

# Memory and Thought

## Section 1: Taking in and Storing Information

What would life without memory be like? Can you even imagine it? Consider all the material stored in your memory: your Social Security number, the capital of England, your first phone number, the important generals of the Algerian Revolution, your best friend in first grade, and so on. What kind of incredible filing system allows you to instantly recover a line from your favorite movie? How does all that information fit in your head?

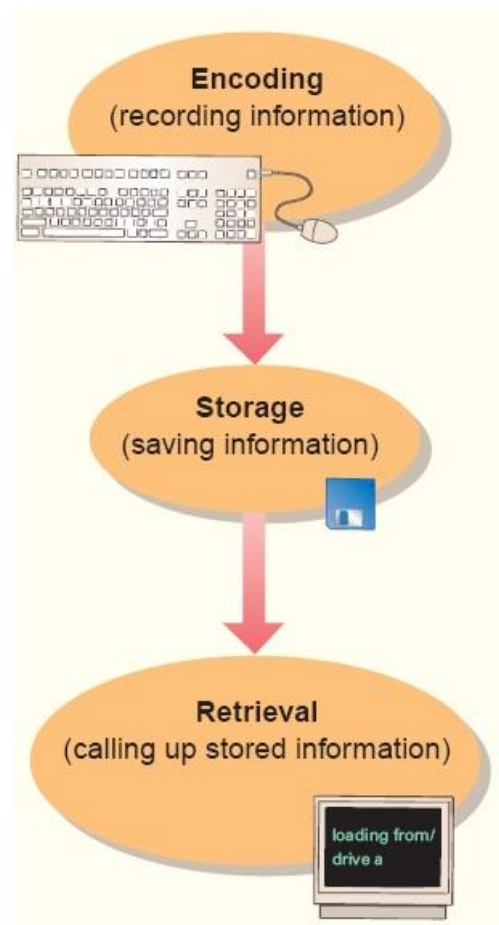
### 1.1. The Processes of Memory

The storage and retrieval of what has been learned or experienced is **memory**. Who sings your favorite song? Who were your friends in eighth grade? To recall this information, you use one memory process, assuming two others occurred previously.

The first memory process is **encoding**, the transforming of information so that the nervous system can process it. Basically, you use your senses – hearing, sight, touch, taste, temperature, and others – to encode and establish a memory. You use *acoustic codes* when you try to remember something by saying it out loud, or to yourself, repeatedly. When you attempt to keep a mental picture of something; you are using *visual codes*. Another way you might try to remember is by using *semantic codes*. For example, you try to remember a set of letters by making sense of them so if you wanted to remember the letters “F”, “A”, “C”, “E” you might remember the word “face”.

After information is encoded, it goes through the second memory process, **storage**. This is the process by which information is maintained over time. How much information is stored depends on how much effort was put into encoding the information and its importance. Information can be stored a few seconds or much longer.

The third memory process, **retrieval**, occurs when information is brought to mind from storage. The case in which information can be retrieved depends on how much efficiently it was encoded.



## Recap

**Memory:** the storage and retrieval of what has been learned or experienced

**Encoding:** the transforming of information so the nervous system can process it

**Storage:** the process by which information is maintained over a period of time

**Retrieval:** the process of obtaining information that has been stored in memory

## 1.2. Three Stages of Memory

### 1.2.1. Sensory Memory

In *sensory memory*, the senses of sight and hearing (among other sense) are able to hold an input for a fraction of second before it disappears. For example, when you watch a motion picture, you do not notice the gap between frames. The action seems smooth because each frame is held in sensory storage until the next frame arrives. The information held momentarily by the sense has not yet been narrowed down or analyzed. It is short-live, temporary, and fragile. However, by the time information gets to the next stage – short-term memory – it has been analyzed, identified, and simplified so that it can be conveniently stored and handled for a longer time. Sensory memory serves three functions:

1. It prevents you from being overwhelmed. Every second of every day; you are bombarded with various incoming stimuli. If you had to pay attention to all these stimuli – what you are immediately seeing; hearing, smelling, and feeling – you might easily feel overwhelmed. Since the information in sensory memory is short-lived, anything that you don't pay attention to vanishes in seconds.
2. It gives some decision time. The information in sensory memory is there for only a few seconds – just long enough for you to decide whether it is worth paying attention to this information. If you choose to pay attention, the information is automatically transferred to short-term memory.
3. It allows for continuity and stability in your world. For instance, iconic memory makes images in your world smooth and continuous, whereas echoic memory lets you play back auditory information, giving you time to recognize sounds as words.

### 1.2.2. Short-Term Memory

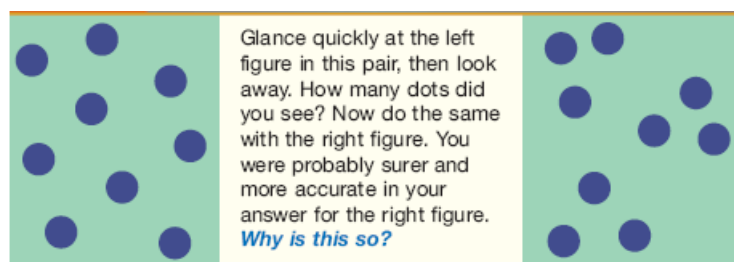
The things you have in your conscious mind at any moment are being held in *short-term memory*. Short-term memory does not necessarily involve paying close attention. You have probably had the experience of listening to someone partially and then having that person accuse

you of not paying attention. You deny it, and prove your innocence, you repeat, word for word, the last words he or she said. You can do this because you are holding the words in short-term memory.

**Maintenance Rehearsal:** To keep information in short-term memory for more than a few seconds, you usually have to repeat the information to yourself or out loud. This is what psychologists mean by *maintenance rehearsal*. When you look up a telephone number, for example, you can remember the digits long enough to dial them if you repeat them several times. If you are distracted or make a mistake in dialing, the chances are you will have to look up the number again. It has been lost from short-term memory. By using maintenance rehearsal (repeating the telephone number over and over again), you can keep the information longer in short-term memory.

**Chunking:** Short-term memory is limited not only in its duration but also in its capacity. It can hold only about seven unrelated items. Suppose, for example, someone quickly reels off a series of numbers to you. You will be able to keep only about seven or eight of them in your immediate memory. Beyond that number, confusion about the numbers will set in. The same limit is there if the unrelated items are a random set of words. However, if those items (numbers, letters or anything else) are all packaged into one chunk, then there is still only one item. Thus we can remember about seven unrelated sets of initials, such as ENS, IP, CCP, even though we could not remember all the letters separately. This is referred to as *chunking* because we have connected, or chunked, them together; in other words, ENS is one item, not three.

One of the tricks of memorizing a lot of information quickly is to chunk together the items as fast as they come in. If we connect items in groups, we have fewer to remember. For example, we remember new phone numbers in two or three chunks (555-6794 or 555-67-94) rather than a string of seven digits (5-5-5-6-7-9-4). As the figure illustrates, we use chunking to remember visual as well as verbal inputs.



Even with chunking, storage in short-term memory is only temporary. Information is available, generally, for less than 20 seconds and no more than 30 seconds, assuming no rehearsal has occurred. After that, it is part of the long-term memory, or it is lost.

**The Primacy-Recency Effect:** It refers to the fact that we are better to recall information presented at beginning and end of a list. For instance, after reading a grocery list of 14 items, we are most likely to remember those presented in the beginning and end of the list.

**Working Memory:** Short-term memory is also called *working memory*. Working memory serves as a system for processing and working with current information. Working memory includes both short-term memory (events that just occurred) and information stored in long-term memory now recalled for current information.

## Recap

**Short-term memory:** memory that is limited in capacity to about seven items and in duration by the subject's active rehearsal

**Maintenance rehearsal:** a system for remembering that involves repeating information to oneself without attempting to find meaning in it

**Chunking:** the process of grouping items to make them easier to remember

Psychologists often compare human memory to a computer; however, unlike a computer, people can never fill their long-term memories so full that there is no room left for storage. *How do the capacities of sensory memory and short-term memory differ?*

	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 where you lived when you were 7 years old

### 1.2.2. Long-Term Memory

**Long-term memory** refers to the storage of information over extended periods of time. The capacity of long-term memory appears to be limitless. It contains representations of countless facts, experiences, and sensations. You may not have thought of your childhood home for years, but you can probably still visualize it.

#### *Types of long-term memory*

- Endel Tulving (1972) proposed that we have two types of memory. **Semantic memory** is our knowledge of language; including its rules, words, and meanings. We share that knowledge with other speakers of our language. **Episodic memory** is our memory of our own life, such as when you woke up this morning. Stored here are personal things where time of occurrence is important. Everyone's episodic memory is unique.
- L.R. Squire (1987) proposed a related model of memory. **Declarative memory** involves both episodic and semantic memory. This is information you call forth consciously and use as you need it. **Procedural memory** does not require conscious recollection to have past learning or experiences impact our performance. One form of procedural memory involves skills, learned as we mature – including both complex skills such as swimming or driving a car and simple skills such as tying a tie. As we gain a skill, we gradually lose the ability to describe what we are doing. Other types of procedural memory, such as fear of bugs, include habits and things learned through classical conditioning.

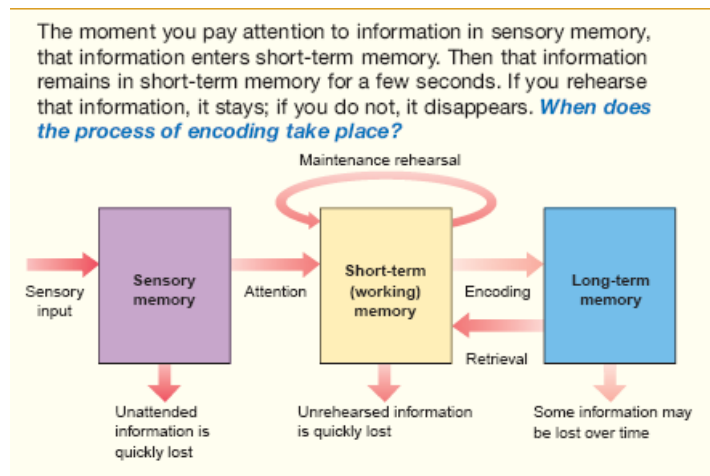
## Recap

**Semantic memory:** knowledge of language, including its rules, words and meanings

**Episodic memory:** memory of one's life, including time of occurrence

**Declarative memory:** memory of knowledge that can be called forth consciously as needed

**Procedural memory:** memory of learned skills that does not require conscious recollection



## **Section 2: Retrieving Information**

### **2.1. Recognition**

Human memory is organized in such a way as to make recognition quite easy – people can say with great accuracy whether or not something is familiar to them. If someone asked you the name of first-grade teacher, for example, you might not remember it. Chances are, however, that you will recognize the name if you heard it. Similarly, a multiple-choice test may bring out knowledge that a student might not be able to show on an essay test. The ability to recognize suggests that much more information is stored in memory than one might think. The process of *recognition* provides insights into how information is stored in memory.

### **2.2. Recall**

*Recall* is the active reconstruction of information. Just think about the amount of recall involved in a simple conversation. Each person uses hundreds of words involving all kinds of information, even though each word and bit of information must be retrieved separately from the storehouse of memory.

### **2.3. Relearning**

While recognition and recall are measures of declarative memory, relearning is a measure of both declarative and procedural memory. Suppose you learned a poem as a child but have not rehearsed it in years. If you can relearn the poem with fewer recitations than someone with ability similar to yours, you are benefiting from your childhood learning.

### **2.4. Forgetting**

Everyone experiences a failure of memory from time to time. You are sure you have seen that person before but cannot remember exactly where. You have the word on the tip of your tongue, but... When information that once entered long-term memory is unable to be retrieved, it is said to be forgotten. Forgetting may involve decay, interference, or repression.

*Decay*: some inputs may fade away, or decay, over time. Items quickly decay in sensory storage and short-term memory, as indicated earlier. It is not certain, however, whether long-term memories can ever decay. We know that a blow to the head or electrical stimulation of certain parts of the brain can cause loss of memory. The memories lost, however, are the most recent ones; older memories seem to remain. The fact that apparently forgotten information can be recovered

through meditation, hypnosis, or brain stimulation suggests that at least some memories never decay. Rather, interference or repression cause people to lose track of them.

**Interference:** refers to a memory being blocked or erased by previous or subsequent memories. This blocking is of two kinds: proactive and retroactive. In *proactive interference* an earlier memory blocks you from remembering related new information. In *retroactive interference* or later memory or new information blocks you from remembering information learned earlier. Suppose you move to a new home. You now have to remember a new address and phone number. At first you may have trouble remembering them because the memory of your old address and phone number gets in the way (proactive interference). Later, you know the new information but have trouble remembering the old data (retroactive interference).

**Repression:** sometimes a person may subconsciously block memories of an embarrassing or frightening experience. This kind of forgetting is called repression. The material still exists in the person's memory, but it has been made inaccessible because it is so disturbing.

**Amnesia:** some people also forget information due to amnesia. Amnesia is a loss of memory that may occur after a blow to the head or as a result of brain damage. Amnesia may also be the result of drug use or severe psychological stress.

## **Recap**

**Recognition:** memory retrieval in which a person identifies an object, idea, or situation as one he or she has or has not experienced before

**Recall:** memory retrieval in which a person reconstructs previously learned material

**Decay:** fading away of memory overtime

**Interference:** blockage of a memory by previous or subsequent memories