**Using the writing frame below answer the follow sections (Max 2000 words):**

Section 1: Explain, using models the differences between Short- Term and Long-Term memory (A.C. 1.1). You should use research evidence and studies to support your explanations e.g. Atkinson-Shiffin model (A.C. 1.2).

Section 2 : Evaluate at least two other models of memory e.g. Semantic memory or procedural memory (A.C. 2.1)

Section 3: Using your knowledge of memory and forgetting, discuss some ‘real world’ applications and methods of improving memory to aid your learning on this course or problems with eye-witness testimony (A.C.3.1).

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The Multi-Store model was created by Atkinson and Shiffrin in 1968. The model aims to display an abstraction of both how memory is encoded and stored in the mind as well as retrieved to conscious thought.

According to this model, stimulus in an environment when paid attention to is passed into Short-term memory which, with significant rehearsal, can be then transferred into Long-term memory. Information in Long-term memory can then be recalled into Short-term memory and passed into a response action.

The Multi-store model allowed for research to be done into the different characteristics between Short-term memory and Long-term memory, but Attkinson and Shiffrin were not the first to coin these terms, nor to attempt to categorise memory in this way. Miller’s famous 1956 article claims that Short-term memory holds 7±2 ‘chunks’ of information at a time, and this claim can backed up by a range of evidence. In Jacobs’ 1887 study, 443 female students from 8-19 years old were given a digit span test where they were asked to repeat aloud a string of numbers or letters in the same order while the length was gradually increased. Jacobs found that the average student recalled a span of 7.3 letters and 9.3 words, supporting Miller’s view.

Meanwhile it’s a lot more difficult to draw conclusions as to the capacity of Long-term memory, with most taking the view that it is potentially unlimited as no research to date has ever given a finite number (Tutor2u, 2021).

In terms of how memory is stored, Baddeley (1966) used semantically and acoustically similar and dissimilar words in order to understand how information was encoded, both in Short-term and Long-term memory. He found that participants did worse with acoustically similar words when tested immediately, while when they were tested after 20 mins they performed poorer with semantically similar words. This tells us that information in Short-term memory tends to be stored and rehearsed acoustically, while in Long-term memory it is stored semantically. This doesn’t mean that information is stored in these ways exclusively, however. Being able to recall vivid images or smells shows that Long-term memory is a system of varied types of encoding.

Rehearsal in the Atkinson-Shiffrin model was an early way of explaining how we are able to encode information, and to its credit makes intuitive sense – if we pay attention to things more, they should be remembered better. However, to draw the line there would be to do the mechanically immense processes of memory a disservice. Craik and Lockhart’s (1972) Levels of Processing model argues that when information is studied more deeply (e.g. studying a word on a semantic level) it is more likely to be remembered, with the inverse being true when it is not studied as deeply (e.g. on a phonetic/acoustic level). Their studies reveal that one of the main limitations of the Multi-store model is its instance on maintenance rehearsal and studies that focus on audio-visual stimuli, when many other types of rehearsal should exist, especially for stimuli like taste or smells which cannot be audio-visually rehearsed.

The Working Memory model (Baddeley and Hitch, 1974) expands on the idea of the single Short-term memory store presented in the Attkinson-Shiffrin model. In this model, independent processes are controlled and distributed by a central executive and is in a sense an abstraction of a person’s attentional system. It controls three kinds of informational stores; the visuospatial sketch pad, the episodic buffer, and the phonological loop. The visuospatial sketch pad and the phonological loop allow for visual and acoustic rehearsal respectively and account for more quirks and niche cases in the attempt to explain memory. The visuospatial sketch pad can be used to explain proprioception and the phonological loop explains why we repeat information to ourselves phonetically instead of other mediums when trying to encode information. The episodic buffer allows for information to be stored even while not being rehearsed.

This model is supported by numerous real-world case studies on patients with damage to different areas of their brain. KF (Shallice and Warrington, 1974) had a severely impaired Short-term memory, usually only able to recall one or two items in a list. However, for meaningful sounds KF showed a normal Short-term memory span, indicating that Short-term memory must rely on different stores of memory within Short-term memory – consistent with the Working-memory model. Furthermore, the model can be used to understand dyslexia, where psychologists can explain the phenomenon as a difficulty of converting visual information into auditory information.

Other case studies can be shown to display other kinds of memory not present in the Multi-store model. HM (Milner *et al*, 1968), another patient with brain damage, was unable to transfer new information into his Long-term memory. He still displayed however the ability learn new motor skills or Procedural memories, which cannot be inspected consciously and so he had to be reminded of them every day.

Hebb (1949) argued that memories are lost over time because they are not actively maintained. When learning takes place a structural change takes place in the brain and while it is still new it is liable to disruption. Disruption usually occurs due to interference, where new or old memories contradict or clash with new learning, or interruption, where we are drawn to new stimuli before the active trace has time to solidify. Through learning and maintenance a permanent structural trace is formed through neurochemical changes. Loftus and Loftus (1980) still argue however that this trace is still susceptible to decay if the information is not practised or maintained.

Although this theory sounds reasonable it’s important to remember that real-world application is vitally important for any model. As it stands, decay theory is impossible to test in a lab setting as it would require a participant to learn information and then do absolutely nothing for a long period of time. Furthermore, although some neurological decay can occur due to age and disease, there is no current evidence to suggest that the major form of forgetting Long-term memories is due to this fact (Solso, 1995).

Interference theory argues that when memories are being retrieved from Long-term memory the accuracy of their recall can be affected by prior or later learning. It distinguishes between Retroactive and Proactive interference, where later learning affects the recall of earlier learning and where earlier learning affects the recall of later learning respectively.

Studies with rats (Nader *et al*, 2000) also show that when memory is recalled and pulled back into Short-term memory it becomes unstable and likely to disruption and interference. This means that memory is not as permanent as it may appear and may cause unexpected consequences when memories are constantly recalled and interrogated. Kroes *et al* (2014) even went so far as to demonstrate that the memories of patients with severe depression can be modified by the use of electroconvulsive therapy. In the Access course, students will be tested on their recall of a range of information and expected to revise and rehearse this information prior. Interference can meddle in these moments, possibly implanting false or inaccurate information if the student is not careful.

It is for this reason that students on the Access course should always segment their learning by subject and try not to study similar subjects during a small frame of time. Baddeley and Hitch (1977) studied rugby players over a period of time and each week they would ask them to recall the names of teams that they had played against that season. They found that recall was not affect by the time since they had played against that team but the amount of games that they had played between then. Since this study reported on real life tests of memory outside of a laboratory setting it has high ecological validity, and therefore proves that interference can affect how memories are recalled.

Flashbulb memories also support this view that memories can be highly distorted. In moments of high intensity and extreme emotion people have a misplaced confidence in their ability to recall specific events (Chen, 2012). This can be dangerous when in comes to eyewitness testimony, where the testimony can lead to exaggerated reports and even false convictions. Furthermore, the recall of the testimony is still susceptible to disruption. Loftus and Palmer (1974) found that changing just one word in a leading question can massively skew participants recall and opinion of a car’s speed during a car crash.

It is in the same vein that context can have a large affect on a person’s ability to recall. Godden and Baddeley’s (1980) study of recall in different contexts tells us that learning and recalling in the same context is a tremendous boon as opposed to the inverse. Therefore, students in the Access course should be encouraged to learn, revise, and write in similar places in order to assist their recall. Discussion in class can also help here, as elaborative rehearsal can only help in the classroom, and any misconceptions or false beliefs can be made sure not to be rehearsed.

From this research it is safe to assume that the function of memory is much more complex than was first presented in Atkinson and Shiffrin’s model. While the Working-memory model can help alleviate some of its shortcomings, it is still clear that we a full abstraction of memory’s interdependent stores and structures.

**Word Count: 1,552**

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