MEMORY

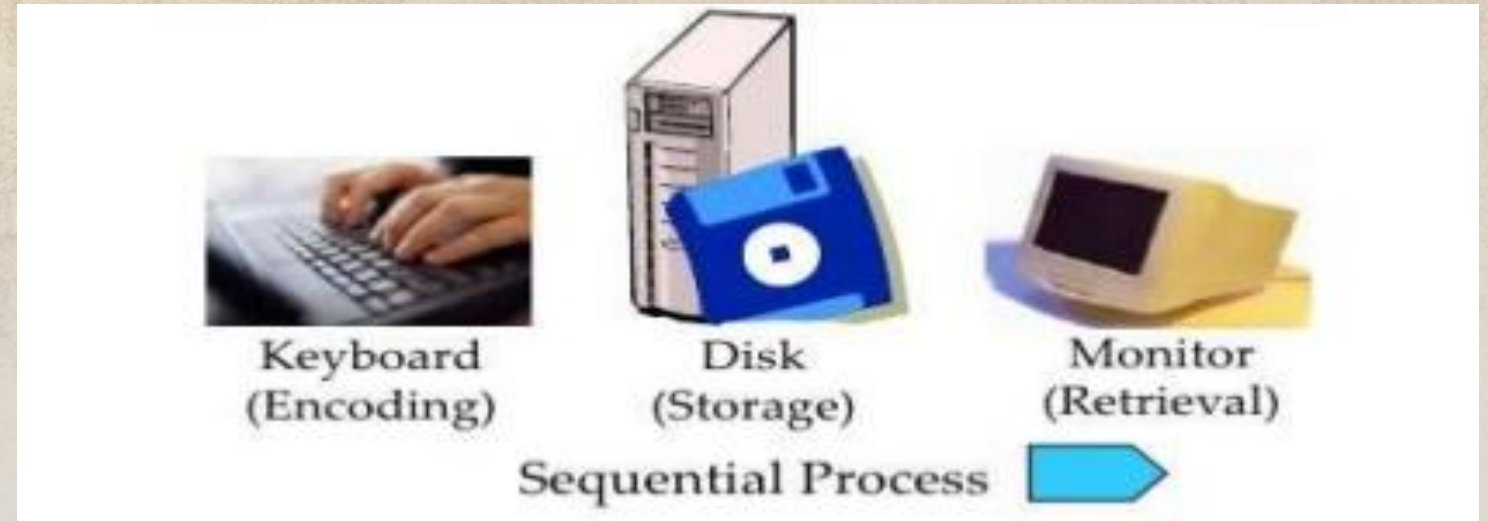
MEMORY PROCESS

- **Encoding**: The initial process of recording information in a form usable to memory, a process called encoding, is the first stage in remembering something.
- **Storage**: maintenance of material saved in memory, if the material is not stored adequately, it cannot be recalled later.
- **Retrieval**: Material in memory storage has to be located and brought into awareness to be useful.

Psychologists consider memory to be the process by which we encode, store, and retrieve information. Each of the three parts of this definition— encoding, storage, and retrieval—represents a different process.

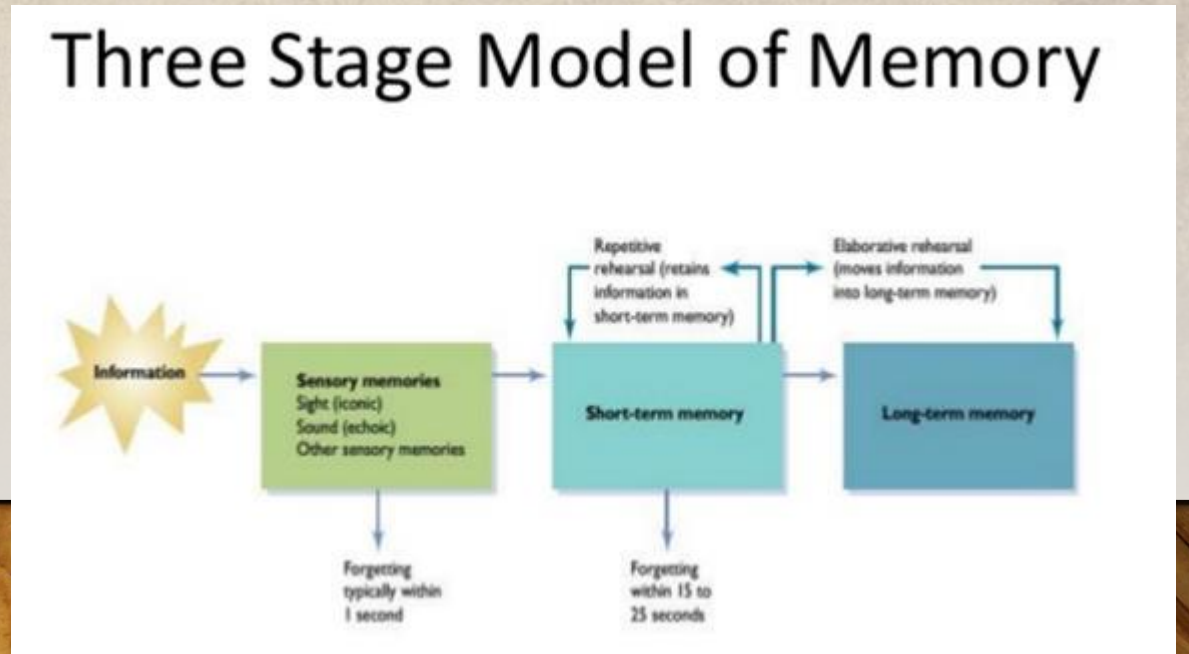
MEMORY PROCESS

According to the **three-system approach to memory** that dominated memory research for several decades, there are different memory storage systems or stages through which information must travel if it is to be remembered.



THREE STEP MEMORY THEORY

The three-system memory theory proposes the existence of the three separate memory stores. **Sensory memory** refers to the initial, momentary storage of information that lasts only an instant. Here an exact replica of the stimulus recorded by a person's sensory system is stored very briefly. In a second stage, **short term memory** holds information for 15 to 25 seconds and stores it according to its meaning rather than as mere sensory stimulation. The third type of storage system is **long-term memory**. Information is stored in long-term memory on a relatively permanent basis, although it may be difficult to retrieve.



SENSORY MEMORY

A momentary flash of lightning, the sting of a pinprick etc. all represent stimulation of exceedingly brief duration, but they may nonetheless provide important information that can require a response. Such stimuli are initially— and fleetingly—stored in sensory memory, the first repository of the information the world presents to us. There are several types of sensory memories, each related to a different source of sensory information. For instance, iconic memory reflects information from the visual system. Echoic memory stores auditory information coming from the ears. Sensory memory can store information for only a very short time. If information does not pass into short-term memory, it is lost for good. Sensory memory can store an almost exact replica of each stimulus to which it is exposed.

SHORT-TERM MEMORY

The information that is stored briefly in sensory memory consists of representations of raw sensory stimuli, it is not meaningful to us. If we are to make sense of it and possibly retain it, the information must be transferred to the next stage of memory. Short-term memory is the memory store in which information first has meaning, although the maximum length of retention there is relatively short. Some theorists suggest that information is first translated into graphical representations or images, and others hypothesize that transfer occurs when the sensory stimuli are changed to words.

SHORT-TERM MEMORY

Specific amount of information that can be held in short-term memory has been identified as seven items, or "chunks," of information, with variations up to plus or minus two chunks. A **chunk** is a group of familiar stimuli stored as a single unit in short-term memory. For example, a chunk can be a group of seven individual letters or numbers and may also consist of larger categories, such as words or other meaningful units. Chunks can vary in size from single letters or numbers to categories that are far more complicated. Specific nature of what constitutes a chunk varies as per one's past experience.

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REHEARSAL

Transfer of material from short- to long-term memory proceeds largely on the basis of rehearsal, the repetition of information that has entered short-term memory. As long as the information is repeated, it is maintained in short-term memory, however, rehearsal allows us to transfer the information into long-term memory.

Elaborative rehearsal occurs when the information is considered and organized in some fashion. The organization might include expanding the information to make it fit into a logical framework, linking it to another memory, turning it into an image, or transforming it in some other way. For example, a list of vegetables to be purchased at a store could be woven together in memory as items being used to prepare an elaborate salad, could be linked to the items bought on an earlier shopping trip. By using organizational strategies such as these—called Mnemonics (pronounced “neh MON ix”) are methods for organizing information in a way that makes it more likely to be remembered.

WORKING MEMORY

Working memory is the memory system that holds information temporarily while actively manipulating and rehearsing that information. Working memory is assumed to be made up of several parts. First, working memory contains a central executive processor that is involved in reasoning and decision making. The central executive coordinates three distinct storage-and-rehearsal systems: the visual store, the verbal store, and the episodic buffer. The **visual store** specializes in visual and spatial information, whereas the **verbal store** holds and manipulates material relating to speech, words, and numbers. The **episodic buffer** contains information that represents episodes or events.

Working memory permits us to keep information in an active state briefly so that we can do something with the information.

LONG-TERM MEMORY

Material that makes its way from short-term memory to long-term memory enters a storehouse of almost unlimited capacity. Evidence of the existence of long-term memory, as distinct from short-term memory, comes from a number of sources. For example, people with certain kinds of brain damage have no lasting recall of new information received after the damage occurred, although people and events stored in memory before the injury remain intact.

LONG-TERM MEMORY MODULES

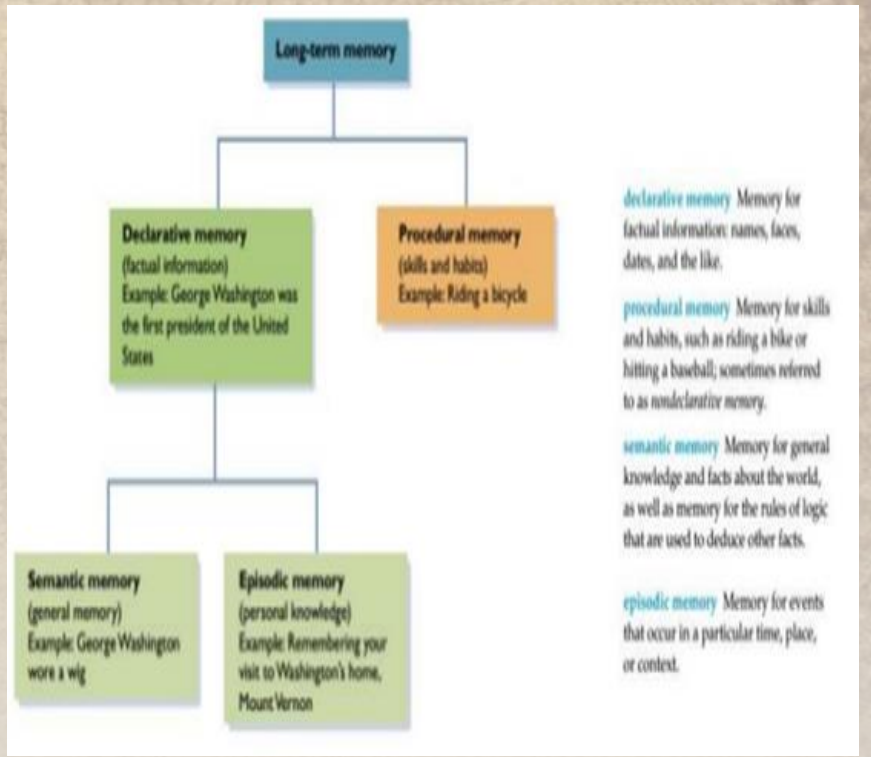
One major distinction within long-term memory is that between declarative memory and procedural memory. **Declarative memory** is memory for factual information: names, faces, dates, and facts, such as “a bike has two wheels.” In contrast, **procedural memory** (or nondeclarative memory) refers to memory for skills and habits, such as how to ride a bike or hit a baseball. Information about things is stored in declarative memory; information about how to do things is stored in procedural memory.

Declarative memory can be subdivided into semantic memory and episodic memory. **Semantic memory** is memory for general knowledge and facts about the world, as well as memory for the rules of logic that are used to deduce other facts. Because of semantic memory, we remember the area codes, Semantic memory is somewhat like a mental almanac of facts.

LONG-TERM MEMORY MODULES

In contrast, **episodic memory** is memory for events that occur in a particular time, place, or context. For example, recall of learning to swim, or arranging a surprise 21st birthday party for our brother is based on episodic memories.

Episodic memories relate to particular contexts. Episodic memories can be surprisingly detailed and can provide information about events that happened long in the past. But semantic memory is no less impressive, permitting us to dredge up tens of thousands of facts ranging from the date of our birthday to the knowledge that Rs. 10 is less than Rs. 100.



SEMANTIC NETWORKS

Knowledge is stored in **semantic networks**, mental representations of clusters of interconnected information. Thinking about a particular concept leads to recall of related concepts. For example, seeing a fire engine may activate our recollections of other kinds of emergency vehicles,

RECALLING LONG-TERM MEMORIES: RETRIEVAL CUES

Retrieval cues guide people through the information stored in long-term memory in much the same way that a search engine such as Google guides people through the Internet. They are particularly important when we are making an effort to recall information, as opposed to being asked to recognize material stored in memory. In **recall**, a specific piece of information must be retrieved—such as that needed to answer a fill-in-the-blank question or to write an essay on a test. In contrast, **recognition** occurs when people are presented with a stimulus and asked whether they have been exposed to it previously or are asked to identify it from a list of alternatives.

Recall is more difficult because it consists of a series of processes: a search through memory, retrieval of potentially relevant information, and then a decision regarding whether the information you have found is accurate. If the information appears to be correct, the search is over, but if it is not, the search must continue. In contrast, recognition is simpler because it involves fewer steps.

RECALLING LONG-TERM MEMORIES: RETRIEVAL EXPLICIT AND IMPLICIT MEMORY

People have memories about which they are unaware has led to speculation that two forms of memory, explicit and implicit, may exist side by side. **Explicit memory** refers to intentional or conscious recollection of information. When we try to remember a name or date we have encountered or learned about previously, we are searching our explicit memory.

In contrast, **implicit memory** refers to memories of which people are not consciously aware but that can affect subsequent performance and behavior. Skills that operate automatically and without thinking, such as jumping out of the path of an automobile coming toward us. Similarly, a feeling of vague dislike for an acquaintance, without knowing why we have that feeling, may be a reflection of implicit memories. Perhaps the person reminds us of someone else in our past that we didn't like, even though we are not aware of the memory of that other individual.

FORGETTING: WHEN MEMORY FAILS

Why do we forget? One reason is that we may not have paid attention to the material in the first place—a failure of **encoding**. **Decay** is the loss of information in memory through nonuse. This explanation for forgetting assumes that memory traces, the physical changes that take place in the brain when new material is learned, simply fade away or disintegrate over time.

In **interference**, information stored in memory disrupts the recall of other information stored in memory. For example, if I'm trying to recall my college classmate Jake's name and all I can remember is the name of another classmate, James, interference may be at work.

Forgetting may occur because of **cue-dependent forgetting**, forgetting that occurs when there are insufficient retrieval cues to rekindle information that is in memory. For example, you may not be able to remember where you lost a set of keys until you mentally walk through your day, thinking of each place you visited.

PROACTIVE AND RETROACTIVE INTERFERENCE: THE BEFORE AND AFTER OF FORGETTING

In **proactive interference**, information learned earlier disrupts the recall of newer material. Suppose, as a student of you first learned Arabic in the 6th grade, and then in the 8th grade you took Sindhi. When in the 11th grade you take a college subject achievement test in Sindhi, you may find you have difficulty recalling the Sindhi translation of a word because all you can think of is its Arabic equivalent. In contrast, **retroactive interference** occurs when material that was learned later disrupts the retrieval of information that was learned earlier. If, for example, you have difficulty on a Arabic subject achievement test because of your more recent exposure to Sindhi, retroactive interference is the culprit. Similarly, retroactive interference can account for the lack of accuracy of eyewitness memories, as newer information about a crime obtained from newspaper accounts may disrupt the initial memory of the observation of the crime.

One way to remember the difference between proactive and retroactive interference is to keep in mind that proactive interference progresses in time—the past interferes with the present. In contrast, retroactive interference retrogresses in time, working backward as the present interferes with the past.