Memory

Prof. Manish Kumar Asthana
Department of Psychology
Indian Institute of Technology Roorkee

Lecture - 30
Memory Disorders- Amnesia-I

Hello, I welcome you all to the lecture series on memory, and today we We are going to start the topic of memory disorders and memory disorders. We will discuss amnesia. Now, in the last few lectures and last few weeks, what we have learned is about memory, the neuropsychology of memory, the involvement of different brain regions, episodic memory, semantic memory, autobiographical memory, and its effect on day-to-day activities. The major challenge which an individual faces, which is very common among the elderly, is the forgetting of information.

Forgetting for a few instants or a few seconds is normal. However, forgetting information at the time of need, forgetting information for a long period of time, and forgetting information in our day-to-day activities may result in a big challenge. Elders generally face a problem of remembering information, the episodic events of their life, remembering passwords, remembering a person's identity, and sometimes information related to themselves. As they age, different types of problems emerge.

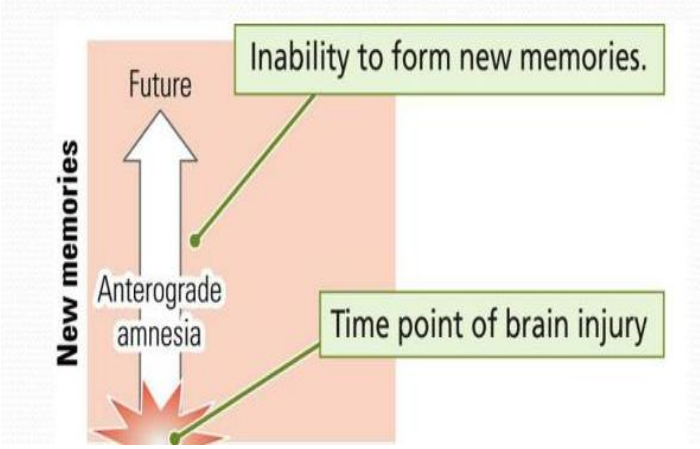
One such common problem is forgetting. In the previous lecture, we discussed forgetting and the ways forgetting can be studied, motivational forgetting, and many other aspects related to it. But here, what we are talking about is if the information is lost from the system, is it lost? Or is it not being stored at all? So if the information is not stored at all, then how are we going to retrieve it?

Many a time, in many instances, we pay more attention to what is lost and what our abilities are in remembering that event. So when we talk about amnesia, amnesia is any impairment of memory abilities, any kind of information with the storage or the retrieval, and this is beyond the normal forgetting where you sometimes forget putting sugar in your coffee or putting salt in your food. Or forgetting your key and entering into an elevator and coming down. These are normal forgettings which you can rectify, which you can overcome. But the information loss which cannot be overcome and is permanent results in amnesia.

Amnesia refers to an acquired condition caused by trauma to the brain. Now, the easy way to understand this is that when any such head injury or any trauma happens to the brain, then people lose the information. The loss of information or the inability to retrieve the information happens after the trauma has occurred. If we see this cartoon, the very famous movie where the Dory fish had a memory problem, amnesia, where she was struggling to remember the information. And her failure to remember the information was bringing laughter to us.

Making our time more enjoyable. But forgetting information for Dory or people like Dory becomes a challenging task. The important aspect to understand is that when the trauma has occurred, after that the loss happens. But definitely in a fictional movie like this, the drama has been designed or projected in a way where people could enjoy. But in a real-life sense, in real life, it could result in a very drastic event.

There are a lot of different types of disorders that can be classified as amnesia. So amnesia can be treated as retrograde amnesia or anterograde amnesia. The loss of information after the trauma to the brain. After the trauma of the brain results in anterograde amnesia. While the loss of information which is happening before the trauma, if we refer T as trauma, then after the trauma, anterograde amnesia, before the trauma, retrograde amnesia.



Source: https://deegan-khensley.blogspot.com/2022/04/explain-difference-between-retrograde.html

Now, the major deficit could be is encoding new information into episodic memory. It is very important for us to understand here that we are talking about the encoding of information, encoding of new information, which is happening in the case of anterograde. Retrograde loss, if we talk about the loss of stored information, It is also equally

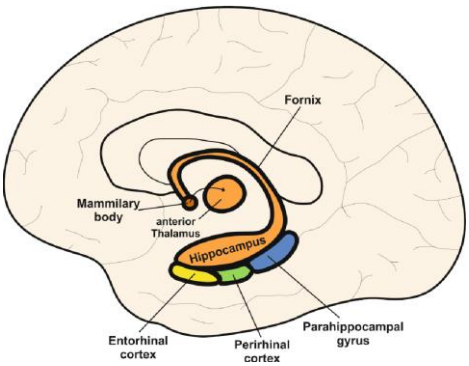
important to note here that when we are talking about episodic memory and encoding of new information into episodic memory.

So in the case of amnesia, the major loss is happening in episodic memory. But not, less likely in semantic memory. Semantic memory is less impaired. Episodic memory seems to be more impaired after trauma of the brain. When we are talking about these amnesias, some of the amnesic effects are retrieval from episodic memory.

So, the failure to retrieve information from the episodic memory. Stored memory is retrograde amnesia. Access to semantic memory is also a challenge, but not that difficult. So, people do have a problem in accessing the semantic memory, but the amnesia effect seems to be a little less in this regard. Accessing working memory, the working memory which we discussed earlier,

the working memory concept introduced by Baddeley and Hitch, and more about the executive control of the memory system. So, amnesia affects all these aspects. When amnesia comes back, it targets these aspects of the memory. Now, let us go into a little detail about anterograde amnesia, as we were referring to learning earlier that after the trauma of the brain, anterograde amnesia arises where people are not able to form new memories, new information, and failure is there. So, the inability to form new memories from the time point of injury.

So, this inability to form new memories is happening because of the brain damage. We had discussed earlier that the initial trace of memory, the initial trace consolidation, requires the brain areas. These brain areas are none other than the hippocampus and parahippocampal regions. These regions ensure that the initial trace consolidation happens. In addition to the sleep.



Source: https://www.semanticscholar.org/paper/The-Integration-of-Memory-and-Visual-Perception-in-Lech/f9a6f2e1453fb73c4380d99f99e806cfab7fcf58

Any damage happening in these areas will result in the impairment of the new formation. Impairment of new information, failure, or the consolidation impairment is happening. As the memory gets old, it becomes independent of brain structures, memory structures as it gets old, as the information gets old. And that is why, after the trauma of the brain, retrieval of old information is not as challenging as the retrieval of endocrine amnesia. Why?

Because in endocrine amnesia, storage is a problem. So something which is challenging in the consolidation itself, which has not been stored, which is not present in the system, how can we retrieve it? So sometimes people even discuss and have arguments related to amnesia that probably it is not about the problem of storage. Maybe people are able to store the information. But maybe it is the problem of retrieval itself.

Maybe we are not able to retrieve the information. Maybe the structures which are responsible for the retrieval have this functioning. Or they may not have the projection. So when we talk about endocrine amnesia, it could result in either mild impairment or severe impairment. And when we are talking about mild impairment, the individual requires more time to encode this information than normal healthy individuals.

They have an impairment, and this impairment is resulting in the failure of encoding information. And something that has not been encoded cannot pass down to storage, and when something has not been stored, it cannot be retrieved. So that is why, when we started our discussion on memory, we discussed encoding, storage, and retrieval. The removal process is as simple as it is.

Encoding has a challenge. Storage and retrieval will not happen. Encoding is okay. Storage is okay. But still, the retrieval is not happening.

Then also, amnesia will happen. Now, in the case of severe impairment, a person may be able to remember little of anything new. Anything that the person is able to learn, something new, can be retrieved and remembered. But this doesn't indicate that the person is capable of retrieving. The problem could be the same: the information may not have been encoded at all, and the remembrance is happening because of association.

We have earlier discussed In previous lectures, we discussed that when we store information, we store it through associative learning. Association makes information

long-lasting. Another point is that in mild impairment, a person may be able to compensate for their deficit and resume their career. What does it mean?

Because the impairment is not Because the impairment is not so challenging, people come up with some compensatory mechanisms which help them. So, preparing a diary, preparing a notebook, noting down, writing down their appointments and important episodes. Or the actions which a person has to execute. These new rehabilitation techniques seem to assist individuals who are suffering from minor impairment.

With severe impairment, the person cannot continue to work. It seems that because of their failure to retrieve information, because of their failure to recollect information, because of their failure to To store information seems to interfere with their processes. The deficits may be episodic or semantic in nature, as we discussed, but mostly they are episodic in nature. Semantic memory seems to be less affected in anterograde amnesia.

In many cases, the deficits could be very specific, as we have also seen. It is specific information that the individual is not able to retrieve. Now, when we are talking about such aspects, it is important for us to discuss the brain areas responsible for amnesia. Now, if you all remember the time when we were discussing the Henry Molaison case, the HM case, the classical case, which gave us a lot of insight. And it provided us with a lot of insight into the consolidation process.

And how new information is being consolidated. How the new information trace consolidation is happening. And what are its challenges. And more than this, the retrieval of information prior to the injury. Suggesting

That the new information processing is impaired, but the old information is intact, which means the old information is not dependent on the memory structures or the trace consolidation structures. So when we discuss this, the prime focus is the hippocampus region, which shows that the memory should be Stored for future reference. So what you see here in the orange body is the hippocampus. And in the hippocampus, you also find an adjacent area of the entorhinal cortex, perirhinal cortex, and parahippocampal region.

In the case of HM, an 8 cm section was removed. Removal of this section reduced the epilepsy problem, providing HM with an aid for epilepsy. However, it resulted in amnesia, specifically endocrine amnesia. Then we discuss the medial temporal lobe and its role in amnesia. And finally, mainly the bodies of the diencephalon, the brain stem.

What we see is that these are the core brain regions responsible for trace consolidation or memory consolidation. The projection of these brain regions to the frontal cortex and amygdala plays a major role in the remembrance of information. As the amygdala is an adjacent area, it brings emotional value into the consolidation. Now, damage to the adjacent area, which is the fornix, can also induce endocrine amnesia, meaning an individual may not be able to consolidate information after surgery.

Hippocampus and medial temporal lobe lesions show deficiencies in recall and recognition tests. So when an individual has to recall or perform recognition, the hippocampus and medial temporal lobe seem to have this problem. Now, when the information becomes old enough, it may not depend on the hippocampus and medial temporal lobe. However, the initial trace is dependent on such brain structures. Damage to the diencephalon shows relatively preserved performance on recognition tests.

So, if the brain is being damaged, then it still preserves the information, which means the performance is not dependent on the diencephalon. Earlier, we discussed the types of long-term memory. And while talking about long-term memory, we discussed non-declarative memory, which is implicit memory or indirect memory. So, what is implicit memory in amnesia?

It refers to the preserved ability to perform tasks that are influenced by past events. Indirectly, it influences your actions without being aware of the event experience. Indirectly. In such cases, we discussed priming. We talked about associative learning.

We talked about habituation, etc. Amnesic patients may sometimes show the influence of earlier events even when they do not recall those events. What does this mean? This means that they understand amnesic patients initially when they become amnesic in the initial phase of forgetting. They remember; they know that some information they are forgetting.

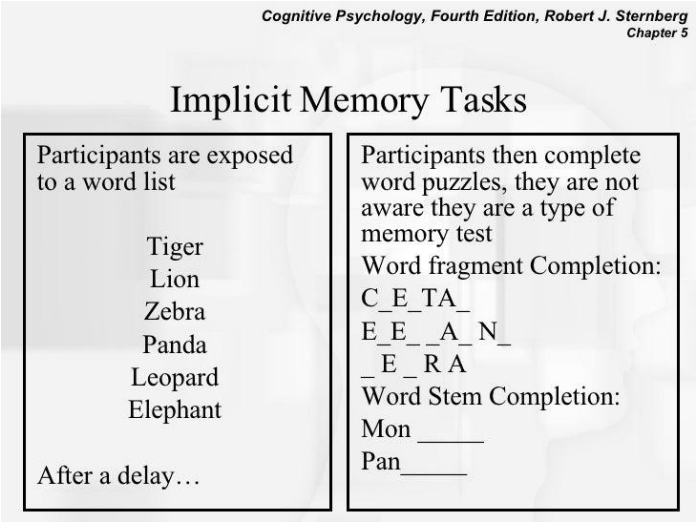
But as time passes by, they are not able to retrieve it. Implicit memory is the result of the influence of processing brain areas that are not directly involved in the episodic memory circuit. The episodic memory circuit is part of the explicit memory system, and that is why they do not have an association. How shall we test the implicit memory task? Very simple design.

This design is known as word fragment completion, and in this word fragment completion, participants are given some letters. They just have to figure out the word. As

you can see on your screen, s underscore h underscore l underscore r. What is this word? If we think of this word, then we think of scholar without much of an effect because our context is an academic institution. So the word which fits in this context is scholar.

Similarly, you can see in this task participants are exposed to a word list like tiger, lion, zebra, panda, leopard, and elephant. What are these? These are all wild animals. Participants then complete the word puzzle. They are not aware that they are taking a type of memory test.

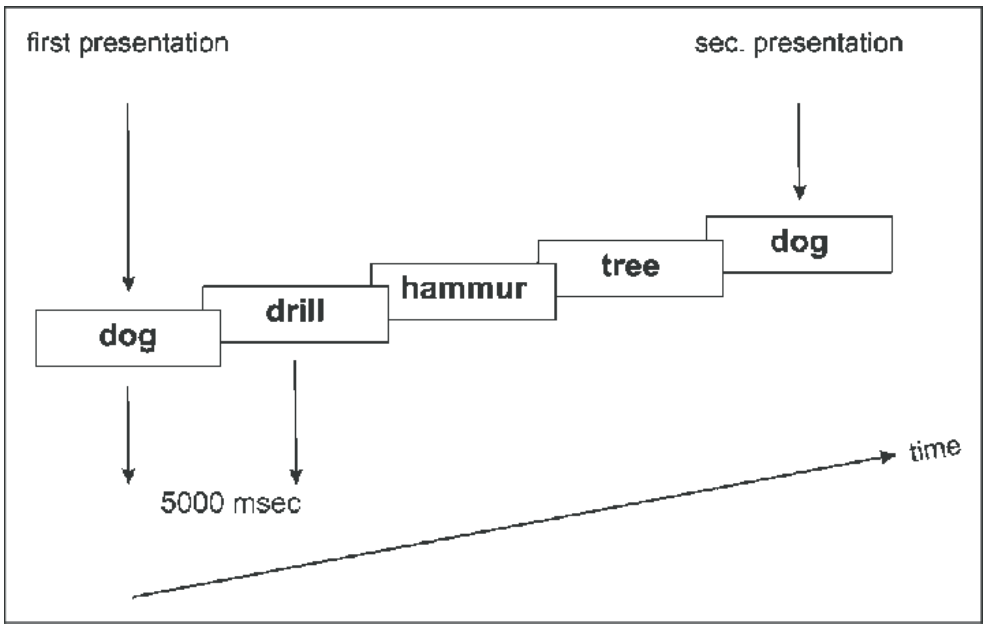
So, the word fragment is C underscore E underscore TA. So, cheetah. And then, elephant. Zebra.



This is how the participant has to fill it. The task can be completed without any reference to the past. For such filling, a pass is not required at all. The participant can simply determine what letters are needed to make the acceptable word, that's it. Amnesic people, amnesic individuals, may be just as good as normal individuals in completing the task.

They do remember what is required. But, as I said, there are two different types of amnesics. So, accordingly, the task is will also be given to them. It is an important aspect for us to understand the concept of repetition priming.

Now, we have understood earlier, and we also discussed that priming is a part of implicit memory, indirect memory, and non-declarative memory. So, what is happening here? With the word scholar. It makes us solve the word fragment easier. So, the first presentation is like. Dog. Then, the second presentation is drill. Hammer tree. And then, the second presentation is dog again. So, participants are shown.



Difference. Like a scholar. If they saw scholar in another context. Sometimes as much as a year earlier. They will still be able to recall it.

So, for this type of retrieval, we do not have to actually have prior experience. Sometimes, based on our different prior experiences, we may be able to answer the problem, and that is why, in many cases, the answers depend on the context itself. Many times, the problem solver looks into the context and tries to solve the problem. So, the effects of repetition are called implicit memory because participants are not always aware of the connection between their earlier experience and their present task, such as here, the first presentation was wrong, the second presentation is wrong, but how these two things are related is an important aspect of it. Now, when we are talking about priming, let us discuss the amnesic syndrome and awareness.

So, in the early stages, patients with Alzheimer's may be accurately aware of their primary loss. Initially, when they come to know about the disease, the memory loss problem, Alzheimer's disease, Because Alzheimer's disease is an umbrella term. Alzheimer's disease includes frontopolar dementia, dementia in general, etc. So here, what we are trying to understand is that people are aware of their memory loss initially, once they have this problem.

But as time passes by, they even forget that they have amnesia. In amnesic syndrome, patients tend to be keenly aware of their deficits. They try to understand their deficiency, that they are incapable of remembering information. As a result, neuropsychological

intervention can help patients with mild to moderate cognitive diminution. So from mild, they can become moderate.

Now, it is very important for us to understand here that when we are talking about awareness, as I said, as it progresses, it becomes more and more acute. As a result, people may find the relevant information, may find their appointment with the doctor because they know that their deficiency in holding the information for too long is affected. Or their processes to retrieve the information are affected. So, neuropsychological intervention helps patients with mild to moderate intracranial amnesia. Here, maintaining a diary is an easy solution.

Although external memory aids can be used to compensate for some aspects of amnesia, being amnesiac can be very frustrating. Not only for the patient but also for the family members. And what do we understand? We clearly understand that the loss of information can be a tricky business. And that is why they tend to cope.

They come up with a coping mechanism. These amnesiacs tend to come up with coping mechanisms. But what are those coping mechanisms? Medved in 2007 clearly and beautifully demonstrated and provided us with an insight. What do amnesiac patients do?

While interviewing patients with endocrine amnesia, he understood that there is memory conversation. The one-to-one conversation is required. The discussions we have with others about the past. In order to cope up In order to deny that the patients are suffering from endocrine amnesia, they tend to have conversations with the counselors and researchers about their past.

Instead, about the new memory information, the formation of new information which is there. So they tend to talk about the past. Medved mentioned that there are three major types of coping strategies. One is memory importation, another is memory appropriation, and memory compensation. What is memory importation?

It describes memory from before the injury as if it had happened afterwards. So they tend to provide a lot of insight about the past before this injury and But after the injury, it seems that it is very difficult for them to preserve the information. It seems it is very difficult for them to have clear consolidation. Memory appropriation suggests that someone else’s repeated telling of the event.

Retrieving the event, retrieving the episode, and how accurate that event is. Then the final coping strategy they come up with is memory compensation. Rather than asking them to

answer a question about their past, they talk about the issues that have arisen from amnesic syndrome. Why do they do that? They tend to compensate for their failure, their deficiency, their dysfunction.

So what we have learned in this lecture today is about amnesia, the loss of information in a healthy individual or an elderly person, the types of amnesia, endocrine amnesia, and if the amnesia is happening before the surgery or before the trauma, then retrograde amnesia, brain areas involved in amnesia, hippocampal, parahippocampal area, medial temporal lobe, frontal cortex, diencephalon, and indirect memories in amnesia, how it is being processed. We also learned and had a game about word fragmentation, the fragment completion task. The word fragment completion task where the participant has to complete the word. The word which has been fragmented.

And then we discussed the repetition finding and amnesic syndrome and awareness. Amnesic syndrome and awareness initially, as the disease has spread less, so they were aware of it, that they do have a memory problem, but as the disease progresses aggressively, they become unaware of the fact that they do have a memory loss problem also. Now, one thing we have to understand when we are talking about amnesia, should we discuss that the encoding hasn't happened, or should we discuss that the storage has been a failure, or should we discuss that retrieval is a failure? Now we have been discussing in the last few lectures about the consolidation process, and phase consolidation is trying to involve not only the memory structures but also structures like the frontal cortex and amygdala.

The involvement of all these three structures ensures how robust and long-lasting the information will be within the system or with the person and in the system. Memory system. Such aspects are very important and crucial for us to learn, and in the coming lecture, we are going to address some more concepts and ideas related to amnesia. Thank you.