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THE MULTI-STORE MODEL


**WHAT YOU NEED TO KNOW**

| Outline Atkinson & Shiffrin’s (1968) multi-store model of memory. |
| Outline and evaluate the key features of the model, including the sensory register, short-term memory and long-term memory store, in relation to: |
| - Coding |
| - Capacity |
| - Duration |
| Evaluate the multi-store model of memory. |

**Multi-Store Model**

Atkinson & Shiffrin (1968) proposed one of the earliest models of memory – the Multi-Store Model (MSM). They suggested that memory is made up of three components: sensory register (SR), short-term memory (STM) and long-term memory (LTM). According to the model, memories are formed sequentially and information passes from one component to the next, in a linear fashion.

Each of the three components has a specific type of coding, capacity and duration. **Coding** refers to the way in which information is changed and stored in memory. **Duration** refers to the length of time that information is held in the memory store and **capacity** refers to the amount of information that can be stored.

Information enters the sensory register via our senses. Our sensory register has an unknown (but supposedly unlimited) capacity and a very limited duration of less than one second (approximately 250 milliseconds). As information enters from all five senses the coding is modality specific and said to be raw, or unprocessed, information.
Information that is attended to is passed to STM, which has a limited capacity of 7+/-2 ‘chunks’ of information and a limited duration of approximately 20 seconds. Information in our STM is coded in an acoustic format. For example, if you were trying to remember a phone number, you might repeat the number over and over in your head.

Thereafter, rehearsed information is transferred to LTM, which has an unlimited capacity and a lifetime’s duration. Information in LTM is coded semantically (by meaning) and can be retrieved from LTM to STM when required.

<table>
<thead>
<tr>
<th></th>
<th>SENSORY REGISTER</th>
<th>SHORT-TERM MEMORY</th>
<th>LONG-TERM MEMORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPACITY</td>
<td>Unknown, but very large</td>
<td>Limited (7+/-2 ‘chunks’ of information) Jacobs (1887) Miller (1956)</td>
<td>Unlimited</td>
</tr>
<tr>
<td>DURATION</td>
<td>Very limited (approximately 250 ms)</td>
<td>Limited (20 seconds) Peterson &amp; Peterson (1959)</td>
<td>Lifetime/Years Bahrick (1975)</td>
</tr>
</tbody>
</table>

**Research Investigating the MSM**

The MSM of memory has been investigated extensively, and research has provided support for the different components of the model. For example, research by **Miller (1956)** supports the idea that our STM has a capacity of 7+/-2 ‘chunks’ of information; **Baddeley (1966)** supports the notion of different types of encoding in STM and LTM; **Peterson & Peterson (1959)** support the idea of a limited duration in STM and **Bahrick (1975)** supports the idea of an unlimited duration in LTM.

**Key Study: Miller (1956) ‘The Magical Number Seven, Plus or Minus Two’ Capacity of STM**

**Aim:** To investigate the capacity of STM.

**Method:** Literature review of published investigations into perception and STM, from the 1930s to 1950s.

**Results:** This existing research suggested that organising stimulus input into a series of chunks enabled STM to cope with about seven ‘chunks’, and this was why more than seven digits, words or even musical notes could be remembered successfully. When we try to remember a phone number, which has 11 digits, we chunk the information into groups, for example: 0767…819…45…34, so we only need to remember four chunks of information and not 11 individual digits.

**Conclusion:** Organisation (or ‘encoding’) can extend the capacity of STM and enable more information to be stored there, albeit briefly.

**Evaluating Miller (1956)**

- Miller’s (1956) theory is supported by psychological research. For example, Jacobs (1887) conducted an
experiment using a digit span test, to examine the capacity of STM for numbers and letters. Jacobs used a sample of 443 female students (aged from 8–19) from the North London Collegiate School. Participants had to repeat back a string of numbers or letters in the same order and the number of digits/letters was gradually increased, until the participants could no longer recall the sequence. Jacobs found that the students had an average span of 7.3 letters and 9.3 words, which supports Miller’s notion of 7+/−2.

- Although Miller’s (1956) theory is supported by psychological research, he did not specify how large each ‘chunk’ of information could be and therefore we are unable to conclude the exact capacity of STM. Consequently, further research is required to determine the size of information ‘chunks’ to understand the exact capacity of STM.

- Finally, Miller’s (1956) research into STM did not take into account other factors that affect capacity. For example, age could also affect STM and Jacobs’ (1887) research acknowledged that STM gradually improved with age.

**Key Study: Peterson & Peterson (1959) Duration of STM**

**Aim:** To investigate how different short intervals containing an interference task affect the recall of items presented verbally, and to infer the duration of STM.

**Method:** The participants were 24 male and female university students. The verbal items tested for recall were 48 three-consonant nonsense syllables (such as JBW or PDX) spelled out letter by letter. These have since been named ‘trigrams’. There were also cards containing three-digit numbers (such as 360 or 294). The researcher spelled the syllable out and then immediately said a three-digit number. The participant had to count down backwards in either 3s or 4s (as instructed) from that number. This was to prevent repetition of the trigram by the participant. At the end of a preset interval of between 3 and 18 seconds a red light went on and the participant had to recall the trigram.

**Results:** Peterson & Peterson found that the longer the interval the less accurate the recall. At 3 seconds, around 80% of the trigrams were correctly recalled, whereas at 18 seconds only 10% were correctly recalled.

**Conclusion:** STM has a limited duration of approximately 18 seconds. Furthermore, if we are unable to rehearse information it will not be passed to LTM, providing further support for the MSM and the idea of discrete components.

**Evaluating Peterson & Peterson (1959)**

- Peterson & Peterson used a sample of 24 psychology students, which is an issue for two reasons. Firstly, the psychology students may have encountered the MSM of memory previously and therefore may have demonstrated demand characteristics by changing their behaviour to assist the experimenter. Secondly, the memory of psychology students may be different from that of other people, especially if they had previously studied strategies for memory improvement. As a result we are unable to generalise the results of this study to non-psychology students.

- Furthermore, it could be argued that Peterson & Peterson’s study has low levels of ecological validity. In this study participants were asked to recall three-letter trigrams, which is unlike anything people
would want to memorise in their everyday lives. As a result we are unable to apply these results to everyday examples of memory and are unable to conclude if the duration of STM may be longer for more important information, such as a vital phone number.

- However, Peterson & Peterson’s study was **highly controlled** and took place in a laboratory of Indiana University. As a result Peterson & Peterson had a high degree of control for extraneous variables, which makes their procedure easy to replicate to test reliability.

**Key Study: Bahrick (1975) Duration of LTM**

**Aim:** To investigate the duration of LTM.

**Method:** 392 American university graduates were shown photographs from their high school yearbook and for each photograph participants were given a group of names and asked to select the name that matched the photographs.

**Results:** 90% of the participants were able to correctly match the names and faces 14 years after graduating and 60% of the participants were able to correctly match the names and faces 47 years after graduation.

**Conclusion:** Bahrick concluded that people could remember certain types of information, such as names and faces, for almost a lifetime. These results support the MSM and the idea that our LTM has a lifetime duration (at least 47 years), and is semantically encoded.

**Evaluating Bahrick (1975)**

- Bahrick’s research used a sample of 392 American university graduates and therefore lacks **population validity**. Psychologists are unable to generalise the results of Bahrick’s research to other populations, for example students from the UK or Europe. As a result, we are unable to conclude whether other populations would demonstrate the same ability to recall names and faces after 47 years.

- Furthermore, Bahrick found that the accuracy of LTM was 90% after 14 years and 60% after 47 years. His research is unable to explain whether LTM becomes less accurate over time because of a limited duration, or whether LTM simply gets worse with age. This is important because psychologists are unable to determine whether our LTM has an unlimited duration (like the MSM suggests), which is affected by other factors such as getting old, or whether our LTM has a limited duration.

- Finally, it could be argued that Bahrick’s study has high levels of **ecological validity** as the study used real-life memories. In this study participants recalled real-life information by matching pictures of classmates with their names. Therefore, these results reflect our memory for real-life events and can be applied to everyday human memory.

**Overall Evaluation of the MSM**

- Support for the MSM comes from the case study of **Clive Wearing**, who contracted a virus that caused severe amnesia (memory loss). Following the virus, Wearing could only remember information for 20-30 seconds; however, he was able to recall information from his past, for example his wife’s name. Wearing was unable to transfer information from his STM to his LTM, but was able to retrieve information successfully. Wearing’s case supports the idea that memories are formed by passing information from one store to the next in a linear fashion and that damage to any part of the MSM can cause memory impairment.

- Further support for the MSM comes from psychological studies. For example, Miller (1959) supports
the idea of a limited capacity of 7+/−2 chunks of information in STM; Peterson & Peterson (1959) support the idea of a limited duration in STM, of approximately 20 seconds and Bahrick (1975) supports the idea of a lifetime duration in LTM. All of these studies support the different elements of the MSM and therefore suggest that the model is an accurate representation of human memory.

- **Baddeley and Hitch (1974)** developed the working memory model (WMM) as an explanation of the complexity of STM and a way of explaining some of the research findings that could not be accounted for by the MSM, for example parallel processing (multi-tasking). [These will be covered in a later section.]

- Finally, evidence from brain scans has shown that different areas of the brain are active when performing STM tasks (hippocampus and subiculum) and LTM tasks (motor cortex). The hippocampus is also involved in transferring short-term memories into long-term memories. This suggests that different brain regions are responsible for the different components of the MSM, supporting the idea that our memory is made up of discrete stores.

**Extension Evaluation: Issues and Debates**

- The MSM takes a **nomothetic approach**, trying to create a universal model to explain the process of human memory. An **idiographic**, individual approach that used examples of real-life remembering may result in a more complex (and arguably more accurate) picture of memory.

- Research examining the MSM is a clear example of **experimental reductionism**, as it attempts to explain a complex behaviour by relying on isolated variables operationalised in laboratory experiments (e.g. the capacity of STM or the duration of STM). However, as memory is a complex phenomenon, many psychologists argue that reducing memory to isolated variables undermines the complexity of human memory.

**Possible Exam Questions**

1. Define what is meant by the term coding. (2 marks)

2. Define what is meant by the term capacity. (2 marks)

3. Define what is meant by the term duration. (2 marks)

   **Exam Hint:** While students are often able to define these key terms accurately, many students fail to pick up a second mark as they struggle with the elaboration of their definition. An easy way to ensure that students secure the full marks is to provide an example related to the sensory register, STM or LTM. For example, coding refers to the way in which information is changed and stored in memory. Information in STM is coded in an acoustic format.

4. Complete the following table, adding the missing information (A, B, C and D) in relation to the features of the multi-store model.

<table>
<thead>
<tr>
<th></th>
<th>SENSORY REGISTER</th>
<th>SHORT-TERM MEMORY</th>
<th>LONG-TERM MEMORY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAPACITY</strong></td>
<td>A</td>
<td>7 +/- 2</td>
<td>Unlimited</td>
</tr>
<tr>
<td><strong>DURATION</strong></td>
<td>B</td>
<td>C</td>
<td>Lifetime</td>
</tr>
<tr>
<td><strong>CODING</strong></td>
<td>Raw (Unprocessed) / Modality Specific</td>
<td>Acoustic</td>
<td>D</td>
</tr>
</tbody>
</table>

5. Describe how psychologists have investigated the duration of STM. (4 marks)
Exam Hint: The key word to note in this question is ‘how’. Students are expected to describe how researchers have conducted their research – the method – in detail. Therefore, students might outline the method of Peterson & Peterson by explaining what the participants were required to do and how duration was measured in this study.

6. Outline two differences between the STM and LTM. (4 marks)

7. According to Atkinson and Shiffrin the STM and LTM are very different. Outline how research has demonstrated the difference between STM and LTM. (4 marks)
   Exam Hint: For this question students need to link the research (e.g. Peterson & Peterson and Bahrick) to the question and say how the results from these two studies show that the STM and LTM are different.

8. Laura still uses an old-fashioned phone book and wanted to phone her colleague Joseph. She looked up his number but, before she dialled the number, she got distracted by her husband and had a short conversation with him. When she looked at her phone she had completely forgotten Joseph’s number.

   Use your knowledge of the multi-store model to explain why Laura forgot Joseph’s number. (4 marks)
   Exam Hint: Sometimes students get confused with application questions such as this and focus on SR, attention and STM, when in fact the answer requires students to focus on STM, rehearsal and LTM. Furthermore, some students mention the concepts of maintenance and elaborative rehearsal that are not part of the original MSM. These were introduced by Craik & Lockhart (1972) as a criticism of the MSM, which simply relied on rehearsal.

9. Many cognitive psychologists have criticised the multi-store model, as it fails to explain memory in everyday life. For example, students often spend hours and hours reading through their revision notes, but struggle to retain the information. However, these same students can remember information found on social media even though they have only seen it once. Explain why this information presents a criticism of the multi-store model of memory. (4 marks)
   Exam Hint: To answer this question effectively, students are required to focus on the two types of information (revision notes and social media) and link these to a criticism of the MSM.

10. Outline and evaluate the multi-store model of memory. Refer to research evidence in your answer. (12/16 marks)
    Exam Hint: With this question, students need to be careful when evaluating the model. For example, when using case studies (HM, KF or Clive Wearing), students need to ensure that they explain whether or not these support the MSM.
# CHECKLIST

<table>
<thead>
<tr>
<th>Specification</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Types of long-term memory</strong></td>
<td>Types of long-term memory: episodic, semantic, procedural.</td>
</tr>
<tr>
<td><strong>The working memory model</strong></td>
<td>The working memory model: central executive, phonological loop, visuo-spatial sketchpad and episodic buffer. Features of the model: coding and capacity.</td>
</tr>
<tr>
<td><strong>Explanations for forgetting</strong></td>
<td>Explanations for forgetting: proactive and retroactive interference and retrieval failure due to absence of cues.</td>
</tr>
<tr>
<td><strong>Eyewitness testimony</strong></td>
<td>Factors affecting the accuracy of eyewitness testimony: misleading information, including leading questions and post-event discussion; anxiety.</td>
</tr>
<tr>
<td><strong>The cognitive interview</strong></td>
<td>Improving the accuracy of eyewitness testimony, including the use of the cognitive interview.</td>
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</tbody>
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