Tricks for the Memory

Close Observation and Mental Strategies

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A GOOD WAY to highlight the importance of memory is to try to imagine what your mental life would be like if you had no memory at all. You would live on the thin edge of the present, unable to look back because you would have no sense of the past, unable to look ahead because you would have no conception of the future. You would lose your past and with it your personality and your sense of personal identity.

Though it is exceedingly rare to find someone with complete amnesia, people with certain brain injuries lose the ability to learn new things. Such a patient can remember his life up to about the time of his injury, but most events since then are missing from his memory. One of my acquaintances, Wayne Wickelgren, once interviewed a young soldier who had suffered such an injury; the soldier could carry on an apparently normal conversation except that he was unable to remember anything from a few seconds before.

When Wickelgren first introduced himself, he and the soldier had a five-minute conversation; then Wickelgren left to go nextdoor. When he returned a few minutes later, the soldier asked, "Who are you?" Wickelgren introduced himself again, whereupon the soldier began the same conversation they had had before. Wickelgren tried to carry out some memory experiments, but the soldier could not remember the instructions long enough to participate.

For such patients, time stops when their brains are injured. They are unable to learn where they are, who their doctors are, what has happened since their injury. Succeeding events simply drop into an abyss. Their lives are bland, senseless tragedies.

Memory gives life its richness — the pleasure of anticipation, the warmth of remembrance, as well as the sorrow of loss and the pain of guilt. But memory is also a scientific puzzle, and researchers have discovered the shape of some of the pieces.

In order to analyze memory we study the learning and retention of simple events, such as an unfamiliar picture, a series of letters or numbers, or a simple sentence or story. A memory experiment begins with a prior assessment or presumption about a subject's state of knowledge; we then present some event that results in perception, or registration, and "trace formation." Next comes a retention interval during which other events occur, and the experiment ends some time later with a memory test. At this time we present cues that are supposed to cause the person to recapture the trace of the original event.

The memory trace is the internal representation of whatever information a person stores at the time the event is presented. There is no way to observe a trace directly; we can only infer its existence from a person's performance at some later time.

Successful remembering requires that all three phases of memory — registration, trace retention and trace retrieval — run off successfully, and failure or loss at any stage will result in failure in performance.

If a person is to remember an event, he must attend to and observe it with some care; the more closely he observes it, the more information he will be able to recall. Most available information is lost at just this point because of poor observation, and many people say they have poor memories when it would be more accurate to say they are poor observers.

Short-Term and Long-Term

THE MEMORY system appears to be divided into two parts — a short-term and a long-term memory. Short-term memory refers to the current contents of your awareness, whereas long-term memory refers to everything else in the system.

During learning, an incoming stimulus is first looked up in long-term memory; the brain tries to recognize, classify or identify the event in terms of known patterns. For instance, if you see a series of letters you automatically search your memory to see if you have already learned them as a word. That is, your brain tries to attach meaning to what it is seeing.

The ease of learning something depends, of course, on whether it falls into a familiar pattern. The perceptual system first segments an incoming stimulus into the largest familiar chunks that it can, and treats these chunks as units that are entered into short-term memory. The capacity of short-term memory appears limited to about five to seven chunks, although the size of the chunks seems relatively unimportant. After one presentation you can recall in order about seven chunks; that is true whether the chunks are binary digits, decimal digits, letters, words, or well-known phrases like "ice-cream cone" or "grandfather clock."

Chunking is an automatic strategy the brain uses in storing information. It tries to understand the incoming pattern in terms of simple rearrangements of familiar patterns. To illustrate the power of understanding versus rote learning, suppose you had to learn the two series below:

IB	MF	BI	TW	AJ	FK
816	449	362	516	941	

They seem like nonsense and would be hard to learn. But they have been made difficult by deliberate camouflaging of the known chunks. Thus the letter series is just a poorly segmented series of the familiar abbreviations IBM, FBI, TWA and JFK. The number series, when put into pairs, is seen to be 9^2 (81), then 8^2 (64), then 7^2 (49), and so on. Such a reorganization makes the nonsense understandable and easy to remember.

Unrehearsed material remains in short-term memory for only about 20 seconds, because new events must be dealt with continually. If you are introduced to a series of people, for example, your short-term memory is presented with a second and third name before you have learned the first. The new material seems to shove the earlier information out of your mind. Unless you transfer information to long-term memory almost at once, you will lose it.

Many of the differences in memory among people occur at the point of transfer. For example, the short-term mem-

ory of brain-injured patients works well, and they can recapture many facts from their distant past, but they can no longer place new facts in long-term memory.

When people intend to memorize something, they call upon some kind of memorization strategy. The earliest and most primitive strategy is rote rehearsal — saying or thinking the names of items over and over in sequence. However, this all-purpose strategy does not produce rapid learning. More successful memorizing techniques are called mnemonic devices; they are procedures that mentally elaborate on the material to be learned, investing it with meaning so that it can be learned faster. The kind of elaboration that works best depends somewhat on the material that has to be learned.

Making Up Meanings

TO LEARN meaningless material, such as letter sequences, the standard trick is to convert the sequence into a meaningful word or phrase. You insert other letters to make a real word. For example, the license plate on one of my cars has the letters FSH which I remember as "FISH with the I missing." My other car has a license plate beginning with CNU, which can be converted into the sound-alike word "canoe." I find it easy to remember that one car is a fish and the other a canoe.

Breaking up historical dates, telephone numbers, social security numbers, populations, and then converting them into words helps commit such numbers to memory. First, break up the long number into a series of two- or three-digit numbers, then use your own code to convert each number into a consonant, making a meaningful word out of the letters. To do this, you first must learn a digit-to-consonant conversion table such as this one:

0 = Z or S	5 = L
1 = T or D	6 = J, CH or SH
2 = N	7 = K or C
3 = M	8 = F or V
4 = R	9 = P or B

Any silent letter or vowel may be inserted to make the consonants form a word. Thus 32, a friend's apartment, becomes MN and can be sounded out as MAN or MOON, so I remember that my friend lives on the moon; a colleague's phone extension, 8741, translates as VCRD and can become VICE RAID.

In order to recall the number, just retrieve the meaningful code words and convert the consonants back into the number. Becoming adept at these conversions is an elementary skill that requires practice. But it pays off if you have to remember many numbers; the extra time spent in learning the code is repaid many times over when you no longer have to look them up.

Matching Names to Faces

A COMMON memory problem is having to remember people's names and to associate them with their owners' faces. The problem of remembering a name-face association seems to break down into three separate subproblems — remembering the face, the name and the connection.

To remember the face, observe it carefully and then concentrate on some distinctive feature such as bushy eyebrows or a cleft chin. To remember the name, look for a meaning in it; if this fails, find a meaningful key word that sounds like a part of the name. Finally, to remember the face-name association, try to think of a bizarre relationship between the key word and the feature of the face. Thus, if Mr. Clausen has bushy eyebrows, think of claws as a key word for Clausen and imagine large lobster claws ripping out Mr. Clausen's bushy eyebrows.

In laboratory experiments, people with no previous practice remember about half again as many faces when they use mnemonics as when they do not. The facial feature, the key word and the name become tightly associated. For instance, in one of our experiments, if a person remembered the facial feature and the key word, his likelihood of remembering the name was about 90 per cent. Any errors were usually the result of poor association of the key word to the name. Only 8 per cent of those who forgot the key word could recall the name; only 3 per cent of those who forgot the facial feature could recall the name. Those who forgot both feature and key word remembered no names. The mnemonic device is clearly helpful for remembering names and faces; an obstacle is that it requires training in the basic skill of converting a name to some memorable key word.

Frequently it is necessary to remember an arbitrary series, such as the items on a grocery shopping list, a series of historical events, or a group of laws in science. The peg-word method provides an efficient way in which to bring those items to mind.

The first step is to learn a list of peg words corresponding to the first 20 numbers. Following are the first 10 we have used in our research:

1 is a bun	6 is sticks
2 is a shoe	7 is heaven
3 is a tree	8 is a gate
4 is a door	9 is wine
5 is a hive	10 is a hen

These peg words are used as mental pegs upon which to hang any new items you want to memorize. This is done by pairing off the items with the pegs and visualizing the two terms in some vivid interaction. Suppose you had to remember a shopping list consisting of milk, matches, apples and bread. You might compose an image of milk being poured over a hamburger *bun*, then of a burning match stuck in the sole of a *shoe*, the apples hanging from a *tree*, then a loaf of bread sticking like a dagger through a *door*. If you visualize these pairs for several seconds, they will stick in your memory. When you want to recall the list, go through the peg words and see what object your imagination placed on each peg.

Understanding by Context

PUTTING unrelated items into meaningful relationships leads us from mnemonics to an issue of practical concern: how and what people learn from sentences. A sentence occurs in a meaningful social context and the utterance conveys a lot of information, including such things as the speaker's intentions and what he presupposes the listener already knows. A person rarely remembers the exact wording and syntax of a sentence; he paraphrases the original statement, changes the exact words, and recalls its gist.

He also uses his knowledge of the world to fill out the situation the sentence seems to describe. This elaboration takes the form of unconsciously adding the normal instruments with which actions are performed or the normal consequences of actions.

For example, if I were to tell you that a boy was building a birdhouse and was pounding a nail into some boards, some time later you would believe that I had told you he used a hammer to pound the nail. If I were to tell you that a boy was out sailing and fell out of his boat, you would later believe that I had told you he fell into the water and got wet.

In understanding a sentence, a person also tends to particularize general terms in a manner suggested by the context. For example, if I said "The container held apples," you would think of the container as a basket; but if I said "The container held cola," you would interpret the container as a bottle. This affects memory insofar as "basket" will cue recall of the first sentence whereas "bottle" will cue recall of the second.

The most important factor determining whether a sentence will be remembered is whether the person understands it. Comprehension involves many things, but one of them is being able to imagine a situation in which the asserted relationships could be realized. Examine the following sentences:

The notes were sour because the seams split.

The voyage was delayed because the bottle didn't break.

The haystack saved him because the cloth ripped.

Most people are puzzled by them; they can't call up a context that will make the causal link in each sentence understandable. And, of course, they forget such incomprehensible sentences.

Suppose, however, that I provide you with a hint for each statement. I tell you the first sentence is about a worn-out bagpipe; the second, about the christening of a ship; the third, about a paratrooper whose parachute ripped. You now understand and will easily remember them, because you can call up from your memory a plausible situation that corresponds to each.

Altering a Memory

YEARS AGO psychologists often studied the accuracy of eyewitness reports, such as occur in courtroom testimony, by playing out some kind of scenario before a class of unsuspecting students. What became immediately apparent in such studies was the tremendous variability of the details the witnesses reported seeing.

They would, of course, forget details regarding the appearances of the actors as well as any names or dates mentioned; and they would forget exactly what was said or who said what. They were likely to misjudge the duration of events and fail to remember the order of specific events. There were often gross distortions.

These studies also found a difference between letting the witness freely narrate his recall of the episode and having him answer cross-examination question. As time passes, a person's free account typically becomes shorter as he forgets details, although it does not necessarily become more inaccurate. However, in a cross-examination the witness is forced to make definite statements about items that hover on the dim margins of his memory. Suggestions and leading questions that probe these gray areas can induce the witness to believe in distorted versions of the episode and produce wide errors.

Lawyers are, of course, familiar with techniques that lead witnesses to desired conclusions. Consider the slight difference between the questions "Did you see the professor hit the students?" and "Didn't you see the professor hit him?" The second strongly suggests that the questioner knows the action happened, just as does the phrase "Don't you remember seeing the professor hit the student?"

One of the subtle and insidious influences of leading questions is that they can alter a person's memory of an event. A witness tends to integrate into his memory any presuppositions hidden in questions he was asked soon after the event. For example, suppose after showing you a film of a car accident I ask you, "About how fast was the sports car going as it ran the stop sign and turned into the intersection?" and you give me some estimate. A week later, if I test your memory, you are likely to say that you saw a stop sign when in fact there was none in the film.

Memory is apparently unreliable, given to invention, and even dangerous — but it is still the source of continuity in our culture and richness and meaning in our lives.

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