

IMPROVING LEARNING AND REASONING STARTING WITH UNDERSTANDING HUMAN MEMORY

This presentation is merely an introduction to the complicated (but fascinating) topic of normal human memory.

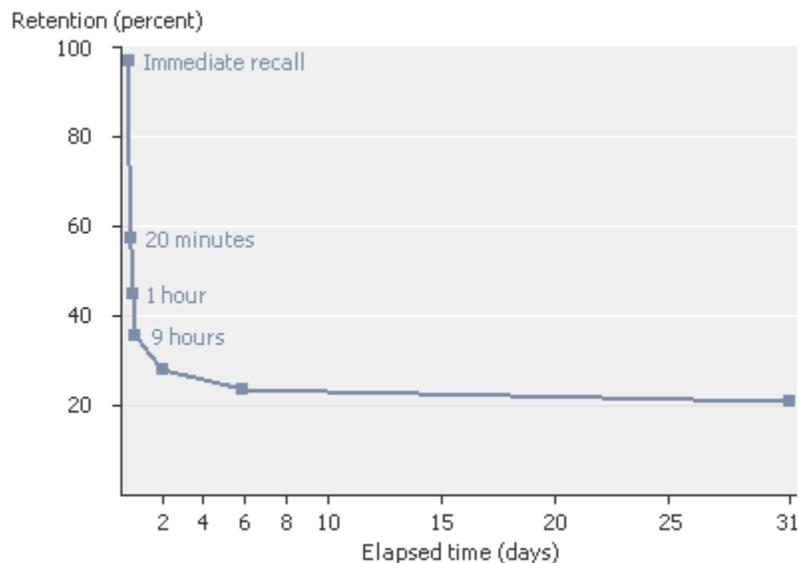
Human psychology is _____.

Cognition basically refers to all forms of _____. Aspects of cognition include _____

Of all the above aspects of cognition, the one that most greatly impacts all the others is _____. Nearly everything we as humans do in some way involves use of our _____ systems.

The brain receives information via senses such as _____.

Almost all of the information our brains receive is _____. To understand how we remember, we first need to understand how quickly we _____. Label the following graph with a suitable title.



Source: Hermann Ebbinghaus, *Memory: A Contribution to Experimental Psychology*, 1885/1913

The graph is an example of what psychologist _____ discovered about the rate at which humans naturally _____. This happens with normal functioning brains, not just in those of older people. The graph will not be

identical for every person, nor for every state of mind of the same person. The rate at which we _____ can be impacted by our current health, how rested we are, and our interest in the content to be learned.

Key point: The _____ shows that _____ occurs _____ after entirely new information is learned and then not used. We must work hard to minimize _____.

Sometimes information we learn now is later needed solely for regurgitation. Maybe you hear a referral telephone number in a voicemail greeting. You need to dial it as soon as you hang up. This is information that you only need to store in your brain for a few seconds. You have no desire nor need to permanently remember it. You might help yourself to remember it by _____ it out loud. If it has a familiar area code, you need no special effort to retain that part. You might also look for patterns that make the rest of the number easier to recall. (Example: 8282-3-82 may be easier to remember than 828-2382). This approach is fine for information that you are only trying to keep in your short-term memory (defined as needing storage for 30 seconds or less) and not permanently hold on to. If, during those 30 seconds, you get distracted, you might lose the number from your short-term memory. Or if your phone's battery then stops working, and you need to charge your phone, and more than about 30 seconds passes without you thinking about the number, you may forget it. What happens after you make the call using the number that you had to remember? Probably you forget it or at least do not remember it accurately in the future. (Exception: If the number reminds you of something, such as another number that you already know, you may be inclined to retain it for longer whether you want to or not.)

When you are not well prepared for a test and try to cram *new (or fairly new) information* into your brain just before the test, how much of it do you remember well during the test? Probably not much. Why? Even though you want to retain it, the information has no real meaning to you, it did not get encoded into your long-term memory during that last-minute cramming, and so your brain naturally allowed you to forget most or all of it.

Compare the above situation to when you already know something very well, and then new, related information is received that you give sufficient _____ to, and you actively think about how the existing and new information are related. In this case, it is easier for your brain to remember the new information even beyond 30 seconds.

Key point: If you attach _____ to new information, think deeply about it, and consider how it _____ to information that you already know, the better your quality of future memory about it is likely to be. Future remembrances are also helped if you use the new information frequently over a long period of time. (How much do you remember of a language that you learned long ago but have since rarely or never used?)

When we save information on a computer hard drive, we expect it to be available in its exact saved form for retrieval at any time in the future. *It is a mistake to assume that normal human memory operates in that way.* Instead, information in our memories is always subject to _____. That conclusion by cognitive psychologists makes sense when you consider that our recollections of details of past events are rarely exactly correct. Sometimes we repeatedly tell a story, the details of which unintentionally gradually change with each remembrance. Maybe you are unable to recall a detail, so you insert what you assume to be the missing information. Over time, in your brain, that assumed information becomes a normal part of the remembrance. Also, two people usually have differing recollections of the finer aspects of a shared event, such as dinner together or a day spent at an amusement park. Some things they may both remember exactly the same, such as the name of the restaurant or park and the general time of year. Yet, finer points are likely to be remembered differently or remembered by one party while completely forgotten by the other. *Again, this "failure" of memory is normal, and it is why it takes work to accurately, completely remember most information.*

The topic of normal human memory becomes more complicated when considering that forgetting is not easy to describe. What does it mean to forget? Does it mean that information is gone from your brain? Not necessarily. The information might still be in your brain, but it takes a _____ to be able to recall it. We commonly associate sounds we like and smells we enjoy with what was happening in our lives at one or more times that we were exposed to those things. Suppose you go a few years without hearing a song that you used to like. Then you hear it one day, and instantly you recall people, places, or other information that you have not thought of in so long. The fact that you remember that past information means that it never left your brain; it just took the sensation of a particular song to *trigger* remembrance of it. This kind of link (music with a past event) happened unintentionally, but you can create links when you need to remember something.

Key point: We *might* be able to help our brains retain important information by mentally _____ it to certain sounds, words, symbols, pictures, or concepts.

For the sake of the limited time in today's discussion, let's think of test problems in two categories: (1) At times we are merely asked to recall something. (2) More often we are asked to _____ on something. If all we have to do is recall exactly what was previously learned, then memorization is sufficient. For _____ (an advanced form of cognition), however, memorization alone is insufficient.

Reasoning occur when _____
_____.

Typically, information you learn in your classes does not merely need to be regurgitated, but rather used in reasoning to solve problems or answer difficult questions. When you allow yourself learn in a superficial way, not giving much attention to what you are taking in, not attaching much meaning to it, or not connecting it to what you already know, then you will have a tough time using it in reasoning to handle unfamiliar tasks.

Key point: Just because information is _____ does not necessarily mean that you understand it well enough to make good use of it. _____ and _____ are not synonymous.

Lots of things can interfere with our _____: Insufficient sleep; depression; altered states of thinking due to drug (prescription or recreational) or other "substance" use; inadequate attention to what we are trying to learn; distractions (from our own thoughts or actions, or actions of other people); being unable to clearly see (or hear) the person speaking, or the board/screen; distractions from personal electronic equipment; being unclear on previously learned material; not having sensibly used the previously learned material in enough problem-solving situations to be comfortable with it; and not taking copious notes (or taking them, but then not using them again!).

Key point: It may take a substantial change in lifestyle to improve the quality of your learning. *Starting this today* could positively impact the rest of your life as a student and a professional. _____ is a lifelong activity. *Learning* how to effectively *learn* is a process in itself that you might never have been educated on but can master.

Advice about improving the quality and depth of your classroom learning:

1. Before each class (lecture, laboratory, or discussion), spend quality time reviewing what you already know and looking over the new material.
2. Come to class well rested and, to the best of your ability, in a good mood.
3. Minimize distractions and stay focused on the learning at hand. Do not let your attention wander.
4. Probably you will learn better if handwriting notes, rather than typing them or photographing the board.
5. As you learn new information, you should be thinking about it, not merely writing it down. (You are a learner, not a stenographer!)
6. As soon as possible after class, re-read the new information slowly, pausing to think of how each portion relates to what you already knew.
7. Rewriting class notes can be useful if you are pausing to give serious thought to what you are rewriting, otherwise the act of rewriting is of little value.

Powerful advice from cognitive psychology about improving brain storage of information: Spend less time repeatedly reading what you want to retain and more time trying to remember what you want to retain.

Advice about improving the quality and depth of your reasoning skills:

1. Before starting on homework, carefully review preparatory information (from lectures and the textbook).
2. Do not treat homework as simply about getting correct answers. After completing each problem, ask yourself what you learned and how you could use that knowledge again with a variety of future problems.
3. Memorization in the absence of understanding is of little value.

4. When you encounter a problem (homework or otherwise) that requires thinking, do not resent it; look on it as a chance to learn. You probably need to reason on it (by using existing information to develop new information) before you can work your way to a solution.
5. Practice reasoning whenever possible. Think about what you are doing. If your usual approach to homework is to scramble through the lecture notes and textbook, looking anxiously for the right sentence, formula, or example problem to emulate, you are not doing much of any reasoning. This results in low learning, and explains the poor test performances of many people.
6. Example problems are to help the reader see how to put into practice the content to be learned. Do not think that copying examples to get the answer means that you are learning on a high level. Are you given example problems on tests? In your future professional career, will example problems be available to use to find answers to tasks that you are assigned?
7. Using a highlighter enhances visual familiarity, but does not necessarily improve comprehension.
8. Rereading enhances _____ (and maybe _____) familiarity, but does not in itself necessarily improve _____.
9. A suggested approach for improved *long-term understanding of concepts and practice with putting concepts into use for problem-solving* is instead of repeatedly _____ at problems that you have solved, or example problems that are solved in a textbook, you should try _____ how to solve them. If you can, stand up at a white/chalkboard when doing this.
10. Do not just copy the study techniques of others. Make sure that your methods are effective *for you*.

This discussion was a brief introduction to human memory. We all can do better with remembering information if we understand how our brains work with respect to memory and forgetting, and if we actively use what we are trying to remember. Will you remember what you learned here today? It depends on what you do with what you learned. Frequently read this document and think about it. Search for more scientific knowledge about human memory.

Let's now watch a short video about the topic of human memory and its fragility.