Lecture 7 - Memory

The Abstract: The first part of this lecture will deal with *encoding*. How do we get material into memory? The problem, as will be demonstrated, is that there are severe bottlenecks between the outside world and your long-term memory (sound familiar from attention?). In the second part of the lecture, we will consider some of the physiology and neuropsychology of memory encoding. In particular, we will talk about the role of the hippocampus in the *consolidation* of memory. Finally, we will talk a bit about the problems of recall or *retrieval* from memory. This topic will carry over into the next lecture.

Lecture Notes:
Why don't you have as much memory as you would like?

Capacity limitations on encoding
        Example from last Tues: **Visual Short Term Memory**

                Visual **<u>Short Term</u>** memory – sounds like parking meters
                Visual **<u>Working</u>** memory – like your computer desktop
                Are they really different? (Not for our purposes)

        Another Example: "Digit span" (but we will do it with color names, why?)

Miller, G. A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. Psychological Review, <u>63</u>, 81-97.

        7+/- 2 what?

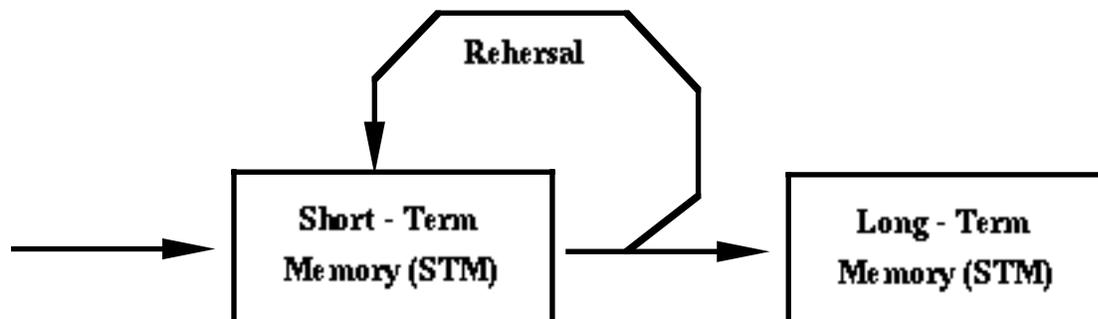   What is "chunking" (yeah, really)

        Counter-example: Picture memory - Why is it a counter-example?

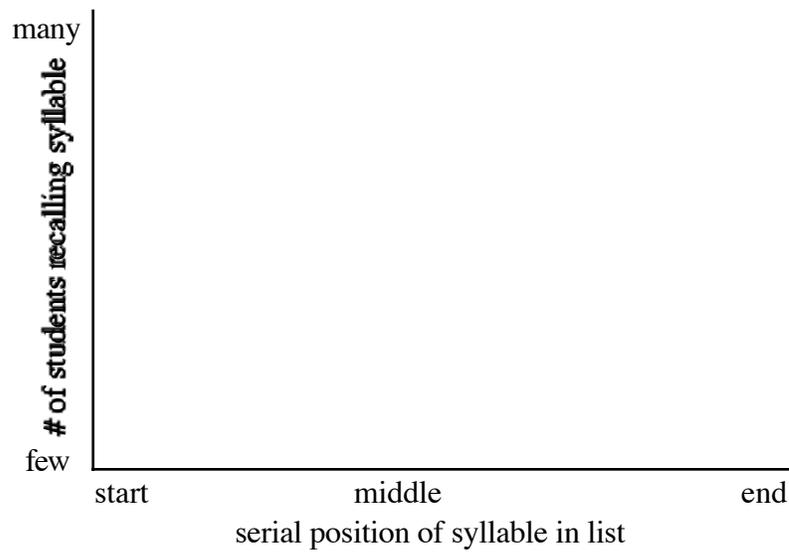Ebbinghaus (Germany, 1885) introduces nonsense into the study of memory

What nonsense gets into long-term memory?

For acquisition of new memory, STM (or WM) can be thought of as another bottleneck. How much information can get through per unit time?

        The Standard Model (Waugh and Norman, 1965; Atkinson and Shiffrin, 1968

The serial position experiment

```
many |
     |
     |
  #  |
  o  |
  f  |
     |
  s  |
  t  |
  u  |
  d  |
  e  |
  n  |
  t  |
  s  |
     |
  r  |
  e  |
  c  |
  a  |
  l  |
  l  |
  i  |
  n  |
  g  |
     |
  s  |
  y  |
  l  |
  l  |
  a  |
  b  |
  l  |
  e  |
 few |_____
        start            middle              end
            serial position of syllable in list
```

Primacy, recency, and rehearsal

Modifying the standard model: Working memory (Alan Baddeley)
        The phonological loop
        The visuo-spatial sketch pad
        The central executive

STM or working memory: the core ideas are

    1) bottlenecks
    2) meaning

Why is meaning important?

        Semantic network as an organizing principle for LTM

                Evidence from priming

                Mnemonics: Using the network

What part of the brain handles encoding from STM to LTM?

        The neuropsych evidence (see Memento…even if I haven't)
        Patient HM (Corkin S (1984), Seminars in Neurology, 4, 249-259)

                Lesion of hippocampus & amygdala (why?)

                HM has a severe **anterograde amnesia**
                Encoding into **implicit** memory is better than into **explicit** memory
                        (what is that distinction about?)

See also **Declarative vs procedural**

So: Hippocampus is vital to the consolidation of STM to LTM.

NICE REF
Squires, L. R. (1992). Memory and the hippocampus: A synthesis from findings with rats, monkeys, and humans. Psych. Review, 99(2), 195-231.

How long does it take to **consolidate** a new memory?

Retrograde Amnesia vs Anterograde amnesia

Evidence from electroconvulsive shock (ECS) in rats

If we have time:
Evidence from electroconvulsive therapy (ECT) in humans

Finally, let's begin talking about **retrieval** from memory

Memory is not a library or archive - at least, not like any library you know about.

The Deese-Roediger-McDermott demo

Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *J. Experimental Psychology: Leanring, Memory, and Cognition, 21*(4), 803-814

Questions to answer from Chapter Seven:

The memory chapter notes that the problem of memory can be divided in the three broad topics of getting into memory (acquisition or encoding), the mode of storage, and getting material out of memory (retrieval and forgetting).

P245 You will want to be able to discuss that model in Fig 7.1. Can you muster evidence for all the parts?

P245 What are primacy and recency effects?

P247 What is chunking?

P249 Of course, what people really want to know about memory is how they can get more of it. So, what does "depth of processing", "understanding", and "mnemonics" are all ways to get more into memory. How do they differ? How are they similar?

P255 What is implicit memory and how can you measure it or demonstrate its existence?

P256 The book makes the good point that "forgetting" is a term that covers a large number of distinguishable phenomena. What, for example, is the difference between "decay" and "interference" as causes of forgetting? How could you tell these apart with an experiment?

P262 Memory distortion is one of the most important "real world" topics in the study of memory. How can memories be distorted? What does this mean for eye witness testimony?

P266 What is a repressed memory? Why is the concept problematic?

P268ff You will want to know the difference between anterograde and retrograde amnesia.

P269 and you will want to be able say something about some of the specific cases discussed here.

Suggestions for further reading

Pillemer, D. B., Goldsmith, L. R., Panter, A. T., & White, S. H. (1988). Very long-term memories of the first year in college. *J. Experimental Psychology: Learning, Memory, and Cognition, 14*(4), 709-715.

If you write about this, think about what memories you are laying down for your old age. Can you guess what will last?

Debiec, J., LeDoux, J. E., & Nader, K. (2002). Cellular and Systems Reconsolidation in the Hippocampus. Neuron, Volume 36, 36(3), 527-538.

This is a ref for the idea that when a memory is reactivated, it becomes plastic again and needs to be reconsolidated. Very interesting and very new. Also very technical. This article might help (It is not in the course file but is easily pulled off the web.

When Remembering Might Mean Forgetting
Steinberg, D (2004) Debate flares over whether retrieved memories risk oblivion if they don't undergo reconsolidation., The Scientist, Volume 18 | Issue 15 | 17 | Aug. 2, 2004; http://www.the-scientist.com/yr2004/aug/feature_040802.html

Slotnick, S. D., & Schacter, D. L. (2004). A sensory signature that distinguishes true from false memories. *Nat Neurosci, 7*(6), 664-672.

And this is a ref that says that there may be a neural signal that can tell true form false memory. If you write about this, consider the social/political implications if this proved to the basis for a test that could be used in criminal (or other) investigations. Good idea? Unconstitutional? You decide.