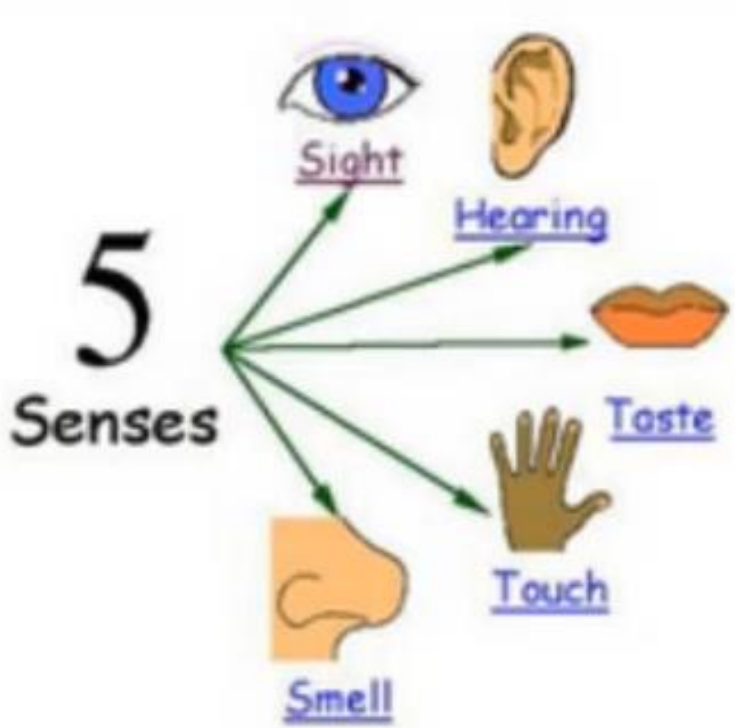
Unit 2:
Understand the Human

Input Output Channels In HCI



Topics Covered

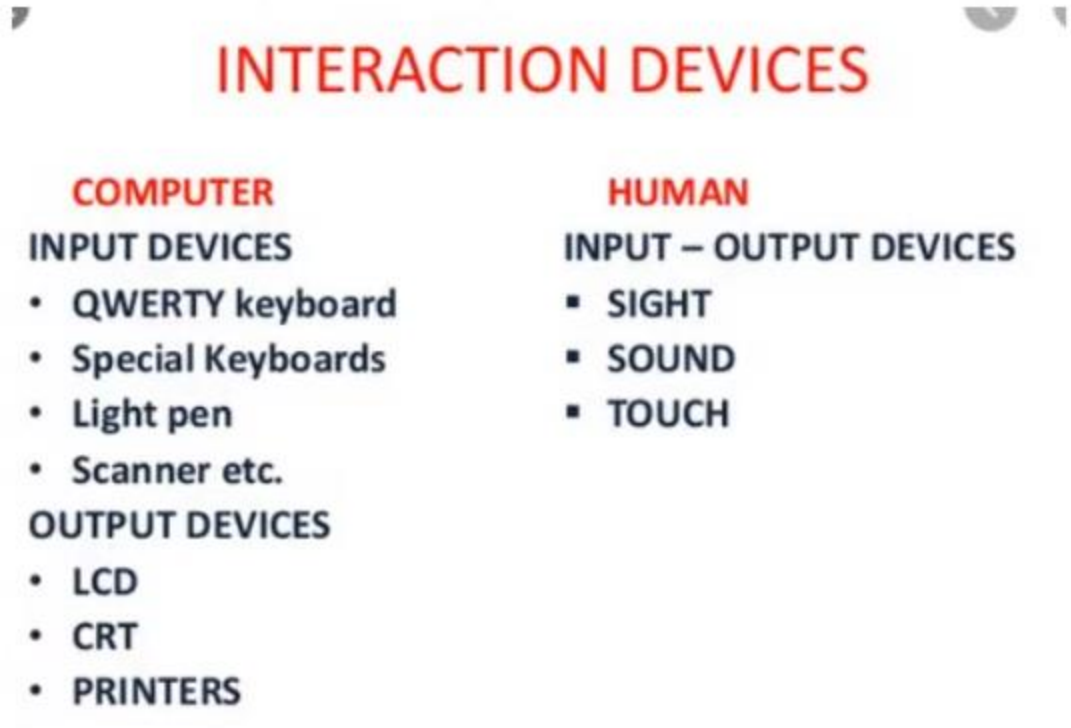
1. What is Input Output Channel?
2. Five major senses of the Human
3. Example of Input Output Channel
4. Input Output Channel: Vision
5. Input Output Channel: Vision Perception
6. Input Output Channel: Hearing
7. Input Output Channel: Touch

What is Input Output Channel?

- A person's interaction with the outside world occurs through information being received and sent: input and output.
- In an interaction with a computer the user receives information that is output by the computer, and responds by providing input to the computer.
- So, the user's output becomes the computer's input and vice versa.
- Input in the human occurs mainly through the senses and output through the motor control of the effectors.

Five major senses of the Human

1. Sight,
2. Hearing,
3. Touch,
4. Taste and
5. Smell.



Of these, the first three are the most important in HCI.

Test and Smell do not currently play a significant role in HCI.

Example of Input Output Channel

- Imagine using a personal computer (PC) with a mouse and a keyboard.
- The application you are using has a graphical interface, with menus, icons and windows.
- In your interaction with this system you receive information primarily by **sight**, from what appears on the screen.
- However, you may also receive information by **ear**: for example, the computer may 'beep' at you if you make a mistake.
- You yourself send information to the computer using your **hands**, either by hitting keys or moving the mouse.
- **Sight and hearing** do not play a direct role in sending information in this example.
- Although they may be used to receive information from a third source (for example, a book, or the words of another person) which is then transmitted to the computer.

Example of Input Output Channel

- Again, human considered as *information processor*
- **Input** channels are the five senses
  - With some more important than others
  - For hci, vision primarily
- **Output** channels are human effectors
  - E.g., limbs, fingers, head, vocal system

Input Output Channel: Vision

1. Vision :

Human vision is a highly complex activity with a range of physical and perceptual limitations, yet it is the primary source of information for the average person.

- Vision begins with light.
- The eye is a mechanism for receiving light and transforming it into electrical energy.
- Light is reflected from objects in the world and their image is focused upside down on the back of the eye.
- The receptors in the eye transform it into electrical signals which are passed to the brain.

Example: Vision Perception

- **Preserving Size & Depth:**

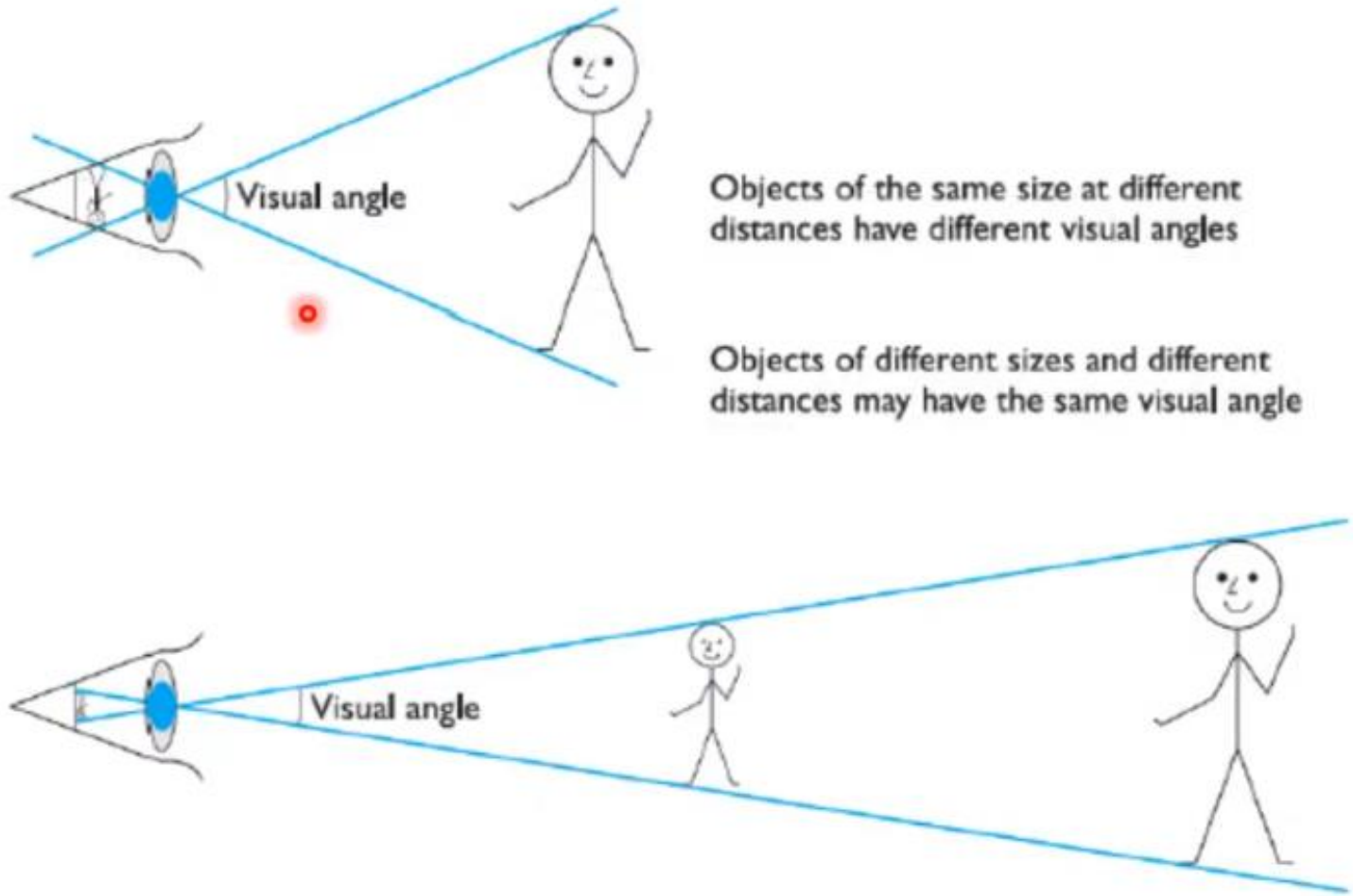


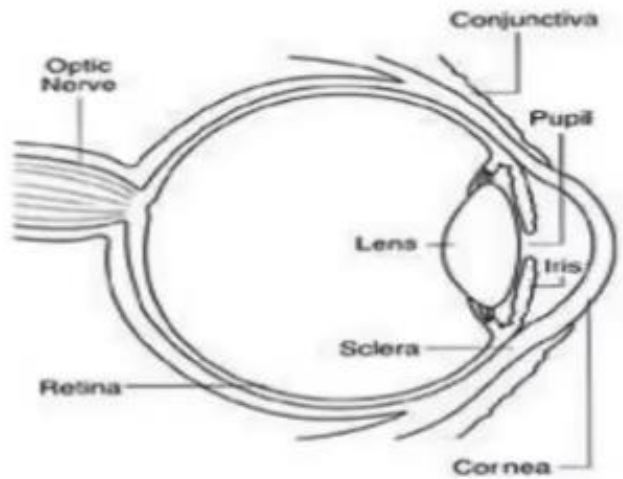
Figure 1: Visual Angel

Input Output Channel: Vision Perception

➢Perceiving brightness:

- A second aspect of visual perception is the perception of brightness.
- Brightness is in fact a subjective reaction to levels of light.
- It is affected by **luminance** which is the amount of light emitted by an object.

THE EYE :



➢Perceiving color:

- A third factor that we need to consider is perception of color.

Input Output Channel: Hearing

- Sound can convey a remarkable amount of information.
- It is rarely used to its potential in interface design, usually being confined to warning sounds and notifications.
- The exception is multimedia, which may include music, voice commentary and sound effects.
- However, the ear can differentiate quite subtle sound changes and can recognize familiar sounds without concentrating attention on the sound source.
- This suggests that sound could be used more extensively in interface design, to convey information about the system state.

Input Output Channel: Touch

3. Touch :

- The third and last of the senses that we will consider is touch.
- Although this sense is often viewed as less important than sight or hearing, we can't imagine life without it. Touch provides us with vital information about our environment.
- The apparatus of touch differs from that of sight and hearing in that it is not localized.

Input Output Channel: Touch

- We receive stimuli through the skin. The skin contains three types of sensory receptor:
  - *thermoreceptors respond to heat and cold,*
  - *nociceptors respond to intense* pressure, heat and pain.
  - *mechanoreceptors respond to pressure.*
- *It is the last of* these that we are concerned with in relation to human–computer interaction.

Unit 2:
Understand the Human

Human Memory

Topics Covered

1. About Memory in detail.
2. Human Memory Storages.
3. Encoding & Retrieval of Memory
4. Where Memory Comes From?
5. Distributive Process Diagram
6. Types of Memory
7. Model of structure of Memory
8. Working View of Memory

Let's Define Memory..!

- Memory is the second part of our model of the human as an information-processing system.
- In general terms one can define memory as the use of past experience to influence or affect human behaviour.
- The multi store model of memory describe how the processes of the stage model of HCI are interconnected.

Human Memory Storages

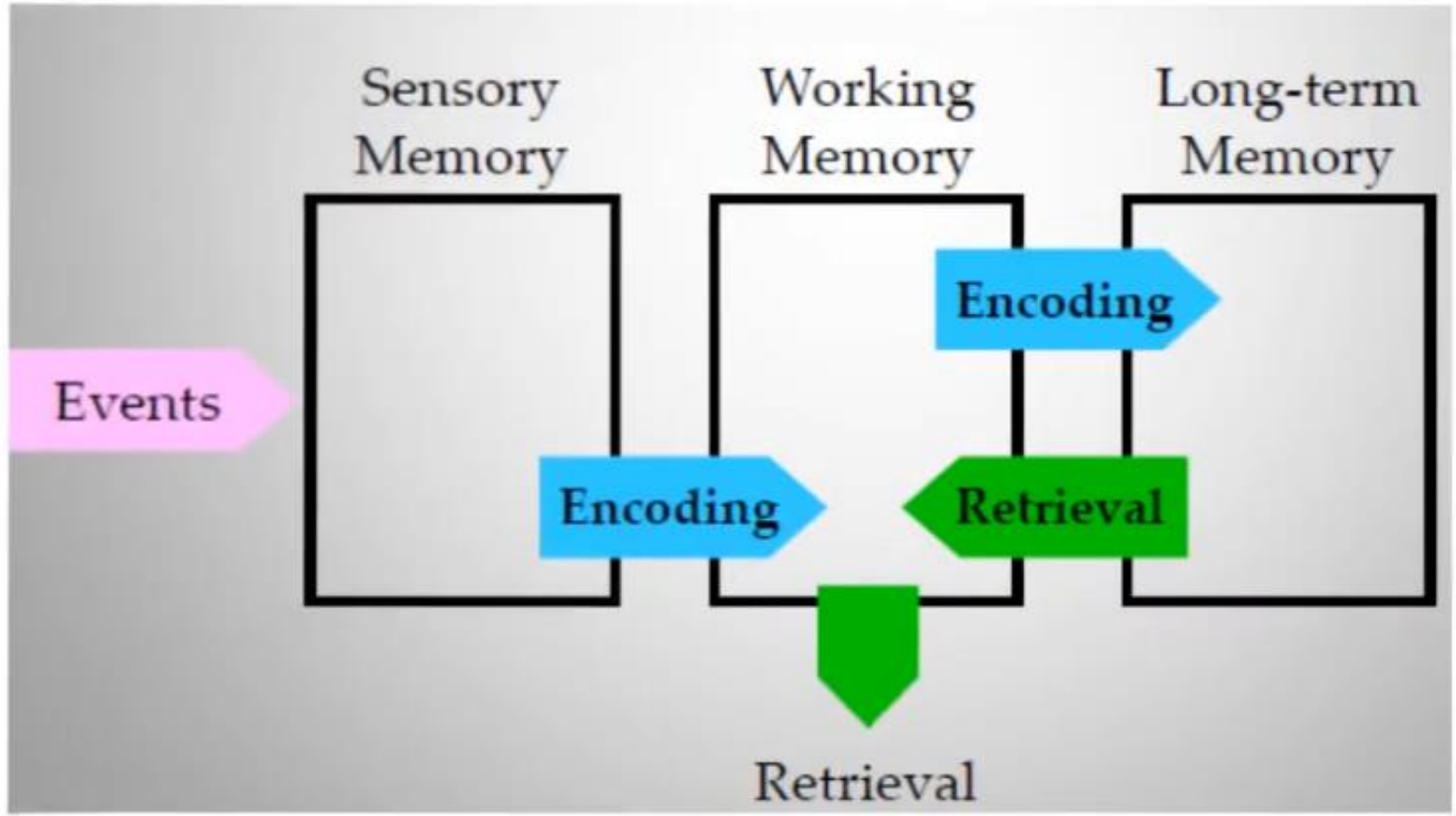
Left brain	Right brain
Words	Images and Patterns
Analysis	Overall situation
Logic	Spatial relationships
Sequential	Parallel
Simple tasks	Complex scenes
Must be taught	No teaching required

About Memory

- Memory is the ability to encode, store and remember information and past experiences in the brain.
- **Encoding:** A process of making mental representation of information.

  It can also mean transferring from short term to long term.
- **Storing:** Process of placing encoded information into relatively permanent storage for later recall.
- **Remembering**: The process of retrieving what has been stored in short term or long term memory.

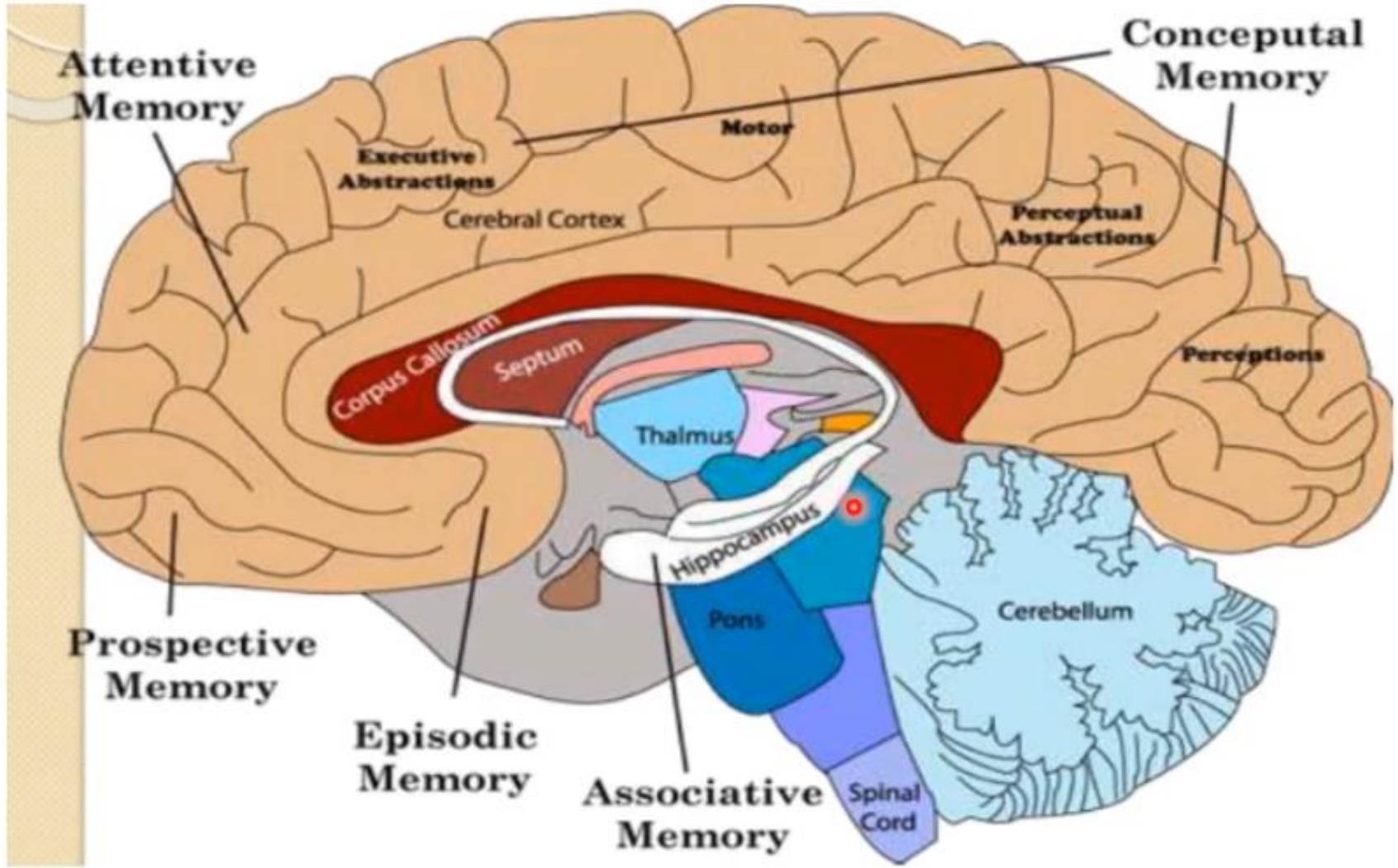
Encoding & Retrieval of Memory



Where Memory Comes From?

- Memory is not located on one particular part of the brain but instead there is a brain wide process in which different parts of the brain work in conjunction with one another(distributing process).
- **For example**: when riding a bicycle, the whole process is reconstructed by the brain in different areas.
- The memory of how to operate the bike comes from one area, the memory of the street paths comes from another area, the memory of bike safety rules in another and the nervous feeling when almost falling or being hit comes from another part of the brain.

Distributive Process Diagram



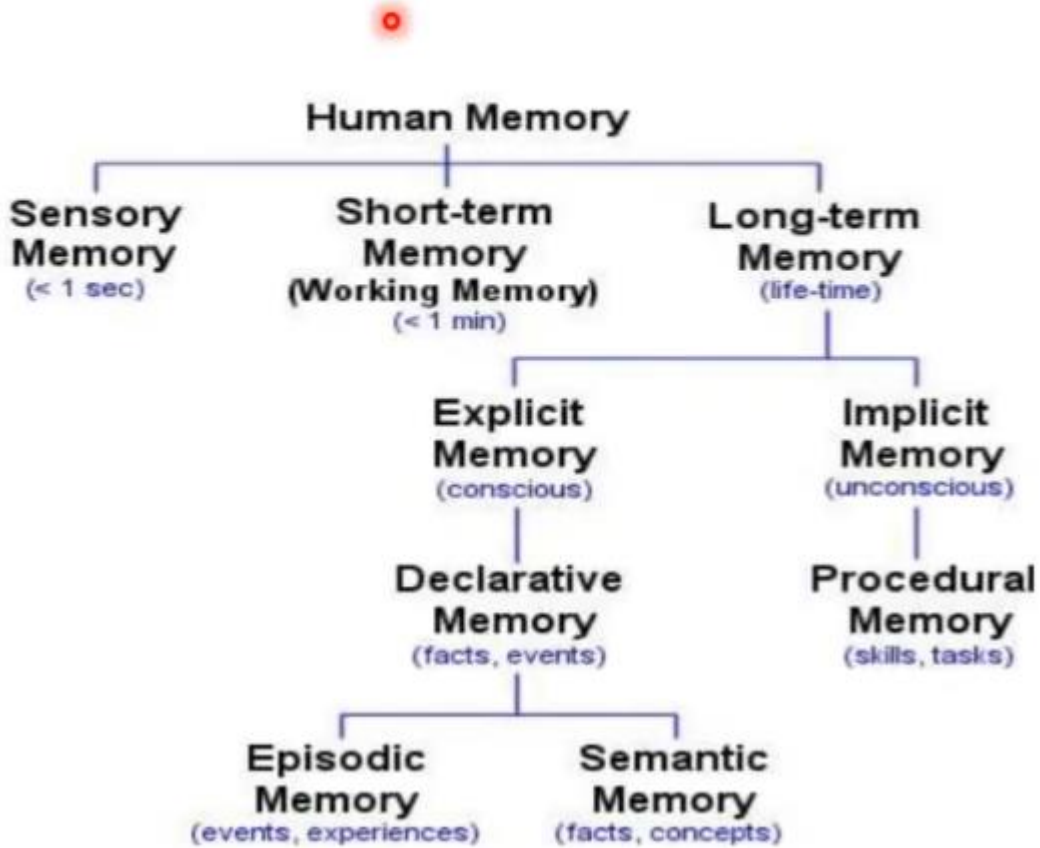
Types of Memory

There are three main types of memory.

1) Sensory memory

2) Long term memory

3) Short term memory



Model of structure of Memory

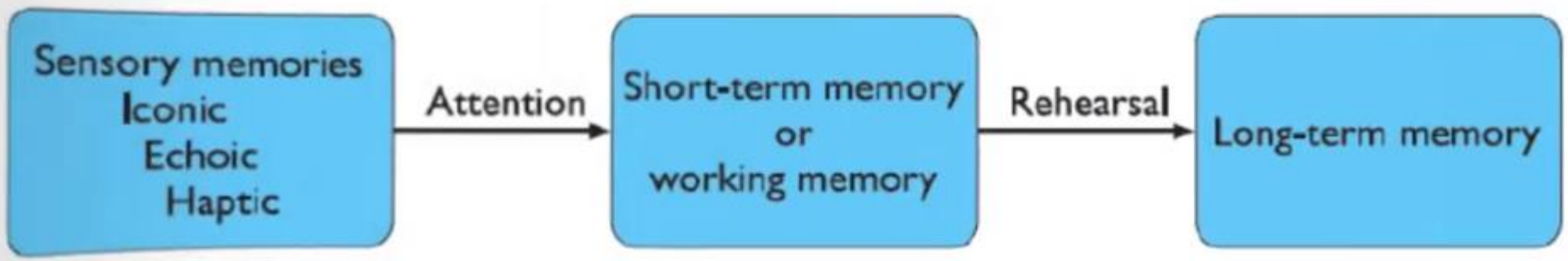
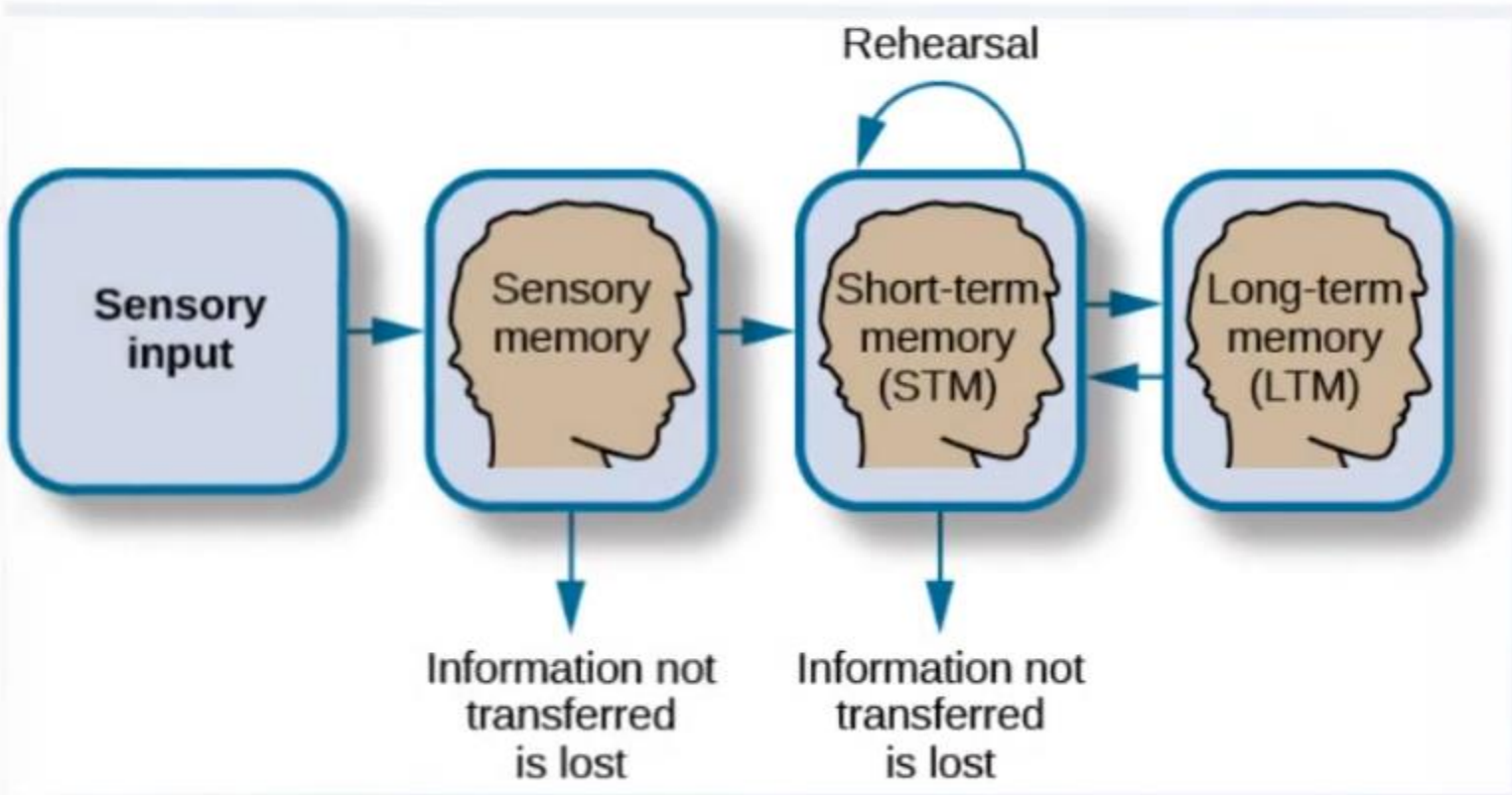


Figure 2: a Model of a Structure of Memory

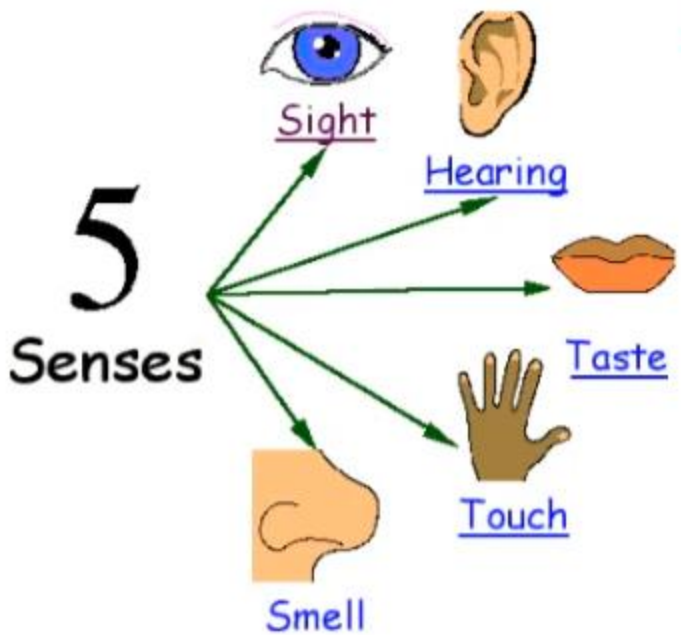
Working View of Memory



Understand the Human

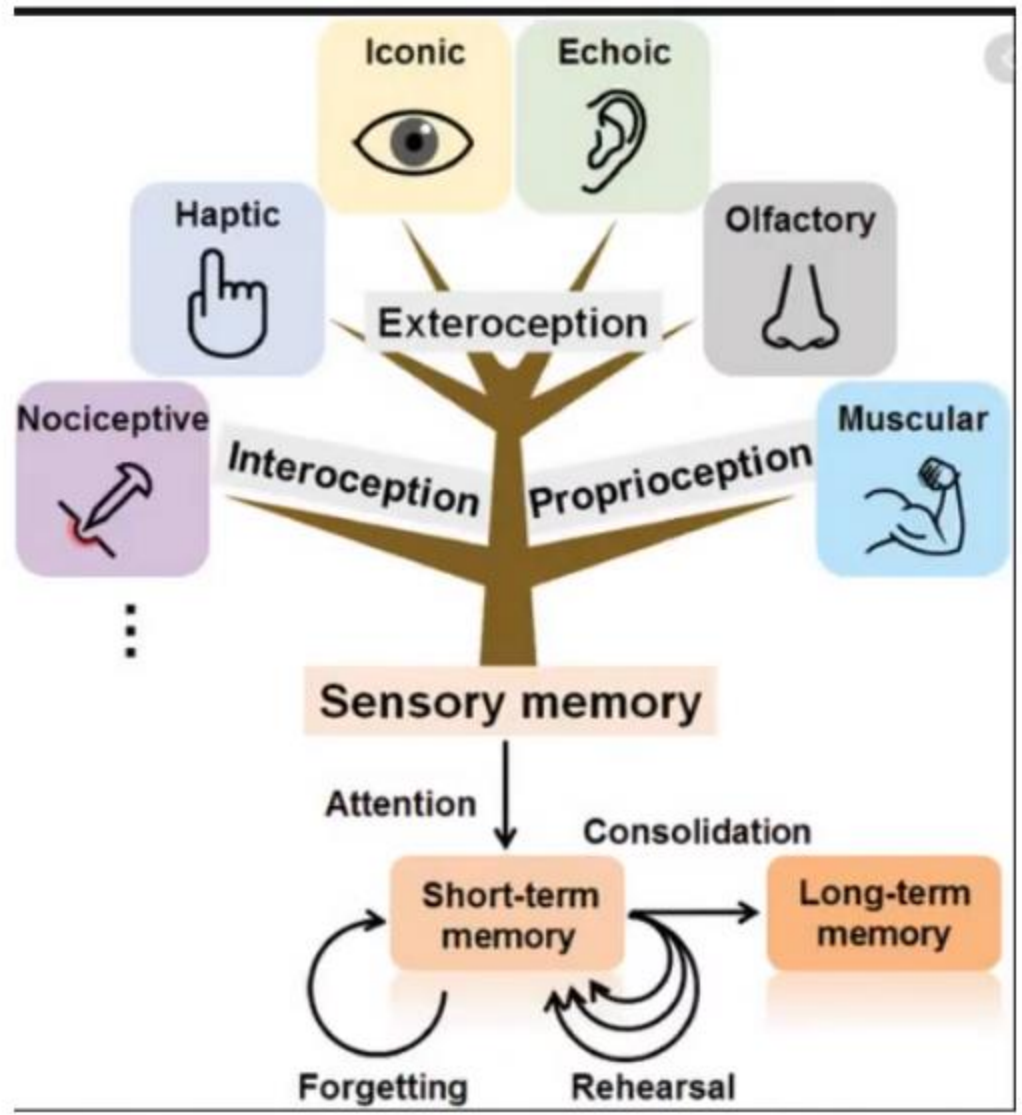
Human Memory

Type 1: Sensory Memory



Topics Covered

1. About Sensory Memory in detail.
2. About Iconic Memory in detail.
3. Examples of Iconic Memory.
4. About Echoic Memory in detail.
5. Examples of Echoic Memory.
6. About Haptic Memory in detail.
7. Examples of Haptic Memory.



About Sensory Memory

- The sensory memories act as buffers for stimuli received through the senses.
- A sensory memory exists for each sensory channel:
    1. ***Iconic memory*** for visual stimuli.
    2. ***Echoic memory*** for aural stimuli.
    3. ***Haptic memory*** for touch.
- These memories are constantly overwritten by new information coming in on these channels.

Function —process for basic physical characteristics
Capacity—large , can hold many items at once
Duration—very brief retention of images 3 sec for visual info, 2 sec for auditory info

What is Sensory Memory?

- Is the shortest-term element of memory.
- The ability to look at an item for a second and then remember what it looked like.
- It is processed approximately 200-500 milliseconds after an item is perceived.
- Sensory memories the Shortest term element of memory.
- In order for anything to enter our memory, it must be picked up by our senses(taste, touch, sight, hearing and smell).
- Sensory memory makes use of these five senses in order to be developed.

Duration of Sensory Memory

The duration of sensory memory varies for the different senses.

Iconic
0.5 sec. long

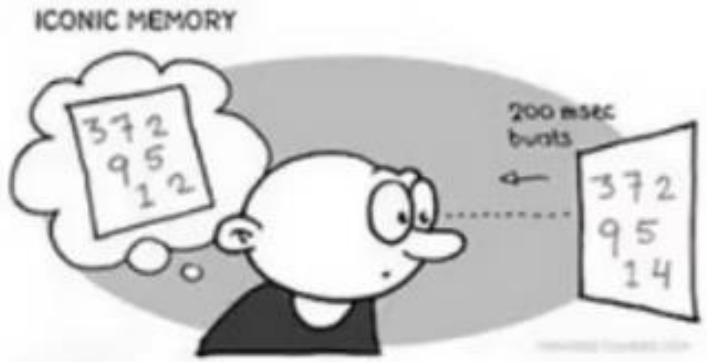
Echoic
3-4 sec. long

Hepatic
< 1 sec. long

Type 1: Iconic Memory

- Holds visual information.
- Store Visual information like Letters, Digits, Colors, Shapes and Orientation etc.
- Iconic memory is a type of sensory memory.
- Hold information in just milliseconds before fading.
- The word iconic refers to an icon, which is a pictorial representation or image.

About Iconic Memory



Iconic memory involves the memory of visual stimuli. It is how the brain remembers an image you have seen.

For example, look at an object in the room you are in now, and then close your eyes and visualize that object. The image you "see" in your mind is your iconic memory of that visual stimuli.

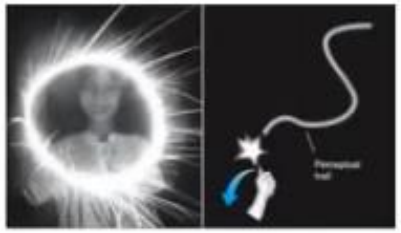
Example: Iconic Memory

Example 1:

Moving fingers in font of eye persistence's of image after things has been removed.

Example 2:

Sparkler Trail or Flash Images in a dark noon, Information remains in memory.



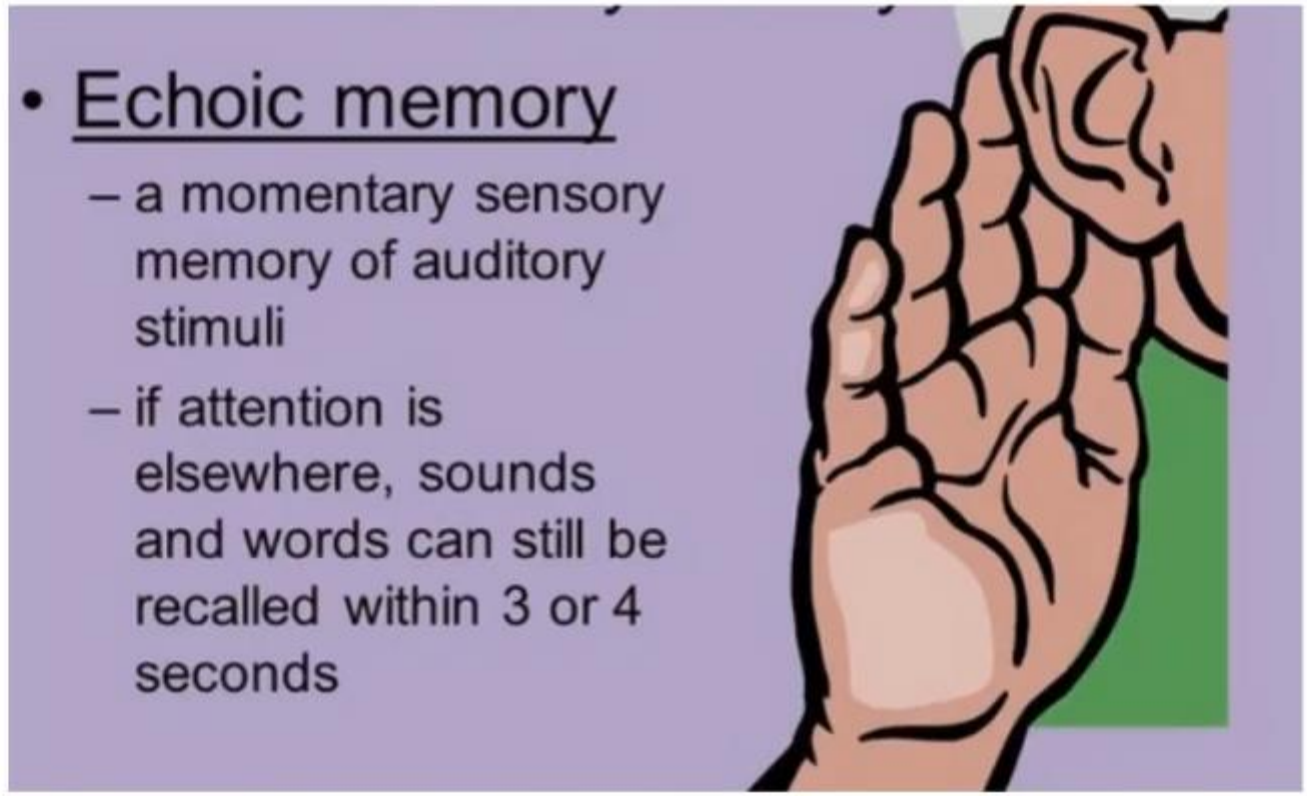
Example 3:

Example 4:

- Consider the example of a cartoon movie, which is nothing more than a series of still drawings flashed in rapid succession
  - Iconic memory allows us to perceive motion in the drawings

Type 2: Echoic Memory

- Echoic memory is the sensory memory that register specific to auditory information (sounds).
- Once an auditory stimulus is heard, it is stored in memory so that it can be processed and understood.



About Echoic Memory

- **Example** – Watching TV and being asked a question.
- Echoic memory is necessary to comprehend many sounds, particularly those involved in speech.
- You cannot comprehend a word until you have heard all the sounds, so auditory information must be stored for sufficient time until all the sounds involved have been received.
- **Example** – The words 'mallet' and 'malice'.
- If echoic memory was as brief as iconic memory, speech might sound like a series of separate distinct sounds instead of words and phrases.

Example: Echoic Memory

Example 1:

This has ability to ascertain the direction from which sound originates & Information received by the ears.

Example 2:

Have you ever had someone ask you a questions when you are reading ? You ask them to repeat the questions.

Example 3:

Person #1: "What time is it?"

Person #2: "What did you say? Oh, 2:30."

Type 3: Haptic Memory

- Haptic memory is the form of sensory memory specific to touch stimuli.
- Haptic memory is used regularly when assessing the necessary forces for gripping and interacting with familiar objects.
- It may also influence one's interactions with novel objects of an apparently similar size and density.

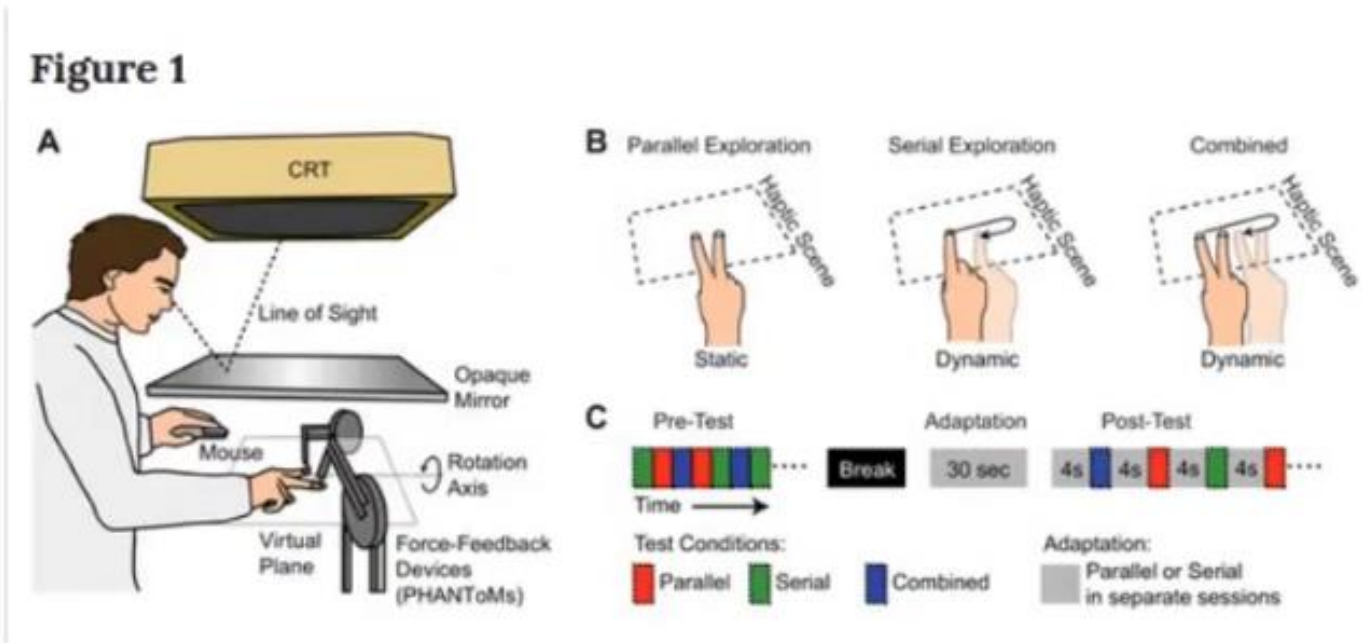
About Haptic Memory

Haptic memory is a form of sensory memory that refers to the recollection of data acquired by touch after a stimulus has been presented. Similar to visual iconic memory, traces of haptically acquired information are short lived and prone to decay after approximately two seconds.

Example: Haptic Memory

Example 1:

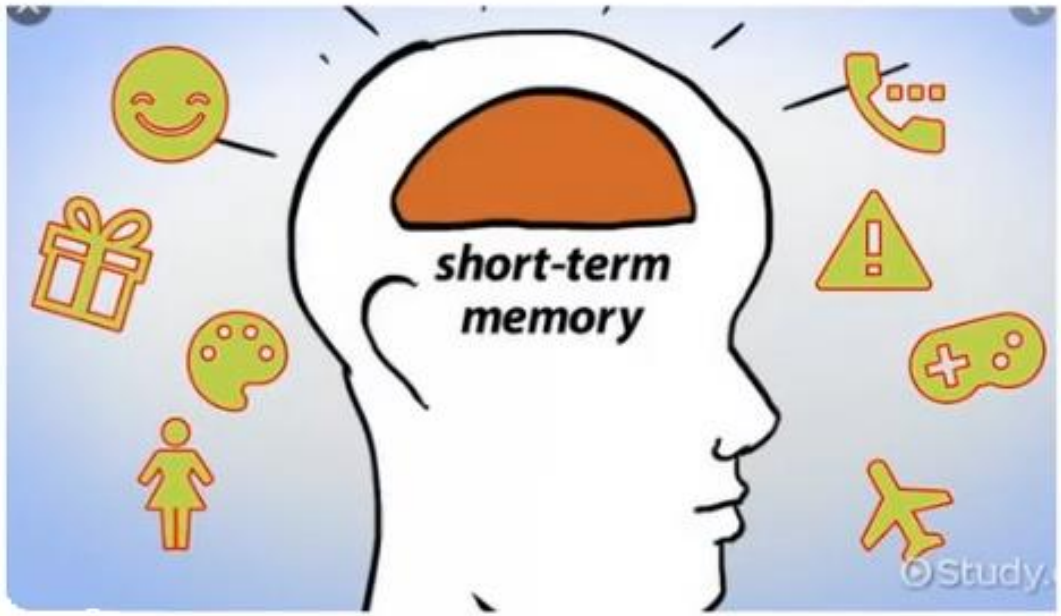
Example 2:



Understand the Human

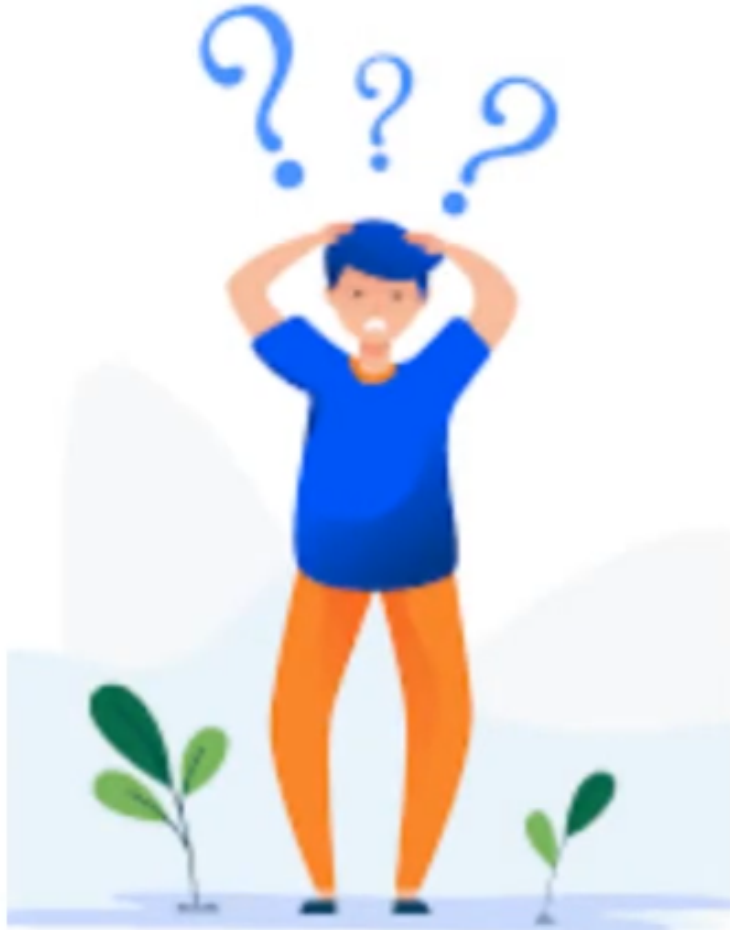
Human Memory

Type 3: Short Term Memory



Topics Covered

1. About Short Term Memory in detail.
2. Characteristic's of Short Term Memory.
3. Functions of Short Term Memory.
4. Examples of Short Term Memory.
5. Difference Between Memories
6. Complete Structure of Memories.



What is Short Term Memory?

- Also called working memory.
- It is everything you are thinking of at the current moment.
- Takes less than one minute to process.
- It is the information we hang on to while doing another process.
- It tends to disappear really fast unless we make an effort to remember it.
- It has limited capacity of information
- It is used to store information which is only required fleetingly.
- Hold data in order to 70ms to 200ms.

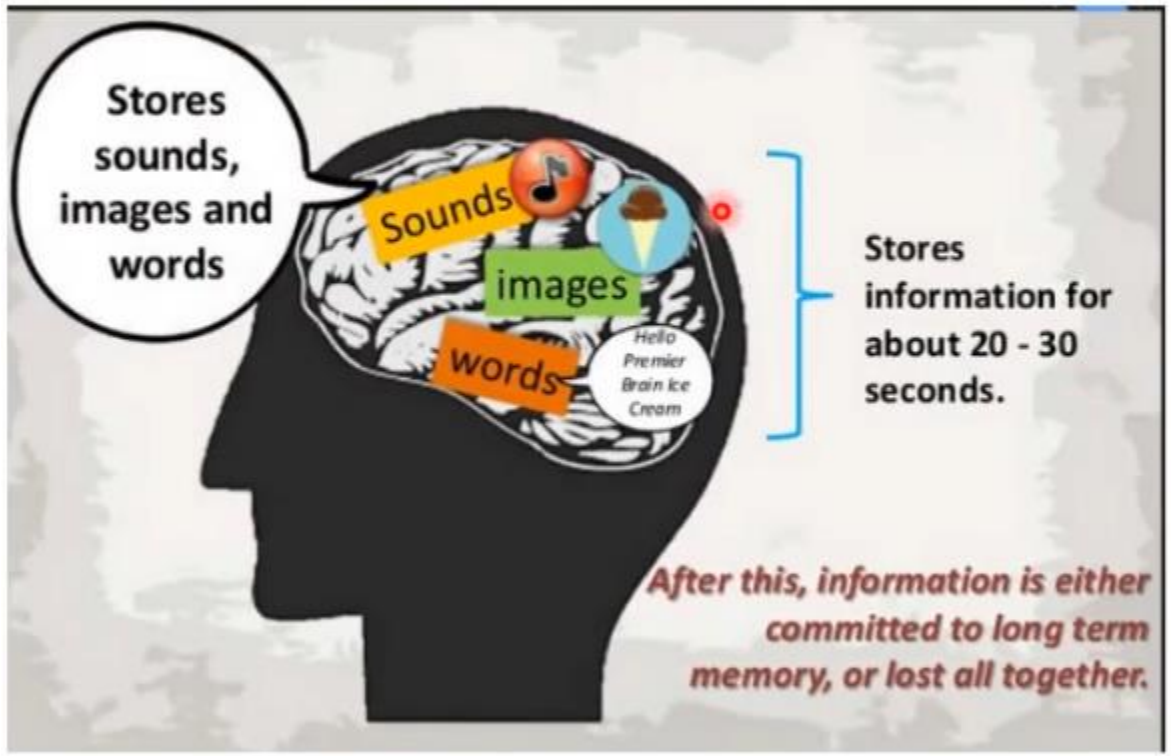
About Short Term Memory (STM)

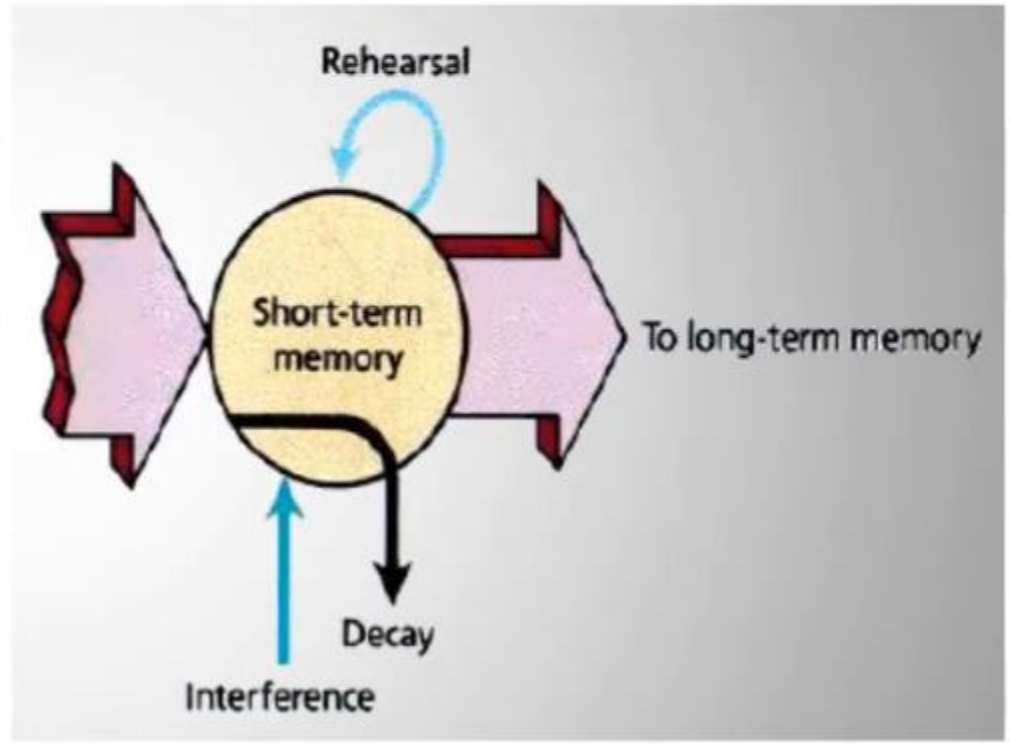
Is where memory is recalled without practicing, something that happened recently.

Short-Term Memory is dependent on the regions of the Frontal & Parietal Lobes

It is believed to rely mostly on an acoustic code for storing information.

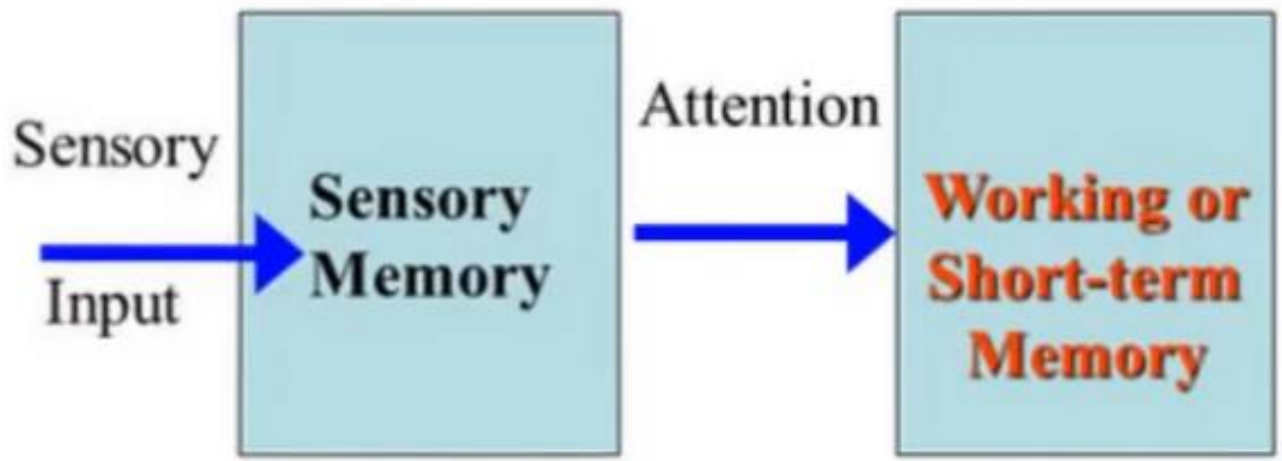
Short Term Memory (STM)





Characteristic's of Short Term Memory

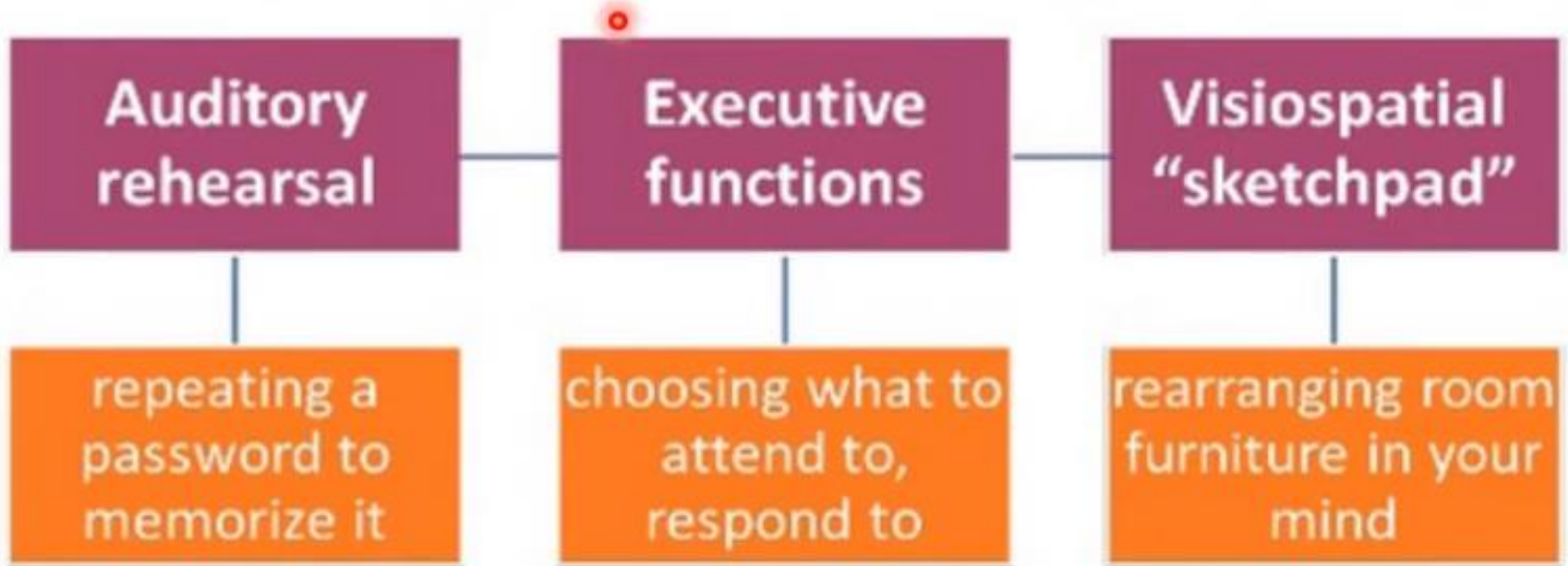
- Function - conscious processing
- Needs your attention!
  - where information is actively worked on
- Capacity - limited (holds 7 +/- 2 items)
- Duration - brief storage (about 10-20 seconds)



Functions of Short Term Memory

The short-term memory is "working" in many ways.

- It holds information not just to rehearse it , but to process it (such as hearing a word problem in math and doing it in your head).



Short-term memory integrates information from long-term memory with new information coming in from sensory memory.

Examples: Short Term Memory

Example 1:

- Calculate the multiplication 35×6 in your head.
- Perhaps 5×6 and then 30×6 and added the results; or you may have used the fact that $6 = 2 \times 3$ and calculated $2 \times 35 = 70$ followed by 3×70.
- To perform calculations such as this we need to store the intermediate stages for use later.

Example: Short Term Memory

Example 2:

- When reading a sentence, you place the beginning of the sentence.
- In mind so as to understand the rest of the sentence.

Example 3:

- Length of sequence in order i.e. 2 6 5 7 8 9 2 5 8 7 0 4 1 (Difficult to remind) .
- Group of chunks i.e. 265 789 258 70 41 (Easy to remind).

Average Person Remind 7+-2 digits.

Difference Between Memories

	Sensory Memory	Short-Term Memory	Long-Term Memory
Capacity	Virtually everything you see or hear at one instant	About 7 items in healthy adults	Vast; uncountable
Duration	Fraction of a second	Less than 20 seconds if not rehearsed	Perhaps a lifetime
Example	You see something for an instant and then someone asks you to recall one detail.	You look up a telephone number and remember it long enough to dial it.	You remember the house you lived in when you were 7 years old.

Complete Structure of Memories