Indian Institute of Technology Kanpur

National Programme on Technology Enhanced Learning (NPTEL)

Course Title
Basic Cognitive Processes

Lecture-34
Memory-VI

By
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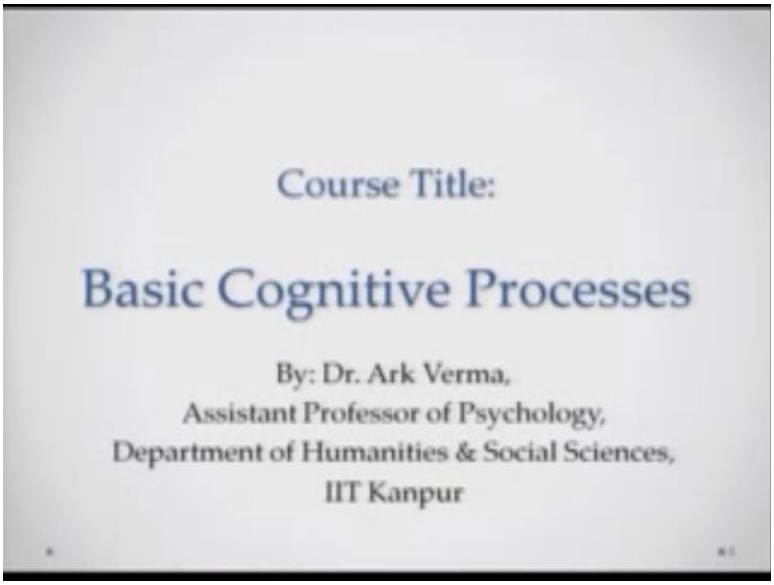

Hello everyone welcome to the course basic cognitive processes I am Dr. Ark Verma from IIT Kanpur.

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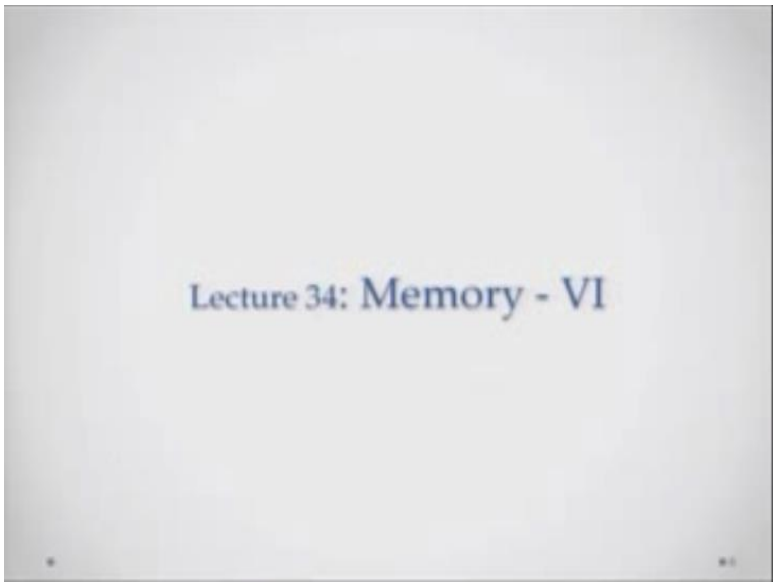

Now as you know we have been talking about memory in the last lectures we talked about long-term memory we talked about explicit implicit episodic semantic priming procedural in those different kinds of memories in the last class now today I will probably be talking to you about a more basic aspect and the more basic aspect being how do you create memories how do you take information and place it in your memory.

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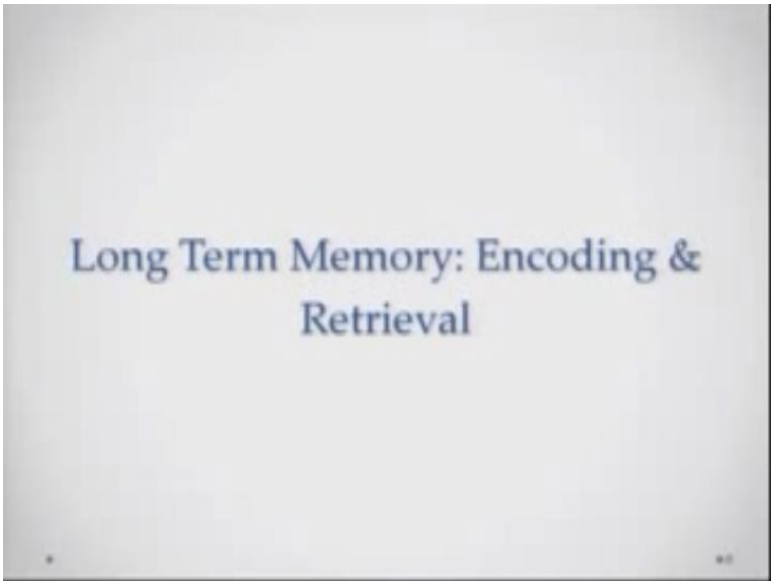

We will also be talking about what it takes to retrieve information already present in your memory out and use it so today we will be talking about encoding and retrieval.

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So let me ask you, you know a very simple question and you can think over it for a couple of minutes and say how do you create a memory how do you make a memory and you know you can tie this example out of say for example how do you study a particular course say for example this course or any other course that you might have done in a regular classroom as well how do you really do that how do you let us say make sure that you have remembered everything.

That was you know taught as part of the course all the assignments all the knowledge that were given so that you do it very well perform very well at the end of the you know semester while the exam is being so there is this demonstration in Gaussian scope where in five different students are asked and they are asked how do they prepare for a particular course and they kind of describe that and some detail.

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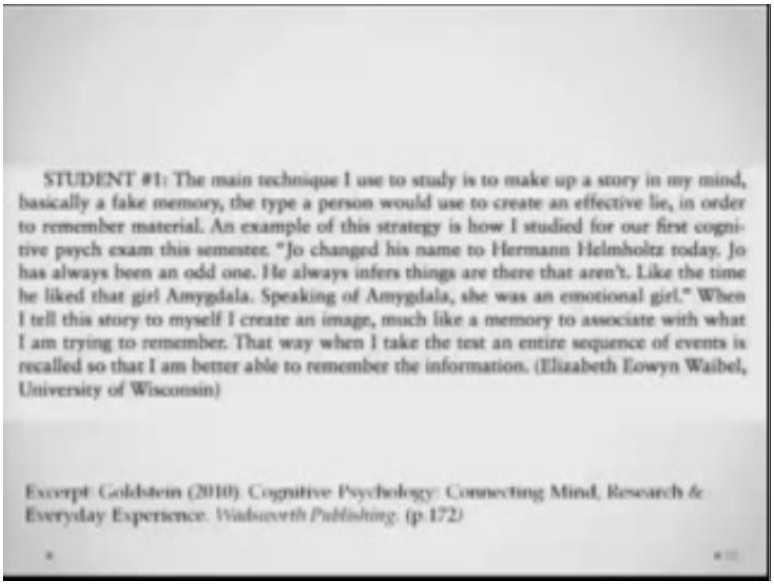

And I will kind of just discuss this video to show you that how different people might have different strategies of making memories or encoding information into their long-term memories say student one says that the main technique he uses is to study while studying is to make up a story in his mind so he says that you know there was his friend and he kind of changed his name to Helmholtz any kind of attached all those things that he knew about Helmholtz to this person.

So let us say the immersed name has changed to Helmholtz and then you start saying that you know emerges a rather queer person he kind of tries to make sense of things that that they are but they are actually not there and say for example you named one of his other friends named amygdalaand he said that this person is an emotional person so what he is doing is he is creating a fake story.

But in this fake story all the important details that he wants to remember are attached to these specific characters of the story so in this way what happens is he is organized or he has pasted the characteristics or important facts that he had to remember to these characters in a particular story in that sense he will remember the story well he is remember the characters well so he does not really need to explicitly mug up the important details.

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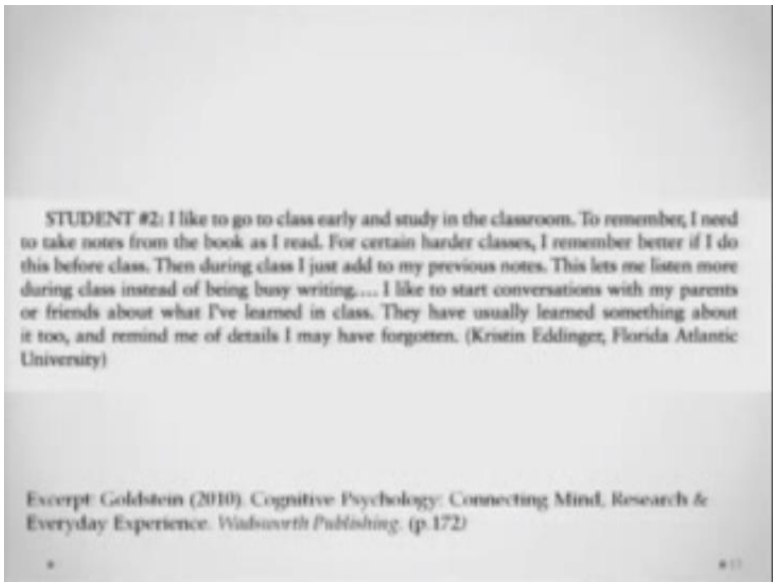

Because he knows the story he knows the gist he knows if you have to talk about amygdale you have you at least know that amygdale is the center is the organ of the brain that is more as a part of the brain that is associated with emotions so this is one way of doing it obviously the other way is that there is this second student who says that he or she would like to go to the classroom early and study to remember that they kind of prior to go into the class make notes and when the class is going on this person is taking more notes because the notes are already there he is not really or she is not really making notes while the class is going on.

So it is kind of dedicating more time to listening while in the class because the notes have already been prepared and just complementing those notes with things that he might have or she might have missed earlier this is one way of preparation so that you remember all the material at the end of the semester about the course so this is and it is very different from the first one the third one says that I kind of like to teach somebody.

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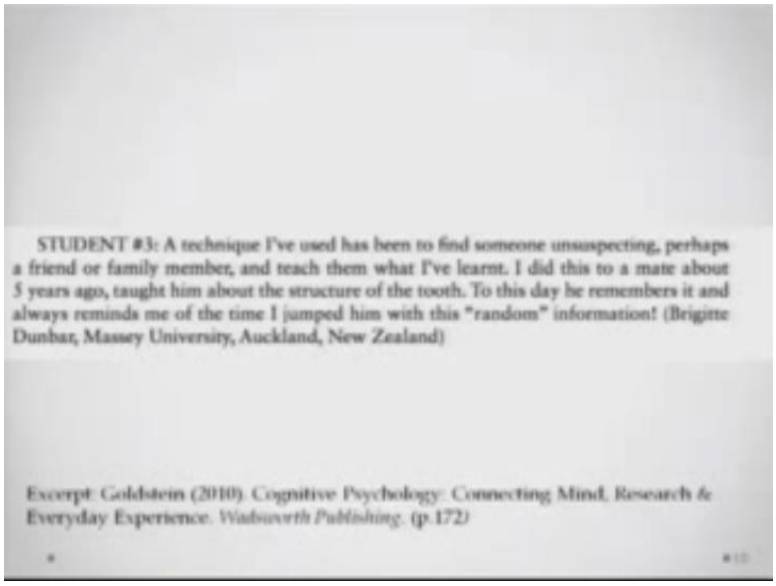

Whatever I have learned say I remember one of the people I know whenever the he or she would comeback from the classroom after a day in school this person would teach somebody else say for example you know a friend or a relative everything that they have learned in the you know in the school during that day so what will happen is that because this person taught that material and some of you might already be a very fit.

For example whatever material you have learned once you have taught that material to somebody else you kind of master that material that material gets really well established in your memory and you will not forget it you know as easily as some of the other material that you have not really taught so this is another third way of doing this the fourth way is that the person can organize their notes it can be tables and graphs.

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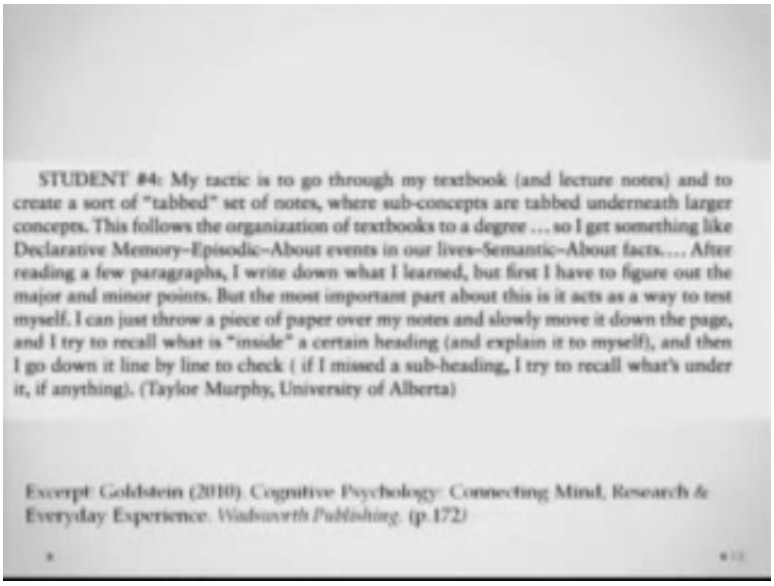

And those kind of things and this organization and this organized way of making notes kind of also might help people remember certain information.

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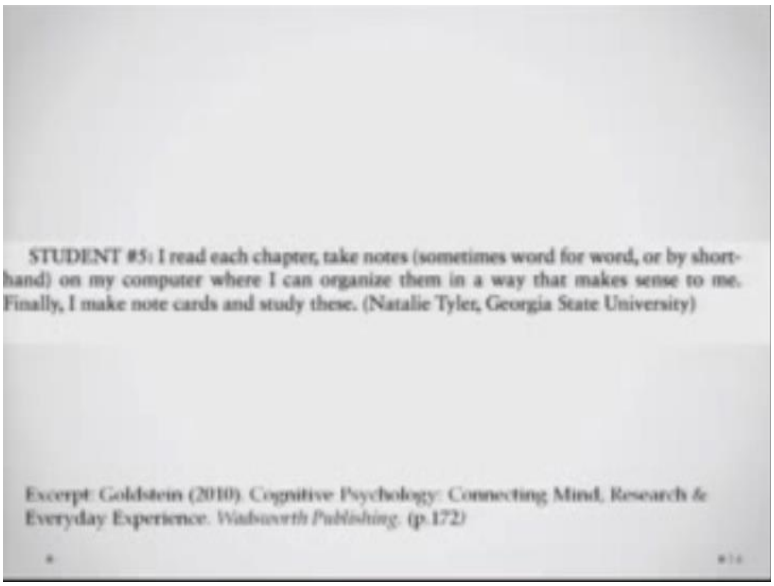

Similarly there is the fourth student who actually reads each chapters takes notes and then organizes the material on the computer screen now you see five different students if talking to ten other students as well different people have different strategies to encode information in the long-term memory.

So this is what we will be concerned about how are you storing information in your memory you might have your own idiosyncratic way your own unique way of storing information so what does this tell us it tells us that nobody and there is no standard way of loading information into the long-term memory and people do it according to you know their own preferences their own likes and dislikes or say for example their own study strategies.

So then how does one study or how does one investigate people is manner of you know storing information in the long term I kind of try and you know do some generalizations do some estimates of what people are doing when they are storing information in their long-term memory now one of the things that probably a lot of people do is called rehearsal.

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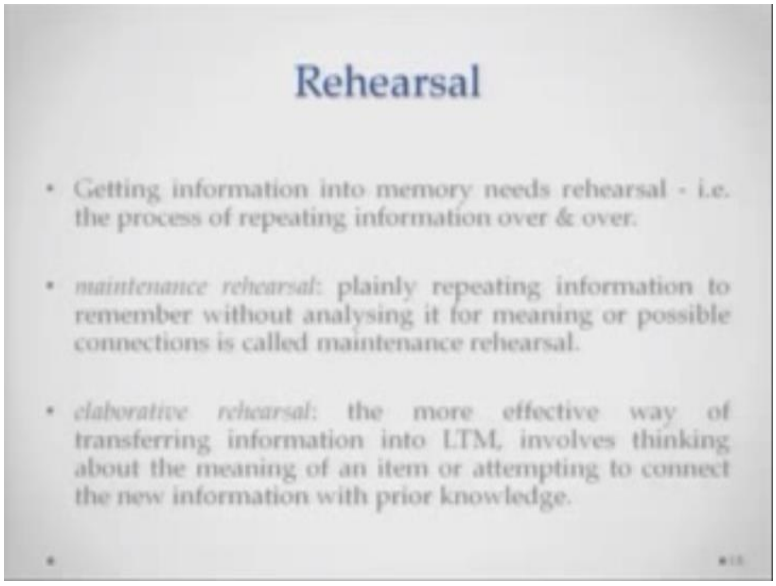

A rehearsal basically means you are getting information into memory by repeating this information over and over again now this repetition could be verbal or this repetition could be writing something down taking notes teaching it to somebody having read it and then repeated while your end so a lot of people are in some sense doing one or the other kind of rehearsal.

Now there are two main kinds of rehearsal that one can talk about first is maintenance rehearsal whatever I am saying and you are also repeating it in your head again and again without really wandering bothering about the meaning of what I am saying then you are basically doing maintenance rehears also you are plainly repeating information to remember but without analyzing it for meaning or possible connections about possible connections with what you already know.

So maintaining in rehearsal is basically when you are typically just repeating or parroting information how good or how bad it is we will talk about in sometime the other kind of rehearsal is called elaborative rehearsal say for example this person who was fond of making fake stories so what he is doing is he's elaborating whatever concepts he has learned by making stories about them and remembering the gist of that information.

It has been seen the research has shown that the more effective way of transferring information into the long-term memory involves thinking about the meaning of an item thinking about the meaning of this information or attempting to connect this information with whatever you already know a good tip about this course or any other course that you might be doing is that you have to try and create your own examples.

You have to try and create whatever I am saying or whatever you might be hearing in any other class create your own examples link the examples that I am giving to something that has happened in your experience as well and in that sense you will understand this much better you will remember this even better after years and months and you know much, much longer time.

So again just a tip so I mean there are two kinds of rehearsal possible maintenance rehearsal and elaborative rehearsal and it has been shown by research that elaborative rehearsal is a better way than maintenance rehearsal so that said let us talk about something else now one of the ways about rehearsal or say for example by elaborative rehearsal might be better than maintenance rehearsal was proposed by Craik and Lockhart back in 1972when they propose what is called the levels of processing approach.

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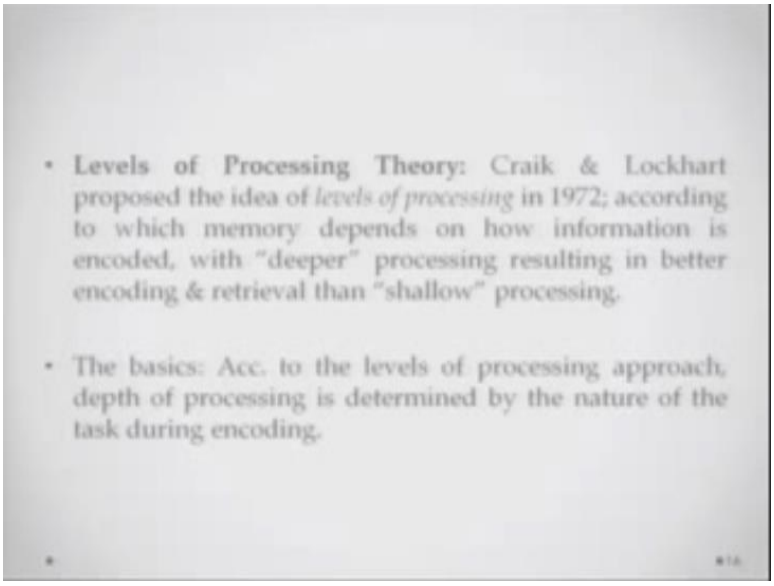

So Craik and Lockhart basically said that memory depends on how much the information is encoded deeply so how deeply you include some information how deeply you analyze some information basically decides how well you will remember that information after a given period of time an information that is more deeply analyzed more deeply encoded is remembered for much longer periods or periods of time as compared to information that was not so deeply or analyzed in a rather shallow manner.

So they basically distinguish between deep processing and shallow processing this is according to the levels of processing approach the depth of processing is determined by the nature of the task during encoding now let us do this demonstration here there is a list of words here there is the word called chair mathematics lamp and car any kind of reading it one of the questions.

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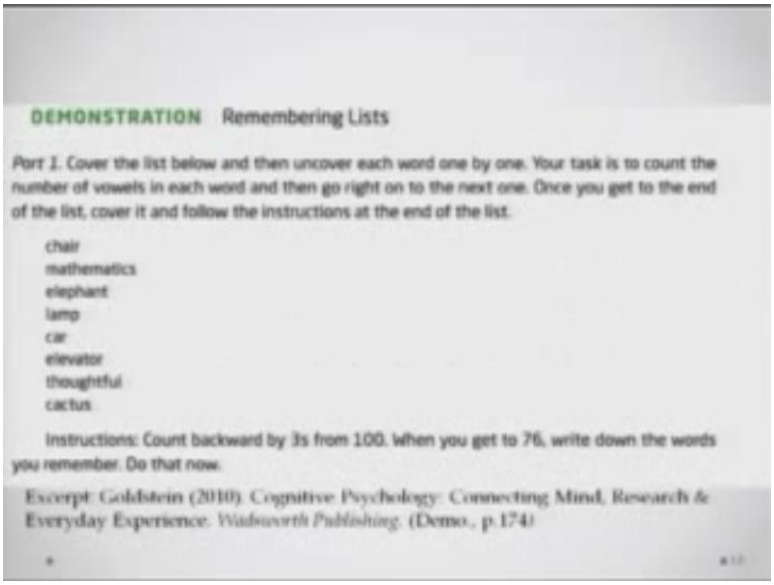

I could ask you is just count the vowels on each of these words and then you move on to another word and while you reach the end of the list you kind of start counting backward by threes and once you have done this you reach a particular number let us say 76 you kind of try and write each, each of these four so, so what you are doing is you're just looking at the number of vowels in these words you are not really looking at the meaning not really linking the meaning.

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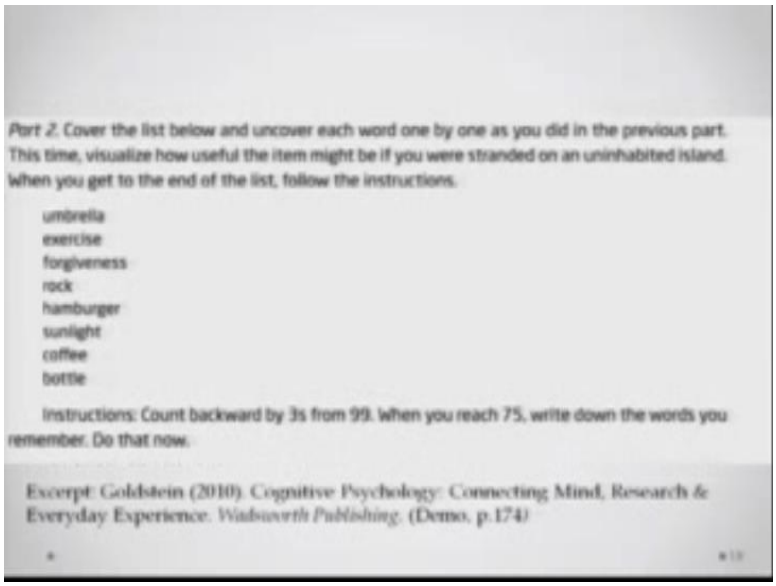

You know to your knowledge or anything you are just looking at the vowels thing another demonstration could be say for example you have to you know again reach each of these words you have to but you have to utilize you have to visualize how each of these objects might be useful to you.

If you were a left deserted on an uninhabited island so there are these words umbrella exercise forgiveness Rock hamburger sunlight those kind of things but you have to think of them as but how useful these words will be if you were left with either of these objects if you are on a deserted island remember the movie castaway we are in and there was this gentleman who was a you know left stranded on this island.

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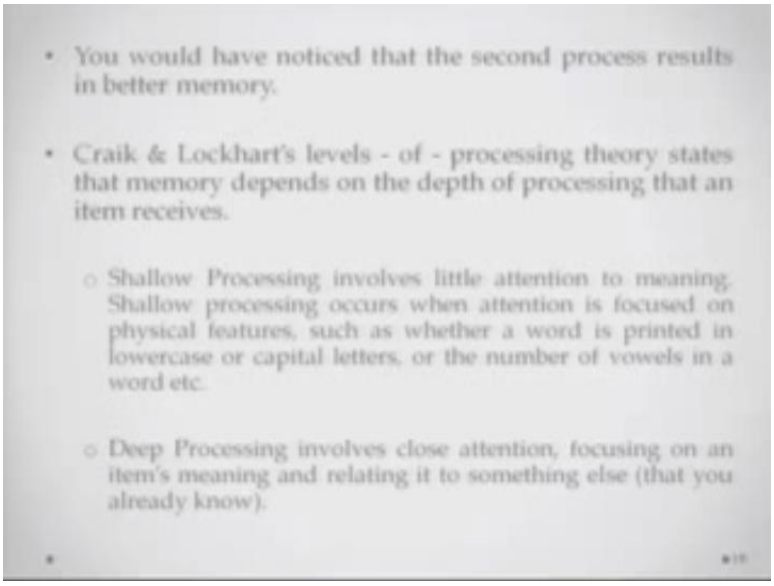

So there are these two tasks one in one where in you are counting the number of wobbles of the list of words another you are kind of imagining how useful these words will be if you were left with their any of these on a deserted island now Creon lokar level of processing shows or it states that memory basically depends on depth of processing something which I already repeated this variation into the two ways one in which you are counting the vowels.

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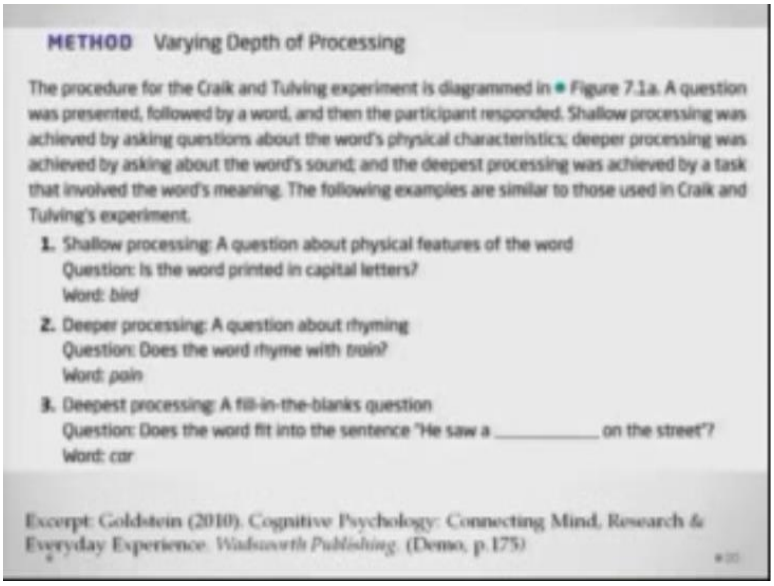

And the other which were imagining that how, how will you use these items when you're in a you know desert island tells you the fact that the second task will be easier a lot of people found that a second task was much easier okay so let us talk in more detail about what shallower D processing means so shallow processing basically invokes little attention to meaning so what you are doing in the task one was you are doing shallow processing.

So it involves less a little attention doing shallow, shallow processing occurs when attention is focused only on the physical features it is not about the semantic feature so it's not about elaboration in any sense so such as a word is presented in lowercase or capital letters or something like that whereas deep processing involves closer attention to the meaning closer attention to how this item is related to you know something.

That you already know now again there is a demonstration so the procedure for Crick Intel means experiment is right here there could be a word and there could be different questions asked about that word which will invoke different kinds of processing different levels of processing that you can do with that word suppose there is a word called bird.

And I can ask you a very simple question is the word printed in capital letters another word is pain and I can ask you if the word rhymes with the word train a third word is car and I ask you to fill it in a sentence I say he saw a dash on the street is it possible that car can be filled in this voltage or a blank.

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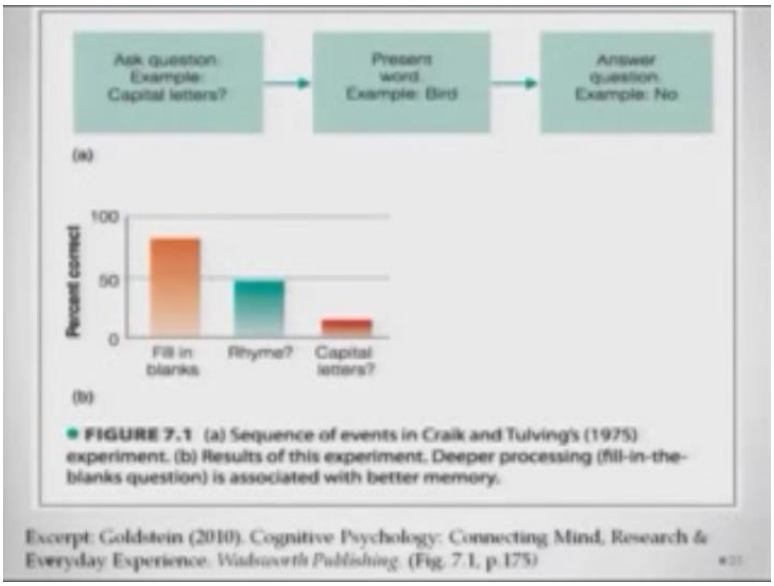

Now this is what something was this is what you know a creek in tulving did in their 1975 experiment and what they found was that the that were used with the fill-in-the-blanks question were remembered much better than words which were just paired with the questions about whether the word is in lower case or uppercase okay.

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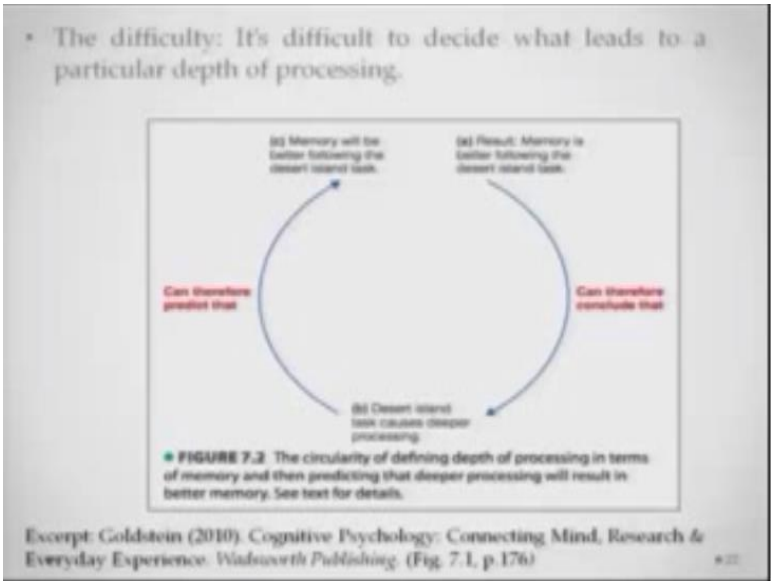

So what does this tell you it tells you that the depth of processing with respect to if you are only focusing on the physical characteristics versus if you are focusing on the use and meaning of those words it determines pretty much how better or how worse you will go you are going to remember that word now it is all good this whole approach of levels of processing and it kind of seems to fit in well as well and if you think about it enough it seems intuitive as well still it can get slightly difficult to decide you know what is contributing to this depth of processing what is leading you know how is depth of processing basically making the memory better okay.

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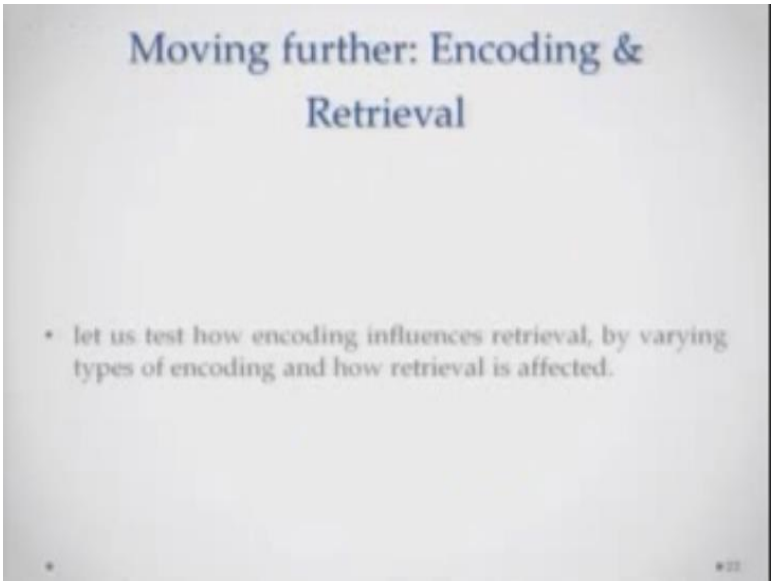

So you can say for example you know if you ask the deserted island ask the words are remembered better but then you say that how but you do not really have any answer as to why this deserted island task is going to you know make your memory about this list of words better so there were some experiments done so we will talk more about these encoding and retrieval things and see how does this actually help.

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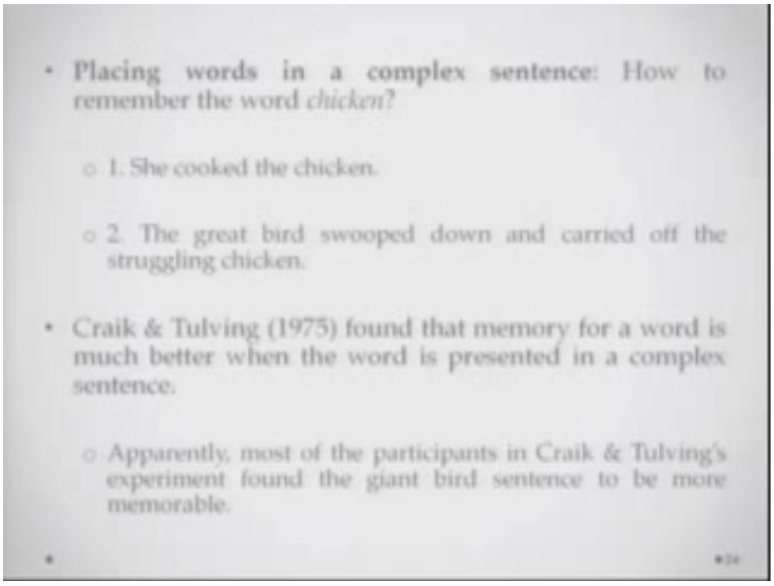

So let us test about how encoding in gets influenced by retrieval by varying the type of encoding how can retrieve will also be affected so there are these different encoding strategies and they can be actually you know used to affect your retrieval performance on a particularly if I ask you to remember the word chicken you can just say she cooked the chicken or you can say the great word bird swooped down and carried off the struggling chicken Creek and telling 90s.

And if I found that a memory for a word is much better when this when the word is presented with a complex sentence so if the two sentences are there she cooked the chicken and in the second set is Ashley and the great bird swooped down and carried of the struggling chicken people would remember chicken better if they were read chicken in the second sentence now why is this happening.

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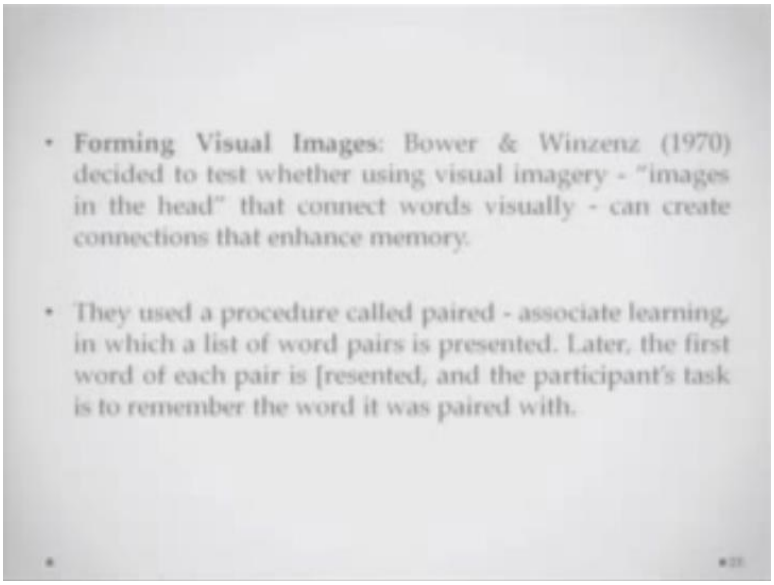

Because it is carrying much more information where in this word chicken is deeply and very well placed so most of the participants kind of in this experiment did better to remember the word chicken if it were presented in the context of sentence two versus sentence one other way of encoding could be by forming visual images so Bauer in Vincent in 1970 they decided to test whether visual imagery that is images in the head connect that connect words visually can create connections that enhance memory.

So they use a particular procedure called paired associate learning in which a list of words is presented later first word of each pair is presented where the participants task is to remember whether the word the word it was paid with so the test phrases I will just present one of the pair and you have to tell me the second of the pair.

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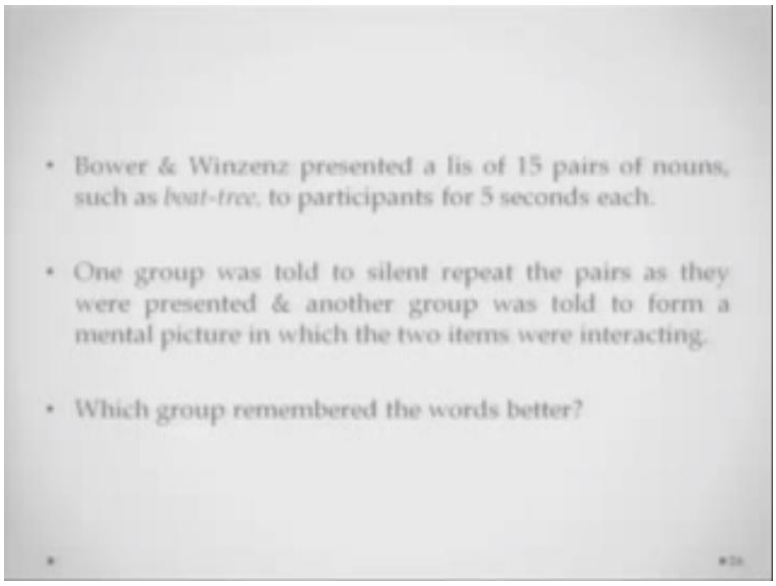

Obviously in the first part I have you know ask you to learn the pair is as well Bauer in Vincennes presented a list of 15 pairs of nouns such as both tree to participants for five seconds each one group was told to silently repeat the pair's as they were presented and the other group was told to form a mental picture in which the two items were interacting so you might you know imagine boat tied to a tree in the second case while you might just be repeating both tree poetry again in the first place which group do you think would have remembered the words better certainly this second group.

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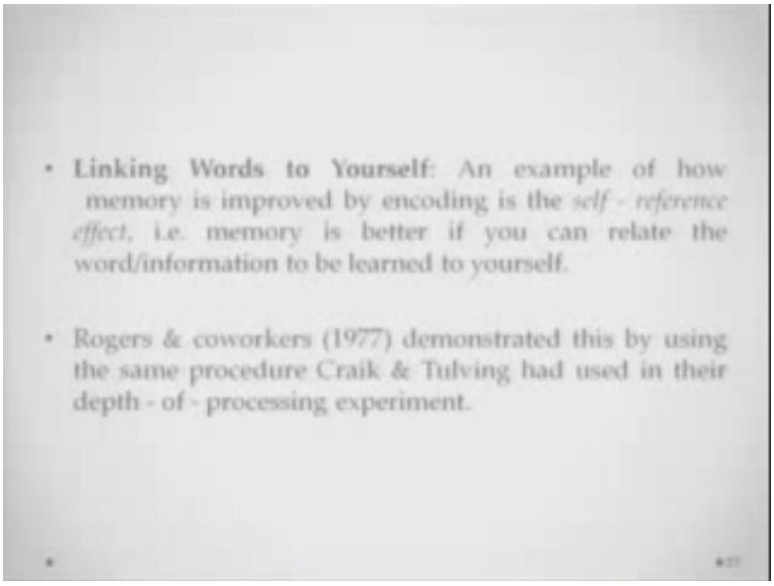

So another way of remembering words or remembering any information for that matter could be by linking the words to yourself so what could happen is an example of this is basically called the self reference effect so memory is found to be much better if you can relate the word or any new incoming information to be learned to be associated to yourself so Rogers and co-workers in 1977 they demonstrated by using the same procedure that Craik and Tulving had used in their depth of crossing experience.

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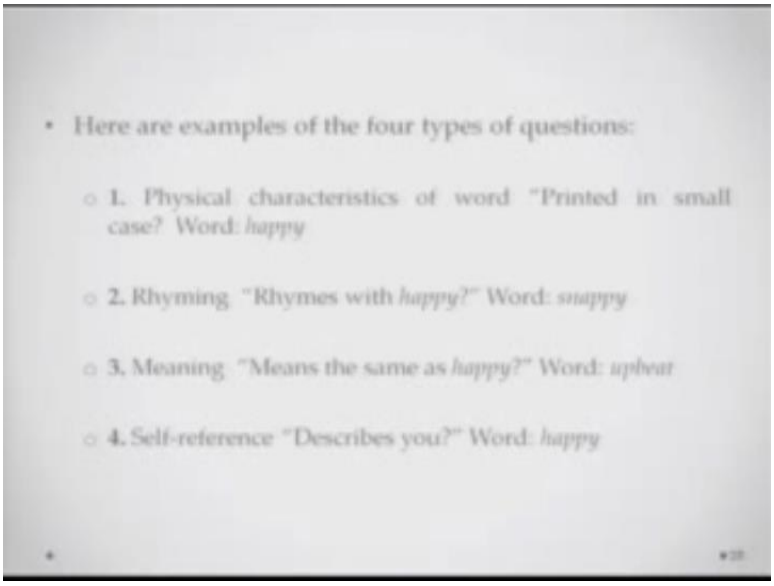

So what they did was they had this list of words and they could ask for different kinds of questions with relevant to these words say well if their word is happy they could just ask if this word is printed in smaller case or higher case if the word is again they would probably ask it whether their word rhymes with the word snappy also does it mean you know mean the same as happy or upbeat something like that and the self reference.

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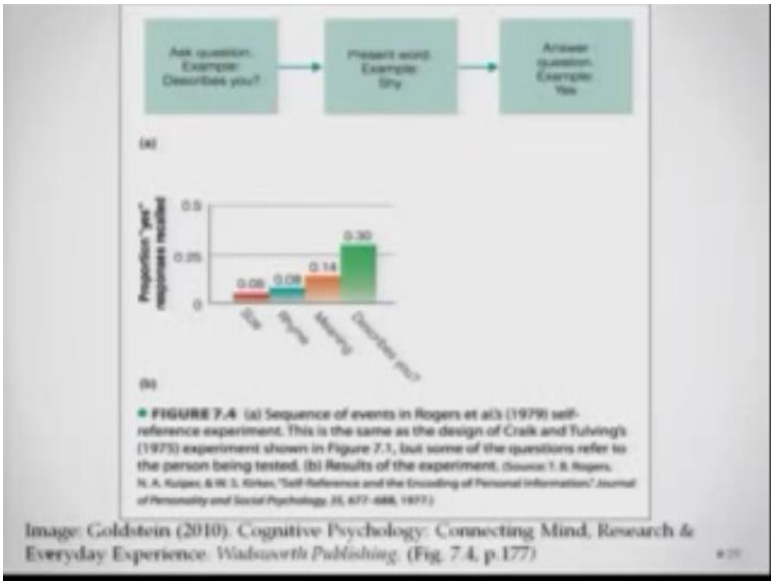

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing.* (Fig. 7.4, p.177)

If a question will be does this describe you so they had this list of words they could ask these four kinds of questions the fourth question was always does this word describe you is this word related to you in any way they found that the fourth question certainly and in most cases for all participants led to much better recall of the words that this fourth question was paired with so it kind of tells you that you are better we are better at remembering information that is irrelevant to us in more ways as compared to information that is not relevant to us.

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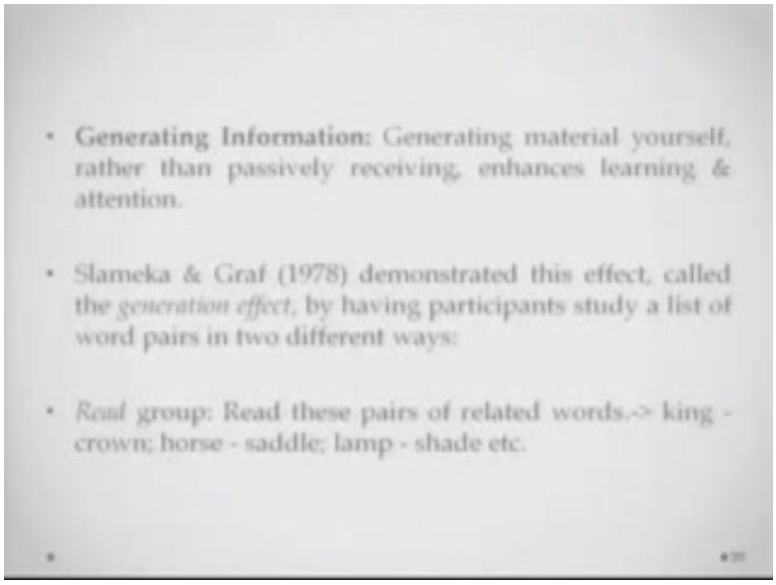

Another thing is you could generate new information related to words if you are generating somebody real yourself if you are learning something and you write it down yourself in your own words you will remember and learn that information much better again an experimental demonstration so Islamic and graph I demonstrated this effect called the word generation effect by having parts must study a list of word pairs in two different ways there was the reading group who read this who read pairs of words in crown horse saddle lamp shade etc.

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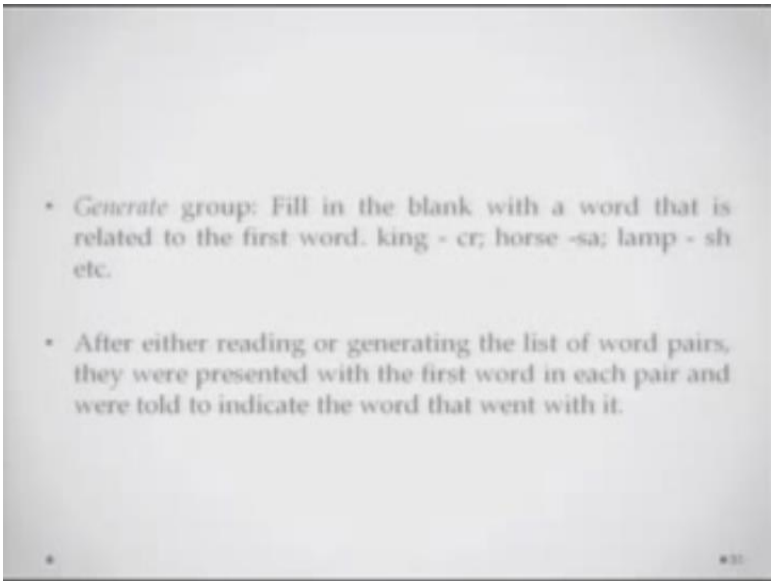

And then there was the generating group who were basically they were basically asked to fill in the blank with the word that is related to the first word so after reading either reading or regenerating the list of words they were presented the first word in each pair and they were told to indicate the word that went with it.

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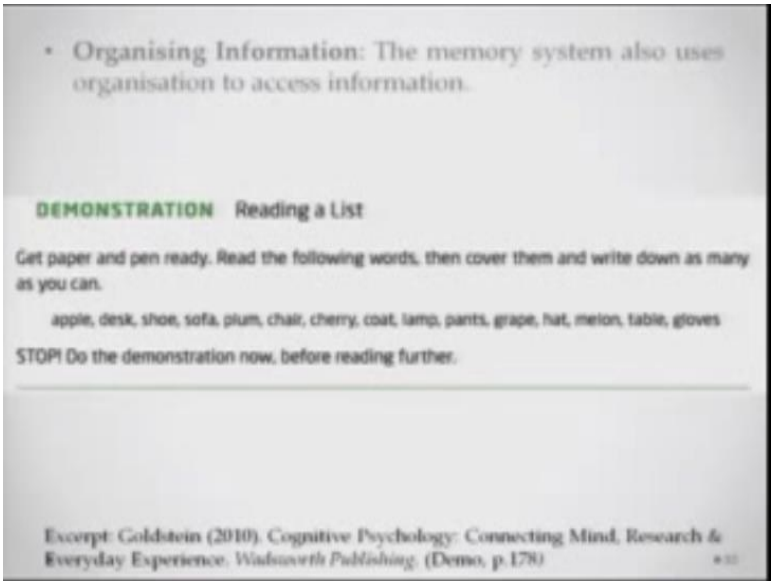

Say there is this list of the words and what they basically found was that a generating group did much better in recalling as compared to the reading group another aspect under the manner of encoding could be organizing information you remember and one of the students said that I organize information in tabs and entries in my notes and that helps me understand whatever I am learning in a much better way so the memory system also uses organization to access information.

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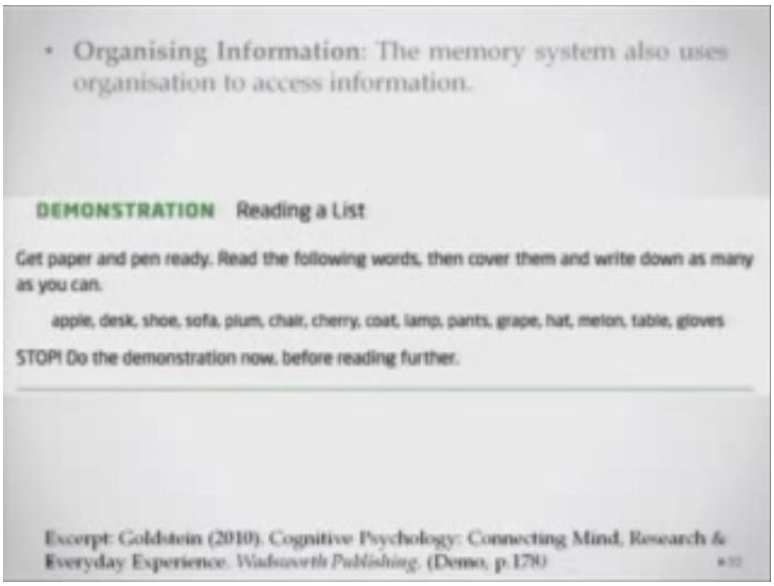

So you are reading a particular list of words which is Apple desk shoe sofa plume etc.

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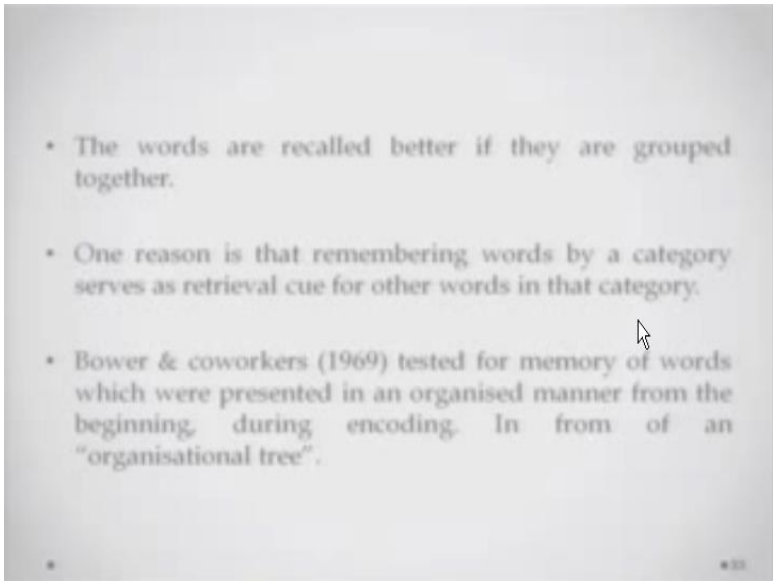

And then these words are recalled better if they are grouped together so if I put all the fruits together all the furniture together other kinds of tools together then you will probably remember them better one of the reasons that you will remember thus this kind of an organized list better is that you have sorted these words into categories and if kind of remembered the instances of the category.

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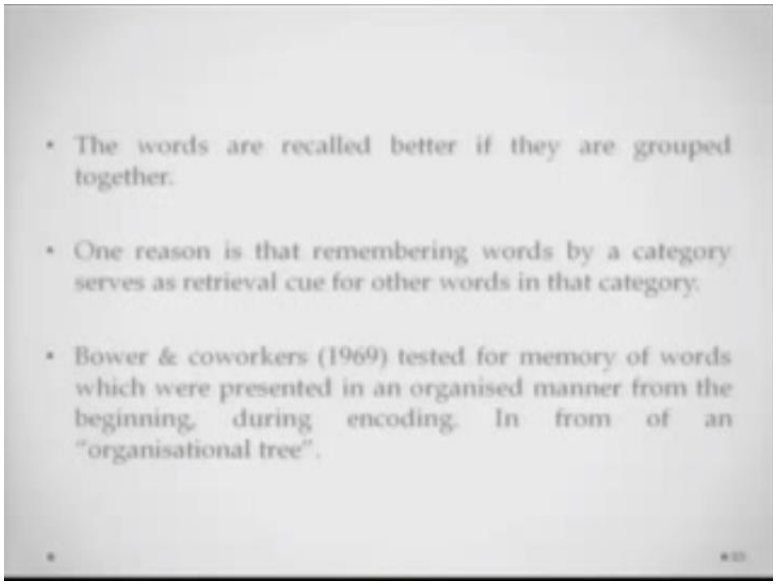

So Bower and co-workers in 1969 they tested for the memory of words which were presented in an organized form from the beginning during encoding in form of an organization tree so they wanted to see if you already give organized information is that recalled better or say for example it is recalled better at the participant themselves organize it.

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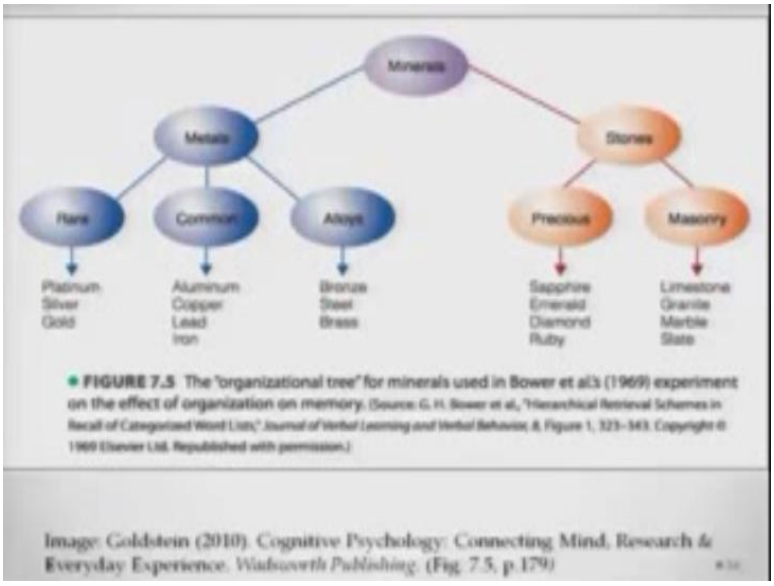

So they give this kind of a tree so there are minerals there are metals and rare metals common metals alloys and there is stones precious stones and masonry use stones and so this is already an organized tree.

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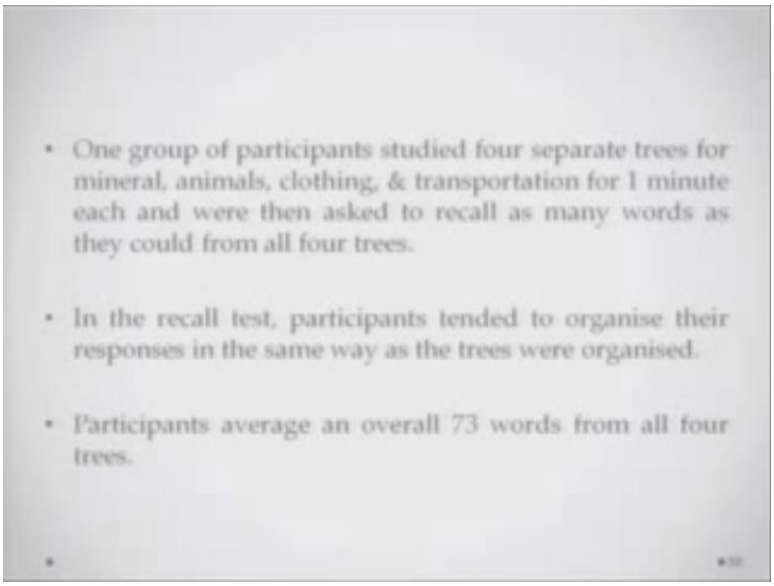

One group of participants were studying these four separate trees for minerals animals clothing and transportation for one minute each and they were asked to recall as many words as they could from all four trees in the recall test it was found that the parts must ended to organize the words response in the same way their responses in the same way as the information was organized in the tree and they could recall very good they recalled in an average of 73 words from all four trees.

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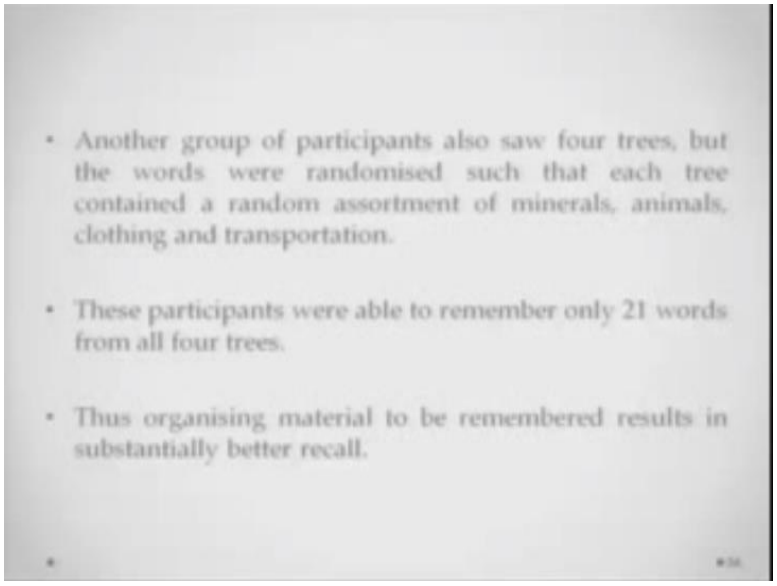

In the second scenario another group of participants saw these four trees but these four trees the elements in this four trees were randomly RNA so that each tree contained a random assignment of minerals animals clothing and transportation now these participants were able to remember only 21 as opposed to 73 in the last in the other group and so organizing material can be concluded to be a very useful way of remembering information.

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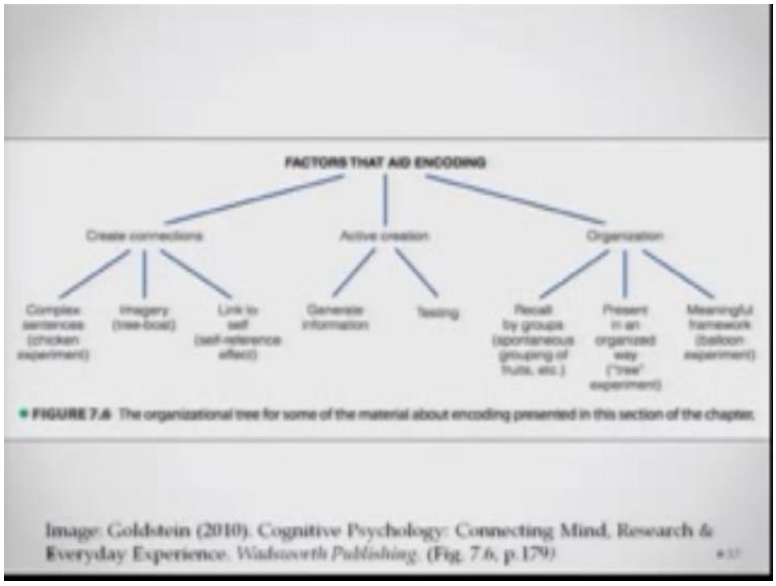

So here you can kind of you know let us try and summarize what all factors could be used to encode information better and how this encoding information better can improve your recall and retrieval of that in a letter say so one of the ways is you have to create connection you could create complex sentences you could do your own imagery thing or you could link the information to yourself the second is active creation you could either generate information or you could do testing.

The third is organization in which you can recall by groups as the information of such an organizational tree you could present in an organized way or you can form a meaningful elaboration.

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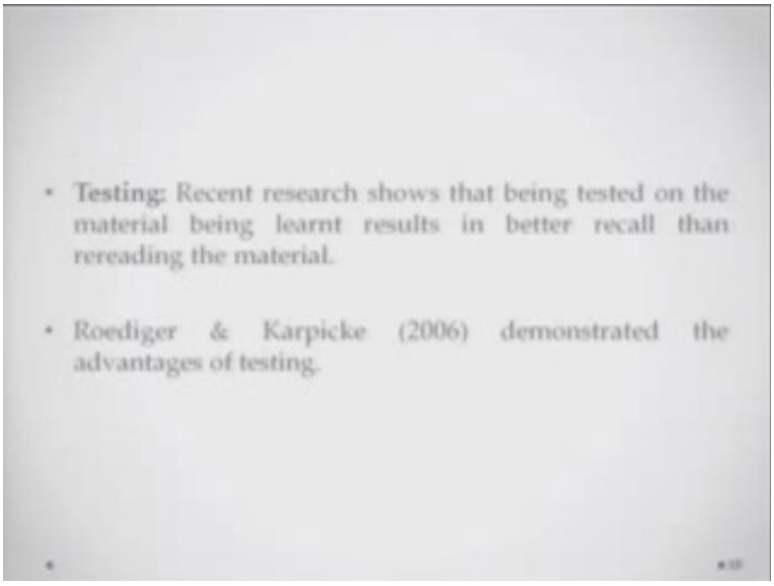

Now you come to one of these things called testing we kind of miss edit probably testing basically also has shown to be resulting in better recall so Roedigar and Karpicke basically they tested the advantages of testing.

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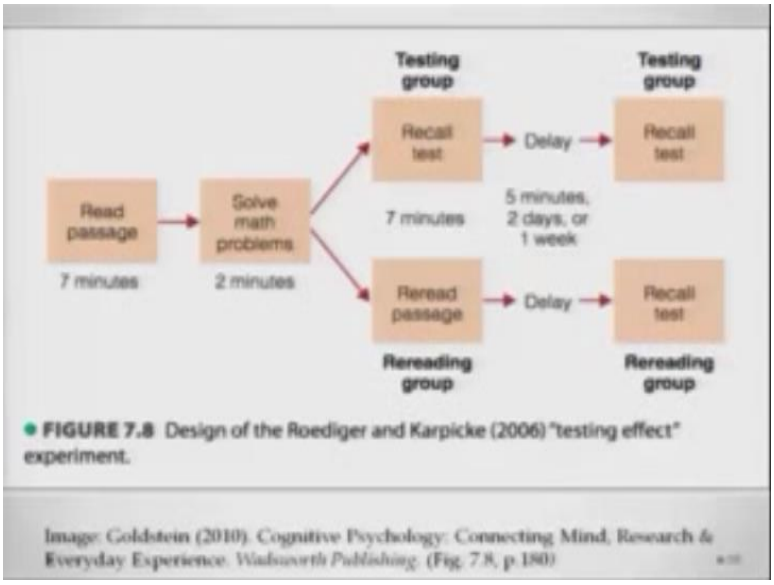

So what they had was they had two groups they had partisans read a particular passage and they had participants solve math problems and then in the testing group the participant took a recall test of that passage and in the second group which is the rereading group they just read the material again and then there was a delay and the delay could be of one week two days or five minutes now after delay it was seen that the testing group was much better than the rereading group after if their delay was as long as two days or one week.

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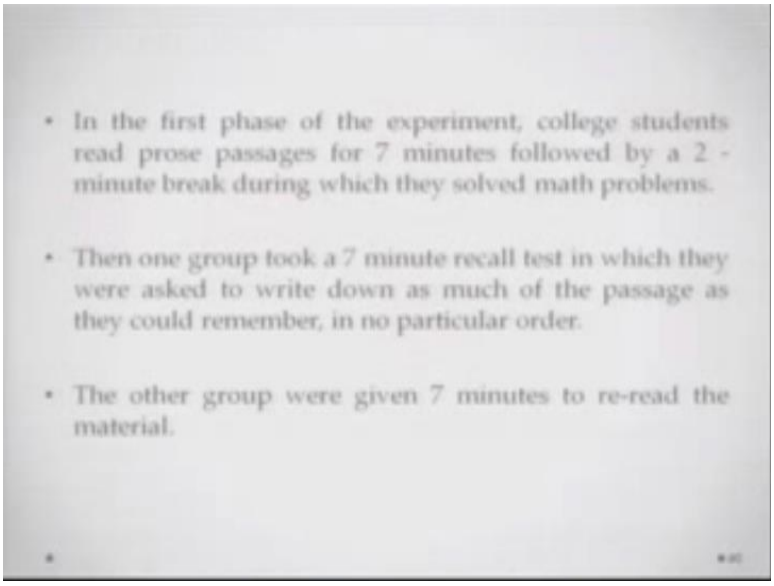

So that is pretty much the result of this group so it tells you that testing also has an advantage so for students it might be a good idea to test themselves again and again repeatedly for that kind of information so that your memory of that particular information gets revised and you know stored better.

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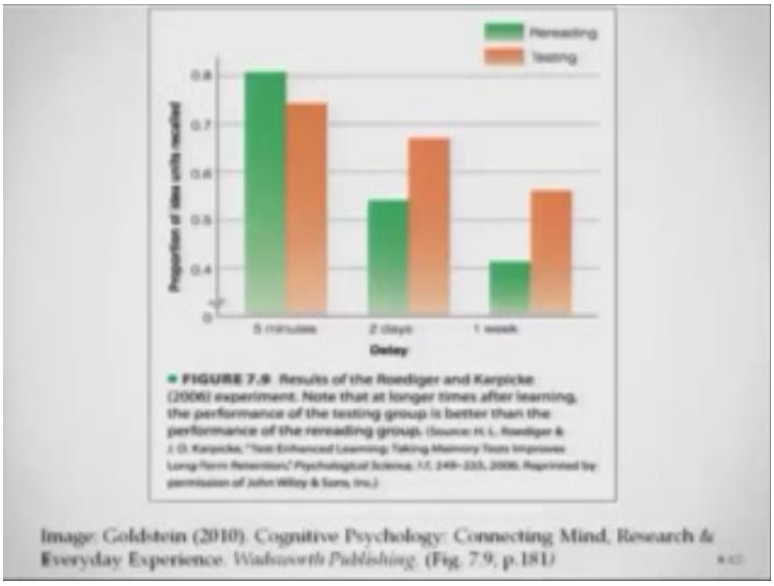

So this basically is referred to as the testing effect here you can see the results so you can see that the testing group is much better than the rereading group even after one week of that information.

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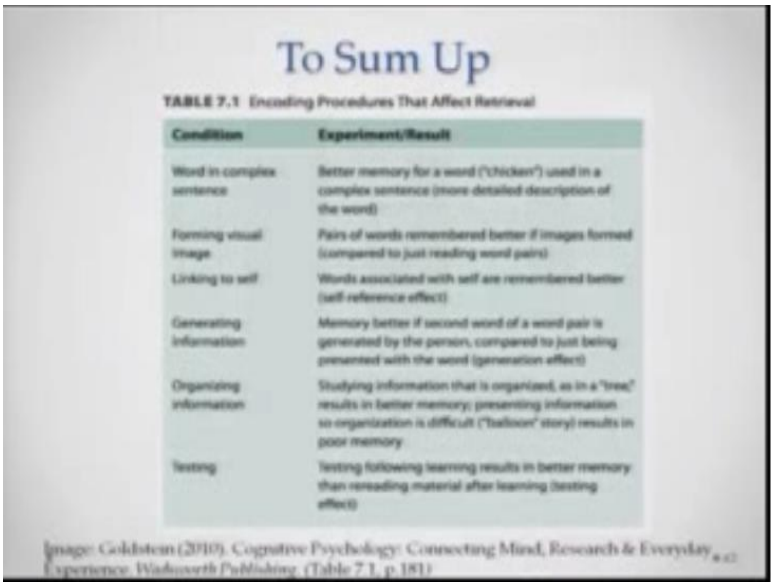

So just to sum up words in a complex sentence can lead to better memory forming visual images obviously can lead to better memory linking to self generating information organizing information say for example presenting information in organized tabulated kind of manner can lead to better memory and the third is testing, testing also leads to better memory in that sense periodical testing of whatever you have learned any particular course might be a very useful strategy to follow.

So the kind of assignments you get during this course every week might be a good way to remember whatever lectures you have had during the entire week and that kind of probably you know goes a long way in helping your learning of whatever material we are giving out here so thank you for this lecture we will kind of talk about another aspect of memory in the next lecture thank you.

Acknowledgement

Ministry of Human Resources & Development

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NPTEL Team

Sanjay Pal

Ashish Singh

Badal Pradhan

Tapobrata Das

Ram Chandra

Dilip Tripathi

Manoj Shrivastava

Padam Shukla

Sanjay Mishra

Shubham Rawat

Shikha Gupta

K.K Mishra

Aradhana Singh

Sweta

Ashutosh Gairola

Dilip Katiyar

Sharwan

Hari Ram

Bhadra Rao

Puneet Kumar Bajpai

Lalty Dutta

Ajay Kanaujia

Shivendra Kumar Tiwari

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