Memory

A Self-Teaching Guide

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John Wiley & Sons, Inc.

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Contents

Introduction

To countless preliterate tribes, memory was the storehouse for the history of their people. To the ancient Greeks and Romans, memory was the key to political success. To more modern memory experts, it was the path to spiritual fulfillment.

But gradually the importance of memory faded, with the advent of the alphabet and the written word. Its value became even less important in the modern age: in our world of typewriters, computers, satellites, and instant communication, memory no longer holds the mystical magic it offered our ancestors. For many in today's world, a good memory is nothing more than a sort of intellectual shorthand, an easier way to study, to succeed in business, to live an organized life.

But in a deeper sense there is far more to memory than recalling dates, finding car keys, or cramming for a history final. It is our memory that transforms a series of unconnected moments into a continuous, unified whole, linking us to our past and pointing the way into the future. We are compassionate because we remember what it is to feel pain. We buttress our lives against disaster because we remember what disaster has cost us in the past. Memory gives us a future more secure than that of creatures who are doomed to repeat their past simply because they cannot remember it. It can rescue us from the fate that awaits those destined to obliteration because they cannot adapt to changed circumstances.

Memory has made possible the development of philosophy and science and song. More personally, it is the repository of our deepest emotions and our most compelling experiences. Memory holds the scent of the sea wind, the sound of a child's laughter, the image of the beloved. It is memory that makes us fully human, because it distills the rich diversity of experience into the essence of the soul.

1 What Is Memory and What Can It Do for You?

Objectives

In this chapter you will learn:

- what memory is
- how memory works
- how to encode a memory
- the key to improving memory

People often talk about memory as if it were a *thing,* like a trick knee or a good head of hair, but in fact your memory doesn't exist in the same way an object exists. Rather, memory refers to the *process* of remembering. Contrary to popular belief, memories aren't plucked fully formed out of little file folders packed away neatly in your brain. Instead, memories represent an incredibly complex constructive power that each one of us possesses.

Here's a simple memory test:

1. Remember these words: corn, radio, horse.
2. Remember this name and address: John Brown, 365 Walnut Street, Pittsburgh, Pennsylvania.
3. Name the governor of your state.
4. Name the past two U.S. presidents.
5. What was the main dish you had for breakfast the past two mornings?
6. What were the last two movies you saw in a theater?
7. Have you had more trouble than usual remembering what you've done for the past few weeks?
8. Has it been harder for you to remember names?
9. Have you noticed a decline in your ability to calculate in your head, such as figuring out a tip or correct change?
10. Have you been forgetting to pay bills?
11. Have you had trouble remembering dates?
12. Have you had trouble recognizing people you should know?
13. Have you had a hard time finding the right word you want to use?
14. Have you had trouble remembering how to do simple tasks, such as how to use the stove or a remote control?
15. Do memory problems interfere with your job?
16. Do memory problems interfere with your functioning at home?
17. Does your memory interfere with how well you cope in social situations?
18. What were the three words you were asked to remember at the beginning of the quiz?
19. What was the name and address you were asked to remember at the beginning of the quiz?

Scoring

Questions 3–6	1 point for each answer you were able to give
7–17	1 point for each "no" answer
Bonus points	3 points each for answering 18 and 19 correctly

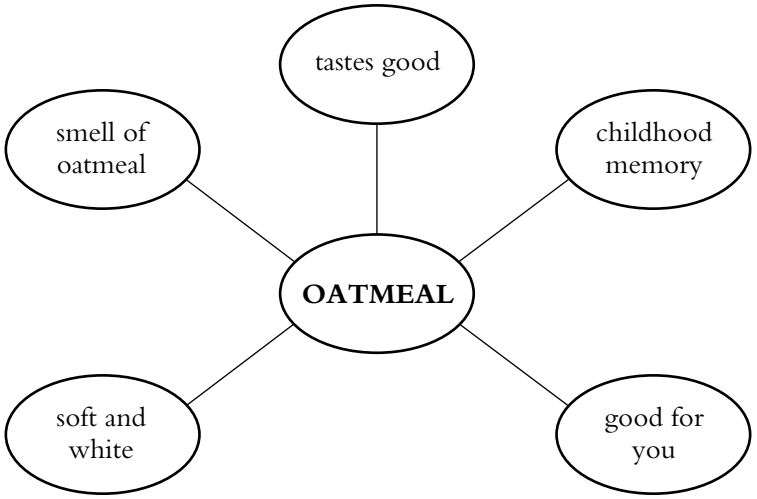
If you scored . . .

19–21	Great job! You have a better-than-average memory.
16–18	Not bad. You've got an average memory.
11–15	A bit weak. You need to work on the techniques in this book.
0–10	Poor memory. You may need a professional evaluation.

Your baby's first cry . . . the taste of your grandmother's cherry cake . . . the scent of the sea wind. These are memories that are a part of the everyday experiences of your life. Collectively, these memories contribute to making you who you are and help you feel comfortable with familiar people and your surroundings. They serve to connect the past with the present, while providing a structure for the future. This is one of the reasons that the shadow of Alzheimer's disease is so terrifying—if we lose the memories that make us who we are, what do we become?

In the past, many experts have thought of memory as some type of computerlike process lodged somewhere in one section of a person's brain. But today most experts theorize that memory is far more complex and elusive than that. Current researchers believe not that a person's memory is located in one particular place in the brain, but instead that it is a process that takes place *throughout* the brain.

Think about what you had for breakfast this morning. If the image of a big bowl of oatmeal popped into your mind, you didn't concoct that image from some neural pocket in the folds and fissures of your brain. That memory was the result of an incredibly complex process that reassembles different memory impressions from a weblike pattern of cells scattered throughout the brain. Your "memory" is really made up of a group of systems, and each plays a different role in creating, storing, and recalling memories. When the brain processes information normally, all of these different systems work together perfectly so that you are capable of cohesive thought.



What seems to be a single memory—that bowl of oatmeal—is actually a complex construction. If you think of oatmeal, your brain retrieves its name, its shape, its function, the smell when it's steaming in the bowl—each part of the memory of what "oatmeal" is comes from a different region of the brain. The entire image of "oatmeal" is actively reconstructed by the brain from many different neural areas. Neurologists are only beginning to understand how the parts are reassembled into a coherent whole.

Let's look at another example. If you're riding a horse, the memory of how to ride the horse comes from one set of brain cells, the memory of how to get from here to the end of the paddock comes from another, the memory of horseback-riding safety rules from another, and that nervous feeling you got when your mount slipped going around the corner came from still another. Yet you're never aware of these separate mental experiences, nor of the fact that they're coming from all different parts of your brain, because they work together so well. In fact, experts tell us there is no firm distinction between how you *remember* and how you *think*.

How Does It All Work?

Scientists still don't fully understand exactly *how* we remember or what occurs during recall. The search for the way the brain organizes mem-

ories and where those memories are acquired and stored has been a never-ending quest among brain researchers for decades. Still, there is enough information to make some educated guesses.

Encoding a Memory

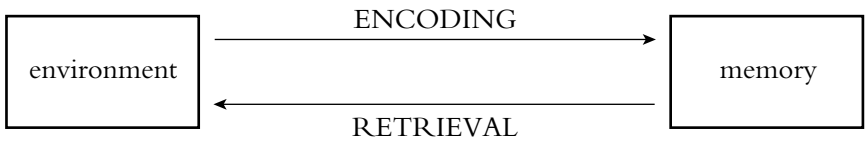
The process of memory begins with the way information is encoded. Encoding is the first step to creating memory—a biological phenomenon rooted in the senses. For example, if your earliest memory is "mother," your brain probably identified one shape as your mother's blouse, another shape as your mother's face, together with the smell of her clothes, the sound of her voice.

Each of these separate sensations traveled to the part of your brain called the **hippocampus,** which integrates these perceptions as they occur into one single experience: "mother." The hippocampus probably consolidates information for storage as permanent memory in another part of the brain.

Yet while a memory begins with perception, it is encoded and stored in the language of electricity and chemicals. Nerve cells interact with other cells across a tiny gap called a **synapse.** All the action in your brain occurs at these synapses, where electrical pulses carrying messages leap across the gaps between cells. The electrical firing of a pulse across the synapse gap triggers the release of chemical messengers called **neurotransmitters.** These neurotransmitters diffuse across the spaces between cells, attaching themselves to neighboring cells. Each brain cell can form thousands of links like this, giving a typical brain about 100 trillion synapses. The parts of the brain cells that receive these electric impulses are called **dendrites**—feathery tips of brain cells that connect to the neighboring cell.

What is a synapse?

Answer: A synapse is the tiny gap across which a signal is transmitted from one nerve cell to another.



Brain cells function together in a network, organizing themselves into groups that specialize in different kinds of information processing. Yet the connections between brain cells aren't permanent—they can and do change all the time. As one brain cell sends signals to another, the synapse between the two gets stronger. The more active the two brain cells are, the stronger the connection between them grows. This means that with each new experience, your brain slightly rewires its physical structure. In fact, how you use your brain helps determine how your brain is organized. It is this flexibility, which scientists call **plasticity,** that can help your brain rewire itself if it is ever damaged.

As you learn and experience the world, changes occur at the synapses and dendrites, and more connections in your brain are created. In this way, the brain organizes and reorganizes itself in response to your experiences, forming memories triggered by the effects of external input prompted by experience, education, or training.

These changes are reinforced with use, so that as you learn and practice new information, intricate circuits of knowledge and memory are built in the brain. For example, if you play a piece of music over and over, the repeated firing of certain cells in a certain order in your brain make it easier to repeat this firing later on. The result: you get better at playing the music. You can play it faster, with fewer mistakes. Practice it long enough and you will play it perfectly. Yet if you stop practicing for several weeks and then try to play the piece, you may notice that the result is no longer perfect. Your brain has already begun to "forget" what you once knew so well.

To properly encode a memory, you must pay attention. Like most of us, you go through your day ignoring quite a lot of stimuli, so that much of what you encounter every day is simply filtered out. Only a few stimuli pass into your conscious awareness. This is important, because if you remembered every single thing you noticed, your memory would soon become bogged down and overloaded. Therefore, the *way* in which you pay attention to information may be the most important factor in how *much* you remember.

If you want to remember a word, thinking about how it sounds or what it means will help. If you use visual imagery to help you memorize something (for example, meeting a person named Mr. Bell and thinking of a bell when you shake hands), you're more likely to remember it. Some experts believe that using imagery helps you remember because it

provides a second kind of memory encoding—and two codes are better than one.

Read the list of words below and try to create a visual picture to go with each word to help you remember it:

stone
smith
barn
rock
tree
bird
young
bean
grin

Memory Stores

Once a memory is created, it must be stored. Many experts think there are three ways we store memories: first comes the sensory stage, when we first notice something. As we perceive something, its registration during perception occurs in the brief "sensory storage" that usually lasts only a fraction of a second. It's our sensory memory that allows a perception such as a visual pattern, a sound, or a touch to linger for a brief moment once the stimulation is over.

After that first flicker, the sensation is stored as short-term memory, a fairly limited cache that lasts for just twenty or thirty seconds before being replaced with other material (unless you constantly repeat it). Most of us find it impossible to remember a phone number after using it the first time, because it's stored only in our ultra-short-term memory. But after using that number more frequently, the information will then become part of our short-term memory; if we use it often enough, ultimately it is stored in long-term memory (also called **retaining**). Unlike sensory and short-term memory, which decay rapidly, long-term memory can store information indefinitely in an unlimited capacity. Most people think of long-term memory when they think of

memory itself—but most experts believe that information must first pass through sensory and short-term memory before it can be stored as a long-term memory.

Because there is no need for us to maintain everything in our brain, the different stages of human memory function as a sort of filter that helps to protect us from the flood of information with which we're confronted every day. People tend to store material on subjects they already know something about, since such information has more meaning. This is why someone with a normal memory may be able to remember in depth more information about one particular subject.

Remembering

When you want to remember something, you retrieve the information on an unconscious level, bringing it into your conscious mind at will. While most people think they have either a "bad" or a "good" memory, in fact most of us are fairly good at remembering some things and not so good at others. If you do have trouble remembering something—and assuming you don't have a physical disease—it's usually not the fault of your entire memory system but an inefficient component of one part of your memory system.

Let's look at how you remember where you left your car keys (something many people have trouble with!). If you're going to remember where you left your car keys, you must first register where you placed them. You must be aware of where you are putting them, or you won't remember the location when you need them again. This is where many people go wrong—when they come into the house, they're busy thinking about where they've been or what they're going to tell their spouse now that they're home. They are not paying attention to where they fling their keys.

If you do pay attention to where you've placed the keys, this information will be retained, ready to be retrieved at a later date. If your memory system is working properly, when you go to find your keys you will remember exactly where you left them.

If you've forgotten where they are, one of several things could have happened:

- You may not have registered clearly to start with where you put them down.

- You may not have retained what you registered.
- You may not be able to retrieve the memory accurately.

Therefore, if you want to stop forgetting where you left your keys, you will have to work on improving all three stages of the remembering process. Research suggests that older people in particular have trouble with all three of these stages, but they have special problems with both registering and retrieving information.

If you're forgetting something, it may be that you haven't encoded it very effectively, because you were distracted while the encoding should have taken place. If you've "forgotten" where you put your glasses, you may not have really forgotten at all—instead, the location of your glasses may never have gotten into your memory in the first place. For example, you probably would say that you know what a ten-dollar bill looks like, but most of the time you've not really encoded it, so that if you tried to describe it in detail, you probably couldn't.

Distractions while trying to remember something can interfere with registering your memories. If you're trying to read a complicated tax return in the middle of a busy airport, you may think you're remembering what you read, but you may not be effectively saving it in your memory.

You may forget simply because you're having trouble retrieving the memory. If you've ever tried to remember something one time and couldn't, but then later you remembered that same item, it could be that there was a mismatch between retrieval cues and the encoding of the information you were searching for.

You'll be better able to remember something if you use a "retrieval cue" that occurred when you first formed a memory. If you memorized a poem in your bedroom while Mozart was playing, listening to Mozart again may help you to recall the poem. This is why vivid memories, such as something traumatic, will recur strongly in the presence of an original accompanying sensation—say, why the sound of a car backfiring to a veteran may trigger the unpleasant memories of war.

What's Your Word Span?

One way to test your memory is to take a word-span test. In this exercise have someone read out the following words one set at a time, one word per second. You then repeat the words back.

The first set has just two words in each. The next has three, and so on until you get to seven. You should stop when you can no longer recall all the words in the correct order for all three sets of the same size. The level at which you could recall two of the three sets correctly is your word span.

house mallet
car watch
match bear

cake grass hat
meat poem cat
bug lane bird

pail sink hair dog
game sea bean pillow
banana cracker lamp sock

knife pencil radio year rabbit
cheese phone book disk plate
kite chair leaf daughter wall

bush cow gem slipper comb pie
clip tent dress dog wine chicken
net cloud pot mouse dock fence

stable driveway spoon moose planet fence pin
toes Indian game yard chip thief nurse
heart globe rock smock beret number church

Score: The word span for a typical American college student ranges from 4 to 6.

Summary

In this chapter we discussed the basic process involved in how you remember: to create a memory, you must first pay attention (notice) it, then retain it, then be able to retrieve it. We don't remember everything; some

information is stored only briefly and then fades away; other details enter short-term memory. Only the important information is eventually transferred into long-term memory.

Memories are not stored in one place in the brain but are a process that involves many different parts of the brain all working together. As brain cells work together, the connections between them get stronger. This means that your brain actually changes as you experience the world and as you practice skills over and over again. This is the key to understanding how to improve your memory.

In the next chapter you'll learn that it's possible to improve your memory—but simply sitting down every day and memorizing a page of text won't do it. In fact, what you do *during* that practice is more important than how much time is spent doing it. One study found that three hours of general memory practice did not improve long-term memory, but three hours of practicing using certain techniques did. In this book you'll learn some of these techniques.

SELF-TEST

As a way for you to review what you have read in this chapter, see how many of the questions you can answer without rereading the chapter.

1. Does memory exist in one part of the brain and, if so, where?
2. What is the first stage of creating a memory?
3. To properly encode a memory, what must you do?
4. What are the three ways a memory is stored?
5. If you forget something, the problem may be in one of three components of your memory system. What are these?

ANSWERS

1. Memory does not exist in one part of the brain, but is a constructive process that occurs in many areas.
2. The first stage of creating a memory is encoding or retaining.
3. To properly encode a memory, you must pay attention.

4. Memory is stored in the sensory stage, in short-term memory, and in long-term memory.

5. The components are registering, retention, and retrieval. That is, you may not have registered the information clearly, you may not have retained what you registered, or you may not be able to retrieve the memory accurately.