

Memory
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Lecture - 27
Forgetting - III

Hello, I welcome you all to the lecture series on memory. The topic we are discussing is forgetting, and in this topic, till date, we have discussed the classical experiment of Hermann Ebbinghaus and related concepts and ideas. Why do we forget? Why is there a need to forget information, and what are the underlying mechanisms of forgetting? Taking this lecture forward, we have to discuss the causes of forgetting.

Forgetting could be due to the inability to retrieve the right information. Retrieval of the right information could be dependent on the cue. Which is present in the environment. Now, at the time of retrieval, failure could happen because of several reasons: if the right cue is not present or if the information is present but the network through which one could reach the information is damaged, then the information cannot be retrieved. There could be numerous reasons why people fail to retrieve information. As you can see, we are talking about the weeding out of information, which means strongly the information which is influenced and the information which is influencing the other.

So, the information which is influencing the other could be acting as an interference. So, no longer would there be a need for the complex information also. Many times, what we do for our easiness, the information needs to be simpler in form. The information which is simple and easy is encoded fast and gets stored. But the information which is complex in nature requires some amount of more time and space for its consolidation.

Now, the reason for forgetting, there are four popular explanations for that. One is the decay method, which we studied earlier when Herman Ebbinghaus was talking about the decay or forgetting curve. We even discussed the interference when we were talking about the primacy and recency effect. The information of primacy is going into our long-term memory. The information of recency is entering into our working memory.

When the information which is there between the primacy and recency is interfering with each other, as a result, the performance decays. The people forget the information. So, at the time of retrieval, they are not retrieving it correctly. So, we saw the effect of

interference in the primacy and recency effect. We also talked about the trace degradation.

The trace degradation is in contrast to trace consolidation. The information which has been consolidated, the experience which you have experienced and consolidated for future reference, has degraded. Because the way people are approaching the information for retrieval, those connections, those networks may have weakened over a period of time as a result of updating and maintenance. Now we also discussed the clue related to the target. Whenever we are retrieving the information, the information which we have to retrieve is specific in nature and it is a target.

So the cue associated with the target, the cue associated with this specific information, if it is absent or if it is not precise or if it is not specific enough, then the failure in retrieval happens. In many instances, what we have seen is that the information is there in the system, but at the time of retrieval, the specific cue is not being provided. For instance, when you are searching for a file in your computer system, you try to search for the file with the name of the file. If you have saved the file with the name Cargo, but when you are searching for the file, you are typing the word Argo.

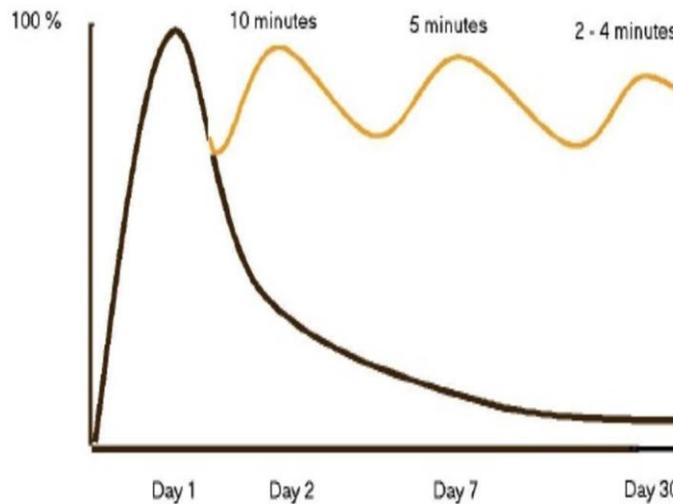
Then you may not be able to retrieve it. So the specificity of the cue is required. And then there is an impairment in the cue. Instead of typing Cargo, you are typing Argo. You may not be able to retrieve the file.

Similarly, the human memory system works like that. When you need to retrieve information, the cue has to be related to the target. So let us study these four potential problems components characteristics of forgetting. A lot of research has been done in this direction of decay.

Decay and forgetting, decay is a part of forgetting, and Mabin Goss in 1883 reported the forgetting curve. He reported how the information people are forgetting and what is the weight of the forgetting. Though he was putting an emphasis upon the saving method, which we studied in the previous lecture. The amount of information which is consolidated or saved, and how can we measure it? Now decay can be seen as an automatic and spontaneous process, and the information is lost over a period of time.

People do not pay attention towards the decay. The information which is getting out from the system is very spontaneous in nature. This decay is happening because we cannot store a huge amount of information. The amount of information which you are storing in

your consolidated system requires some maintenance. And this maintenance requires some cognitive cost.



Source: <http://www.edugyan.in/2017/03/theories-of-forgetting-distortion.html>

This cognitive cost ensures the information which is present in the system stays for a long period of time. So when maintaining this information, maintainers can only be provided to a limited amount of information. Hence, the decay constantly happens from time to time. And it is subjective in nature. Somebody registers the information of mango with the summer.

Some people register the information of mango as a fruit which is highly used in North India. So, the registry of information happens and, depending on the maintenance of this information, it becomes long-lasting or stays in the system. Now, to test the decay, a divided retention task is used. A divided retention task is very simple. Two different modalities are used.

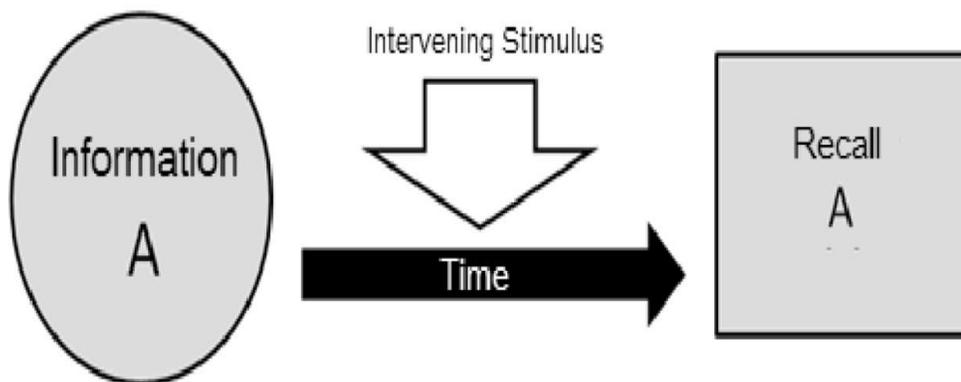
Or a similar modality can be used. So, a person has to remember a list of words. A list of words is given to the person. And if a person has to recall, this is the scale of recall. Where 0%, 200%, 1 is moving.

Then, in this case, what we see is that the recall increases but after a certain while it starts to decrease. Why is this decrease happening? Why is this distortion happening? The distortion is happening because of the tone which is presented simultaneously in the background when the person is remembering the words. So, the person is remembering the words while listening to a tone, and this tone is discouraging the rehearsal.

The tone could be of different wavelengths, could be of different decibels, and instead of a tone, you could add some more. Natural sound also may produce a similar effect. However, in addition to the natural sound, the effect seems to be more robust. More interference is being found. In the real world, we do not register information or process information.

Single, multiple, or thousands of stimuli are coming together. Selection is happening. Execution is happening. Integration is happening. This is what we have learned.

When we were studying about working memory. How the central executive system is selecting information from the visual-spatial sketchpad, auditory-phonological loop, and this information is passing through the episodic buffer and then getting integrated. So the tone should be different enough from the word such that interference is eliminated. That is why a white tone is being used. If a natural sound could be used, then similarity may occur.



Source: <https://www.semanticscholar.org/paper/Retroactive-Interference%3A-Forgetting-as-an-of-Alves-Bueno/2c0b1538bde48c150aa8a20fe51b67f52d384168/figure/1>

Definitely, memory researchers who are using the divided attention task ensure that the similarity between the two stimuli should not be the same. There should be a clear distinction. But the nature of the task is depicting, suggesting that an attentional shift is there. Attention needs to be divided. Though not consciously, but unconsciously.

So if we are studying in a classroom and then there is a foul smell, we are prone to notice the foul smell present in the classroom. Our sensory system will detect this. The olfactory

system will not sit in the class and shut itself down, pretending there is no foul smell or pleasant smell in the classroom. The other types of sensory systems are constantly working together hand in hand. It is not that only the visual system or auditory system is working alone.

So in this divided attention task, what we have observed while rehearsing and remembering the list of words is that a background tone is interfering with the rehearsal. As a result, the decay is being observed. The decay rate could be fast. Even in a short time interval, the intervening activities can affect the rate of forgetting. In a short time, 2 to 4 minutes, 5 minutes, or 10 minutes of interference, you could see how the effect was there.

Now, the decay rate, the decay rate indicated That some amount of information is being lost from the system. Division of attention is there, which is in the background. The presence of another sound is interfering with the target sound. As a result, people do not have time to rehearse.

And when they do not have time for rehearsal, decay occurs. Now, we talk about interference. What we understand about interference is that we forget because other events are interfering either with the storage or the retrieval of memories. Interference could be happening. So, the other events, the other events are interfering with the storage process.

So, when we are moving from encoding to storage to retrieval, Any event interfering here or here. So, if this event 1, when it is occurring here, interferes here, then storage will not happen. Storage will not happen. Or when the event is happening here, then retrieval will not happen.

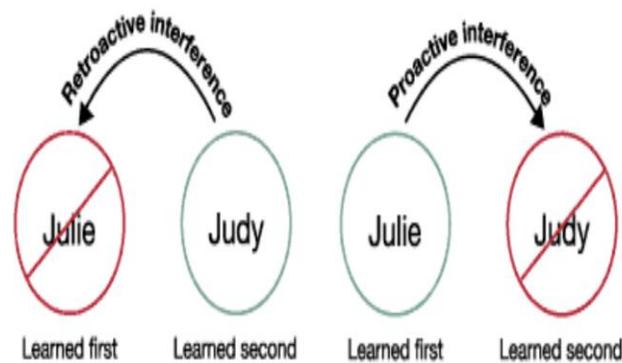
Now, interference does not assume that the memory trace would fade over time. It does not indicate that if you leave the information as it is, then the memory will disappear from the system. No, interference refers to the involvement of another event, either intentionally or unintentionally. So, when you see a system like this, information A is there, some intervening stimuli are present, and you are trying to recall this information A. So, there are two possibilities. This information can easily be retrieved, or this information

cannot be retrieved. When it is easy to retrieve, this means the information has been stored properly. When it is difficult to retrieve, then the information is hard to retrieve

because maybe the storage hasn't occurred, or during retrieval, some other form of information is interfering. So, the assumption is that forgetting happens because other mental events disrupt the normal storing and retrieving process. The mental events.

So, these are mental processes, mental events. These events are nothing but mental events. Cognition. While rehearsing the table of 12, I ask you to recite a song or recite a poem.

This will interfere with the recitation of your table itself. Now, if you see the interference, Baddeley and Hitch, who proposed the working memory concept, tried to demonstrate that retroactive interference could be of different types. So, what they proposed is that the interference could be retroactive interference or proactive interference. What does this mean? They conducted a very simple classical experiment involving a rugby football team.



Source: <https://sites.psu.edu/intropsychf19grp7/2019/10/17/retroactive-and-proactive-interference/>

They simply asked the participants to recall the team they had played earlier in the season. Players would miss some games. So the problem of monitoring was to track the weeks elapsed from one game to another. They had a lot of failures. So, when the person has to retrieve the information, while retrieving the information, another event is interfering.

The other event is the match they are currently playing. So, when they have to retrieve the information from the past and then what they are currently playing, the current information is interfering with the retrieval of the previous information. So, time did not appear to be nearly as important as the number of intervening games. Here, time was not

important at all. But what interference predicts is that forgetting is a result of similar events, blocking storage and retrieval.

Now, when we are talking about mental event 1 and mental event 2, these two are different types of mental events. These are two different types. But when we are talking about the blockage of storage and retrieval, these two mental events need to be similar. So, what were we people talking about? So, for instance, if you see here, initially, the name of the person learned is Julie.

And when the person is learning the second time, it's Julie, it's not Julie. So, what happens? The new information, Julie, is trying to interfere with the retrieval of the previously stored information, which is Julie. This is known as retroactive interference.

However, when the first learning is so robust, so strong, that when you are doing a second learning, it is overriding the new learning. That is proactive interference. So, in one case, the new information is interfering with the previous information and leaving the impression. And in another case, the old information is strong enough and leaving the impression, blocking the new upcoming information, that is proactive interference. Such interferences have been classified into these two types: retroactive interference and proactive inhibition.

What is happening in these two types of interferences? In these two types of interferences, Either the previously learned information is interfering with the new incoming information and damaging it, impairing it. Or the new incoming information is blocking the retrieval of the previously learned information and leaving its impression. So when does retroactive interference happen when old information can't be retrieved?

The old information can't be retrieved because new learning has occurred. The newly learned information is interfering with the previously learned information. So whatever you have learned in your graduation is going to interfere with the retrieval of your school knowledge. And this leaves an impression of retroactive interference. Where the old information cannot be retrieved.

Proactive inhibition is talking about when old information is so robust that it overshadows the recent one, leaving an impression. That is why, in relation to memory, whenever we talk about retroactive or proactive, we use a model like conditioning. In the conditioning model, we try to depict if the safety memory or the fear memory followed by extinction memory, which will be more robust. These are two natures of memory, two

distinct neural structures, and how these two distinct structures are coordinating with each other. So in one case, when the fear memory is so strong, it is inhibiting the extinction, and when the extinction memory is so strong, that is, the safety memory is so strong that it is interfering with the fear memory retrieval.

So, then it becomes a therapeutic intervention, an effective therapeutic intervention, so that the retrieval of fear memory is not happening. Now, proactive and destructive interference suggests that our memories are distinct in nature, with a very unique pattern. And what you see in these two cartoons is the percentage of team names recalled correctly. You could see that from the 90%, the drop is there. It improved a little bit.

But as the game is passing by, the performance is getting worse and worse. You can see the difference. This is the difference. When we talk about the, so this is A retroactive, this is B proactive, so this is A retroactive. Now let us talk about the proactive inhibition.

What do we see? Once you have recalled the first list of items, zero interference, 70% recall, the highest. However, when there is a previously shown to you, then there is a decrease, it decreases. What is decreasing? The recall is decreasing.

Why is it decreasing? Because there is interference. And as you see the interference, the performance is decreasing and decreasing. More information is present in the environment, so the performance will come down. Now, we discussed the decay, and we discussed the interference.

Let us discuss the trace degradation. What does trace degradation suggest? It suggests that old memory might be thought of as erased or overwritten. And that is why there is no trace of consolidation there. If there is a trace of consolidation, then the information should have been retrieved.

But the information has not been retrieved. This means the information which is present there has been overwritten. Or it is not present in the system as well. What we studied from the classical literature of memory is that sleeping would keep learned material from being erased by other activities. What are those other activities which erase the memory?

You sleep late at night, have unhealthy habits, unhealthy diet habits, and an unhealthy lifestyle. All these activities are going to affect your sleep, which eventually affects your learned material. We have been discussing earlier also that for the consolidation of information, sleep plays a major role. Once you are in deep sleep, REM sleep, then only slow wave spindles are generated. These slow wave spindles are

activating the networking areas from the frontal cortex to the hippocampus. And then the decision starts. Then the selection starts. Which information needs to be stored and which information does not need to be stored. Trace degradation assumes that it is the contrary of the memory trace.

So trace degradation is contrary to trace consolidation. Unless trace consolidation is there, which means that it has become resistant to interference. When it is not resistant to interference, trace degradation can be seen. It has been overwritten or it is removed from the system as well. It explains why head trauma usually disrupts recent memory, and that is why.

That is why it is suggesting trace consolidation is The information is stored and preserved in the system. However, trace degradation is unlike trace consolidation. The information has not been consolidated. The information is only present in your system.

And when head trauma generally happens, it disrupts recent memories. The memory which has not been consolidated, the memory which has not been preserved in long-term memory. And that is why in any head trauma case, the working memory and short-term memory are compromised while the LTM remains intact. When we talk about this decay, when we talk about interference, and when we talk about trace degradation, we have to understand that either, as trace degradation suggests, the information has been rewritten or the information is being lost.

But some groups of researchers believe, how can we be sure enough that the information is not present in the system or the information has been overwritten? How can we be sure enough? It may be that the cue is not there to retrieve the correct and specific information. The cue which we are using may have been impaired.

So, as I was telling you earlier, if you have saved a Word file, if you have saved a Word file on your computer with the word 'whale,' then you cannot do the search with 'hole.' Just changing this letter. One single letter, the Q impairment can occur. Why is the Q impairment happening? Because the target cannot be retrieved.

The Q is not correct. Both 'whale' and 'hole' are five-letter words. But the meaning is very different. So, the same target memory, so what we talk about is the retrieval queue. There are no longer links there to the same target memory.

But it is associated with other memories. Earlier, we discussed the networking of memories. How the hierarchical network model was there. And this network is providing assistance. And this is how we store information.

The association could have been lost through extinction. Extinction is nothing but an unlearning phenomenon or, as we call it, safety learning. You are unlearning. Unlearning what? When initially this blue

square was being paired with the shock. This is resulting in threat memory. The blue square is always predicting the threat. While when this blue block is presented alone, safety memory is formed when it is presented alone.

So this is forming a safety memory, this is forming a threat memory, and we try to see which is going to leave the impression. Now in this, generally, we use the Pavlovian conditioning model to study safety memory, fear memory, fear unlearning, fear learning, overlearning, etc. Another point here in the Q impairment is the Q overload. Sometimes the distinct nature of the Q itself creates a lot of fan effect.

The blades of the fan, if you see when it rotates, It makes a circumference. So similarly, at the center is the cue. And this cue is being associated with many other cues or much other information. So the retrieval cue becomes associated with different target memories.

Not only one target memory is there, but it is being associated with many target memories. And as this happens, it is strengthened, while any one target will weaken. So, what is happening? One target is becoming strengthened while the others are getting weakened. Why is this happening?

Because of the cues. So, the nature of the cue is very important for us. Then, in the cue impairment, We also talk about the cue availability. Which cue is available to you?

So, when we are talking about the apple, we need a queue. The fruit with iron, queue availability. Now, the fruit with iron could be any number of cues that would be there. But while encoding this information, we are encoding it with specific details. So, encoding a specific principle proposes that retrieval cues are effective only if the information connects them to the target information.

So here, the target information is associated with that. The target information is stored at the time of encoding. So the process, we know how the process is happening. So when

we are talking about this time of encoding, here the target information, So, whatever the context at the time of encoding can also influence our ability to remember.

Now, when you are remembering this, if you are in a classroom, the classroom context will provide you assistance in the ability to remember this item. If you are at home, then that context is going to help you remember a different nature of the information. So, we are, the encoding specificity is there. The context is playing a role. And this we even discussed in Pavlov's dog experiment.

Pavlov's classical conditioning experiment. Where we discussed the nature of the encoding item. Then another key availability is the retrieval-induced inhibition, which means That one retrieval is trying to inhibit another retrieval. So this retrieval 1 is inhibiting retrieval 2 and many others.

So the action of making the memory trace inaccessible through suppression temporarily. Suppression means the access to the memory is blocked. So why is retrieval inducing inhibition? Because if you talk about the example like truck driver, truck mechanic, these are two distinct pieces of information and two distinct professions are also there, one and two. So when we are talking about the retrieval-induced, my truck got damaged, the engine is not working, then my retrieval should be truck mechanic.

But instead of remembering the truck mechanic, I am saying the truck driver is going to fix the carburetor of my engine. So the truck driver tried to inhibit the the retrieval of the truck mechanic. This happens every day in day-to-day life. Let us summarize what we have studied in this lecture.

We studied the unique concept and process of decay, why decay happens, and how the presence of another stimulus leads to decay. How this additional stimulus interferes, blocks, and inhibits the recall of the target items. While talking about decay, we also studied that there are different types of interference processes. One process is retroactive, and another is proactive.

When the new information overrides the previous information, when the new memory overrides the previous memory, that is retroactive interference. And when the new learning is not strong enough, robust enough, or powerful enough to override the previous memory, then that is proactive interference. In this proactive interference, the previously learned information dominates the new learning. We even discussed in detail the trace consolidation.

Once the trace consolidation happens, then the trace degradation does not occur. But if the information is overwritten or not present in the system, then this indicates trace degradation. The information that was initially present has degraded over time. We even discussed the last component of forgetting, which was cue impairment.

When the queue is impaired and when the queue is available but it is not specific, then how is the forgetting happening? We discussed these four components of forgetting: decay, interference, trace degradation, and queue impairment. Talking about how the forgetting is happening, how the process of forgetting is occurring. So, any one of these four processes is occurring. With this,

I will end this session, and in the next class, we are going to continue the lecture on forgetting. Thank you.