

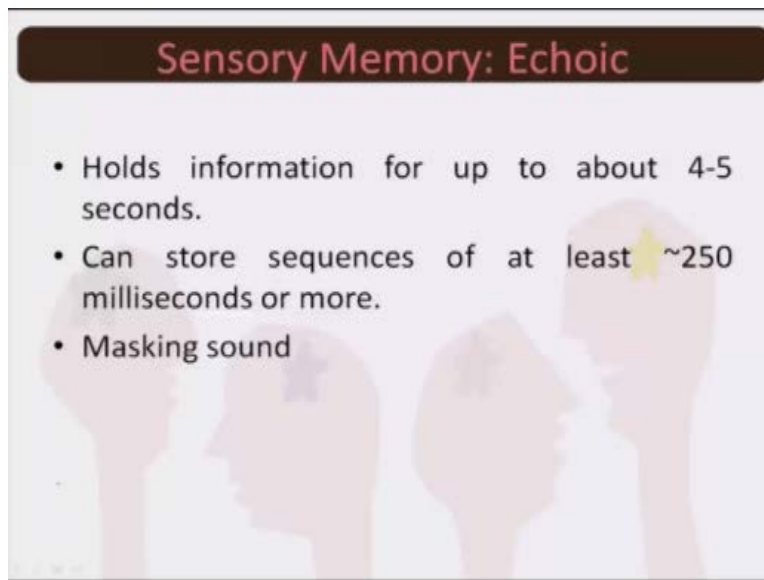
Indian Institute of Technology Kanpur
National Programme on Technology Enhanced Learning (NPTEL)
Course Title
A Brief Introduction to Psychology

Lecture – 14
Memory

By
Prof. Braj Bhushan Humanities & Social Science
IIT Kanpur

Till now we have talked about that iconic memory let us now move to the other from of sensory memory that is echoic memory in case of iconic memory we discussed at the total amount of information that will be returned is little more but in terms of duration okay it had a relatively shorter period compare to echoic memory because echoic memory can hold information up to 4 to 5 seconds okay

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and further more it can also store the sequence of at least 250 milliseconds or more okay now recollect now what we talked about in the previous lecture and this as to do with the way we had talked about issues in case of sensation we said that ear specially the inner ear which has the

fluid filled in the collier as the nervous endings and because the replies that are created it takes lintel longer time to settle down therefore by default the amount of information that will at light right at the level of the sensory motility will be little longer.

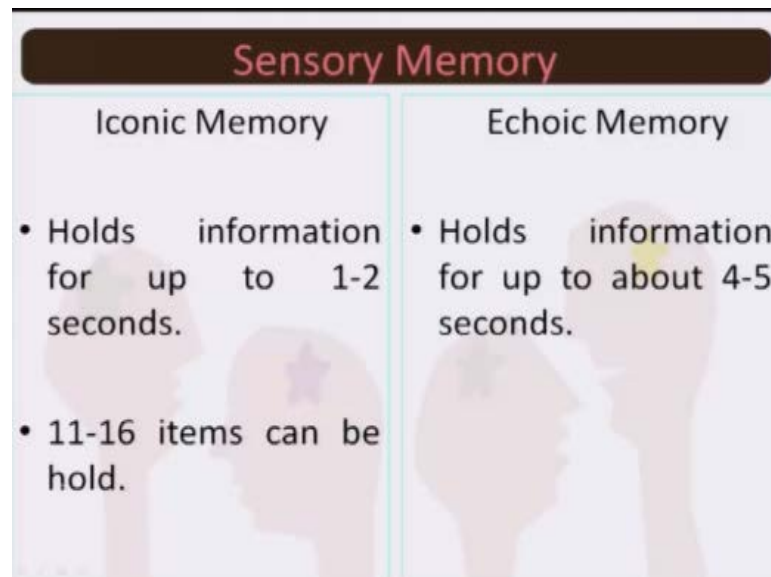
Okay because in the previous case in the case of eyes it was basically the assist to the trans configuration and back to this is configuration which was now basically facilitating the storage of were as in the case of echoic memory it is know the settling down of the repose that is created in the cholera and therefore we realize that in terms of the auditory implies that we receive from the external world.

That amount of information even thought it might be less compare to what we retired at the level of eyes but in terms of duration we have much more no longer life compare to iconic memory auditory information but the problem is because both of them have no very limited period of time iconic memory for 1 to 2 second echoic memory fro at max 4 to 5 seconds.

So the chances are that if you have a stimulus of the same intensity that enters the ear then there would be masking you remember even in the case of iconic memory we said at brightness and pattern masking are possible even at the level of the sensory motility okay similarly here in the case of echoic memory the sound masking can take place and this becomes a barrier okay because it will not allow you to listen to the what you call the purest form of auditory impulse and retain it for a maximum of five seconds.

Having discussed it echoic and iconic memory let us just now make a comparison between the two iconic memory in terms of duration it is just one to two seconds wanted two seconds.

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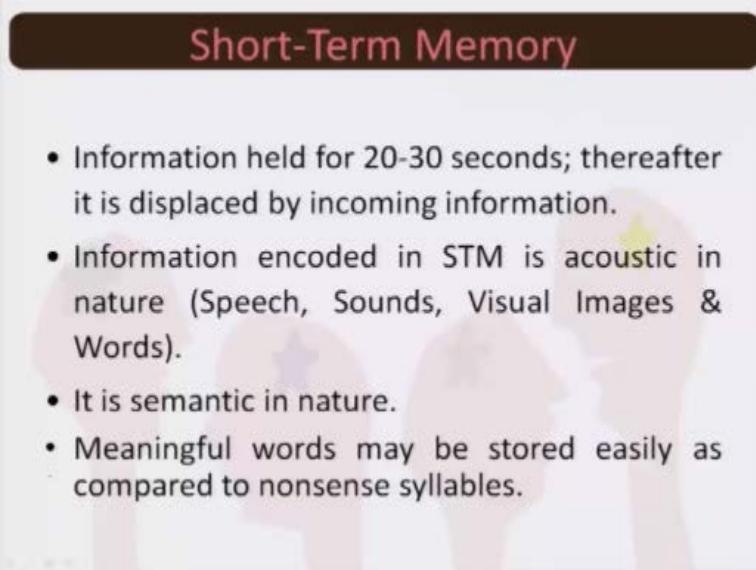


whereas a echoic memory in terms of duration is four to five seconds okay so the life of echoic memory is little longer compared to iconic memory but the advantage in the case of iconic is that it can store it can retain relatively longer amount of bit of information no so approximately somewhere between 11 to 16 items can be held in terms of iconic retention attention echoic retention okay the moment you have a now two sounds of equal masking will talk place now have not talked sensory memory let us now go to other form of memory that is short term storage short term memory now in terms of life short term has much longer life compared to the sensory memory okay iconic just 1 to 2 seconds echoic just 4 to 5 seconds but short-term can store information for approximately 30 seconds.

So 20 to 30 seconds is the now elastic time limit for which information can be stored in the short term memory okay this would mean that after the end of 30 second either the information which is at the level of the short term memory would trickle down go to the long-term storage or it will be basically replaced it will be fleshed out by the incoming information okay and we saw in the competency model of memory that loss of information takes place from all the three channels.

So sensory memory short term memory, long-term memory from everywhere we have no loss of information but in case of short-term storage either the information moves on to long-term storage or information is lost and replaced by the incoming information what is also interesting about short-term memory is that the information.

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Short-Term Memory

- Information held for 20-30 seconds; thereafter it is displaced by incoming information.
- Information encoded in STM is acoustic in nature (Speech, Sounds, Visual Images & Words).
- It is semantic in nature.
- Meaningful words may be stored easily as compared to nonsense syllables.

That comes to short-term storage is encoded okay in a ekistics format so a speech, sound, visual images, words they constitute know the code that is retained by the short-term memory okay because these are no meaningful things speech has its meaning sounds might have meaning visual images would represent something okay and words it is again non not nonsense syllables so because it is words therefore it would carry some meaning there for the information that comes to short-term memory it is largely symmetric in nature it is meaningful in nature.

Okay and because no meaningful words and meaningful symbols meaningful sounds allows you to process it in a different way compared to when you have nonsense syllables are you have things which are completely devoid of meaning so the moment you start elaborating it okay you remember the Craik and Lockhart model no so perceptual level of analysis the structural level of analysis symmetric level of analysis all of them had different impact on memory money so if we

go for meaningfulness then by different you elaborate the information because you elaborate the information therefore symmetric things meaningful things will have longer life compared to meaningless things.

there are no whole lot of research in psychology comparing meaningful words with nonsense syllables and there it has been uniformly realized that meaningful words they have a stronger storage compared to the nonsense syllabus okay and this seems know pretty obvious say for instance if you are told rose okay it is much easier for you to have a mental image of rose and thereby remembrance of the word roes will be a little longer compared to if I say XTPY okay which is nothing but four distingue alphabets that have been temporarily presented to very neck to neck.

Because it has been pronounced altogether there for you might try your best to recollect it okay hold it for little longer but then it is extremely difficult if such information such set of nonsense syllables are presented to you in a secrets what has a further been realize in case of short-term memory is, that if you have a longer piece of information, then the possibility is that you might break it into smaller chunks. Now thing of a situation, you are given a number a number which is no it has long, long, long chain of numerals, okay. Let me show you this example and then we will come back to the discussion on chunking.

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Short-Term Memory

- STM can hold 5-9 chunks of information.
- Several items can be combined into one chunk.
- About 7 chunks can be retained.
- About 40 items can be combined into 7 chunks & can be held in STM.

65465115193131 = 14 digits

Now look at your screen, I am writing certain numbers. If I ask you to memories this number and retain it at least for 30seconds because that is the duration of the short term memory. Now if you start no memorizing each of them, okay. You have a longer chain no? So you have total 14 digits here. Now if you want to memorize it as fourteen different set of information, okay. You are putting your short-term storage in the big problem.

Usually what has been realized that most of us either form chunks of two or three bits of information so those who would form a chunks of two would do something like this 6546 511 519 3131, okay.

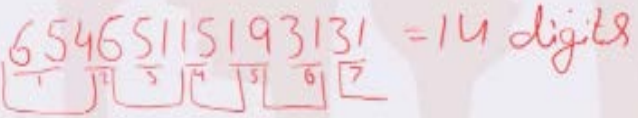
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Short-Term Memory

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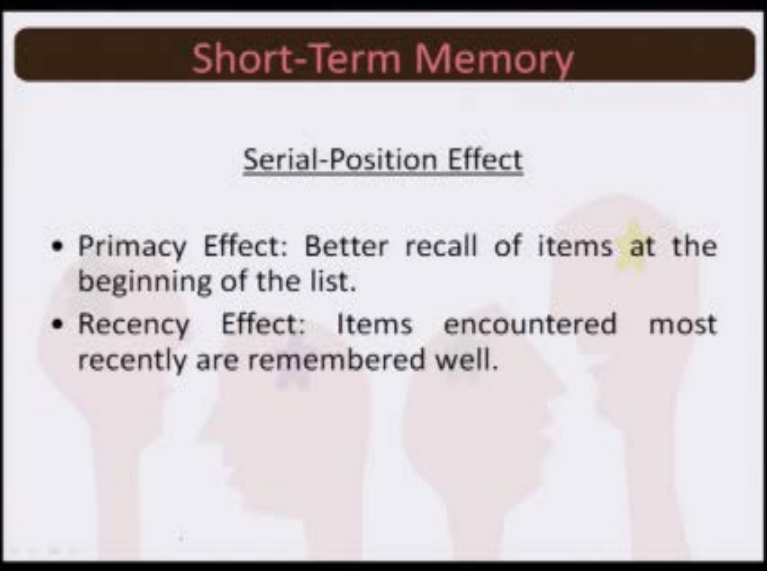
65465115193131 = 14 digits

1 2 3 4 5 6 7



Now this 14 basically becomes 123456 and 7. So simple seven chunks, now this is something that very easily your brain can store, you would realize that there are people who formed chunks of three. So they would do something like this.

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Short-Term Memory

Serial-Position Effect

- Primacy Effect: Better recall of items at the beginning of the list.
- Recency Effect: Items encountered most recently are remembered well.

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Short-Term Memory

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65465115193131 = 14 digits

1 2 3 4 5 6 7 8 9 10 11 12 13 14

The slide features a title bar at the top. Below it, a list of four bullet points describes the capacity and function of Short-Term Memory (STM). At the bottom, a handwritten example shows a 14-digit number, 65465115193131, being broken down into four groups of three digits each (654, 651, 151, 931) and one final group of two digits (31). These groups are numbered 1 through 5, illustrating how a long string of digits can be managed by chunking it into a smaller number of units.

So now you have 1, 2, 3, 4, and just 5 chunks, life becomes much more simpler, okay. So if I have to recollect the number it becomes very easy for me, why it becomes easy for me? Because I am now trying to no memorize the number in terms of chunks, okay. So I say 654 651 151 93 131, it is much easier, you would realize that say for instance take when you have to recollect the mobile number which is a 10 digit number in our country.

If you have to memorize that number, how do we do that? Okay. And you would realize that even if you take your own example perhaps to do not remember more than 3, 4 mobile numbers. You remember mobile numbers of only those which no matters to you, parents, siblings, best friend something like that. Now what we do, that if we have our longer set of information we break it into pieces.

And these smaller no forms of information which is either I said no you can combine two of them or you can make a chunk of three bits of information. Four bits practically you will not find people using 4 bits, okay. Now things becomes much easier and therefore it has been realized that somewhere between five to nine chunks can very easily be stored in short-term storage. So nine chunks will primarily mean that 9 into 3.

If you are making a chunk of three, okay. So 27 bits of information you are basically able to restore further approximately 30 seconds, okay. Similarly in children say that if the minimum span is going to be 5, okay. Then 5×3 is 18. So 18 bits of information a child can also restore. And then in terms of say the number of items now that we are extending that say there could be possibility of forming chunks of four.

Then you realize that approximately research has showed that 40 items can be restore, 40 discrete items broken into chunks and accordingly the chunked information when you recollect it, when you store it you realize that 40 distinct items can be stored right at the level of short-term memory. So if you compared iconic verses echoic, okay. No the maximum that since the memory could provide was at the level of iconic memory with 11 to 16 items.

Here in short-term memory we go up to 40 items no. So there is a huge jump now, both in terms of pieces of information and also in terms of the temporal duration of this day of information, okay. Now two things are very interesting in short-term memory, say for instance if you are given a list, okay. A List which has say 20 names, of people who can be your friends who are told the list you hear it.

And then you are told to remember the nomenclature, okay. Say for example I say Ram Kumar, Ashok Varma, Pradeep Kumar, Sinha, okay. Arun Kumar saying, okay. Vishvanath Kumar Sharma, I keep on, keep on telling you names or the way the psychologists done in terms of their experimental work, let they have taken alphabets, okay. The combination of meaningful and then non sense syllables both.

In increasing order of difficulty for example H E he these are two alphabets but he is a pronoun, okay. S H E she, okay three alphabets but it has a meaning, okay. So the difficulty level has changed no? From two alphabets he to she three alphabets, then I say HOME, home, okay. So 1, 2, 3, four alphabets, okay. So two alphabets three alphabets, four alphabets. So with increasing no degree in the list, you also increase one alphabets.

Therefore this is called as a hierarchical difficulty level. Similarly if I make no non-sense syllables I just put alphabets which has no meaning, you know XT two alphabets and I compared, okay. H E he verses XT, okay. The second alphabet was say and the second word was she. Now SHE and I say XTP, okay. The third word was home which had four alphabets and I say X else that P.

It has been realized that whether you use meaning words or you use non-sense syllables, two effects will very interestingly come forward and these effects combined they are called as serial position effect. so the position of the meaningful word or the nonsense syllables okay, in the series okay, this is called serial position effect, and serial position effect will have two things know primacy effect and the recency effect. Primacy effect okay, the effect the recall of the items.

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Short-Term Memory

Serial-Position Effect

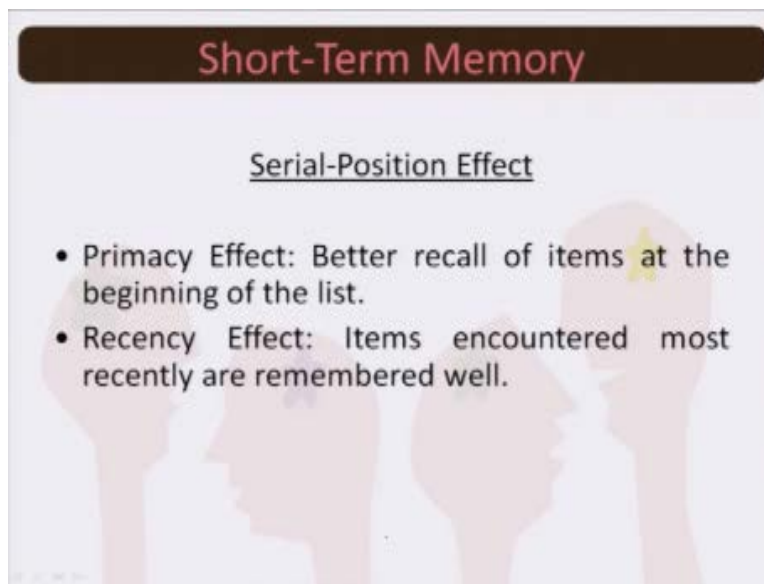
- Primacy Effect: Better recall of items at the beginning of the list.
- Recency Effect: Items encountered most recently are remembered well.

Which are presented in the primary stage, in the initial stage that is the primacy effect okay, so if I start with he, she home okay, and go up to knowledge government statistics the longer ones okay, then you realize that the words which we are spoken in the beginning they have a better recollection, why they have a better recollection, because we were mentally ready for the test

okay, you knew at certain words will be presented to you and you will be asked to reproduce it. Then the words that come in the center okay, they have know the adverse effect in terms of recollection.

But then the words which came towards the end okay, before the test terminated and you were asked to recall the word, those words are also have a better probability of being recalled and that is called recency effect, why? Because these were the items that you encountered.

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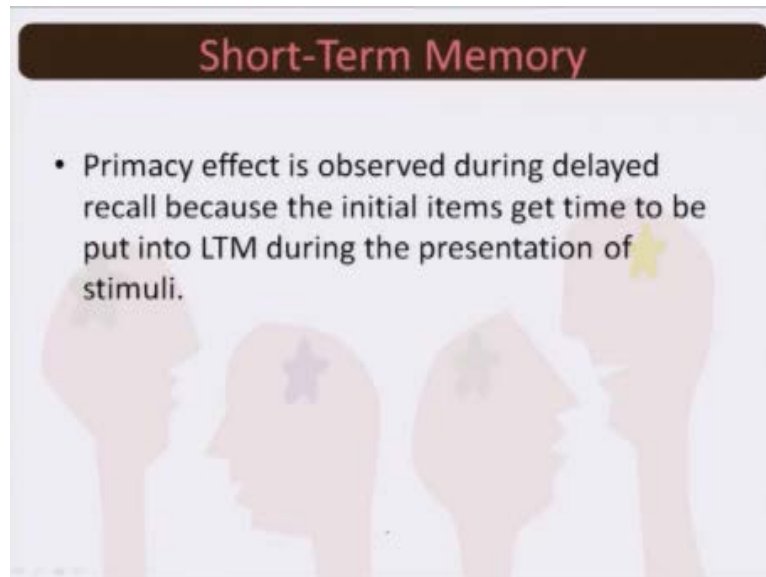
Short-Term Memory

Serial-Position Effect

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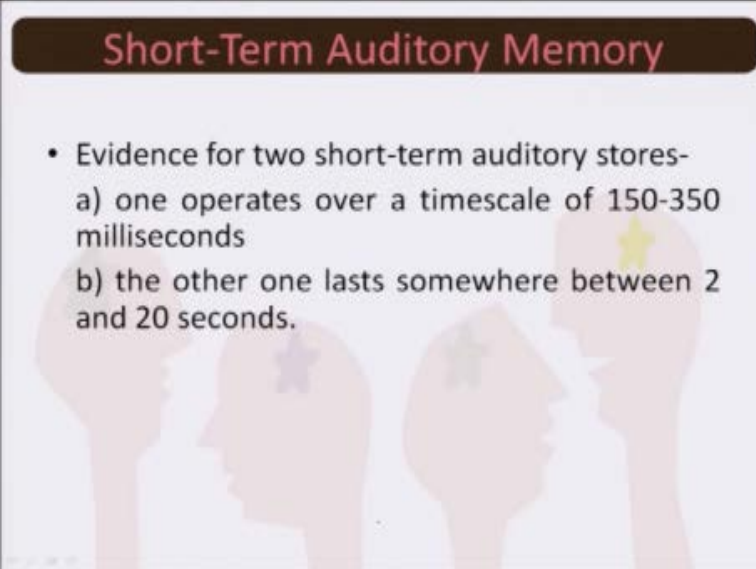
Most recently and because it was encountered very, very recently therefore the chances of it being recollected is very high, fine. So primacy and recency effects these two are very much dominantly founding shorten storage, in the combined order both these effects are called as serial position effect. Now primacy effect is observed during delayed recall because.

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The initial items, they get time to be put in the long term during the presentation of the stimuli, so there is a possibility that although we said that know this is something that you find in the shorten storage okay, there is a possibility that the information might know trickle down to the long-term storage as well. In terms of short-term auditory memory, there are now evidence for two short term auditory storage.

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Short-Term Auditory Memory

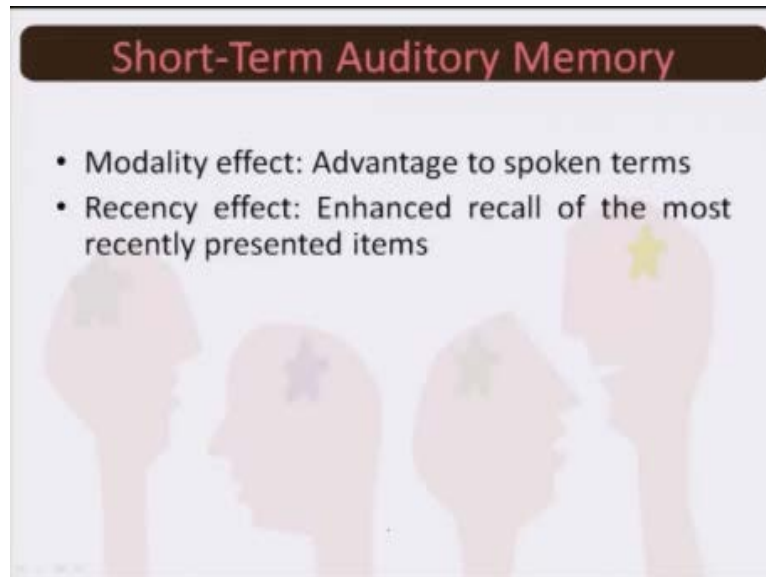
- Evidence for two short-term auditory stores-
 - a) one operates over a timescale of 150-350 milliseconds
 - b) the other one lasts somewhere between 2 and 20 seconds.

The slide features a background illustration of four stylized human heads in profile, facing right. Each head has a small star on its forehead, with the stars in different colors (yellow, purple, green, and orange from left to right). The slide is framed by a thin black border.

One which operates over a time scale of 150 to 350 milliseconds and the second one which basically last somewhere between two to twenty seconds okay, so again you find that even though it is now more archaic in nature okay, there could be a possibility that there could be two different auditory stores the system that is working. But remember one thing, because we are on an introductory course we are also on a brief introduction to this very course, therefore we will not venture into the details of all these things.

There is also something called modality effect and recency effect okay, recency we have already discussed, but in terms of auditory memory there are also advantages.

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To the spoken words know, so the modality that has been used for inducing the information for sending the information to short term storage and the nature of that very signal is something that also plays its role in terms of short-term auditory memory. Now what is very interesting in short-term storage is, that there could be a possibility of rehearsing the information, why there is a possibility of rehearsal because the information has come and unlike the sensory storage okay, you have the possibility of a storing the information for approximately somewhere up to 30 seconds okay.

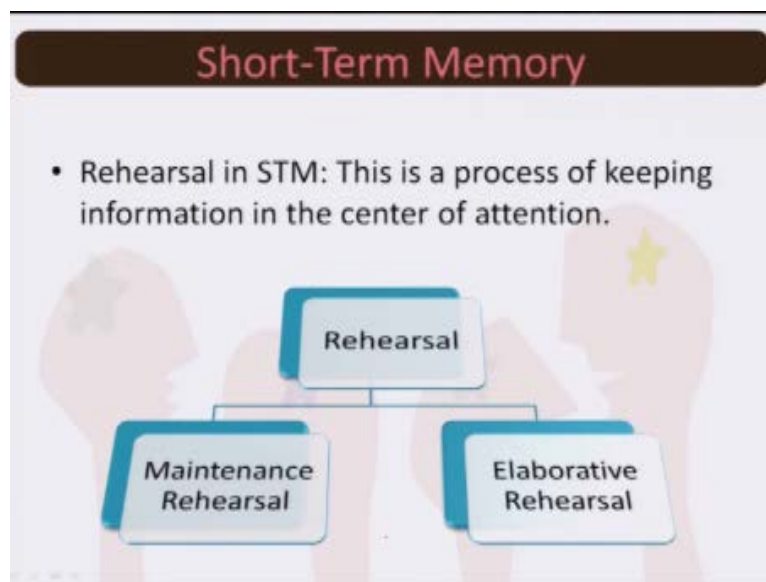
Now before you understand what rehearsal means and what are the two different types rehearsal understand this information by recollecting one of your past experiences. I am just trying to state a situation and you try to recollect something that you had experience in the past. Say, you look at a telephone number in the directory okay, 2597024 okay, that is the number that you read in the telephone directory, and then you start moving towards your say drawing room where the handset is kept.

The telephone directory was put somewhere else, the telephone handset is put somewhere else and what you have to do is, to remember this number till you dial it. So, what we do usually we

remember 259, 259, 259, 7024, 2597024, 2597024 what are we doing remember we are chunking the information, so 259 forms one chunk 7024 forms the other chunks okay. And then once you come to that handset and you dial 2597024.

The moment you have completed the dialing you forget the number that you had tried to store for that period okay. You knew that the significance of this is a storage is only till you successfully dial the number, you were rehearsing the number but what, what were you actually doing? You were rehearsing because you wanted to retain this information only till you could successfully dial, this is called mentally rehearsal okay.

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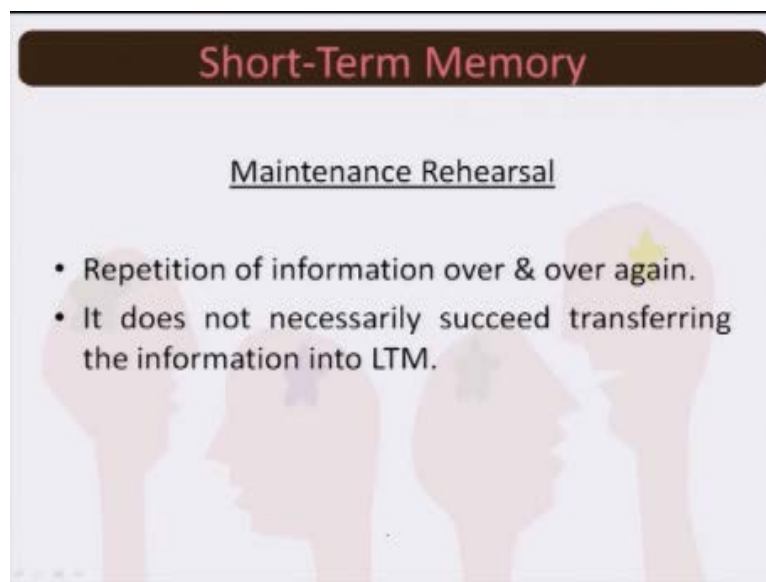


You are maintaining the information till the goal is achieved, the goal is to dial this number that is it okay. The second set of rehearsal could be, when you go for more and more of elaborate expansion of it, so you receive the information and then you start elaborating it. So while rehearsing it you try to understand, who this man is and what in what way is he related to my father.

Why is he is that my father has asked me to convey this to him over phone okay. His name is exactly the name of a neighbor of mine who happens to also to be a good friend of my father. He was you are now stretching that information of this rehearsal, now is becoming elaborative in nature.

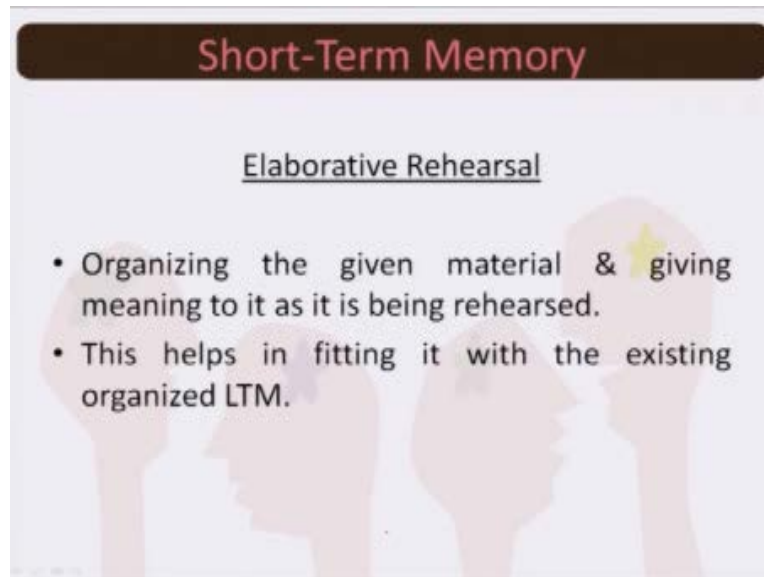
Therefore, in short term there is a possibility of a rehearsal which could either be maintenance oriented or it could be elaborative in nature. If it is elaborative in nature we say it is elaborate yourself, if it is only for given period of time okay, then it is called maintenance rehearsal and rehearsal plays an extremely important role in short-term storage. Now in maintenance rehearsal.

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The repetition of information is seen over and over again okay, but it does not necessarily succeed transferring the information to long-term memory okay. Whereas in elaborator yourself okay, there are chances that the information will be transferred to long-term storage. Compared to maintenance rehearsal in the case of elaborative rehearsal the organization is done of the given material.

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In terms of providing meaning to it, while it is being rehearsed. So you are rehearsing it, but you are also trying to give meaning to it, and therefore because meaning is being a sign therefore it helps in fitting this very information with the information that all receive exist in our long-term storage okay. Because the information is now put in a harrier key it is been put in a meaningful order therefore, it resembles to the pattern that suits the long-term storage, and therefore elaborative rehearsal is bound to push the information towards long-term storage, pushing information towards long term storage.

We would mean that the information will now be available to you even after the lapse of 20 seconds duration the concept of chunk that we talked about okay, $7+ -2$ $7 - 2$ will be 5 and $7+2$ will be 9 remember in chunk we said that 5 to 9 chunks can be stored so this is basically the outcome of $7+ - 2$ this is called the magic number okay because this allows know the information to be ordered in the form of chunks okay.

And this chunk a combination of it can be stored with us for a relatively longer period okay so up to 30 seconds maximum of 9 chunks okay, and if you combine them together then it is helps us a lot in terms of arriving at a distance now the size of the chunk.

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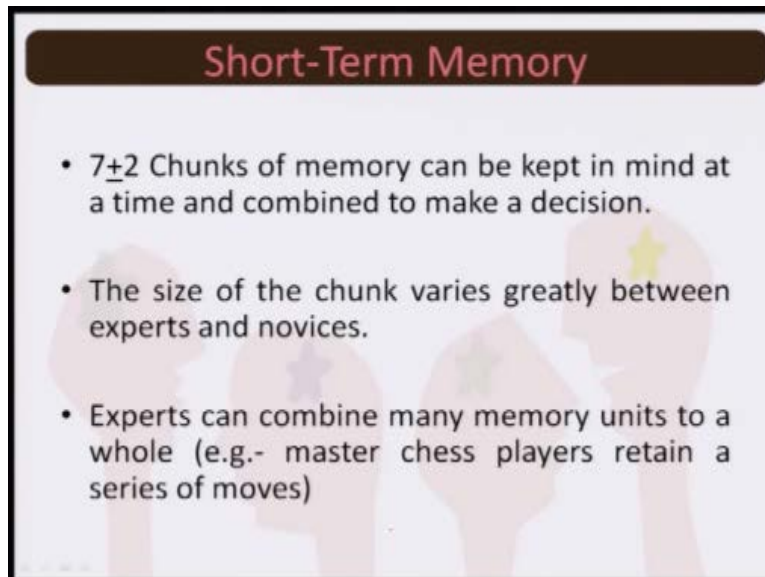
Short-Term Memory

- 7 ± 2 Chunks of memory can be kept in mind at a time and combined to make a decision.
- The size of the chunk varies greatly between experts and novices.
- Experts can combine many memory units to a whole (e.g.- master chess players retain a series of moves)

Where varies greatly between experts and novices now especially if you compare now say children when they try to memorize number the telephone number the 10 digit mobile number for instance they usually do not show the tendency of now making chunks of three or making chunks of four but gradually with little more experience we all start doing.

That we still on the start doing that but even though we might have grown up if you take adults who are not say chess players and compared with say chess master you would realize that chess masters have much better memory and their use this span of memory like at anything because they have to retain a series of moves okay so you need a very good story system that helps you recollect what was the step that your opponents are taken okay in a cities and this will help you anticipate what could we be the probably movement of your opponent if you make this type of a move okay and again studies show that experts can combine.

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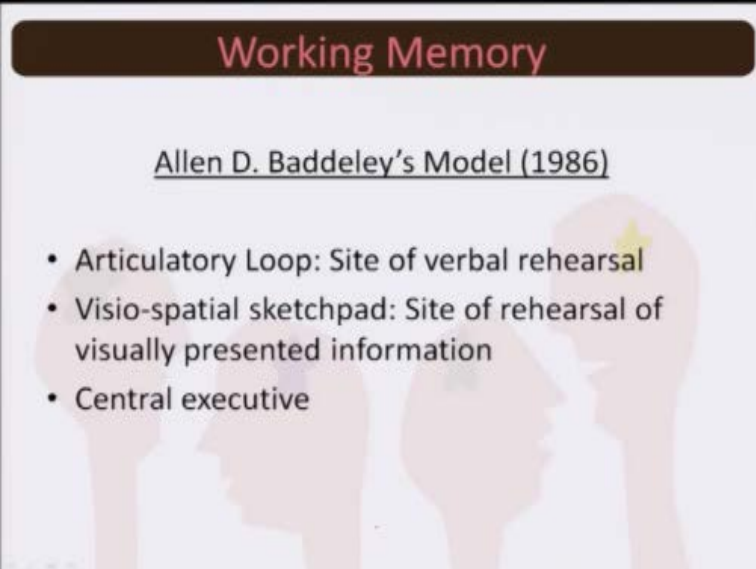


Short-Term Memory

- 7 ± 2 Chunks of memory can be kept in mind at a time and combined to make a decision.
- The size of the chunk varies greatly between experts and novices.
- Experts can combine many memory units to a whole (e.g.- master chess players retain a series of moves)

Many memory units into a whole okay if they are now master of that very field compared to if somebody has a novices if somebody is just a beginner another interesting concept that was introduced to short-term memory was the concept of working memory give by Alan Bradley Allen Bradley is model talk about three things.

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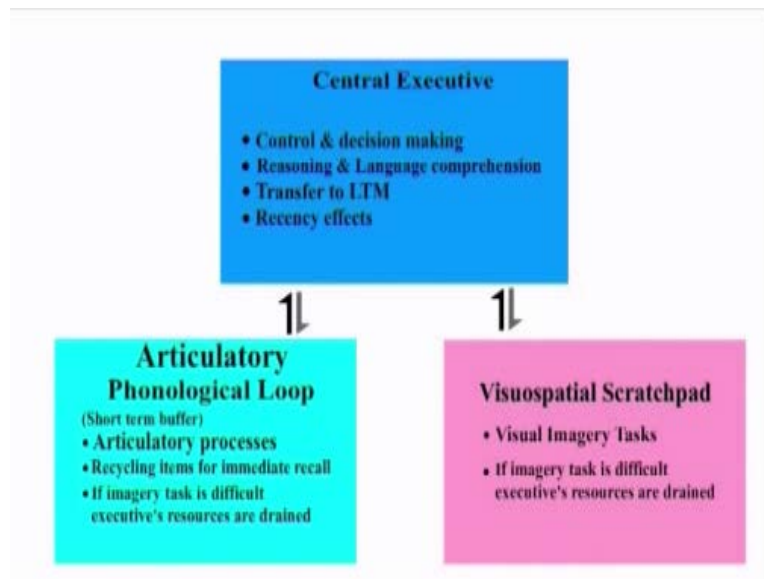
Working Memory

Allen D. Baddeley's Model (1986)

- Articulatory Loop: Site of verbal rehearsal
- Visio-spatial sketchpad: Site of rehearsal of visually presented information
- Central executive

Articulatory loop the Visio-spatial is sketchpad and the central executive.

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Alan Bradley is model of working memory comprises of three things central executive Articulatory loop and Visuospatial scratchpad the central executive as a control over things and place role in decision making reasoning language comprehension and transfer of information to long-term memory are the tasks that it controls residency effect is also a function of the central executive the central executive depends upon Articulatory Loop it is also known as phonological Loop it is a short term buffer.

Where verbal rehearsal takes place the articulatory loop recycles items to facilitate immediate recall the central executive also depends upon Visuospatial sketchpad it is also known as Visuospatial scratchpad as I told you and it has to do with the real soul of visually presented information.

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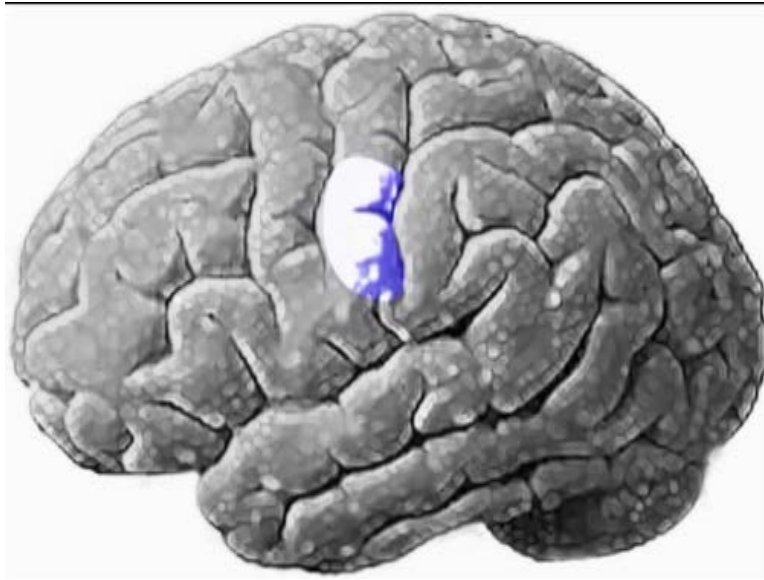


This animation shows you the location of working memory in the brain this is area 12 of the brain.

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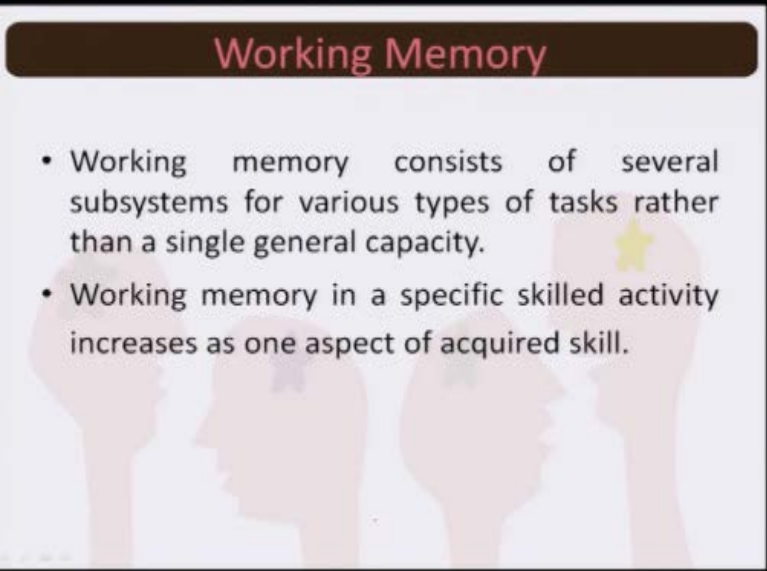
And is responsible for objects related working memory close to it is area 47 which is responsible for face working memory.

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And this is area 46 and it is responsible for spatial working memory now working memory basically consists of several subsystems of various types of tasks.

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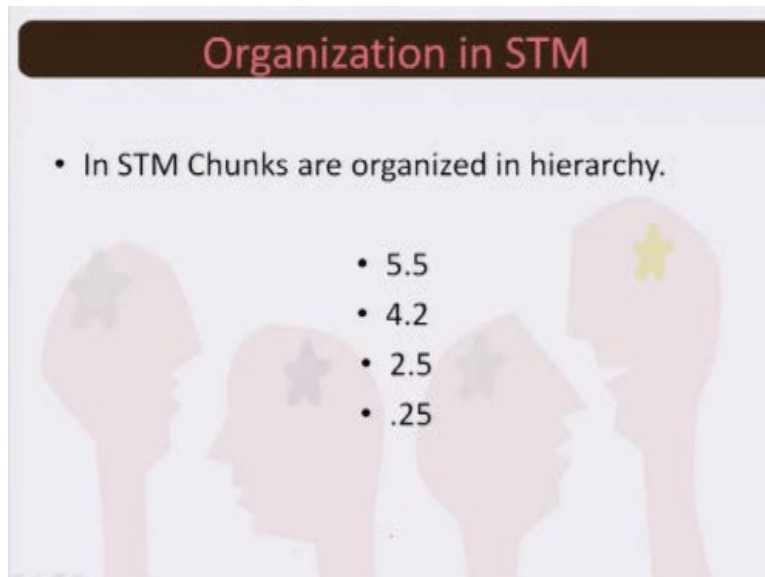
Working Memory

- Working memory consists of several subsystems for various types of tasks rather than a single general capacity.
- Working memory in a specific skilled activity increases as one aspect of acquired skill.

The slide features a background illustration of four stylized human heads in profile, facing right. The heads are light pink with darker pink outlines. The second head from the left has a small yellow star on its forehead. The slide is framed by a dark brown border at the top and bottom.

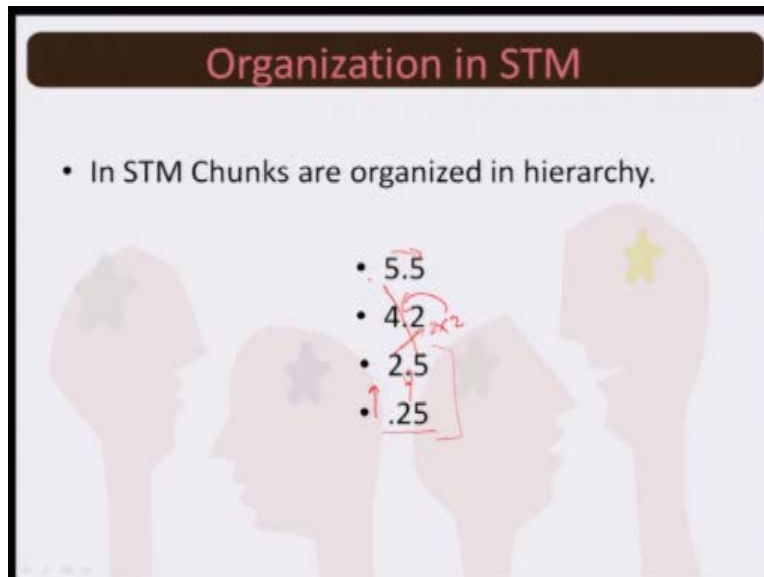
Rather than single general capacity okay and working memory in a specific skilled activity increases as one aspect of acquired skill.

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What is also very interesting to know is that the information the chunks that we form they are organized in hierarchy in the short term memory if you try too disorganized it then storage becomes problematic okay now you see your screen now.

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You see point 25 the moment you go up okay you realized that the decimal places has changed now it becomes 2.5 okay now you can use different strategies to memorize this information but one interesting think could we at that you realized at the first number was point 25 then you realized at this moved up and the decimal position changed so basically you remember only set with repositioning of the decimal point and then you say that this very information this is how it moved.

So 2 moved to the 3rd position it became 2x2 this which was 4 and this 5 moved to the top and this was repeated okay now you just now organized thing like that and then you realize that remembering this information is not at all difficult but if you do not organize information in the hierarchal order recollecting it becomes very difficult retaining it become so whether it is a laboratory also whether it is maintenance both will have problem maintenance of course will have problem in because the numbers are not run what you call arise in hierarchal rather they are more randomized.

Okay if you go for elaboration then elaboration by default will try to make it a little more meaningful and they Are by try to arrange it in a hierarchy so with this we have completed our

discussion on short-term storage when we meet next in our 3rd lecture we will be talking about long term memory.

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