Lecture Notes

# Chapter 6: Retrieving Memories From Long-Term Storage

## Learning Objectives

* Recognize an example of the use of long-term memory
* Describe various aspects of long-term memory, including its capacity, coding, retention duration and forgetting, and retrieval of information
* Compare and contrast the subdivisions of long-term memory: semantic vs. episodic, implicit vs. explicit, and declarative vs. procedural
* Discuss the levels-of-processing theory of memory
* Differentiate between anterograde amnesia and retrograde amnesia

## Outline

**I.** Setting the Stage

**A.** In the last chapter, we focused on the formation of new memories and on memories held for brief periods of time.

**B.** This chapter will focus on the kind of memory that corresponds better with the layperson’s definition of memory: information retrieved after some long period of storage.

**II.** Aspects of Long-Term Memory

**A.** Long-term memory (LTM) is thought to differ from short-term memory in many ways.

**1.** The capacity of LTM is virtually unlimited.

**a)** Landauer estimated the number of bits of information stored by a 35-year-old adult as one billion.

**b)** However, not all of the information in LTM is retrievable at any given moment.

**2.** Information in LTM is thought to be encoded semantically, by meaning.

**a)** Baddeley presented participants with lists of words to learn and tested recall after a 20-minute interval during which participants worked on another task to prevent rehearsal.

**b)** Semantically similar words were harder to learn than acoustically similar words.

**3.** At least some information in LTM lasts for decades or even a lifetime.

**B.** Forgetting occurs rapidly at first and then levels off.

**1.** Hermann Ebbinghaus discovered this “forgetting curve” by learning lists of nonsense syllables each day, testing his recall after varying periods of time and measuring the amount of additional time necessary to relearn the list.

**2.** Later studies using **paired associates learning** have investigated why forgetting occurs; this task involves listening to pairs of words (*flag-spoon, drawer-switch*) and then being asked to recall the second word when given the first (*flag-?, drawer-?*).

**a)** *Proactive interference* occurs when previous learning makes retention of new information more difficult; the more paired-associate lists a participant has learned, the harder it is to learn additional lists.

**b) Retroactive interference** occurs when learning a new list interferes with your recall of a previously learned list.

**3.** Anderson and Neely posited several possible theories of how interference works.

**a)** In general, a **retrieval cue** points to a target memory.

**b)** However, when that retrieval cue becomes associated with other targets, during retrieval the second target “competes” with the first.

**c)** John Anderson describes a phenomenon known as the **fan effect,** in which the more facts you learn about a particular concept, the more time you need to retrieve any given fact.

**C.** Retrieval of information from LTM can be enhanced through techniques called **mnemonics.**

**1.** The **method of loci** requires that the learner imagines a series of familiar places that have some sort of order to them and then visualizes items that you need to remember in each of the locations along the path.

**2.** The technique of *interacting images* is a more general method of remembering to-be remembered items on a paired-associates list by visualizing the two items interacting in some way.

**3.** The *pegword method* also uses imagery to associate to-be-remembered items with a previously learned rhyme: “One is a bun, two is a shoe, three is a tree” and so forth.

**4.** Other techniques to improve retrieval involve *recoding* the material to be learned, adding extra words or sentences to *mediate* your memory and the material (for example, learning the sentence “Every good boy does fine” to remember the notes on the lines of the musical staff, EGBDF).

**D.** Several other principles of retrieval can be used to aid recall.

**1.** Material organized into categories is more easily recalled than information with no apparent organization.

**2.** When trying to retrieve information, it is a great advantage to have the same context information available as at the time of encoding—a principle known as **encoding specificity.**

**3.** Studies of **state-dependent learning** have demonstrated a similar effect of pharmacological states; material learned while intoxicated is usually recalled better when the person re-creates that state.

**4.** More controversial is the **mood-dependent memory effect,** which states that if you learn information in one mood, you will be more likely to recall it when you are in the same mood.

**5.** The **spacing effect** states that you are better off studying material in a number of short sessions than in one longer session.

**a)** This may happen because of **encoding variability;** spacing allows the context of encoding to change so that a wider variety of cues can be attached to the material.

**b)** Thus, the spacing effect is explained primarily in terms of the encoding specificity principle.

**6.** A retrieval cue is most effective when it is highly distinctive and not related to any other target memories, according to the concept of **cue overload.**

**7.** The best way to remember material may be to test yourself on it, according to research on the **testing effect.**

**III.** Subdivisions of Long-Term Memory

**A.** Tulving drew a distinction between two **memory systems**, episodic memory and semantic memory.

**1. Episodic memory** holds memories of specific events in which you yourself participated.

**a)** The organization of episodic memories is temporal, by time.

**b)** The case study of “Gene” illustrates a man who has no episodic memories from his past, but knows many “facts” about his life.

**c)** Episodic memory tends to be associated with more frontal lobe activity than semantic memory.

**2. Semantic memory** holds information that has entered your general knowledge base.

**a)** The organization of semantic memory is arranged on the basis of meaning.

**b)** Schacter reports a case study of a woman who no longer knew the meanings of common words or the names of famous people, but could still remember incidents from her life.

**B.** Other cognitive psychologists have proposed a distinction between implicit and explicit memories.

**1. Explicit memories** are things that are consciously recollected.

**2. Implicit memories** are not deliberate or conscious, but show evidence of prior learning and storage.

**a)** Evidence of implicit memory can be seen in **repetition priming** studies, in which participants are given brief exposure to a word (such as *button*) and then are given a word completion task ( *\_ U \_ T O \_).*

**b)** Participants are not consciously aware of having seen the word, but their word completion responses indicate that they did, in fact, “remember” it.

**c)** Amnesic participants in memory studies perform more poorly on explicit memory tasks, but quite comparably to nonamnesic participants on implicit memory tasks.

**3.** Performance on implicit memory tasks seems to be “dissociated” from performance on explicit memory tasks.

**a)** This could be because explicit and implicit memory are two distinct systems, with different brain structures associated with each.

**b)** Or, it could be that the two kinds of memory tasks require different cognitive procedures, although they both tap into a common memory system.

**(1)** Implicit memory tasks may require *perceptual* processing.

**(2)** Explicit memory tasks may require more *conceptual* processing.

**C.** Another proposal for different subdivisions of LTM involves distinguishing **declarative** from **procedural** memory.

**1.** Declarative memory contains knowledge, facts, information, and ideas that can be described in words, pictures, or symbols.

**2.** Procedural memory holds information concerning action and sequences of actions—“how to do things.”

**IV.** The Levels-of-Processing View

**A.** Rather than believing in distinct types of memory (sensory memory, STM, LTM), some psychologists argue that there is only one kind of memory storage but different types of processing that take place within that store.

**B.** The **levels-of-processing theory of memory** argues that memory depends on the initial encoding of the information to be remembered.

**1.** Processing that is superficial or “shallow” does not lead to good retention, while processing that is “deeper” (more meaningful) improves retention.

**2.** Craik and Tulving used an **incidental learning** (learning that is not done “on purpose”) task to demonstrate the levels-of-processing effect.

**a)** Participants were asked to answer questions about a series of words.

**(1)** Some questions required only superficial processing: Is this word printed in capital letters?

**(2)** Some questions asked if the target word rhymed with another word.

**(3)** Some questions asked if the target word fit into a sentence.

**b)** Later, participants were given a surprise memory test on all of the target words they had seen.

**c)** Participants had much greater recall of the words that they had fit into sentences than of the words for which they had answered superficial questions.

**C.** One problem with this theory is pinning down the definition of what defines “depth.”

**1.** Faces rated for honesty are remembered better than faces categorized by gender.

**2.** Words that are fit into simple sentences are not as well recalled as words that are fit into more complex sentences.

**3.** Craik and Tulving extended their original theory, arguing that elaboration of material adds depth to processing and therefore aids recall.

**4.** Baddeley, however, has reviewed studies that show that, under certain circumstances, acoustic processing can result in greater recall than semantic processing.

**D.** Some aspects of information may be encoded *automatically*—for example, the frequency of occurrence of a particular stimulus.

**V.** Amnesia

**A.** Much can be learned from cases of people suffering profound impairments in their LTM (**amnesia**).

**B.** Amnesia can result from damage either to the hippocampal system (including the hippocampus and the amygdala) or to the midline diencephalic region.

**C. Anterograde amnesia** extends forward into time from the initial point of memory loss.

**1.** Anterograde amnesia affects LTM but not working memory.

**2.** It affects memory regardless of modality (visual, auditory, and so forth).

**3.** It spares memory for general knowledge, but impairs recall for new facts and events.

**4.** It spares skilled performance.

**5.** Even when amnesic patients do learn a new skill, they show *hyperspecific memory*, expressing their learning only in a context that is extremely similar to the conditions of encoding.

**D. Retrograde amnesia** involves loss of memory for information acquired and stored before the onset of amnesia.

**1.** All amnesic patients show at least some retrograde amnesia, although not all patients show anterograde amnesia.

**2.** The time span for which memory is lost can vary widely, from a few weeks to many years.

**3.** The temporal extent of retrograde amnesia may shrink slowly over time, with the most remote memories being the most likely to return.

**4.** Retrograde amnesia typically spares information that was “overlearned” before the onset and does not seem to affect skill learning.

**E.** Studies of amnesic patients tell us something about **memory consolidation,** a process by which new information initially persists in a fragile state and consolidates over time.