

Case study: episodic memory



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Unlike other living beings we humans have the unique ability of recalling the past. We are able to recall a past event and all the emotions associated with the same while in a totally different situation or a different place (eg: first day in college or day you got the best student award etc.). In short we can travel back to the past in our minds. This kind of memory which involves recalling of past events is called episodic memory. Episodic memory enables a person to remember personally experienced events as such. It makes it possible for a person to be consciously aware of an earlier experience in a certain situation at a certain time. Thus, the information of episodic memory could be said to concern the self's experiences in subjective space and time (Tulving (1993), *Current Directions in Psychological Science*, 67). Episodic memory along with Semantic memory makes up Declarative memory or Explicit memory which is one of the main two divisions of memory. Semantic memory is involved in the storing of general knowledge of the world (independent of person's identity or past) and makes it available for retrieval. Unlike episodic memory, the retrieval process does not involve mental time travel. With the advanced techniques such as the fMRI, the role of hippocampus and other related structures in memory formation has been well established. The question of how the brain allows us to re-experience episodes from our past still remains unanswered. Every event in our life is stored as memory in three stages.

Encoding

The first stage is encoding. Encoding begins when an act is perceived and ends with the recording of the same. It is the initial processing of information which can be either visual or acoustic or both. From immediate memory

assessing tests like digit span it is possible to measure how much information has been encoded. Engram is the product of encoding. The term engram was introduced by Richard Semon(1904). Some information is stored on the basis of their phonological characteristics (eg: ate, date, mate, skate). The sequences with similar sound were found to be recalled less accurately. This happens because the words with similar sounds have less distinguishing features when compared to words which sound dissimilar (eg: sit, mall, dime, sour). Similarity of meaning (eg: accurate, precise, correct) has no such effect, which means that in immediate memory task, coding is phonological and not in terms of meaning (Baddeley, 1966a). How well can we remember learned information and what influences it? Craik and Lockhart (1972) suggests that information is better remembered when it is encoded deeply. It can be illustrated by maintenance rehearsal and elaborative or relational rehearsal. The former is a shallow form of processing without giving thought to meaning of an object or its association with some other object (eg: pointing out all the 3 letter words in a newspaper article) while the latter is the level of processing which involves giving the object a meaning as well as associating it with some past experience(eg: remembering a phone no. which is similar to national insurance no.). In 1975, Craik and Tulving conducted an experiment which involved learning of 60 words by the participants and then they were asked to recall some words when they are shown one of the following 3 questions. a) Was the word in upper or lower case? (Shallow processing or maintenance rehearsal), b) Does the word rhyme with _____ ? (auditory processing) and c) Does the word fit in the following sentence? (Semantic processing – understanding meaning of the word, Elaborative rehearsal or deep processing). Out of another larger list, <https://assignbuster.com/case-study-episodic-memory/>

the participants were asked to pick out the appropriate word, as the original words had been mixed into this list. The participants were better able to recall words which had been processed more deeply – that is, processed semantically, supporting level of processing theory[i].

It is evident through researches that there is a link between episodic memory functions and the frontal lobes of the brain (Tulving, 1985; Schacter, 1987). The left and right prefrontal lobes are part of an extensive neuronal network that subserves episodic remembering, but the two prefrontal hemispheres play different roles. Left prefrontal cortical regions are differentially more involved in retrieval of information from semantic memory and in simultaneously encoding novel aspects of the retrieved information into episodic memory. Right prefrontal cortical regions, on the other hand, are differentially more involved in episodic memory retrieval (Tulving, E., Kapur, S., Craik, F. I. M., Moscovitch, M., & Houle, S. (1994)). Researches into the neurobiological basis of memory essentially began with the case of Patient H. M. The patient had severe epilepsy as a teenager and when he stopped responding to medication, bilateral temporal lobectomy was performed in which the medial temporal lobes on both sides of the brain were destroyed, removing the amygdala, part of the hippocampus, and surrounding brain tissue. After the surgery the patient was found to have become severely amnesic. H. M. had a complete loss of memory for events subsequent to bilateral medial temporal lobe resection 19 months before, together with a partial retrograde amnesia for the three years leading up to his operation; but early memories were seemingly normal (Scoville WB, Milner B (1957)). H. M.'s score (112) on Wechsler-Bellevue Intelligence Scale

showed that there was no impairment of general intelligence but the below average score (67) on Wechsler Memory Scale reflected the damage on memory. Another case of amnesia was Clive Wearing's. He was a well known British musician and conductor who contracted a virus which only causes cold sores, but in his case it attacked the brain. This infection damaged his hippocampus making it impossible for him to form new memories. He remembers very little from the past. But surprisingly he is still able to play his piano although he will not remember what he was playing after he's done, which shows that his procedural memory was intact. His memory span is around 7-30 seconds which means that his ability to retain information in his short term memory is lost.

Consolidation

The term “consolidation” was coined by the German researchers Müller and Alfons Pilzecker. They claim that memory takes time to fixate or undergo ‘Konsolidierung’ (Müller and Pilzecker, 1900). The term consolidation refers to the progressive post-acquisition stabilization of long-term memory[ii]. Every new memory requires time to enter into long term memory. During this period it is prone to many interferences which can either be caused due to some external stimuli which can be in the form of injuries, infections etc. These interferences can make memories fade over the passage of time. The interferences caused subsequent to learning is called retroactive interference and interference from prior learning is termed as proactive interference. Müller and Pilzecker (1900) proved the existence of retroactive interference by asking their experiment participants to learn a list of six syllable pairs by reading it aloud stressing on the second syllable. This was

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repeated 12 times. This was followed by a gap of 18 seconds during which the experiment apparatus was made ready for the next list of syllables. During this time gap the participant was either given another list (filled interval) or left to relax (unfilled interval). The participant was asked to produce the second syllable when presented with the first syllable of each pair. The result of the experiment showed that filled intervals led to a lower percentage of recall.

Write about Interference with Consolidation?

Dewar et. al, (2010) examined the effect of retroactive interference in anterograde amnesia. They examined 10 severely amnesic patients and 10 controls. The participants were instructed to learn a passage and try to remember as much as possible for immediate recall. The immediate recall was followed by a 10 minute time gap during which the participants were either asked to relax (unfilled interval) or to attend a tone detection task (filled interval). After the task the participants were subjected to delayed recall. The amnesic participants who had filled intervals performed very poorly during delayed recall when compared to those with unfilled intervals, which shows that any new information interferes with their ability to retain previously learned ones. The result indicates that anterograde amnesic patients are still able to form new memories but their ability to consolidate memories is weak and slow. This leads to the loss of previously learned information when something new is learned. The only way they can learn is to have a time delay to fortify the previously learned information before further learning.

Types of Consolidation

There are two types of consolidation – Synaptic Consolidation and System Consolidationⁱⁱ.

Synaptic Consolidation is seen among all species. In synaptic consolidation, long term memory is the memory which lasts for more than 24 hours.

According to the standard model of synaptic consolidation, memory traces or engrams can exist in two forms: short term and labile or long term and stable. The short term memory trace will either decay or transform to long term form or it will develop along with the long term form. It is assumed that suprathreshold neurotransmitter signals are involved in the long term form. These signals trigger synaptic consolidation.

System Consolidation is in which the memories from hippocampus are transferred to the neo-cortex where they are stored in a more permanent formⁱⁱⁱ. The standard model of system consolidation states that long term memories are registered in the hippocampal formation and neocortex. Synaptic consolidation is assumed to be involved in the stabilization of these internal representations because it is achieved within a period of minutes to hours. Subsequently a system consolidation process is initiated (triggering factor unknown) where the memory trace is reorganized over a period of weeks and the burden of retention is shifted to the neocortex. Ultimately the neocortex independently maintains the internal representation and actualizes it on retrieval.

Memory trace theory

Retrieval

The process by which stored memory is accessed is called retrieval. How exactly a memory is retrieved still remains vague. In our daily life we are constantly exposed to information. Some of this information acts as cues that makes us reminisce. This shows that the memory retrieval process is cue driven. These cues for memory retrieval can either be explicit (eg: a word or a phrase) or Implicit (Dewar, 2010).

Tulving and Pearlstone (1966) in their study ‘ Availability versus accessibility of information in memory for words’ identified that cued recall was higher than non-cued recall. They provided their participants with lists of words which belonged to different categories. Half of the subjects were asked to recall the words with category names as cues and the other half without cues. The latter half was found to be able to recall more words when they were presented with cues.