

IV Memory

4.1 Nature and Definition

- Memory is the retention of information/what is learned earlier over time. It is the way in which we record the past for later use in the present.
- Memory is a blanket label for a large number of processes that form the bridges between our past and our present.
- To learn about the nature of memory, it is useful to separate the **process** from the **structure**.

4.1.1 Memory Processes

- Memory process is the mental activities we perform to put information into memory, to keep it there, and to make use of it later.
- This involves three basic steps:
 - a) **Encoding:** Taken from computer science, the term encoding refers to the form (i.e the code) in which an item of information is to be placed in memory. It is the process by which information is initially recorded in a form usable to memory. In encoding we transform a sensory input into a form or a memory code that can be further processed.
 - b) **Storage:** To be remembered the encoded experience must leave some record in the nervous system (the memory trace); it must be squirreled away and held in some more or less enduring form for later use. This is what memory specialists mean when they speak of placing information in storage. It is the location in memory system in which material is saved. Storage is the persistence of information in memory.
 - c) **Retrieval:** is the point at which one tries to remember to dredge up a particular memory trace from among all the others we have stored. In retrieval, material in memory storage is located, brought into awareness and used.
- Note that failures to remember can result from problems during any of the three phases of the memory process. If, for example, you encode a new item of information only as a sound pattern, there would be no memory trace of its meaning. If both the sound and the meaning were encoded and held for the length of the retention interval, the item might have been misfiled in memory. If so, the item might be impossible to retrieve even though it is still stored in memory.

4.1.2 Structure/stages/forms of Memory

- Memory structure is the nature of memory storage itself- how **information is represented, how it is organized** in memory and **how long it lasts**.
- Although people usually refer to memory as a single faculty, the term memory actually covers a complex collection of abilities and processes.
- The cognitive perspective has dominated psychology's view of memory for the past years although in recent years it has become integrated with understanding of the neuro-psychology of memory.
- Many cognitive psychologists relate the mind to an information processor, along the lines of a digital computer that takes items of information in; processes them in steps or stages, and then produces an output.

- Consider how the computer works; First, it takes in information (for instance via keystrokes) and translates the information into an electronic language, then the computer permanently stores the information on a disc, and finally it retrieves the information (file) stored on a disc on to a working memory (which also receives new information from the keyboard) and the information is put on to the screen as part of the working memory.
- Models of memory based on this idea are *Information processing theories*. Like the computer, we also store vast amounts of information in our memory store house. From this storehouse, we can retrieve some information onto a limited capacity working memory, which also receives information from our current experience. Part of this working memory is displayed on the mental “screen” we call consciousness.
- A number of such models of memory have been proposed. One of the most important and influential of these is the one developed by Richard Atkinson and Richard Shiffrin(1968). According to Atkinson and Shiffrin, memory has three structures:
 1. **Memory/Sensory Register:** It is the entry way to memory. It is the first information storage area. Sensory memory acts as a holding bin, retaining information until we can select items for attention from the stream of stimuli bombarding our senses. It gives us a brief time to decide whether information is extraneous or important. Sensory memory includes a number of separate subsystems, as many as there are senses. It can hold virtually all the information reaching our senses for a brief time. For instance, visual images (Iconic memory) remain in the visual system for a maximum of one second. Auditory images (Echoic memory) remain in the auditory system for a slightly longer time, by most estimates up to two second or so. The information stored in sensory memory is a fairly accurate representation of the environmental information but unprocessed. Most information briefly held in the sensory memory simply decays from the register. However, some of the information that has got *attention* and *recognition* pass on short-term memory for further processing.
 2. **Short-term Memory:** is part of our memory that holds the contents of our attention. Unlike sensory memories, short-term memories are not brief replicas of the environmental message. Instead, they consist of the by-products or end results of perceptual analysis. **STM** is important in a variety of tasks such as thinking, reading, speaking, and problem solving. There are various terms used to refer to this stage of memory, including working memory, immediate memory, active memory, and primary memory. Short term memory is distinguished by four characteristics:
 - **It is active-** information remains in STM only so long as the person is consciously processing, examining, or manipulating it. People use STM as a “workspace” to process new information and to call up relevant information from LTM.
 - **Rapid accessibility** - Information in STM is readily available for use. In this respect, the difference between STM and LTM is the difference between pulling a file from the top of a desk versus searching for it in a file drawer, or between searching for information in an open computer file versus searching for a file stored on the hard drive.
 - **Preserves the temporal sequence of information-**

Subjects provided with a list will generally remember it (and repeat it if asked) in just that order.

- **Limited capacity-** Years ago, George Miller (1956) estimated its capacity to be “the magic number seven plus or minus 2”. That is, on the average, people can hold about seven pieces of information in STM at a time; with a normal range from five to nine items. Some researchers have questioned whether Miller’s magical number is so magical after all. Everyone agrees, however, that the number of items that short-term memory can handle at any one time is small. According to most models of memory, we overcome this problem, by grouping small groups of information into larger units or *chunks*. Chunking is the grouping or “packing” of information into higher order units that can be remembered as single units. Chunking expands working memory by making large amounts of information more manageable. The real capacity of short-term memory, therefore, is not a few bits of information but a few chunks. A chunk may be a word, a phrase, a sentence, or even a visual image, and it depends on previous experience. STM memory holds information (sounds, visual images, words, and sentences and so on) received from SM for up to about 30 seconds by most estimates. It is possible to prolong STM indefinitely by rehearsal- the conscious repetition of information. Material in STM is easily displaced unless we do something to keep it there.

3. Long term Memory

- It is a memory system used for the relatively permanent storage of meaningful information.
- The capacity of LTM seems to have no practical limits.
- The vast amount of information stored in LTM enables us to learn, get around in the environment, and build a sense of identity and personal history.
- **LTM** stores information for indefinite periods. It may last for days, months, years, or even a lifetime.
- The LTM is assumed to be composed of different sub systems:
 - **Declarative/ explicit memory-** the conscious recollection of information such as specific facts or events that can be verbally communicated. It is further subdivided into semantic and episodic memories. **Semantic memory-** factual knowledge like the meaning of words, concepts and our ability to do math. They are internal representations of the world, independent of any particular context. **Episodic memory-** memories for events and situations from personal experience. They are internal representations of personally experienced events.
 - **Non-declarative/ implicit memory-** refers to a variety of phenomena of memory in which behaviour is affected by prior experience without that experience being consciously recollected. One of the most important kinds of implicit memory is procedural memory. It is the “how to” knowledge of procedures or skills. Knowing how to comb your hair, use a pencil, or swim

Serial Position Effect

- The three-box model of memory is often invoked to explain interesting phenomenon called the **serial position effect**. If you are shown a list of items and are then asked immediately to recall them, your retention of any particular item will depend on its position in the list.
- That is, recall will be best for items at the beginning of the list (the *primacy effect*) and at the end of the list (the *recency effect*). When retention of all the items is plotted, the result will be a U-shaped curve.
- **A serial position effect** occurs when you are introduced to a lot of people at a party and find you can recall the names of the first few people you met and the last, but almost no one in between.
- According to the three-box model, the first few items on a list are remembered well because short-term memory was relatively “empty” when they entered, so these items did not have to compete with others to make it into long term memory. They were thoroughly processed, so they remain memorable.
- The last few items are remembered for a different reason: At the time of recall, they are still sitting in STM. The items in the middle of the list, however, are not so well retained because by the time they get into short-term memory, it is already crowded. As a result many of these items drop out of short-term memory before they can be stored in long-term memory.

Forgetting

- Psychologists generally use the term *forgetting* to refer to the apparent loss of information already encoded and stored in the long-term memory.
- The first attempts to study forgetting were made by German psychologist Hermann Ebbinghaus(1885/1913). Using himself as his only subject, he memorized lists of three letter non-sense syllables- meaningless sets of two consonants with a vowel in between, such as FIW and BOZ.
- By measuring how easy it was to relearn a given list of words after varying periods of time from initial learning had passed, he found that forgetting occurred systematically.
- The most rapid forgetting occurs in the first hours, and particularly in the first hour. After nine hours, the rate of forgetting slows and declines little, even after the passage of many days.
- Ebbinghaus’s research had an important influence on subsequent research, and his basic conclusions had been upheld. There is almost always a strong initial decline in memory, followed by a more gradual drop over time.
- Furthermore, relearning of previously mastered material is almost always faster than starting from a scratch, whether the material is academic information or a motor skill such as serving a tennis ball.
- Psychologists have proposed five mechanisms to account for forgetting: decay, replacement of old memories by new ones, interference, motivated forgetting, and cue dependent forgetting.

1. The Decay Theory

- The decay theory holds that memory traces or engram fade with time if they are not “accessed” now and then. This explanation assumes that

when new material is learned a memory trace or engram- an actual physical change in the brain- occurs.

- In decay, the trace simply fades away with nothing left behind, because of the passage of time. We have already seen that decay occurs in sensory memory and that it occurs in short term memory as well, unless we rehearse the material. However, the mere passage of time does not account so well for forgetting in long-term memory. People commonly forget things that happened only yesterday while remembering events from many years ago.
- Although there is evidence that decay does occur, it does not seem to be the complete explanation for forgetting. Memory specialists have proposed an additional mechanism: Interference

2. Interference

- Interference theory holds that forgetting occurs because similar items of information interfere one another in either storage or retrieval. The information may get into memory, but it becomes confused with other information.
- There are two kinds of interference that influence forgetting: **proactive and retroactive**. In **Proactive Interference**, information learned earlier interferes with recall of newer material. If new information interferes with the ability to remember old information the interference is called **Retroactive Interference**.

3. New memory for old/ displacement theory

- This theory holds that new information entering memory can wipe out old information, just as recording on an audio or videotape will obliterate/wipe out the original material. This theory is mostly associated with the STM, where the capacity for information is limited to seven plus or minus chunks. It cannot be associated with the LTM because of its virtually unlimited capacity.

4. Motivated Forgetting

- Sigmund Freud maintained that people forget because they block from consciousness those memories that are **too** threatening or painful to live with, and he called this self-protective process **Repression**.
- To day many psychologists prefer to use a more general term, *motivated forgetting*.

5. Cue Dependent Forgetting

- Often when we need to remember, we rely on retrieval cues, items of information that can help us find the specific information we're looking for.
- When we lack retrieval cues, we may feel as if we have lost the call number for an entry in the mind's library. In long-term memory, this type of memory failure may be the most common type of all.
- Cues that were present when you learned a new fact or had an experience are apt to be especially useful later as retrieval aids.

- That may explain why remembering is often easier when you are in the same **physical environment** as you were when an event occurred: Cues in the present context match from the past.
- Your mental or physical state may also act as a retrieval cue, evoking a **state dependent memory**. For example if you are intoxicated when something happens, you may remember it better when you once again have had a few drinks than when you are sober.
- Likewise, if your **emotional arousal** is specially high or low at the time of an event, you may remember that event best when you are once again in the same emotional state.

Improving Memory

- Someday in the near future, drugs may be available to help people with memory deficiencies to increase normal memory performance. For the time being, however, those of us who hope to improve our memories must rely on mental strategies.
- Some simple mnemonics can be useful, but complicated ones are often more bother than they are worth. A better approach is to follow some general guidelines.
- **Pay Attention:** It seems obvious, but often we fail to remember because we never encoded the information in the first place. When you do have something to remember, you will do better if you encode it.
- **Encode information in more than one way:** The more elaborate the encoding of information, the more memorable it will be
- **Add meaning:** The more meaningful the material, the more likely it is to link up with information already in long-term memory.
- **Take your time:** If possible, minimize interference by using study breaks for rest or recreation. Sleep is the ultimate way to reduce interference.
- **Over learn:** Studying information even after you think you already know it- is one of the best ways to ensure that you'll remember it.
- **Monitor your learning:** By testing yourself frequently, rehearsing thoroughly, and reviewing periodically, you will have a better idea of how you are doing.