MEMORY AND LEARNING

Learning is a relatively permanent change in behaviour that marks an increase in knowledge, skills, or understanding thanks to recorded memories. A memory is the fruit of this learning process, the concrete trace of it that is left in your neural networks.

Human memory is fundamentally associative. You can remember a new piece of information better if you can associate it with previously acquired knowledge that is already firmly anchored in your memory. And the more meaningful the association is to you personally, the more effectively it will help you to remember. So taking the time to choose a meaningful association can pay off in the long run.

Also, contrary to the image that many people have of memory as a vast collection of archived data, most of our memories are actually reconstructions. They are not stored in our brains like books on library shelves. Whenever we want to remember something, we have to reconstruct it from elements scattered throughout various areas of our brains.

Thus, scientists today view remembering not as a simple retrieval of fixed records, but rather as an ongoing process of reclassification resulting from continuous changes in our neural pathways and parallel processing of information in our brains.

To illustrate these two fundamental properties of memory, suppose that a school class has visited a museum of Egyptian art on a rainy day. Ten years later, the teacher, now retired, reads a history book that mentions the name of a mummy that was on display in that museum. The mummy's name reminds the teacher of that class trip ten years ago. Then, by association, the teacher remembers some students from that class whom he had not even thought about since then. He can even remember how fascinated they were with the mummy, and some of the questions they asked him about it. In short, he has formed associative memories: one thing reminds him of another, which reminds him of yet another, and so on.

Now imagine that one of the students had had a very bad time on that trip, because she was interested in a boy in that class, and he was ignoring her. Ten years later, as she is taking off her wet raincoat, she too remembers that day. Except that now she remembers herself as holding that boy's hand while they listened, enraptured, to the teacher’s explanations. Why the change? Because she ended up marrying that boy, and they are very happy together, so her present happiness has embellished her memory of the past. Thus, memories are not like snapshots that are always the same every time you take them out to look at them. They are also something that you reconstruct.

But memory has other characteristics than can make learning easier once you understand them.

SENSORY, SHORT-TERM AND LONG-TERM MEMORY

In the 1960s, the distinction among various types of memory according to their duration was the subject of passionate debates. Some scientists thought that the most elegant way to account for the data available at the time was to conceptualize memory as a single system of variable duration. But bit by bit, evidence accumulated that suggested the existence of at least three distinct memory systems.

Though the mechanisms of these three systems differ, they do flow naturally from one into
An item can be defined as a “piece” of information. Consequently, one way to increase the storage capacity of short-term memory might be to increase the size of these pieces of information through a more effective encoding strategy, such as grouping.

Here are two phenomena suggesting that there are in fact two distinct systems for short-term and long-term memory.

First of all, our abilities to retain items at the start and end of a list are not equally affected by distractions. If a distraction occurs, we tend to forget the items at the end of the list (i.e., those stored in short-term memory) while remembering the ones at the start of it. In technical terms, the recency effect is attributable to short-term memory, while the primacy effect is attributable to long-term memory.

Second, people with anterograde amnesia cannot form new long-term memories, but their short-term memory remains intact.

While the other and can be regarded as three necessary steps in forming a lasting memory.

According to this now generally accepted model, the stimuli detected by our senses can be either ignored, in which case they disappear almost instantaneously, or perceived, in which case they enter our sensory memory. Sensory memory does not require any conscious attention; as information is perceived, it is stored in sensory memory automatically. But sensory memory is essential, because it is what gives us the effect of unity of an object as our eyes jump from point to point on its surface to examine its details, for example.

For instance, if the object in your sensory memory is a red octagon, you may or may not pay attention to it. If you do pay attention, you recognize that it is a stop sign. Once you have paid such attention to a piece of information, it can pass on to your short-term memory. Your short-term memory lets you record limited amounts of information for periods of less than one minute. With an active effort, you can keep a piece of information in short-term memory for longer—for example, by repeating a telephone number until you have finished dialing it. Otherwise, the memory will disappear in less than a minute.

Keeping an item in short-term memory for a certain amount of time lets you eventually transfer it to long-term memory for more permanent storage. This process is facilitated by the mental work of repeating the information, which is why the expression “working memory” is increasingly used as a synonym for short-term memory. But such repetition seems to be a less effective strategy for consolidating a memory than the technique of giving it a meaning by associating it with previously acquired knowledge.

Once the piece of information has been stored in your long-term memory, it can remain there for a very long time, and sometimes even for the rest of your life. There are, however, several factors that can make these memories hard to retrieve. These factors include how long it has been since the event stored in your memory occurred, how long it has been since the last time you remembered it, how well you have integrated it with your own knowledge, whether it is unique, whether it resembles a current event, and so on.

Many experiments still need to be conducted to assess the influence of each of these factors more closely. Nevertheless, we are beginning to gain a better understanding of the underlying systems necessary for each of these three types of memory to work properly.
Implicit memory is the kind of latent memory that we are not aware of, but that nevertheless influences our behaviour. All advertising is based on the principle of implicit memory. We are so bombarded by advertising messages that we think we no longer even see them and hence do not remember them. But experiments have shown that when we go into a store and have to choose among products with equivalent characteristics, we tend to buy the one that has been the subject of an advertising campaign, and we cannot even say why.

The same principle would also explain what is happening when you have a brilliant idea that seems to have sprung straight out of your own imagination, then realize later on that you actually read about it while browsing through last Saturday’s newspaper.

Implicit memory is also where many of our conditioned reflexes and conditioned emotional responses are stored. The associative learning that constitutes the basis for these forms of memory is a very old process, phylogenetically speaking, and can take place without the intervention of the conscious mind.

We form implicit memories without being aware that we are doing so. Hence, scientists who study such memories must often try to uncover them by indirect methods, such as "priming". In priming, researchers try to increase the speed or accuracy with which their subjects make a decision by first exposing them to information that relates to the same context, but without the subjects’ having any other particular reason to retrieve the piece of information concerned. For example, subjects will take less time to decide that the string of letters "doctor" is a word if they have first been shown the word "nurse" than if they have first been shown an irrelevant word, such as "north", or a nonsense word, such as "nuber".

Like implicit memory, explicit memory can be divided into subtypes - most often, episodic and semantic memory.

Semantic memory can be regarded as the residue of experiences stored in episodic memory.
Semantic memory homes in on common features of various episodes and extracts them from their context. A gradual transition takes place from episodic to semantic memory. In this process, episodic memory reduces its sensitivity to particular events so that the information about them can be generalized.

Conversely, our understanding of our personal experiences is necessarily due to the concepts and knowledge stored in our semantic memory. Thus, we see that these two types of memory are not isolated entities, but rather interact with each other constantly.

In Alzheimer’s disease, patients quickly develop difficulty in retrieving individual words and general knowledge. Studies have shown that in tasks such as describing and naming items, these patients display a loss of knowledge of the specific characteristics of semantic categories. Initially, they lose the ability to distinguish fine categories, such as species of animals or types of objects. But over time, this lack of discrimination extends to broader, more general categories. At first, if you show such patients a spaniel, they may say, “that is a dog”. Later, they may just say “that is an animal”.

Episodic memory (sometimes called autobiographical memory) lets you remember events that you personally experienced at a specific time and place. It includes memories such as the meal you ate last night, or the name of an old classmate, or the date of some important public event. The most distinctive feature of episodic memory is that you see yourself as an actor in the events you remember. You therefore memorize not only the events themselves, but also the entire context surrounding them.

Episodic memory is the kind most often affected by various forms of amnesia. Also, the emotional charge that you experience at the time of the events conditions the quality of your memorization of the episode.

Semantic memory is the system that you use to store your knowledge of the world. It is a knowledge base that we all have and much of which we can access quickly and effortlessly. It includes our memory of the meanings of words—the kind of memory that lets us recall not only the names of the world’s great capitals, but also social customs, the functions of things, and their colour and odour. Semantic memory also includes our memory of the rules and concepts that let us construct a mental representation of the world without any immediate perceptions. Its content is thus abstract and relational and is associated with the meaning of verbal symbols.

Semantic memory is independent of the spatial/temporal context in which it was acquired. Since it is a form of reference memory that contains information accumulated repeatedly throughout our lifetimes, semantic memory is usually spared when people suffer from amnesia, but it can be affected by some forms of dementia (see sidebar).