
Chapter 5: Short-Term & Working Memory
Chapter 6: Long-Term Memory: Structure
Chapter 7: Long-Term Memory: Encoding & Retrieval & Consolidation
Chapter 8: Everyday Memory & Memory Errors

Study Questions:

Ch 5. Short-Term and Working Memory

5.1. What is the difference between sensory memory and short-term memory?

- Hint: Sensory memory does not play a major role in the topics covered in Psych 355. For Psych 355, it suffices to know:
  - (i) Sensory memory precedes short term memory in the input of perceptual information.
  - (ii) Visual sensory memory is called "iconic memory." Auditory sensory memory is called "echoic memory."
  - (iii) Sensory memory has a very large capacity, but the information decays rapidly. Most or all of the information is lost within one second.

The following is interesting to think about but not required in Psych 355.

- Is it possible to manipulate information that is in sensory memory? E.g., if your sensory memory were filled with the image created by a flash in dark office room, could you manipulate the image while the information is in sensory memory, for example, to decide whether two pencils that are lying on top of the desk are the same length or not?
- The answer to this question is "No, information in sensory memory cannot be manipulated." What does this show about sensory memory. Answer in footnote1.

5.2. Capacity limits

- Approximately what is the limit in the amount of information that can be retained in short-term memory (STM)? What does the magic number 7 plus or minus 2 refer to?
- If someone challenged you to prove scientifically that short-term memory has limited capacity, what evidence would you cite? Explain carefully why the evidence proves that STM has limited capacity, i.e., what are alternative explanations for the evidence, and can they be excluded?
- Approximately what is the limit on the duration for which information can be retained in short-term memory?2 How do we know that information in short-term memory lasts for only a limited duration?

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1 Sensory memory is a very brief storage for the physical effects of a stimulus. We can direct attention to different aspects of information in sensory memory, but we cannot manipulate it. To manipulate information, we need to represent it in working memory (which, of course, is the modern name for short-term memory).

2 Hint: It is very difficult, possibly impossible, to measure how long information lasts in STM if it is not rehearsed but also not interfered with by other information that enters STM. See the issues raised in Question 3 above.
5.3. What are proactive and retroactive interference? What is the difference between a theory of forgetting that hypothesizes that it is caused by decay and a theory of forgetting that hypothesizes that it is caused by interference?

- The following issue was discussed in the Goldstein textbook and the Psych 355 lectures. Initially, it was thought that the Brown-Peterson task measured the rate of decay of information in short-term memory (STM). Later it was found that proactive interference is a major cause of forgetting in the Brown-Peterson task. Explain what is meant by release from proactive interference (release from PI). The fact that subjects in the Brown-Peterson experiment display release from PI shows that PI is a major cause of forgetting from STM - explain why this is so.

- To this day it is unclear whether forgetting from STM is caused entirely by interference, both proactive and retroactive, or whether at least some forgetting from STM is caused by decay. My intuitive belief is that decay must also contribute to forgetting from STM; that interference is not the only cause of forgetting from STM. But it is very hard to prove that decay occurs in STM.

5.4. What are recoding and chunking? Discuss how recoding and chunking help us overcome STM capacity limits when we manipulate information in working memory (WM).

5.5. What is the relationship between these two theoretical constructs: Short-term memory (STM) and working memory (WM)? Are they two separate parts of the memory system? What features do the STM model and the WM model have in common and what features are different in these models?

5.6. What functions are performed by the phonological loop (PL) in working memory (WM)? What are the main pieces of evidence for the claim that WM has a PL?

5.7. What functions are performed by the visuospatial sketchpad (VSP) in working memory (WM)? What are the main pieces of evidence for the claim that WM has a VSP?

5.8. What evidence shows that WM has both a PL and a VSP? In other words, how do we know that not all functions of WM are performed by the PL alone (no VSP) or the VSP alone (no PL)? Hint\(^3\).

5.9. What is articulatory suppression? Articulatory suppression is used in experiments that support the hypothesis that the phonological similarity effect and word length effect result from verbal rehearsal in PL. Describe one such experiment and explain why the results support the hypothesis that these effects result from verbal rehearsal in PL.

5.10. Brandimonte found that performance on a mental subtraction task actually improved when subjects engaged in articulatory suppression. Describe the mental subtraction task and explain why articulatory suppression improves performance on this task.

5.11. What is the function of the central executive in the working memory (WM) model? Can you list 2 or 3 main functions of the central executive?

5.12. Research with monkeys has demonstrated that there is a process of visuospatial rehearsal that is analogous to phonological rehearsal, except that it occurs in working memory for visuospatial representations. What kinds of task are monkeys required to perform that demonstrates the operation of visuospatial rehearsal (the short-term retention of visuospatial information)? A combination of physiological and behavioral evidence has confirmed that visuospatial rehearsal does occur in

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\(^3\) Think about Brook's image scanning experiment (moving a dot around the periphery of an F, or noticing the nouns in a sentence).
monkeys' prefrontal cortex. Can you describe this evidence? Hint: Think about "mnemonic scotoma."

5.13. What is meant by "neural mind reading"? Pages 144 - 145 discuss the use of neural mind reading to generate an argument that humans can retain visual patterns in working memory (the stimulus pattern is first displayed, then taken away).

5.14. Chapter 1 discussed a series of studies by Beilock and colleagues of why some people might "choke" under pressure (see Chapter 1, pp. 16-17). Review these studies. Chapter 5, pp. 146 - 147, continues this discussion by relating it to capacity limits in working memory. What happens in working memory in low and high pressure situations? Why do people with high working memory capacity perform worse on simple math problems when the external pressure is high, but people with low working memory capacity perform as well or better when the external pressure is high. I.e., explain the pattern of results displayed in Figure 1.12 (p. 17).

**Ch 6. Long-Term Memory: Structure**

6.1. What are the different components of long-term memory? Perhaps it would help to consider the following figure:

![Figure 6.6 (p. 156)](image_url)

I have blanked out some of the key features of this figure. Can you fill them in? Can you briefly explain what type of information is stored in these different components?

6.2. What are the main differences between the functions served by working memory (WM - what does it do?) and the functions served by long-term memory (LTM - what does it do?)?

* What evidence shows that WM and LTM are different memory systems? How would you disprove the hypothesis that all we have is one big memory system that performs all of the functions that are attributed to WM and LTM?

6.3. What is the typical shape of the serial position curve? What causes the primacy effect? What causes the recency effect? What kind of experimental manipulation will eliminate the recency effect? What kind of experimental manipulation will enhance the primacy effect?

6.4. It is thought that there are three main codes for storing information in STM and LTM: phonological codes, visual codes, and semantic codes. What is the difference between these three codes? What kind of evidence is used to show that each of these codes plays a role in the storage and manipulation of information in memory?

6.5. Is there neurological evidence for the distinction between episodic and semantic memory? If so, describe some examples of findings that support the claim that humans have different brain systems for episodic memories and semantic memories.
6.6. Goldstein argues that autobiographical memories often contain a mixture of episodic and semantic memories (see pp. 164 - 166). Does this idea make sense to you? Give an example of a personal semantic memory (p. 164). Goldstein discusses a process of semanticization of remote memories; he relates this idea to whether older people "remember" or "know" that events from their past had occurred. What is the remember/know distinction as it applies to this case? Does the pattern of "remember" and "know" judgments for memories of the near and distant past support the idea that remote memories become semanticized?

6.7. Some clinical cases are known of people who had difficulty creating new episodic memories. Do these people also have difficulty imagining things that might possibly happen to them in the future? If so, what does this suggest about how the brain processes representations of episodes, both the ones we have experienced but also episodes that were merely imagining in anticipation of what might happen?

6.8. How does implicit memory differ from explicit memory? Give examples of individuals with impaired explicit memory who do not have impaired implicit memory (or at least their implicit memory is much less impaired than their explicit memory). What can they do and what can they not do?

6.9. Tulving showed that the forgetting curves are different from explicit and implicit memories. Relate this fact to the phenomenon which we have all experienced where we have the feeling that we have met someone before but we cannot remember when or where we met this person. Could this be due to a dissociation between explicit and implicit memory? The French have a term, *déjà vu*, that describes the experience of having encountered a place or situation before without being able to recall when or where this might have happened. Once again, is this a dissociation between explicit and implicit memory?

6.10. What is procedural memory? Give an example that shows that HM had a functioning procedural memory even though his long-term episodic memory was severely impaired.

**Ch 7. Long-Term Memory: Encoding & Retrieval**

7.1. What is the depth-of-processing hypothesis?
- Deeper processing usually (but not invariably) produces better recall of the studied material. Why is this generally true.
- Can you name the phenomenon that shows that sometimes shallower processing is associated with better memory at a later point in time⁴?

7.2. Suppose you are studying for a test that will be given in 7 days. What strategies can you adopt in your study habits that will increase the chances that you will remember the material at the test?
- Why would associations that you generate yourself in relation to some material that you are studying be more effective at assisting future recall than associations that are suggested to you by someone else, even if this other person is very knowledgeable about the subject that you are studying?
- Why does testing a person's knowledge of a subject improve their knowledge of the subject, even if the answers to the questions are not given to the person who is tested?
- Compare the effect of testing on some material versus spending an equal amount of time rereading the material. Do testing and rereading have different effects in the short-term and in the long-term? What is the difference? What is the evidence that suggests that there is a difference?

⁴ See the discussion of transfer appropriate processing, pp. 192 and discussion in the Week 6 Friday section.
• If you have the option to study one hour per day for three days, or three hours consecutively on one day, which option will produce stronger memory for the studied material? Why does it have this effect?

• What kind of mental images make effective mnemonic devices? Are mental images better or worse as mnemonic devices than concise, relevant statement?

7.3. What is consolidation in LTM? What does reactivation refer to and how is it related to consolidation?

7.4. According to the standard model of consolidation, the hippocampus plays an important role in the early stages of consolidation, but it becomes less and less important as a memory is consolidated over time. Explain how the role of the hippocampus is thought to change as a memory starts with very little consolidation, and then acquires increased consolidation over time (assuming that one keeps thinking about this memory).

• HM's memory problems were due to the fact that his hippocampi were surgically removed. One of HM's symptoms was that he had trouble remembering events in his recent past (1 - 4 days preceding the surgery), and some difficulty remembering even earlier events. In other words, his retrograde amnesia was temporally graded. Do these facts support or conflict with the hypothesis that the hippocampus plays an important role in the consolidation of memories? Explain.

7.5. It is claimed that long-term memory representations are malleable at the time of retrieval. In other words, when a person retrieves a memory, that memory is more vulnerable to change than when the memory remains in long-term memory without retrieval.

• The textbook and lecture described an experiment where fear conditioning in a rat could be undone if memory for the fear conditioning is combined with injection of a drug. Describe this experiment. Did the results support the claim that long-term memory representations are malleable at the time of retrieval? What evidence supports this interpretation?

• Analogous methods have been used to treat patients with PTSD. How is the malleability of memory representations during retrieval used to reduce fear responses to traumatic memories.

Ch 8. Everyday Memory and Memory Errors

8.1. What is the reminiscence bump? What is the typical age range during which people experience a reminiscence bump? What causes the reminiscence bump? Does it occur at the same time for everyone, or are their systematic differences for people with different life experiences? Briefly describe how each of these hypotheses attempts to explain the existence of a reminiscence bump:

• Self-image hypothesis
• Cognitive hypothesis
• Cultural life script hypothesis

8.2. What is childhood amnesia? It is really not known what are the primary causes of childhood amnesia, but what are the main hypotheses as to why everyone experiences childhood amnesia?

* This topic was discussed briefly in lecture (lec07-1.p355.spr15) and not in Goldstein.

8.3. What is a flashbulb memory?

• Are flashbulb memories just like other memories for important events, or do they differ from ordinary memories?

5 If you are too young to have ever encountered a flashbulb, try googling "what is a flashbulb?".


• Studies have compared people's memories of "flashbulb" events to their memories of other personal, but less dramatic, events from the same time period. As time passes over months and even years, do these two types of events differ in the amount of detail forgotten? As time passes over months and even years, do these two types of events differ in people's confidence in the accuracy of their memories?

• What factors might cause flashbulb memories to be different from other less dramatic memories that are equally old?

8.4. What are schemas or scripts in memory?

• Remember that chunking makes it possible for people to extend the limits of working memory. If a person can chunk the information in working memory into a smaller number of units, then the person can maintain more information in working memory. E.g., a chess expert remembers the positions of all pieces on a chess board after a brief glance, but a novice can't do this.

• Schemas and scripts help people chunk their experience - instead of trying to remember all of the details of a situation, a person can organize the information around a larger schema. E.g., instead of trying to remember all of the details of your trip on an airplane, as if they were a series of unrelated facts, you can organize your memories of the plane trip into "chunks" that are defined in terms of schemas or scripts about air travel. What does this mean? Schemas and scripts make it easier to encode and retrieve information about life experiences.

8.5. There is more than one reason why people who have witnessed a crime make errors in eyewitness testimony. List some of the reasons why errors in eyewitness memory occur.

8.6. Psychologists have observed that misinformation effects can distort eyewitness memory. What is misleading postevent information (MPI)? What is a misinformation effect? Give an example of how a cognition experiment demonstrates that MPI can affect eyewitness memory for an initial experience.

8.7. People often use a feeling of familiarity to decide what is or is not a true memory of a prior experience. Give an example of experimental evidence that would support this claim. It may be that a feeling of familiarity is often a valid cue for whether someone or something plays a role in a prior experience, but it obviously is not always reliable. Give an example where it might not be reliable.

8.8. What is the "recovered memory controversy". Is it possible to create false memories of traumatic events? Is it possible to forget traumatic events like an instance of childhood sexual abuse?

• Most laboratory demonstrations that false memories can be created do not try to create memories of traumatic events, simply because doing so would be unethical. But there have been demonstrations that it is possible to create false memories of more mundane childhood events, e.g., psychologists have caused subjects to have a false memory that they had knocked over a punch bowl at a wedding when they were 6 years old, or that they had been lost in a shopping mall for a short period when they were a young children. What are the methods that psychologists have used that can cause people to have false memories?