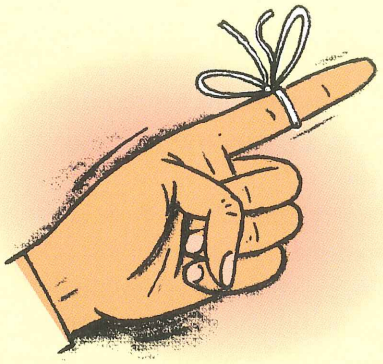
CHAPTER 8



Memory

In this chapter, you will learn about:

- the three tasks in memory formation
- various systems of memory formation and storage
- forgetting
- memory and learning

In the late 1800s, Hermann Ebbinghaus contributed to the growing experimental study of psychology with his studies on memory. Ebbinghaus made up long lists of "nonsense syllables" such as EOF, PEB, or RUV. He tried to memorize these lists under various conditions and tested himself on how long it took him to learn them and how well he remembered them. Although Ebbinghaus's most lasting findings were about how easy it is to forget rather than to remember, his work laid another cornerstone in the foundation of experimental psychology.

How do sensory impressions become memories? Is there a difference between your memories of the date of the signing of the Declaration of Independence and of how to play the piano? Why do you automatically remember some things and have to struggle to remember others?

Memory is a complex behavior that uses many different brain systems. There is still much to be learned about how and why we remember—and how and why we forget.

What Is Memory?

Memory is a mental process responsible for **encoding**, **storage**, and **retrieval** of information.

You may recognize these three terms as coming from the field of computer science. Once again, psychologists find familiar technology useful in describing mental operations. But keep in mind that computers and brains work very differently and that, at some point, the computer metaphor breaks down. After all, the software and hardware of the computer process information in a different way than does the "wetware" of the mind.

* ***Encoding.*** We can think of the encoding phase of memory as the process of taking input from the senses and converting it into a form that the brain can process. This would be like the computer taking input from the keyboard, mouse, digital camera, or scanner and converting it into the 1s and 0s of computer language.
* ***Storage.*** Encoded information can then be retained. This storage of information can be temporary or permanent, depending on its potential use. Some information might be temporarily stored in the computer files you presently have open and with which you are working. Once you save a file, it is stored on your hard drive—to be accessed as needed.
* ***Retrieval.*** At the appropriate time, the stored information can be accessed, either for its own usefulness, to be combined with other incoming information, or to be processed with other information from storage. This retrieval of information is like opening a file or an application that you want to use.

Stages of Memory

Where do each of the three processes occur?

The three-stage model of memory formation is often used to describe the steps of acquiring information, processing it, and either using it at the time or storing it for later use. This model is based on the following **three** stages of memory:

1 Sensory Memory

Information from the outside world enters your brain through the senses. Each sense has a storage area for its particular type of information—visual, auditory, touch, taste, and smell. Information is held in **sensory memory** for a very brief time—a few seconds at most. We constantly scan our environment with our senses, so if information remained in sensory memory for very long, we'd experience blurred images, discordant blends of sound, or mixtures of tastes or odors.

2 Short-Term Memory (STM)

From sensory memory, information goes into short-term, or working, memory. The information in **short-term memory** is what you are consciously aware of at any moment in time. Thinking about the last sentence you read, recognizing the face of a friend in the hall between classes, or holding a telephone number in your mind until you can dial it all take place in short-term memory.

3 Long-Term Memory (LTM)

Long-term memory is like a hard drive, containing information you store for later use. You can access your LTM for answers to test questions, memories about your past or people you know, or procedures such as how to drive a car or use an index in a book.

Sensory Input and Sensory Memory

Our senses gather information from the environment and send it to different parts of the brain as sensory memories. The purpose of sensory memory is to hold information long enough for it to be recognized or attended to and then either ignored or passed on for further processing.

* ***Visual Memory.*** As you scan your surroundings, you make short-lived visual representations of what you see. The information is constantly changing, so your visual memory holds each representation for less than a second.
* ***Auditory Memory.*** Sounds that you hear are retained for a little longer, up to a couple of seconds. This may be because sounds generally occur only once, while visual information can be scanned several times a second. In addition, we may need to hold auditory information long enough to join successive sounds and identify them as words.

Similar brain regions store information on touch, taste, and smell, but much less research has been done on these sensory memory regions.

Attention and Recognition

If you processed everything entering your senses, you'd be overwhelmed with information. Attention and recognition determine whether something that enters sensory memory is ignored (forgotten) or sent along to short-term memory for further processing.

We tend to pay attention to something that is:

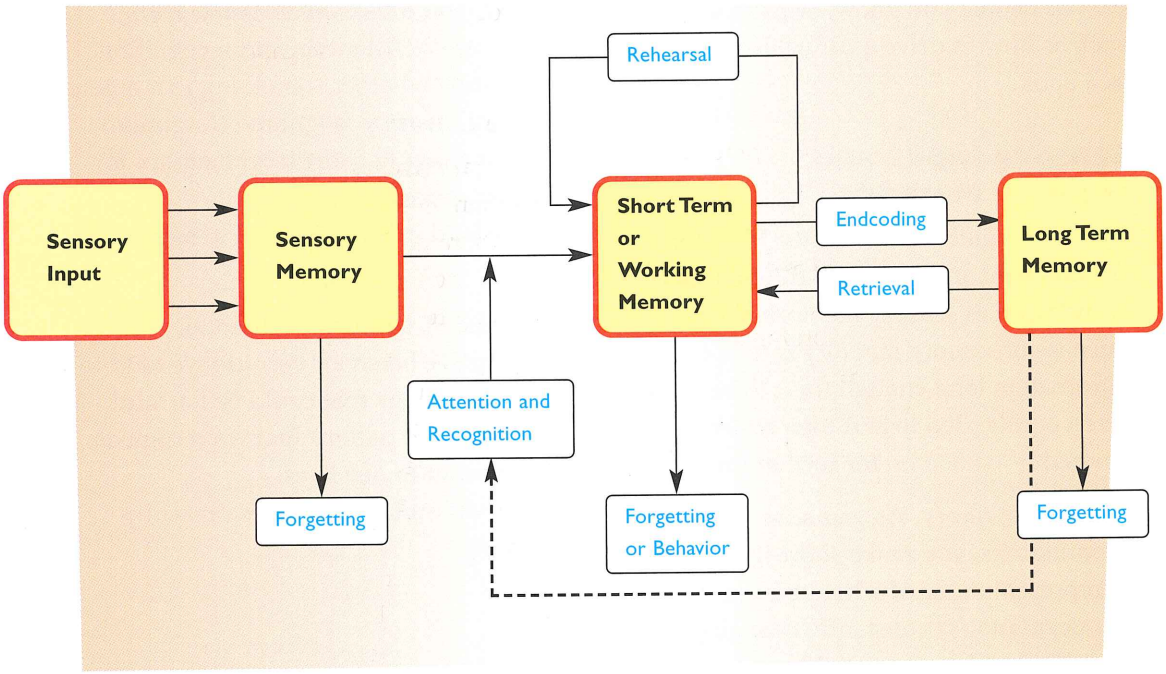
* Unusual, sudden, or dramatic—an adaptive behavior because we tend to notice things that could be harmful.
* An idea or pattern that we recognize.
* Relevant to our lives.
* Important to what we're presently doing.

Attention is the concentration of mental effort on sensory or mental events. Attention determines what information from the environment is sent on for further processing. People can consciously decide to attend to or ignore certain types of information, but often, unconscious values, beliefs, or emotions determine the process.

How do we recognize the personal importance of something? According to the diagram below, information doesn't make it to short-term memory (or long-term memory) unless we've paid attention to it or recognized it as something important. But without comparing the new input to something we already have in long-term memory, how do we know whether it is important?

The dotted line on the diagram shows this input from LTM to the process of recognition and attention. The connection may not be this direct. Theorists have suggested several ways that it might occur.

The Information Processing Model of Memory



▲ The diagram shows an overview of the steps that cognitive psychologists believe we go through in memory formation.

Short-Term Memory

Short-term memory contains the things we are presently aware of. Short-term, or working, memory holds information, moves it from one place to another, and provides space for thinking and problem solving.

It is important to note that sensory input isn't necessary to have something going on in STM. When you're thinking about what you did last weekend or trying to decide what to cook for dinner, you may be drawing all the information you are using from your long-term memory. STM works on internal or external input similarly.

Encoding in STM

Information in short-term memory may be in the form of pictures (iconic), sounds (acoustic or echoic), or occasionally, meaning (semantic). For example, when trying to hold a telephone number in memory, most people hear it (acoustic encoding), although some people will see the number (iconic encoding).

One possible explanation for the acoustic preference in STM is that humans had spoken language before written language and so developed an efficient storage mechanism for sounds. What letter comes before *q* in the alphabet? Many people have to "say" the letters in order before answering. This suggests that the alphabet is stored acoustically rather than iconically.

There are **two** exceptions to the acoustic preference of STM.

1. Iconic images of extremely vivid or highly emotional memories seem to move through STM and into LTM relatively unchanged. This was once called "flashbulb memory." Studies have shown that, although people believe that such memories are more complete and accurate, the memories are actually as flawed as those of events stored in less emotional situations.
2. The second exception is called eidetic imagery—sometimes known as photographic memory. Some children and even fewer adults can record a scene or store pages of a book as images that can be recalled later without error.

Time Duration of STM

Information stays in short-term memory for less than 30 seconds unless it is rehearsed or elaborated upon in some way. **Rehearsal** is repetition, and **elaboration** is adding meaning to something by connecting it or organizing it with other information already in long-term memory.

If you look up a phone number, you probably keep repeating it to yourself until you reach the phone. If you don't, you may have to circle back to the phone book. If you do this long enough, the number may move on to LTM.

What methods might you use to link the name and face of a person you've just met?

Capacity of STM

In the 1950s, George Miller observed that STM is capable of holding only 7 plus or minus (±) 2 pieces of unrelated information. For example, most people couldn't hold a number such as 11749486712 in STM.

A process called **chunking**—grouping pieces of unrelated information—can overcome this limitation. By chunking the number to 1-174-948-6712, eleven pieces of information become four—the typical way we say a telephone number. In a study done over several months, one person was able to increase his memory from 7 digits to 72 simply by combining the digits into groups that were meaningful to him.

The 7 ± 2 "pieces" may be digits, numbers, words, familiar phrases, or ideas. Chunking is often used by experts to recall huge amounts of information in a particular field. Some chess players can hold an entire chessboard of pieces as one item in memory because they have a name for that particular alignment of pieces.

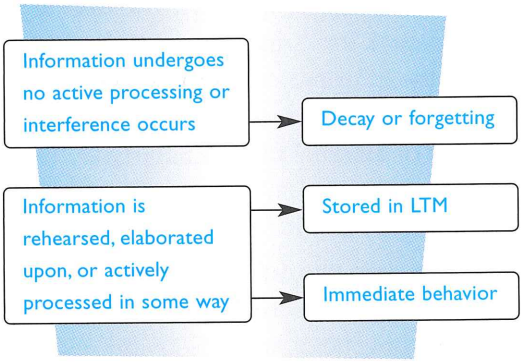
Storage in STM

Most of what has passed through your STM today has been forgotten. If the information wasn't important enough to be rehearsed or elaborated upon, the signal simply faded. This might be true of the sound of your alarm or the color of a towel you used. This reason for forgetting is called **decay**.

While reading the paper, you find an interesting article you plan to share with a friend. As you are rehearsing it, the phone rings, distracting you from the article. When you hang up, thoughts of the article are gone! Any event that prevents you from rehearsing or elaborating information in STM is likely to prevent that information from being retained and passed on to LTM. This reason for forgetting is called **interference**.

Output of STM

What happens to information in STM?



Information that is processed in STM may lead to an immediate behavior followed by decay or forgetting. Once you've decided what to make for breakfast, there's no real need to send that information to LTM. You may retain a memory of what you ate, but not of the process you used in deciding what to prepare.

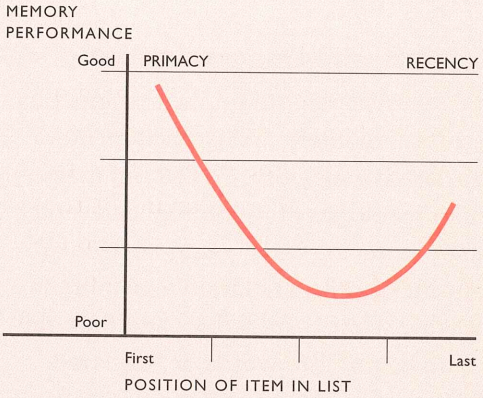
"To find out if you're someone who could benefit from our Memory Improvement Seminar, please press 59736222582095217059."

Evidence for STM-LTM

Why do psychologists think that there are two different memory systems (STM and LTM) rather than just one? Continuing the work of Ebbinghaus, researchers ask participants to memorize and recall lists of nonsense syllables, such as ZOK or BIR. Participants are then asked to recall the syllables in order of their appearance on the list (serial learning) or in any order (free recall). Typical results are shown in the graph.

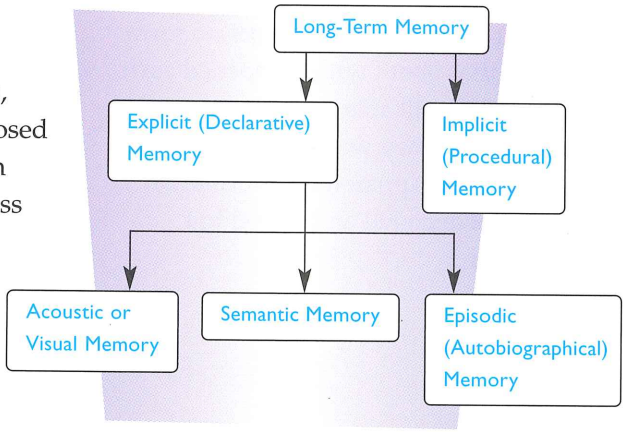
Participants tend to remember better the first syllables in the list. This is called the *primacy effect*. Researchers interpret this as resulting from more rehearsal time or chunking of earlier syllables and subsequent passage to LTM. In the middle of the list, there are too many syllables to rehearse, and they are coming too fast to chunk.

The ability to recall the last syllables—the *recency effect*—is attributed to their presence in STM. If the recall isn't requested until 30 seconds after the final syllable is presented—and during that time, the person is asked to perform an interference task such as counting backwards—the primacy effect remains, but the recency effect disappears. This lends support to the idea of two different types of memory.



Long-Term Memory

Long-term memory is not what it seems, because theorists believe that it is composed of several different types of memory—in terms of content, location, and the process of memory formation. Here is a general overview of the types of LTM.



Explicit and Implicit Memory

Do you remember when and how you learned to walk or tie your shoes? Probably not. It would be difficult for you to describe in words how you acquired those skills. Memories that are difficult to put into words or that we don't remember acquiring are called implicit memories.

Memories of things that have happened to you and of things that you know—such as facts, concepts, and principles—can more easily be described. You can actively search for and find these memories. These are called explicit memories.

Procedural and Declarative Memories

Some theorists refer to implicit memory as procedural memory and explicit memory as declarative memory. Procedural memories are memories of perceptual and motor skills—"knowing how"—and are difficult to put into words. Declarative memory is "knowing what"—memories and thoughts that can be put into words or "declared."

Researchers proposed these two different types of memory after observing people with certain kinds of memory loss. Although unable to retrieve information about their lives or, in some cases, to form new memories about what happened each day, they were still able to perform many different skills. They were even able to learn new ones. Apparently, information could still be encoded and stored but not retrieved.

Encoding in LTM

As in short-term memory, information in long-term memory may be acoustic, visual, or semantic. Long-term memory may also be episodic. What's the difference between these types of information?

Acoustic Memories. Acoustic information may be sentences, thoughts, or sounds that we store "as is." The little song you sang when learning the alphabet or a parent's often-repeated "Clean up your room" are examples.

Visual Memories. These memories take **two** forms:

1. Imperfectly reproduced images of scenes, pages in a book, or other visual stimuli.
2. Cognitive maps by which we organize our environment. These may look like regular maps or may be made up of familiar landmarks. It's likely that we even have visual maps composed of symbols that represent concepts or relationships with people in our environment.

Semantic and Episodic Memories. What is your home address? How did you learn your home address? The answers to these two questions are different, as are the ways in which the information is encoded.

In general, semantic memories are memories of facts, concepts, and principles. They might include the capital of Illinois, the concept of truth, or the principle of supply and demand. Semantic memories can be acquired at any time and tend to remain stable over time.

Episodic (autobiographical) memories are memories of things as they are related to your life. What you had for supper last night, what the weather was like on Tuesday, and where you went on your last vacation—these are episodic memories.

We learn episodic memories in the sequence in which they happen. Episodic memories are more likely to undergo changes over time as memories adjust to more mature interpretations. An older person's memories of her childhood may be very different from what actually occurred.

Depth of Processing

One theory about the encoding of semantic memories is called Depth of Processing. The theory proposes that information processed at a semantic level—in terms of its meaning or relevance—is more effectively encoded, and thus retrieved, than information processed superficially.

Researchers presented participants with a list of words. On each trial, the participants had to answer a question about each word.

Physical Properties of the Word—Is the word in all capital letters? How many vowels are in the word?

Acoustical Characteristics of the Word—Does the word rhyme with _____?

Semantic Characteristics of the Word—Does the word mean the same as _____? Does the word fit into this phrase?

Researchers found that the more deeply (semantically) the word was processed, the more likely it was to be recognized on a later test of retrieval. They suggest that the deeper the processing, the better the memory. Another interpretation is that because semantic processing takes longer, time spent may be the key factor in efficient encoding and storage.

These findings would suggest that the more time you spend in organizing, associating, or giving other meaning to new information, the easier you will be able to retrieve it at a later time.

Sidebar

Tips for Improving Your Memory

The more you can organize, associate, and elaborate on incoming information, the richer the encoding and the greater the opportunities for retrieval. Here are just a few ways to improve your memory:

1. Organize information in a graphic organizer, chart, or table showing relationships among elements or ideas.
2. Identify ways in which the information is relevant to your life.
3. Link the information to other ideas already in your LTM. These may include actual connections or metaphors, such as comparing the mind to a computer.

Duration of LTM

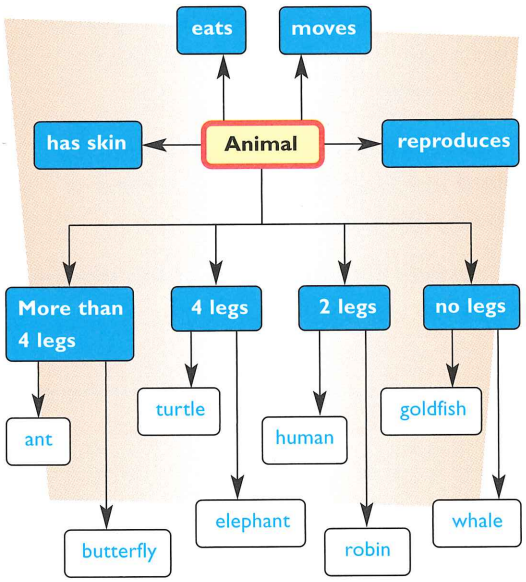
Assuming that information has been richly encoded and apart from the factors involved in forgetting, information will remain in long-term memory permanently.

Capacity of LTM

It was once believed that the capacity of LTM memory was limitless. Some researchers have tried to calculate the number of possible connections that a person could make, but without definite knowledge of how information is chunked, the size of the units stored, or the biological processes that help produce memory, these attempts are strictly theoretical. Others have tried to base the capacity of memory on the electrical power available in the brain. For all practical purposes, the number of things your memory will store is infinite—even if you sometimes feel as if you can't remember one more thing for that big test!

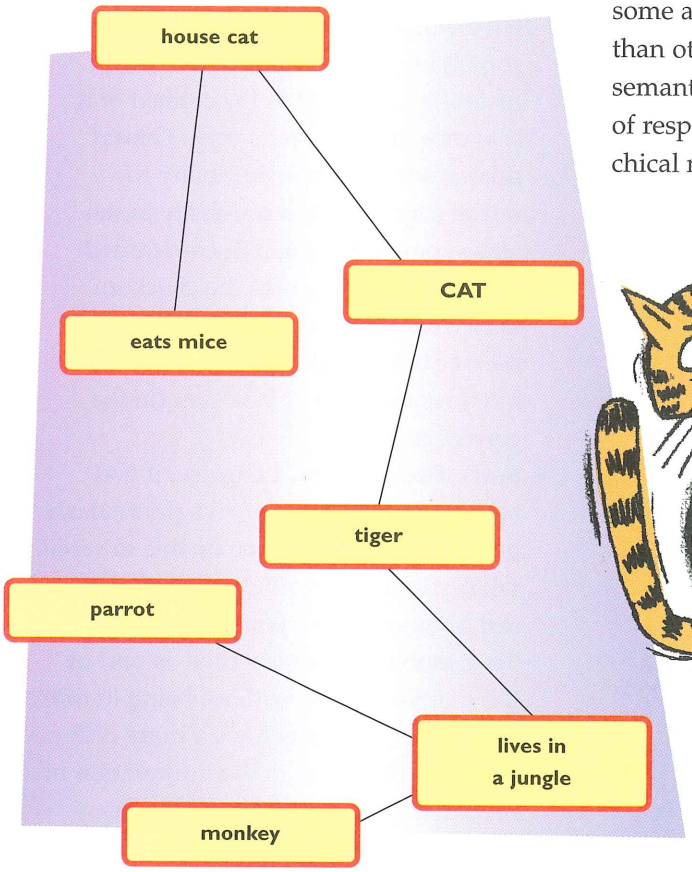
Storage of Semantic Memories

Early researchers believed that semantic memories were stored in hierarchical form. Below is a possible hierarchical structure for the classification of animals:



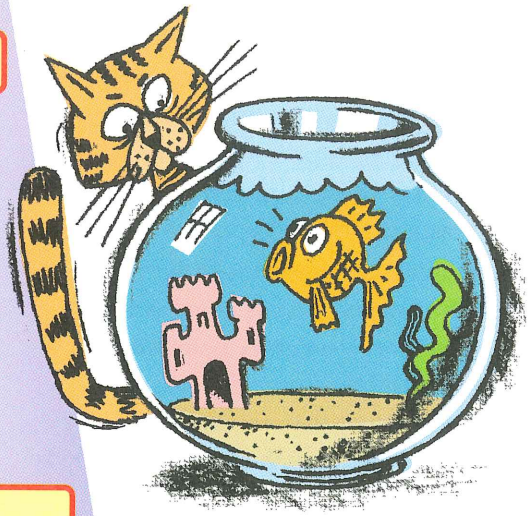
A network is one form of hierarchy that lets you make more complex connections among levels within. It models how you could connect a cat to mice, to witches, and to the idea of "nine lives."

A network can be pictured as a collection of items linked to one another in multiple ways. Here is a very simplified example of a network on the concept of *cat*. The network links obvious and not so obvious items (parrot) to *cat*.



There are many other ways in which information could be organized hierarchically. Animals could be divided into air, sea, and land creatures or into birds, mammals, and insects. The categories in the hierarchy will determine the ease with which a person can answer questions such as "Is a butterfly an animal?" or "Does a goldfish have skin?"

You can see how, if a person is asked to say whatever word comes into his or her head when you say "cat," the network could lead to "parrot" or "eats mice." In an actual network, some items are closer together or connected in multiple ways, so some answers (connections) are more likely than others are. The network model of semantic storage explains a wider variety of responses than the less complex hierarchical model.



Memory Retrieval

Once information has been encoded and stored, how is it retrieved? Studies involving the retrieval of information are most often used in trying to understand memory. But memory retrieval is much more than just answering a question about what you know or what happened in the past.

Recall and Recognition

There are **two** ways in which previously stored information—sometimes called a *memory trace*—can be retrieved.

1. **Recall.** If you're asked the name of your fifth-grade teacher or the name of the sixteenth president of the United States, you must go into your LTM and hunt for the correct response—the particular trace that holds the information you need. **Recall** involves searching for and producing information from memory.
2. **Recognition.** Identifying teachers you've had from names on a list takes much less random searching through your databanks. **Recognition** is identifying whether or not you've encountered something, such as a person, thing, or word, before.

In general, recognition is easier than recall. You are given a cue about where to look in memory—an entry point into the network. Multiple-choice tests require recognition rather than recall, while essay tests generally require that you recall a body of information about a particular idea.

Tip of the Tongue (TOT)

At times, you might know the meaning of the word you want and be able to identify several examples, but you can't think of the word itself. You might say, "It's on the tip of my tongue," meaning that some of the information is there for you, but you just can't access the rest. This partial recall of related information suggests that memories aren't necessarily stored together.

Cueing Memory

Several other factors can affect your ability to retrieve information.

* ***Context Dependence.*** Context is the environment in which you encounter something. You may recognize the meaning of a word in the context of a sentence, but not on its own. *Context dependence* describes the ability to retrieve a memory more easily in the same context in which it was learned. You may not recognize the checkout lady from the grocery store when you see her in the mall. She looks familiar, but you just can't "place" her (in the correct context).
* ***State Dependence.*** Likewise, if you studied when you were in a particularly good mood, you may be unable to recall what you memorized if you're feeling sad or angry when you take the test. Your mood or state is stored as part of the memory trace. Without being in that same state, you may have a more difficult time "linking" to the information in memory. This influence on memory retrieval is called *state dependence.*

Forgetting

If you're asked a question and can't retrieve the answer from memory, is it because you've forgotten? Not necessarily. Consider the three stages it takes to form a lasting memory: it may be that you never encoded the information, that it was somehow stored incorrectly, or that there is a problem with the retrieval process. Assuming that the information has been properly encoded and stored and retrieval isn't a problem, there are still several reasons why a person may forget.

Reasons for Forgetting

* ***Decay.*** Early theories suggested that memory traces were electrical signals that moved through the central nervous system. If the memory wasn't activated over long periods of time, the signals would weaken and eventually disappear, or decay.

* ***Interference.*** Interference might also contribute to forgetting. You've seen how interference can prevent a memory in STM from being rehearsed or elaborated sufficiently to move to LTM. Once in LTM, how can a memory be interfered with?

One theory regarding interference says that even after information has entered LTM, a consolidation period follows during which the information is settling in to its permanent location and connections are being strengthened. If you undertake another memory task during this time, new bits of information can interfere with one another and prevent the appropriate links from forming within the network.

Studies have shown that people who learn material just before going to sleep have better recall than those who learn during the day. One reason for this is that there is no chance for interference from other information. Other researchers have found that there's an increase in "fast-wave" sleep patterns after a learning task, suggesting that some memory consolidation may occur during sleep.

Amnesia

One serious reason for forgetting is amnesia. **Amnesia** is a temporary or permanent inability to remember. The study of people with amnesia has been one of the most important ways in which researchers have learned about memory. Amnesia has a number of possible causes:

* ***Physiological Causes.*** Brain tumor, head injury, stroke, or other trauma to the central nervous system can cause amnesia. Damage to parts of the brain produces different types of amnesia. Observing types of damage has helped researchers understand some of the processes involved in memory.
* ***Substance Abuse.*** Korsakoff's syndrome, a form of amnesia, is caused by chronic vitamin deficiency associated with alcohol abuse. Even after a patient stops drinking, the brain damage that was produced is generally irreversible.
* ***Psychogenic Causes.*** Although many people form vivid images of highly emotional events, others may become unable to recall the event except under hypnosis or when a similar event occurs. Many psychologists believe that some memories are repressed even among otherwise healthy individuals.

The two most common forms of amnesia are *retrograde* amnesia, in which a person loses the ability to form new memories after a trauma, and *anterograde* amnesia, in which the person cannot recall events that occurred just before a trauma. The latter is often irreversible and may indicate brain damage.

Amnesiacs may lose their ability to retrieve autobiographical memory but retain their semantic memory. They know the name of the president but not their own name. Others may learn new things but not remember doing them. The fact that many amnesiacs seem normal in every way except their specific loss of memory lends support to the idea that memory is a process separate from other cognitive functions.

Three-Stage Model of Memory Formation

Memory Stage	Sensory Memory	Short-Term Memory	Long-Term Memory
Time	Up to 2 seconds	Up to 18–20 seconds	Relatively permanent
Capacity	Full sensory impression	7 ± 2 units of information	Unlimited
Process	Holds sensory information briefly prior to processing	Works actively, consciously in processing, problem solving, preparation for long-term storage	Keeps information in long-term storage
Types	Input from each of the five senses	Information from senses or from LTM	Implicit/explicit, (procedural/declarative), semantic/episodic acoustic or visual

Can an Eyewitness's Memory Be Trusted?

Many court cases hinge on the testimony of an eyewitness because juries are often persuaded by somebody who was present when the events in question took place. However, studies have questioned the accuracy and reliability of these reports. Should eyewitness testimony continue to play the same major role in the courtroom?

THE ISSUES

Most people think that nobody could give more accurate or complete information about an event than somebody who witnessed it. According to surveys, juries consider eyewitness testimony very important to their verdict decision.

However, many studies have shown that eyewitness testimony can be wrong. Eyewitnesses can only remember what they were paying attention to. They can miss important details at the crime scene without realizing it.

Another problem is that it is very difficult for human memory to avoid being influenced by new information. If a lawyer were to ask "Did you see the pipe on the ground?" a witness may be influenced into mistakenly remembering that a pipe was present when he didn't actually see one. Studies show that when new objects are mentioned, eyewitnesses frequently add those objects to their original memories without realizing it.

Finally, juries are heavily influenced by witnesses that provide a large number of details and who appear confident in their testimony. Even when the details are irrelevant to the case, and the report does not seem to match up with the evidence, this sort of eyewitness testimony will have a significant effect on the jury.

Many lawyers say that there is no substitute for an eyewitness. However, some claim that in order to make the legal system more just for everybody, changes should be made in the way eyewitness testimony is used and presented.

THE PROCESS

1. **Restate the issues**. In your own words, restate the basic question presented.
2. **Provide evidence**. From your own experience and the information above, list the evidence *for* trusting eyewitness accounts.
3. **Give opposing arguments**. From your own experience and the information above, list the evidence *against* trusting eyewitness accounts.
4. **Look for more information**. What else would you like to know before you draw any conclusions? Make a list of your questions. On the Internet, in the psychology section of the library, or in the index of psychology books, research the way that *eyewitness testimony* is used in court and studies on its reliability and accuracy.
5. **Evaluate the information**. Make a chart with two columns:

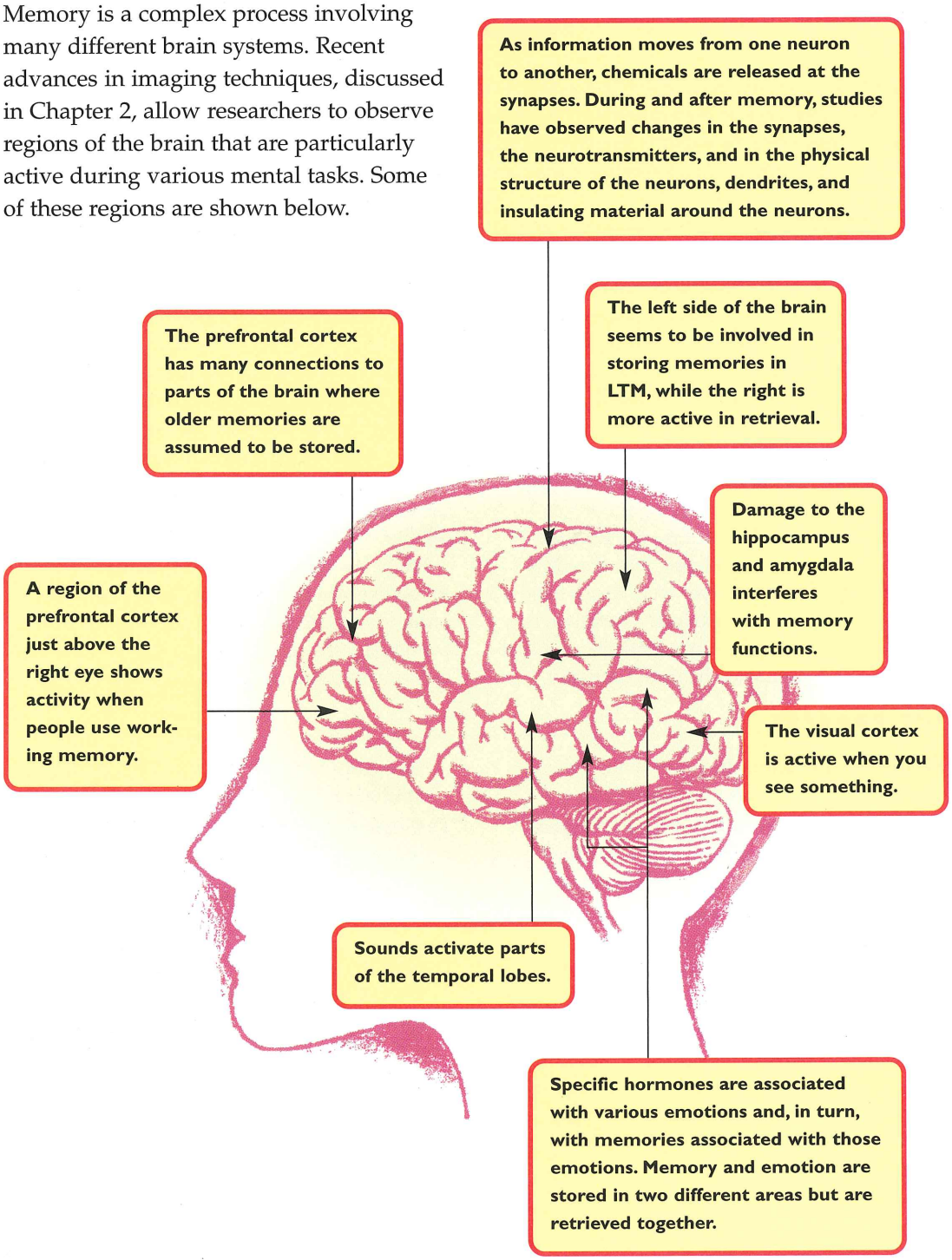
Trusting Eyewitness Testimony	
For	Against

Record the argument in each column and rank each argument in importance from 1 to 5, with 1 as the most important.

6. **Draw conclusions**. Write one paragraph supporting your answer to the question, "Should the way eyewitness testimony is used in a court of law be changed?" Give facts to support your conclusion.

The Biology of Memory

Memory is a complex process involving many different brain systems. Recent advances in imaging techniques, discussed in Chapter 2, allow researchers to observe regions of the brain that are particularly active during various mental tasks. Some of these regions are shown below.



Memory and Learning

No learning takes place unless something is remembered. Memory formation and retrieval can be enhanced in a number of ways, such as the elaboration, organization, and context learning already mentioned. Here are **four** approaches to improving and understanding how we learn.

1 Principle Learning

This useful technique involves learning the basic principles before trying to recall details. For example, if you first understand that the basic principle of dog training is stimulus-response, you can apply that principle to each new trick that you want to teach your dog.

2 Schemas

As it is encoded and stored, information can become associated with a variety of schemas, or patterns the brain recognizes. For example, a word such as *honest* may be part of schemas for banking, working, shopping, or friendship. The word *honest* encountered in a new context will expand the schema and increase understanding of complex ideas.

3 Mnemonics

Mnemonics are memory techniques based on active processing of information. For instance, if you have to memorize a list in an exact order, associate each word on the list with an object in the room—in the order in which you scan them. Then, when you go to recall the list, you mentally scan the room. Or, you might create a humorous or unique connection for list items, or tie together, in story form, the objects or words you have to remember. Again, the more unusual the story, the easier it will be to remember. You might also create a picture containing all of the objects on your list. Images can hold much more information than memories stored as words.

4 Learning Curves

If you are learning something that requires the accumulation of information, the rate at which you learn will generally rise with more practice and will then level off. If you are learning something very unfamiliar, your rate of learning may be very slow. Once you've caught on, it may then rise quickly. Different learning tasks produce different learning curves.

Clearly, much remains to be understood about how we encode, store, and retrieve information. Here are just a few issues:

* ***Repressed Memory.*** Are some traumatic memories repressed? Can they be recovered? Should they be recovered?
* ***Lab vs. Real Life.*** Do the memory studies done in laboratories teach us anything about what we do in real life?
* ***Reconstruction.*** To what extent do memories reflect what actually happened? How do we change history?

Chapter 8 Wrap-up

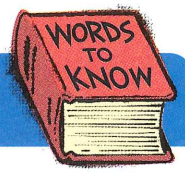
MEMORY

Our memory systems encode, store, and retrieve information. One model suggests that there are three stages of memory formation: sensory memory, short-term (or working) memory, and long-term memory. Multiple system models suggest that long-term memory can be further broken down into explicit and implicit memory, procedural and declarative memory, and episodic and semantic memory.

Anything that will produce more active processing of information will tend to increase the probability that information will be encoded and stored effectively and be available for retrieval. Forgetting can occur because of decay, interference, or physical or mental trauma.

Memory processes can be linked to both structural and chemical processes throughout the brain.

Psychology



amnesia—temporary or permanent inability to remember. *p. 127*

chunking—process of grouping pieces of unrelated information. *p. 120*

decay—condition in which unrehearsed or unretrieved information is lost from memory. *p. 120*

elaboration—addition of meaning to information to organize it or make it more relevant and hold it in STM. *p. 119*

encoding—process of converting input into a form that can be stored in long-term memory. *p. 116*

interference—any event that prevents rehearsal or elaboration of information in STM. *p. 120*

long-term memory (LTM)—memory of information stored for later use. *p. 117*

memory—mental process responsible for encoding, storage, and retrieval of information. *p. 116*

recall—searching for and retrieving information from memory. *p. 126*

recognition—identifying something encountered before. *p. 126*

rehearsal—repetition of information to hold it in STM. *p. 119*

retrieval—process of getting stored information through recall or recognition. *p. 116*

sensory memory—memory of information very recently perceived by the senses. *p. 116*

short-term memory (STM)—working memory where information is consciously and actively processed. *p. 117*

storage—temporary or permanent retention of information in memory. *p. 116*