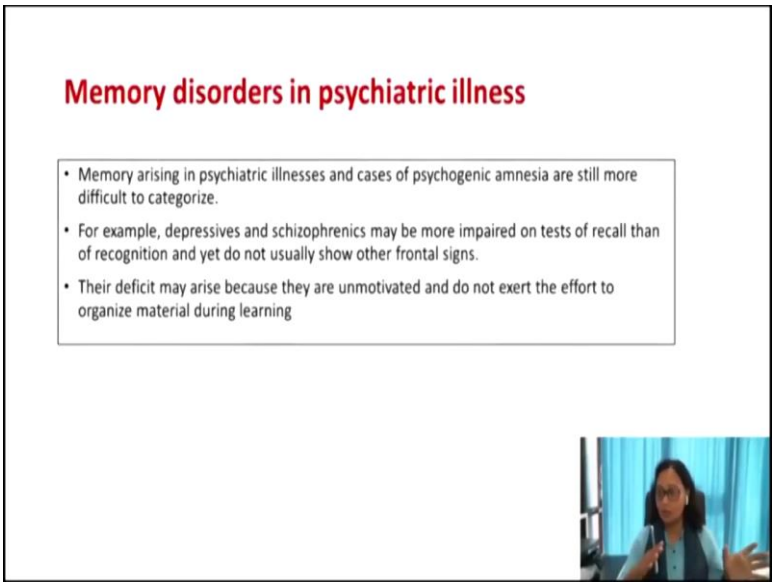

So, in a nutshell this is about memory in the areas that affect storage and consolidation, coming back to memory disorders and psychiatric illness. So, many times an individual with psychosis or with depression shows memory deficit. Now, the real cause has not been very clear, but because they do not show you know frontal sign of memory deficit. So, it is not because of a lesion, it is not because of a process problem with encoding that the memory deficit suffered.

Perhaps, it is because of you know the way they are paying attention to the information, most of the times they may not be focused in receiving the information that is why there is a problem with encoding or they may not be motivated to you know again grasp that information. So, grasping that information, organizing it and you know so, basically the encoding process may be affected because of their lack of motivation, lack of interest in listening to the information, but it may not be specific damage or a lesion in a the storage circuitry that causes memory deficit in psychiatric illness.

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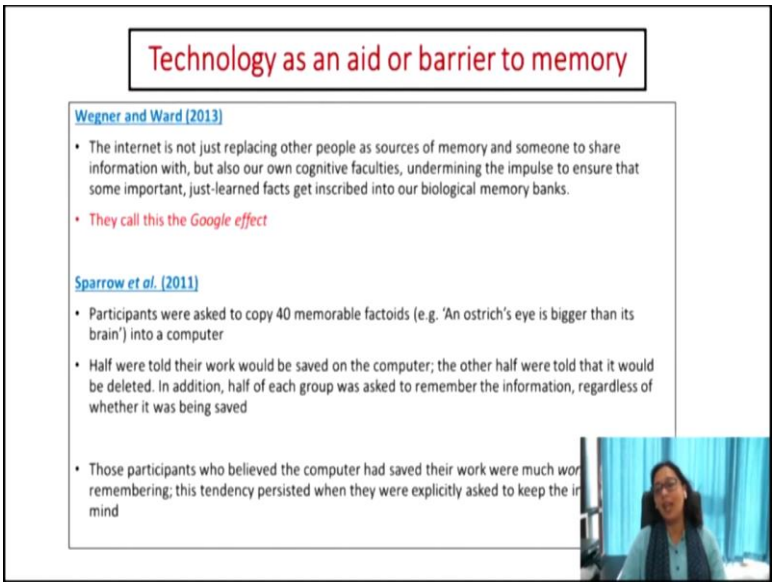

So, say whether technology is an aid or a barrier in memory. So, you know recent studies by Wegner and Ward they say that the Google effect ok using Google too much ok has helped to has affected our memory in a negative way and we do not use our cognitive faculties enough to store the information or we do not even use other humans as resources as sources of information, but we depend on a computer or on technology for memory. So, our human ability of storage is also being affected, there is always an argument about this that well, people who learned in the basic period when people learn through both memory; obviously, they had a larger memory a capacity than us, but ok we are not functioning any lesser.

If we have storage units to keep that we have books to keep that information now we have PDF files it is helping us ok we can use that memory space for something more important. So, this the argument continues, but of course, if you check out for yourself 20, 10 years or 15 years ago you would be able to remember the phone numbers of your friends, family, birthday, today it is the Facebook or you know some other social media or something else reminding us or we have the numbers phone numbers stored in our mobile memory if not in our memory.

Now, this a classic example experiment was done by Sparrow et al in 2011 and they presented factoids to participants and these factoids were this a group was. So, some of the participants were told that the information that is being presented to them will be kept

in a computer will be stored in a computer, the other half was told so they had to be to remember it. And whether it was being saved or not again there were subgroups who were told that well you still learn it, ok remember it and the other group were not told anything. So, it has been seen that the participants who believed that there was a computer which could store information they their memory suffered more they forgot most.

So, they were not motivated enough to use their brain to store that information actively despite and more. So, in the group who were told despite being kept on the computer who were told to actively recall it remember it retain that information there you know their performance was also poor. So, even when you are consciously told to remember any information once you are aware that there is another storage unit taking responsibility we are too casual about using our own brain and our own memory to store information.

Now, let us look at what would happen if we remembered everything.

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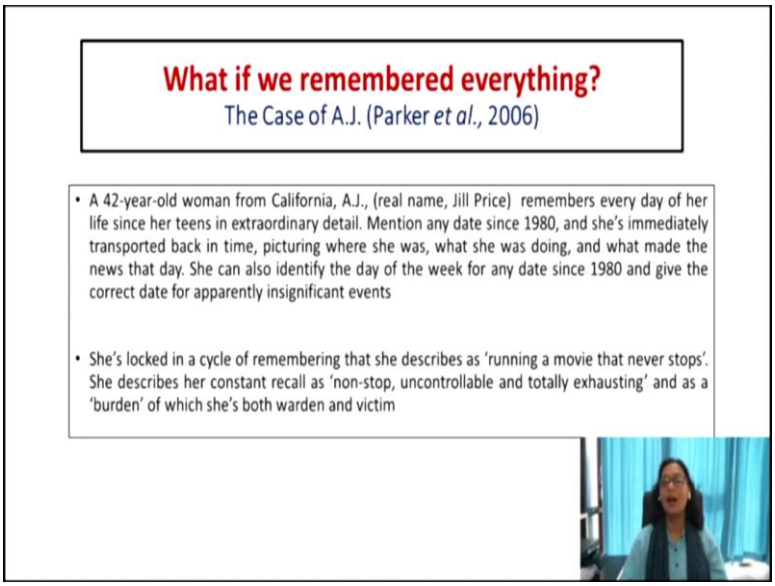

And you know this case was reported by Parker in 2006. So, there is a 42 year old woman from California named A.J who remembers every day of her life since her teens in extraordinary details. So, if you tell her a day she can tell you what color dress she was wearing and what she was doing and what was on the news and everything. So, this to her if you just go through an interview you will see this to her is very very distressing

because she is locked in a cycle of remembering and she says it is like a running a movie that never stops.

So, along with the even episodic memory she also remembers some sad and happy part, now think about it we go through a lot of stresses and sadness and you know all kinds of emotions in our life it is always good to remember the happy one, but if you keep rehearsing the sad one it is not a very pleasant thing to happen.

So, the brain consciously actively tries to remove something. So, for this lady it is not only even though she has a greater capacity of holding information. So, for her she does not need to displace things from short term memory to store new information, but for her it is more distressing because the emotional content of that memory also lives on in the same balance through the years. So, well, this has been quite a long lecture we end here and hope you have enjoyed it.

Thank you.