**Human Memory Assignment: Unit Code: CBA940, completed by Lauren Robinson: student number: 5170019.**

**Introduction (A.C. 1.1)**

All research into memory is a hypothetical construct at its basis, as there is no physical representation of where it is stored. It denotes three distinguishable but interrelated processes, which are the three key foundations of all models, these are registration, storage and retrieval. Registration (or encoding) is the transformation of sensory input such as a sound (acoustic), semantic or a visual image into a form that allows it to be registered into memory. A real-world example that could be used is how a computer can only encode information if it is presented in a format that the computer recognises. Storage is the operation of holding or retaining information into memory, that is modified in the brain for easier storage. There are three forms of storage, consisting of sensory memory, short-term memory and long-term memory. Finally, retrieval is the process by which stored information is extracted from long term memory, there are three types of retrieval which are, free recall, cued recall and recognition. (*Gross, 2015*)

“Memory is the process of maintaining information over time” (*Matlin, 2005*) (*McLeod, 2013)*

Diagram

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This diagram shows the order that these three processes work in. (*McLeod, 2013)*)

**Difference between Short-Term and Long-Term Memory (A.C. 1.1 & 1.2)**

Short-term memory (STM) as well as Long-term memory (LTM) can be analysed in terms of three key aspects: capacity, duration and coding. Capacity refers to how much information that can be stored in the brain, duration is how long the information can be held in storage and finally coding is how sensory input is represented by the memory system. Although both STM and LTM work based on these three aspects, they are viewed to function differently. Looking at STM, capacity is viewed to hold seven bits of unrelated information, which can be increased through chunking. Ebbinghaus (1885) and Wundt (1860s) were two of the first psychologists to theorise this, however this was famously corroborated by Miller (1957) who wrote an article “The magical number seven, plus or minus two”, within this article he showed how chunking can be used to expand the limited capacity of STM by using pre-existing memory stores to encode new information. This wouldn’t present as an issue for LTM as capacity is theorised to be unlimited. Duration is described to hold roughly 15-30 seconds unaided, which can be increased by rehearsal. The Brown-Peterson technique (Peterson and Peterson, 1959) investigated the effects of preventing rehearsal, they instructed participants to remember various trigrams and then they were given a distractor task, such as counting backwords, in threes or out loud. Peterson and Peterson found that the longer the distraction, the less the participants were able to recall. (Figure 1) however they do believe that with maintenance rehearsal, information can be stored in STM almost indefinitely, with LTM suggesting several years to unlimited. Coding is mainly acoustic, with some semantic and visual aspects being possible. Conrad (1964) presented participants visually with six components, for three-quarters of a second. When asked to recall them, he found that mistakes were made due to ‘auditory confusion’ which suggested to him that STM is coded through auditory means. Similar tests have been conducted for LTM which found mainly semantic to be dominant, with visual, acoustic, olfactory and gustatory to all be present as well. Baddeley (1966) concluded that LTM encodes semantically in his experiment. He showed participants four lists of words that were acoustically similar (list A), acoustically dissimilar (list B), semantically similar (list C) and semantically dissimilar (list D). He found that when recall was given immediately, list A was recalled worse than list B, he found little difference between the recall of list C and D, which indicated that STM is encoded acoustically, however after a timeframe of 20 minutes. It was demonstrated that list C was recalled worse than list D, indicating that semantic LTM encoding was dominant due to the confusion of words with similar meaning. (Hill. G, 2010)

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(Fig 1) Representing the data reported by Peterson and Peterson in their experiment detailed above. (McLeod, 2018)

Atkinson and Shiffrin (1968, 1971) created the Multi-store Model (MSM) where they proposed there are three unitary memory stores, where they see sensory memory, STM and LTM as permanent structural components of the memory system. They believe that information is transferred between these stores in a linear sequence, this has been described as an information processing model and can be compared to the way a computer works, consisting of an input, process and output. The model system also comprises more transient control processes, of which rehearsal is key. There are two main functions of rehearsal, one of them is to act as a buffer between sensory memory and LTM by maintaining incoming information within STM, the other is to transfer information to LTM. Information from sensory memory can be easily fed into STM if a pattern recognition occurs, this will work by information being matched with something already stored in LTM.

This model within itself is a passive way of explaining memory and is quite simplified, however there is general agreement that there are key differences between STM and LTM and this model provides the basis for other models to advance on. It is described by Atkinson and Shiffrin that there is sensory memory, which is constantly taking in information from the five senses, however we do not pay attention to most of it. Whilst the capacity is very large, the duration is very brief, with it to be believed that most of the information is lost due to decay. However, if attention is applied to the information, it is then transferred over to STM. Information will only stay in the STM for a period of up to roughly 30 seconds, without any rehearsal, then it will be lost to displacement or decay. However, with maintenance rehearsal it is possible to expand the duration of remembering and transfer the information over to LTM. Elaborative rehearsal is a more effective way of keeping information in LTM by connecting it to something that is already known in LTM, making encoding an easier task to take place as the memories will have a stronger structure.

Fig 2 Title

Diagram

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This is a diagram of Atkinson and Shiffrin’s multi-store model (MSM) (*McLeod, 2017*)

Murdock (1962) investigated STM and LTM in his experiment ‘The serial position effect’ where he presented participants with a list of words between 10-40 and were shown between one to two seconds, they were required to free recall these words and it was evidenced that the probability of them recalling any of the words depended on its serial position. He found that words at the end of the list were often called out first and were more accurate, evidencing the recency effect, suggesting the words are being stored in the STM which can typically hold seven items, plus or minus two. As well as this, the words from the beginning of the list were also recalled well compared to those in the middle, however they were not as accurate as the words in the end of the list, this shows the primary effect which suggests that the words have reached the LTM. The poorest recall was seen to be the words in the middle, this could be theorised that this is due to the words being in the sensory memory for too long to be transferred over to STM and not long enough to be in LTM, this causes displacement and can be referred to as an asymptote. The serial position effect is shown to hold, regardless of how long the list may be.

Chart

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This figure is showing a typical serial position curve (McLeod, 2008)

This was further supported by (Glanzer and Cunitz, 1966) who constructed a variation of Murdock’s study, they presented two groups of participants with the same list of words. They instructed the first group to recall the words immediately, whereas they had the second group practice the Brown-Peterson technique by counting backwords in threes after 30 seconds, they found that the recency affect disappeared whilst the primary effect was largely unaffected. It is suggested that this was due to the earlier words having an opportunity to transfer into the LTM, however the most recent words were left vulnerable to the counting task (Eysenck, 1993)

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This Figure shows the Glanzer and Cunitz study in 1966

The study of brain- damaged patients also supports the MSM of memory as if STM and LTM are distinct within themselves, damage to different parts of the brain should impair one without affecting the other. Looking at the case study of H.M. by (Milner et al., 1968) he had been suffering seizures since he was 16 and at 27 underwent surgery to remove the anterior, two-thirds of his hippocampus, most of his amygdala and parts of the temporal lobe, they did this in hopes of elevating his epilepsy. This resulted in H.M. sustaining severe anterograde amnesia, whilst he showed preserved STM from before the surgery, he was unable to transfer new information into his LTM after the surgery. He was able to learn and remember perceptual and motor skills, although he could not recall them on his own incentive and had to be reminded each day of what skills he could perform. This supports Atkinson and Shiffrin’s MSM of memory as it illustrates very convincingly that there are two separate spheres where information is stored and retrieved.

**Evaluate at least two other models of memory (AC 2.1)**

The working memory model by (Baddeley and Hitch 1974) agreed on the basic structure of the MSM model, however they believed that it was much more complex and versatile with the central executive, visuospatial sketchpad, phonological loop, and episodic buffer all playing a part. They believed that the STM has different components which was confirmed by Shallice and Warrington (1970) where they studied a man called KF who sustained STM damage from an accident, it was shown that he could process numbers that were said, but not if he was shown them, this indicates that his audio memory is still there.

Semantic memory is a part of the LTM that involves the capacity to recall words, concepts or numbers that are essential to our understanding of language. Semantic memory involves our general knowledge, whereas episodic memory involves personal life experiences. Whereas procedural memory involves recollections of information we aren’t consciously

aware of, such as riding a bike, it is responsible for implicit memory. Going back to the previous study mention, HM was able to learn new motor skills by transferring it somewhere in his LTM but could not actually recall learning it himself, which shows the different aspects of STM and LTM being used.

Diagram

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This figure shows what (Baddeley and Hitch 1974) included within their model.

**Discussion of How to Improve Memory (A.C. 3.1)**

Elaboration is a strong strategy to use in order to improve memory, Craik and Tuiving (1975) found deep semantic level processing to increase recall in their study where they had participants process things in a semantic way or a structural and phonemic way. It showed that recall is much easier if we have made a more meaningful connection to the information we are trying to process and connected it with existing knowledge. Another example could be how Ley (1978) found patients remembered medical information better if they already had an existing medical background. Elaborating on information and connecting it to knowledge I already have will help me to transfer new information that I am learning in class to my LTM to use when required. I could use the method of Loki, when trying to lean a list, it would be easier to link each item to a place or route that I already know. Then I can recall on aspects of my LTM to remember the information I had stored in my STM. Imagery is also an effective way of improving memory, by imagining the information that requires processing into a mind map.

Another strategy could be improving consolidation, by limiting disruption and increasing the ability to focus and retain information. For example, Jenkins and Dallenbach (1924) found that participants had better memory recall when they went straight to sleep after learning new material. As well as McGeoch and MacDonald (1931) found the effects of interference to be high when two sets of material were learnt close together or were similar in nature.

The cognitive interview (Fisher & Geiselman, 1992) is a method that was devised to improve accounts of eyewitness testimonies, using these four basic principles; mental reinstatement, report everything, change order and change perspective, in practice these principles should improve recall. (McLeod, 2019)

**Conclusion**

In conclusion, there are many different models to explain STM and LTM as well as methods to improve memory, however there are limitations and strengths to all models and methods, there is not a model or a single method that covers everything that there is to know or one that can be proved to be absolute. All research into memory is as experiments, where we focus on whether it is replicable to indicate its reliability.

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