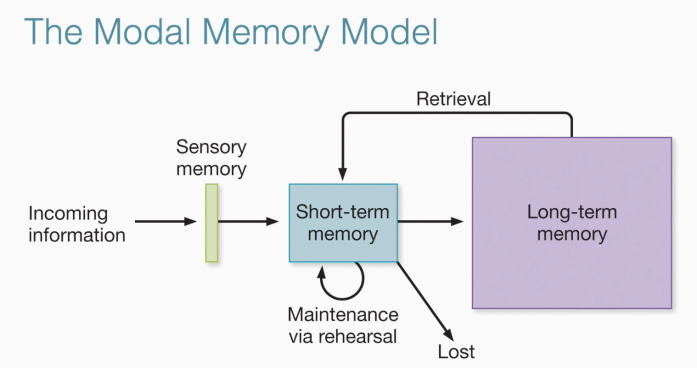
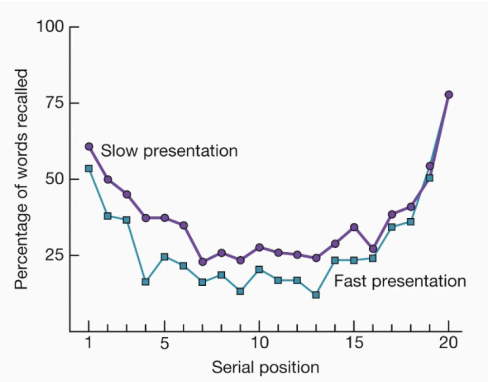
Chapter 6 - Memory

- **Modal memory model**: Outdated, but provides us a nice skeleton to start from.

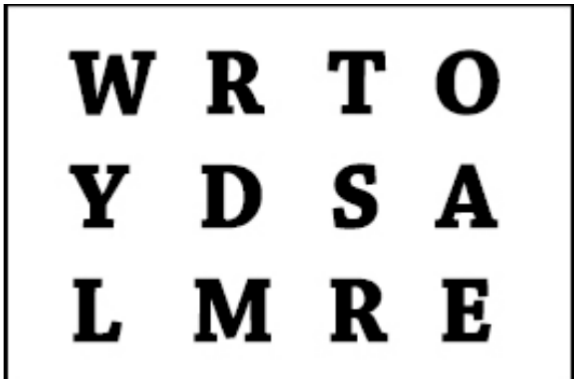


  - **Sensory memory** = storage that very briefly holds inputs in its raw sensory form (e.g. iconic inputs, auditory inputs, etc.).
  - **Short term memory** = memory that you're working with, aka info that is in use.
    - ST memory is either lost, or transitions into LT memory.
    - The **rehearsal loop** = the process of maintenance via rehearsal.
      - Info is taken from short term memory, then restored via rehearsal.
      - This slows down/prevents the loss of info from ST memory, thus increasing odds of info transitioning to LT memory.
  - Retrieval from long-term memory is slower, and not necessarily possible in all contexts.
  - **Evidence for Modal Model:**
    - Sensory memory experiments (see below) provides evidence for the left side of the Modal Memory model.
    - **Serial positioning experiments** provide evidence for the right side of the Modal Memory model. In particular, 2 effects present in serial positioning experiments do this:
      - **Recency Effect** provides evidence for STM: The idea that the last few items on a free recall task are still in working memory, so they are very easy to retrieve/recall. This supports the idea that working memory exists and is distinct from LT memory.
      - **Primacy Effect** provides evidence for LTM: The idea that the first few items on a free recall task are more likely to be stored in long-term memory via rehearsal, and thus are easier to retrieve/recall than the middle items. This supports the idea of the rehearsal loop and its associated effect on long-term memory, and that LT memory is distinct from ST memory.
      - Recency effect generally > primacy effect.
    - **Interference** impacts the recency effect:
      - If subjects have a 30 second unfilled delay between final word and recall, there is basically no change in recall ability, since the words are still active in working memory.
      - If this 30s is filled with other words or distractions, then the recency effect basically disappears, which implies that the working memory was busy processing the new stimuli. This is evidence that working memory is quite limited and that the recency effect is due to working memory.

        - The primacy effect still exists in both scenarios, implying that the system responsible for it (LT memory) is entirely different than the system responsible for the recency effect (ST memory)
    - LT memory can be manipulated via **presentation speed**:

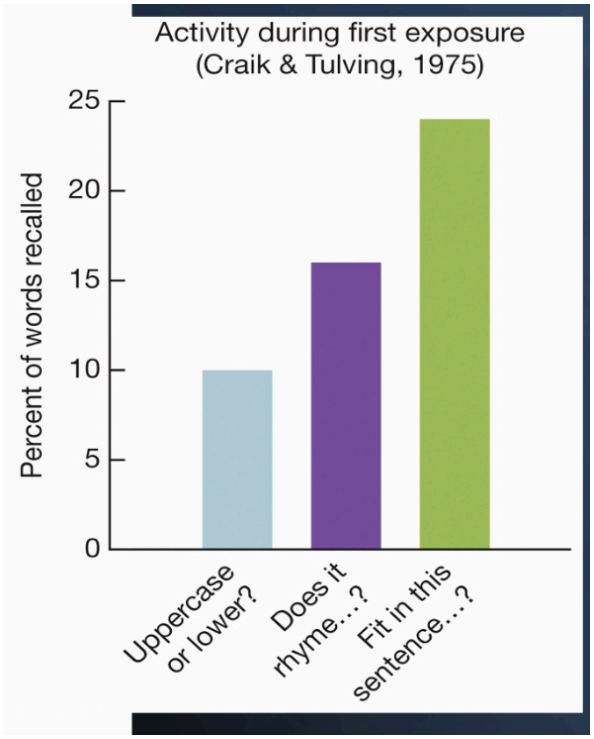


        - Slow presentation = greater primacy effect with all items since there is more rehearsal time available in between words. This is evidence that LT memory exists and that the rehearsal loop helps move things from ST memory to LT memory.
    - Brain activity: Working memory retrieval activates the **perirhinal cortex** whereas long-term memory activates the **hippocampus**.
- **Sensory Memory**
    - Very limited, very temporary
    - **Evidence:**



    - Participants were shown this grid for just 50ms. When asked to report all of the letters, they could usually only get 3 or 4. On the other hand, when asked to report a specific row, they almost always got it, regardless of which row it was.
        - This implied that the entire display was stored as an iconic memory in the “sensory memory box” for a brief time, and could be “read off” when appropriately cued.
        - The report-all condition failed because by the time they got to letter 4 or 5, the iconic memory had already faded away.
- **Working memory**
    - The modern interpretation of “short term memory”. Should really be thought of as which memories are currently under the “active” status rather than an explicit place of storage.
- **Working vs Long-term Memory**

    - Working memory is temporary and fragile, whereas long-term memory is long-lasting and robust.
    - Working memory has very limited capacity, whereas long-term memory has almost unlimited capacity.
    - It is very easy to store things in working memory, but long-term memory requires some effort.
    - Retrieval is easy for working memory (I mean, it's basically trivial - you're already thinking about it) but can be slow, difficult or even unsuccessful for long-term memory.
- **Function of Working Memory**
    - Used whenever multiple elements/ideas are combined/compared in the mind.
    - The digit span test is a commonly used test for WM capacity. That being said, in its raw form, it tends to overestimate participants that are good at chunking.
    - People generally have a 7 +/- 2 chunk capacity.
    - Chunks vs items: remembering a phone number like 416-967-1111 is one chunk, but 9 items.
    - Different regions of the brain are activated depending on the type of tasks your working memory is dealing with.
    - **Operation span task**
        - Assesses WM capacity while it's working, aka the ability to hold information while actively processing other information.
            - E.g., how many letters can you solve while working on a math problem?
            - E.g. **Reading span task**: Recall each sentence's last word. Requires processing a sentence while keeping word in working memory in mind.
        - More accurate than digit span task and correlates with metrics like standardized academic tests and reasoning/reading comprehension tests.
- **Entering long-term storage**
    - 2 main types of rehearsal: maintenance and relational/elaborative.
    - **Maintenance** = shallow, rote, mechanical rehearsal. E.g. repetition of the word, rereading, etc.
    - **Relational/elaborative** = deep, thinking about semantic meaning of concept, how it relates to other things
        - E.g. **Relational**: thinking about how memory nets compare to the computational dynamics of LSTMs and transformers.
        - E.g. **Elaborative**: "People eat cows" doesn't encode a memory as well "People all around the world eat cows, which have been domesticated since antiquity".
            - The jury is still out on why this happens.
    - Relational/elaborative rehearsal is generally much better than maintenance in terms of long-term memory storage, but also much more effortful.
        - E.g., identifying the Apple logo is very difficult, because even though we've seen it so many times, we never engage with it on a deeper level. I mean fr tho who really is out here trying to meaningfully engage on an intellectual level with the concept of the Apple logo?
- **Depth of Processing**
    - **Shallow processing** = superficial engagement with the material. Not much semantic processing if any at all.
        - E.g. is the word DOG capital or lowercase? What typeface is it? What color is it?

- **Deep processing** = thinking about the material in a meaningful and mentally engaging way.
  - E.g. Does the word DOG fit in the sentence “He walked his ___”? What other words is the word DOG similar to?
  - The deeper one processes information, the more pathways are created to access a specific memory, therefore the easier that memory is to retrieve. In other words, deep processing -> more connections.
  - Attention to meaning involves thinking about relationships, and therefore different ways to think about the meaning, and therefore more connections.
- 

- Intention to learn by itself doesn’t matter much - that being said, learning with intent tends to matter in general since it often engages deeper levels of processing. This of course, ultimately depends on the subject.
- Incidental learning often happens because the participant is engaging deeply with material out of interest or curiosity.

- **Acquisition, Retrieval and Storage**
  - These 3 things are not easily separable:
    - “Effective” learning depends on how the info will later be retrieved.
      - E.g. One might employ a completely different storage method for a multiple choice test on psych terms vs a test full of long answers on those same psych terms.
      - E.g. One might want to study wearing the same clothes they will test in, in the same room, since those environmental cues help with pathway creation and retrieval.
    - New learning is grounded in previously learned knowledge
      - E.g. How effectively one can process and store information about dedekind cuts depends on one’s prior exposure and ability to retrieve information about natural numbers, integers, etc.