Memory: sensory and working memory

Psychology ATAR Unit 3

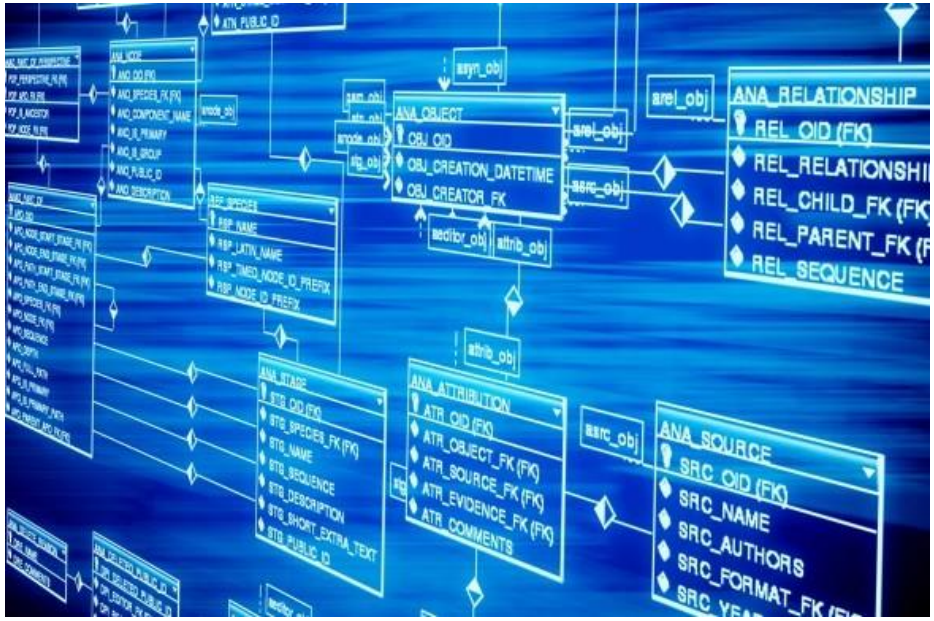
Chapter 11 pg. 260-264
Chapter 14 pg. 340-341

Memory

- Memory: an active system that receives information from the senses, organizes and alters that information as it stores it away, and then retrieves the information from storage

Memory systems

Until recently, memory has been compared to a computer and defined by an **information-processing model.** In this model there are 3 stages: Encoding, storage & retrieval



Memory systems

Encoding

- Information is changed from raw sensory data into a usable form that the brain can process
- Information is encoded visually, acoustically or semantically (word meaning)

Storage

- The retention of information in the brain's neural pathways

Retrieval

- Information is retrieved/ taken out of storage when needed

Memory systems

Atkinson and Shiffrin (1968) elaborated on this model and proposed that information goes through three stages:

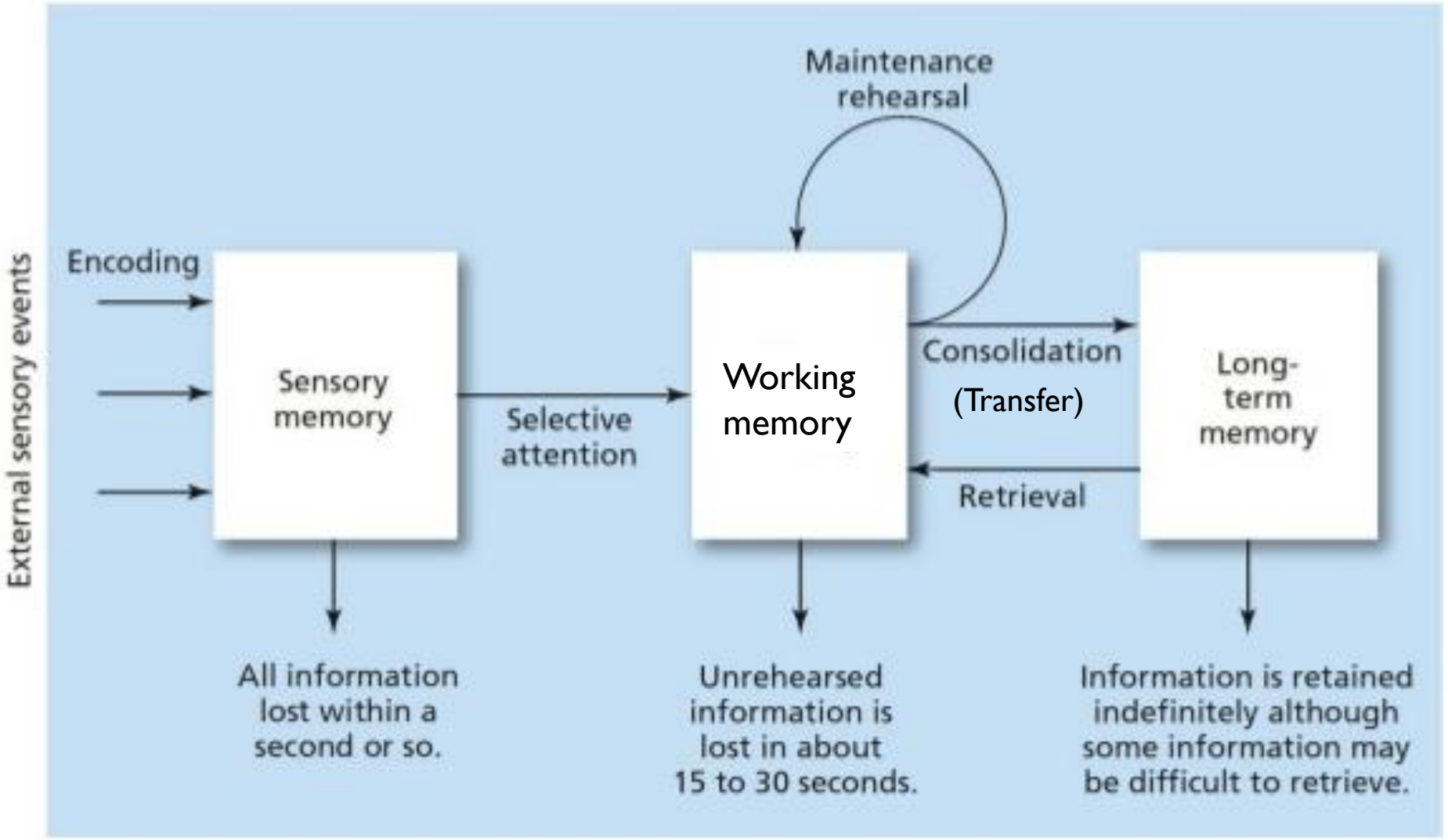
1. Sensory memory
2. Short-term memory
3. Long-term memory

Today, researchers have integrated these ideas and suggest that memory is created by a collection of systems, working interdependently. There is no one portion of the brain solely responsible for all memory, though there are certain regions related to specific memory sub-systems.

Multi-store model

- Memory is made up of multiple systems that interact with each other.
- Each memory system can also work independently.
- Each system differs in function, capacity and duration.

Multi-story model: an overview



Sensory memory

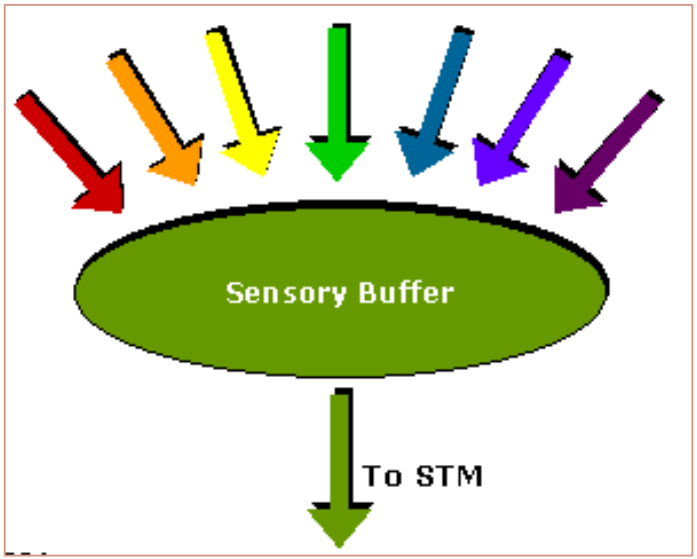
Specific to

- Visual memory (iconic)
- Auditory memory (echoic)

Duration

- Brief retention rates:
  - Iconic: 1/3 second
  - Echoic: 3-4 seconds

Sensory memory



Capacity

- Large

Information

- Is meaningless unless it is selected for further processing in working memory (WM)
- We are unconscious of what enters sensory memory but become conscious of what goes into WM

Working memory

A short term memory system used to store and process the information that we are currently thinking about.

Duration

- Stores information longer than sensory memory:
  - Lasts about 18 seconds

Capacity

- Small – 7 plus or minus 2 items (Miller, 1956)

Working memory

Information

- Can be retained longer if it is reviewed and repeated consciously – information is encoded accoustically (sound)
- Imagining, problem solving, analysis, reasoning, comprehending, planning
- Chunking can increase WM capacity ie. looking for patterns or grouping information

Examples

- When we read we hold the first words in WM while we process the rest of the sentence
- We also use it in mental maths e.g. 5+7+12=?

Activity

- Is 3 x 3 + 4 = 13? (yes or no) FRUIT

- Doing calculations uses your working memory
- Having to remember the word also uses working memory
- Remember the magic number of
  7 +/- 2
- See if you can chunk the information to improve your retention of the words.

Activity

- Is 16 / 4 – 1 = 3? AIRPLANE
- Is 10 / 2 + 4 = 9? ROAD
- Is 12 / 4 – 3 = 5? GREEN
- Is 10 / 5 + 6 = 8? LUNCH
- Is 2 x 3 – 2 = 3? APPLE
- Is 20 + 2 / 2 = 20? SKY
- Is 15 / 5 + 4 = 7? COMPUTER
- Is 13 – 2 + 5 = 17? CRAZY
- Is 10 – 2 x 2 = 6? SANDWICH
- Is 9 / 3 – 2 = 1? DOG

WM model: Baddeley & Hitch

Baddely & Hitch propose that there are four subsystems to working memory:

1. Phonological loop (verbal working memory)
2. Visuospatial sketchpad (visual & spatial working memory)
3. Epidosic buffer
4. Central executive

WM model: Baddeley & Hitch

Phonological loop

- Stores a limited amount of sounds/words
- Information can be kept active through sub-vocal rehearsal

Visuo-spactial sketchpad

- Stores visual and spatial information
- Essential for mental imagery and spatial reasoning

Example: locating a glass in the kitchen without looking at it

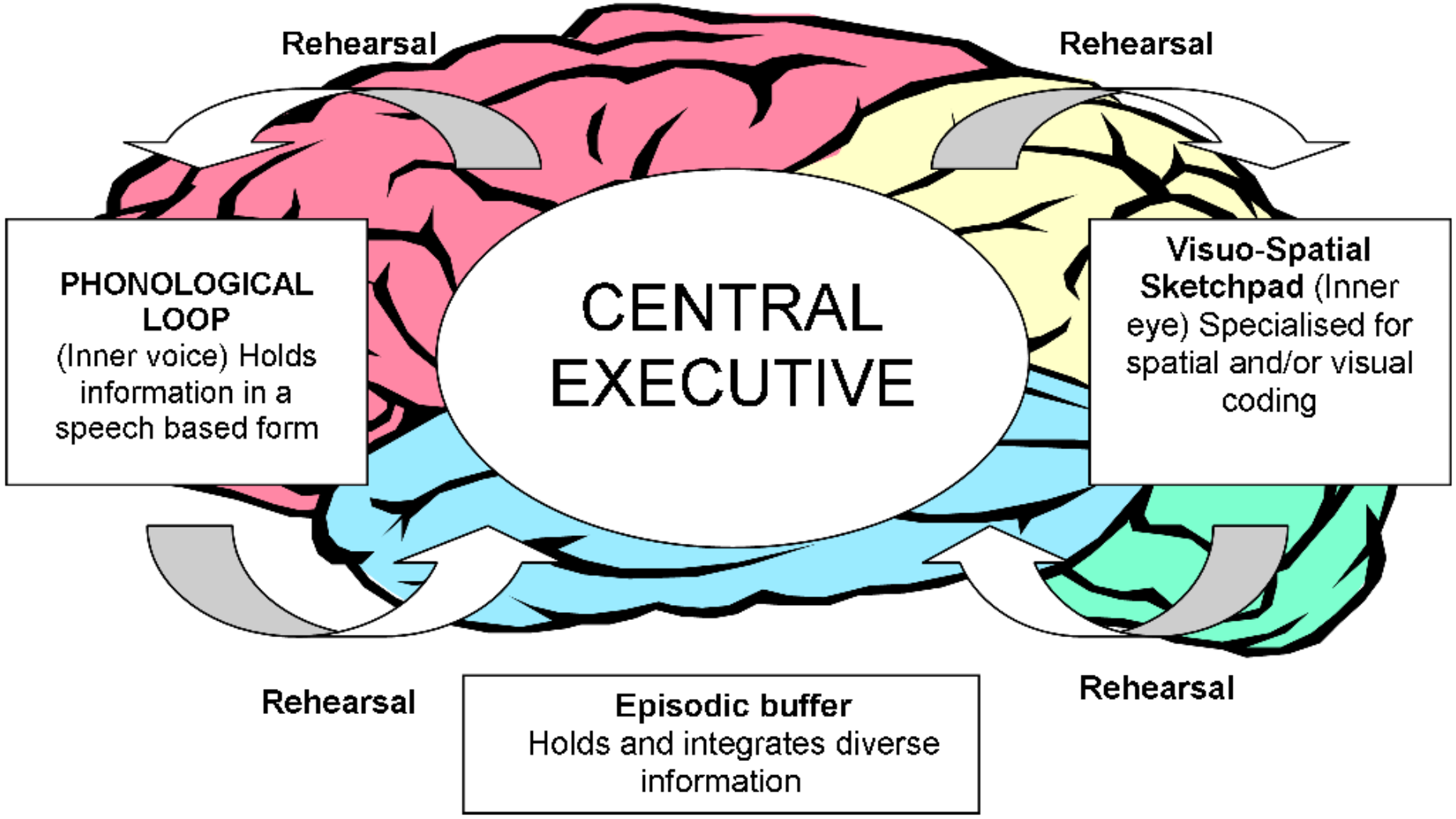
WM model: Baddeley & Hitch

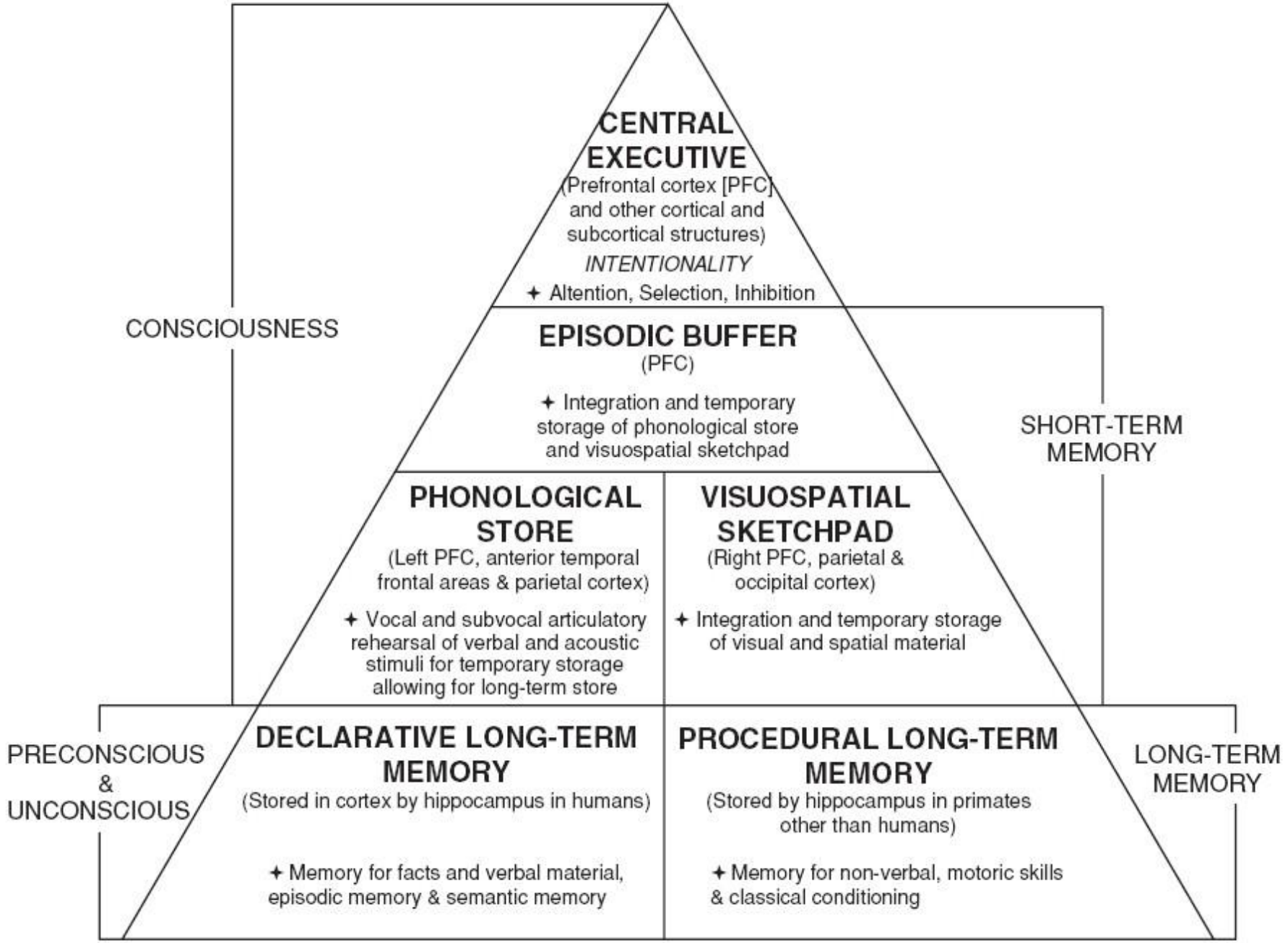
Episodic buffer

- Temporary store that integrates information from the phonological loop, visuospatial sketchpad and long term memory

Central executive

- Coordinates activities between the phonological loop, visuospatial sketchpad and episodic buffer
- Allocates attention and directs cognitive efforts
- It plans and coordinates but does not store information


Rehearsal
Rehearsal
PHONOLOGICAL LOOP
(Inner voice) Holds information in a speech based form
CENTRAL EXECUTIVE
Visuo-Spatial Sketchpad (Inner eye) Specialised for spatial and/or visual coding
Rehearsal
Rehearsal
Episodic buffer
Holds and integrates diverse information


CENTRAL EXECUTIVE
(Prefrontal cortex [PFC] and other cortical and subcortical structures)
INTENTIONALITY
✦ Altention, Selection, Inhibition
CONSCIOUSNESS
EPISODIC BUFFER
(PFC)
✦ Integration and temporary storage of phonological store and visuospatial sketchpad
SHORT-TERM MEMORY
PHONOLOGICAL STORE
(Left PFC, anterior temporal frontal areas & parietal cortex)
✦ Vocal and subvocal articulatory rehearsal of verbal and acoustic stimuli for temporary storage allowing for long-term store
VISUOSPATIAL SKETCHPAD
(Right PFC, parietal & occipital cortex)
✦ Integration and temporary storage of visual and spatial material
PRECONSCIOUS & UNCONSCIOUS
DECLARATIVE LONG-TERM MEMORY
(Stored in cortex by hippocampus in humans)
✦ Memory for facts and verbal material, episodic memory & semantic memory
PROCEDURAL LONG-TERM MEMORY
(Stored by hippocampus in primates other than humans)
✦ Memory for non-verbal, motoric skills & classical conditioning
LONG-TERM MEMORY

Working memory: rehearsal

There are 2 types of rehearsal:

- Maintenance rehearsal
- Elaborative rehearsal

Maintenance rehearsal

- Remembering information for immediate use

Example: telephone number

- Repeating it aloud or in your head - does not transfer into LTM

Working memory: rehearsal

Elaborative rehearsal

- Actively processing and encoding information into LTM

Example: Associating the telephone number with another one you already know – finding patterns

- Trying to make the information more meaningful so that it can be remembered over time

Consolidation theory

- This theory suggests that information that is transferred from WM to LTM needs a consolidation time
- Neurons in the brain change physically when new information is learned and stored
- These physical changes lead to a new memory being formed
- This process takes about 30 minutes
- If the memory is disrupted during this time it may be lost or stored incorrectly

Interaction between WM & LTM

Serial position effect

- The effect of an item's position in the list on how well it is recalled.
- In a long list of items, the first and last items are remembered best

Primacy effect

- First items on a list receive more rehearsal and are more likely to be transferred to long term memory (LTM)

Recency effect

- The last items are remembered because they are still in the person's working memory

Crash Course

Learning (10 min)

https://www.youtube.com/watch?v=128Ts5r9NRE&index=12&list=PL8dPuuaLjXtOPRKzVLY0jJY-uHOH9KVU6

Memory (10 min)

https://www.youtube.com/watch?v=bSycdIx-C48&index=13&list=PL8dPuuaLjXtOPRKzVLY0jJY-uHOH9KVU6

Remembering and forgetting (10 min)

https://www.youtube.com/watch?v=HVWbrNIs-Kw&index=14&list=PL8dPuuaLjXtOPRKzVLY0jJY-uHOH9KVU6