2d. Memory - Atkinson-Shiffrin

Atkinson-Shiffrin's multi-store model of memory

Human memory: a collection of interconnected and interacting systems, each of which has distinguishable functions and is represented throughout the brain by different neural mechanisms.

- This means that we do not have a memory — we have different *memory system*

All models refer to memory as involving 3 fundamental processes:

1. **Encoding: conversion of information into a usable form so that it can be neurologically represented ('placed') and stored in memory**
2. **Storage: retention of the encoded information over time**
3. **Retrieval: recovery of stored information and bringing into conscious awareness for use when needed.**

Key processes of the multi-store model:

1. **Control processes:**

- **Control processes are selected and used by each individual and may vary in different situations.**
- **They are under the conscious 'control' of the individual and which control process is used**
- **ds on what the individual does.**
- E.g. Attention, rehearsal and retrieval are all control processes

2. **Structural features:**

- **Structural features are the permanent, built-in fixed features of memory that do not vary from one situation to another.**

- The three different stores are the basic structural features (Short term store, long term store and sensory store)
- Other structural features include the amount of information each store can hold at any given moment (i.e. storage capacity) and the length of time information can be held by each component (i.e. storage duration).

Sensory Memory

Overview:

Types of sensory memory:

- Iconic memory
- Echoic memory

Capacity and duration of LTM:

- Capacity of both iconic memory and echoic memory is unlimited
- Echoic memory has a greater duration than iconic memory
- Duration of sensory memory = 0.2-4 seconds

Sensory memory: A very brief memory store (like a computer's buffer)**. Information enters this register and is then transferred to STM.**

- **According to the multi-store model of memory, sensory memory is the first stage of memory. Sensory memory relates to memory within our sense organs.**
- **It is where information in our environment is received by our senses.**
- **Sensory memory has an unlimited capacity but only a very brief duration.**

Function:

- Information held in sensory memory has not yet entered our awareness and, if we don't pay attention to it, it never will.
- Sensory memory prevents us from being overwhelmed by the huge amounts of incoming sensory information.

- Duration is very brief, but long enough for our brain to determine whether the incoming sensory information is important enough to be transferred to our short-term memory.

Types of sensory memory:

- **Iconic memory: refers to visual sensory memory. (Icon is from the Greek word meaning 'image'.)**
- **Echoic memory: refers to our auditory (sound) sensory memory.**

Practice questions:

Explain the role of iconic memory in assisting us to see our surroundings as continuous rather than disjointed images (2 marks).

Iconic memory stores impressions of images for 1/3 of a second, allowing each impression to slightly overlap the next. This is long enough for us to link the impressions of the image to the next image we see, so that when we pay attention to them (and transfer them to long term memory), we are able to make sense of the world as continuous

Explain the role of echoic memory in assisting us to hear sounds as meaningful words rather than a jumble of unrelated sounds (2 marks).

Echoic memory stores impressions of sounds for 3-4 seconds for each impression to slightly overlap the next. 3-4 seconds is long enough for us to be able to link impressions of sound with the next syllable or word we hear, so when we pay attention to them (transfer them to STM) we are able to make sense of the sounds as a word or the words as a sentence.

Short-term memory (STM)

Overview:

Capacity and duration of STM:

- Capacity = 7+/- 2 bits of information

- Duration = between 12 to 18 seconds/30 secs

Increasing duration:

- Maintenance rehearsal

Transferring information from STM to LTM:

- Elaborative rehearsal

Short term memory: a memory system with limited storage capacity in which information is stored for a relatively short time, unless renewed in some way.

- STM stores information temporarily, but for a longer time than sensory memory (and less than LTM).
- In STM, information is no longer exact replica of the sensory stimulus, but an encoding (or representation) of one. This may be in a *verbal* form (words, numbers) or *non-verbal* form.
- When you pay attention to information in sensory memory, or retrieved info from LTM, the info enters STM.
- STM holds all information you are currently aware of at any moment in time. E.g. the feeling of something rubbing against your shoulder will not enter STM until you direct you attention to it.
- STM is the place where all conscious perceiving, thinking, feeling, reasoning and other mental processes take place

Duration of STM:

- Most STM info can be retained for a few seconds

Capacity of STM:

- Compared to sensory memory, STM has very limited storage.
- The limit of STM is range of 7 ± 2 units. (Difficulty problem-solving when more than this)

Decay and Displacement:

Decay of information in STM occurs when information is not maintained by rehearsal – information fades away with time.

- E.g. You may forget what you want to say next in a conversation, while you wait for someone else to stop talking.

Displacement occurs when new information pushes out old information.

- E.g. Forgetting someone's name just after you meet them. You many engage them in a conversation rather without rehearsing their name.
- When STM is 'full', new items can only enter by pushing an old item out.

STM as working memory:

Working memory emphasises the part of memory where information is temporarily held and actively 'worked on' as we undertake our everyday tasks.

- Enables us to consciously use information from both sensory memory and LTM.
- Information from sensory memory is processed in working memory and information is retrieved from LTM to perform mental processes.
- E.g.
    - interpreting emotions and feelings
    - language comprehension
    - daydreaming
    - problem-solving
    - reasoning, planning and decision making

Rehearsal of information:

- **Rehearsal is the process of consciously manipulating information to keep it in STM, to transfer it to LTM or to aid storage and retrieval.**

- Information can be kept in STM (or working memory) for longer than the usual maximum of about 18 to 30 seconds if it is rehearsed.

Maintenance rehearsal: involves repeating the information being remembered over and over again so that it can be retained (or 'maintained') in STM (or working memory).

- Can involve simple repetition of words or visual or spatial information such as images or 'mental maps'.
- While maintenance rehearsal is an effective strategy for retaining information in STM, it does not assist in encoding information for more permanent storage in LTM.

Elaborative rehearsal: the process of linking new information in a meaningful way with other new information or information already stored in LTM to aid in its storage and retrieval from LTM.

- Involves focusing on the meaning of the information.
- E.g. Rather than 'memorising' the definition of memory for the end-of-year exam by repeating the definition aloud/writing it down over and over again, your ability to recall the definition will be enhanced if you link it to learning and think about the nature of its relationship to learning.

Long-term memory

Overview:

Types of long term memories:

- Declarative/Explicit
- Semantic
- Episodic
- Non-declarative/Implicit
- Procedural
- Classically conditioned memories

Capacity and duration of LTM:

- Relatively permanent store

Long term memory: a memory system that stores large amounts of information for a very long time – possibly permanently.

- Comprises of two different systems called declarative/explicit and non-declarative/implicit memory.

Capacity and Duration of LTM:

- Capacity:
- Vast, potentially unlimited
- Duration:
- Potentially permanent
- Some information may be lost or inaccessible over time

Explicit and Implicit memory:

The way memories are retrieved from LTM (with or without conscious awareness) helps us further classify memory as either:

Explicit memories: when information CAN be consciously or intentionally retrieved and stated. Declarative memories are examples of explicit memories.

- The LTM of specific facts and events most of which can be stated or 'declared'.
- Procedural memory is 'knowing how'
- Explicit memory is 'knowing that'
- Examples:
    - Identifying a type of flower
    - Explaining a statistic formula
    - Remembering what you ate last night
    - Recalling the capital of France

- Recalling a happy or sad event from the past

1. **Episodic memory: explicit memory for personally experienced events.**

- A mental 'personal' diary with records of 'autobiographical' episodes we directly or indirectly experience.
- Event details include:
  - time
  - place
  - psychological and physiological state of the person
- Episodic memory examples:
- Your memory of the opening ceremony of the last Olympic games
- How you felt during a trip to the dentist last week
- What you ate for dinner last night and how it tasted
- Your memory of your first day at school
- Your birthday party
- Recalling an episode of your life

2. **Semantic memory: declarative memory for facts or knowledge.**

- Unlike episodic memories, semantic memories are NOT tagged with details of time and place.
- For example:
- Knowing that humans are mammals
- Knowing that January is first month of the year
- Knowing that the word 'assist' means help
- Knowing the 'i' comes before 'e' except after 'c' rule
- Shows facts or knowledge

Implicit memories: when remembering something does not involve conscious or intentional retrieval but can be expressed through actions or behaviour.
Procedural memories also represent implicit memories.

- Implicit memory involves memory that does not require conscious or intentional retrieval.
- You are not aware that you are remembering and it occurs effortlessly.
- The term ‘implicit memory’ is used because the existence of a specific memory can be ‘implied’ (or inferred from) responses that can be observed.
- Implicit memories are also referred to as *non-declarative* memories because people find it difficult to describe in words (‘declare’) what is being remembered.
- Examples include:
    - Motor skills like brushing your teeth (procedural)
    - Fears and taste aversions (classically conditioned) - entering fight-flight-freeze response without conscious awareness.

1. **Procedural memory: The LTM of actions and skills that have been learned previously.**

- "How to do something" memories (think procedure = method)
- Sometimes called 'skills' or 'habits'
- How to:
    - Brush your teeth
    - Tie your shoelaces
    - Access the internet
    - Serve a tennis ball
    - Ride a bike

2. **Classically conditioned memory: Conditioned responses (CR) to conditioned stimuli (CS) acquired through classical conditioning are also considered to be a type of implicit memory.**

- For example: fear/anxiety at the sight of a spider involves an implicit memory whether or not you have an explicit/declarable recollection of the past event that led to that fear.

- Simple conditioned reflex responses involve implicit memory.
- For example: salivating to the sound of a bell that has been acquired through classical conditioning will occur automatically without conscious awareness in response to a relevant stimulus.

Practice question:

Using an example, distinguish between episodic and semantic memory (2 marks).

Episodic memory is the explicit memory store for specific events/personal experiences associated with a time and place (E.g. Your birthday party), whereas semantic memory is the explicit memory store for facts about the world that are not associated with a time or place (E.g. Donald Trump is the president of America)