







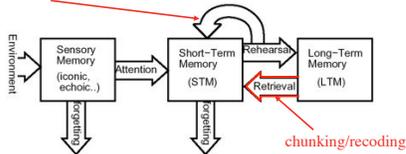






# STM Capacity

- Often Measured with Memory Span Tests
  - Normal capacity is about 7 +/- 2 Items
- Chunking
  - Capacity can be improved by recoding information into groups.
  - NFLCBSIRAMTV-> NFL CBS IRA MTV
- Re-coding
  - Changing the mental format or representation of information.
  - e.g., visual -> auditory, chunking
- Rehearsal
  - Mental repetition/recycling maintains info in STM



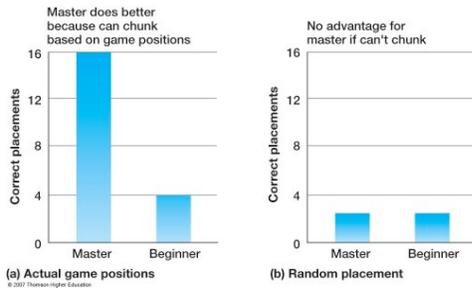
## Stop: Recall

- Which list were you able to remember better?
- How can we explain chunks?
  - Chunks seem almost like a cheat because we can get more information per “unit” than normal.
  - Does this make sense at a psychological level? What about at a neurological level?

## Learning, Chunks, and Automaticity: Chess

- Showed expert and novice chess players arrangements of pieces from chess games for 5 seconds.
- Subjects had to studied these configurations and then replicate them.
  - Actual game positions
  - Random positions
- What do you think happened?

# Learning, Chunks, and Automaticity: Chess

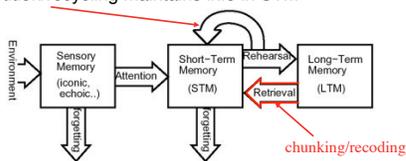


# Learning, Chunks, and Automaticity: Chess

- This is not due to the master developing better short-term memory.
  - Otherwise what would you expect?
- The patterns are broken into meaningful chunks in the mind of the expert.

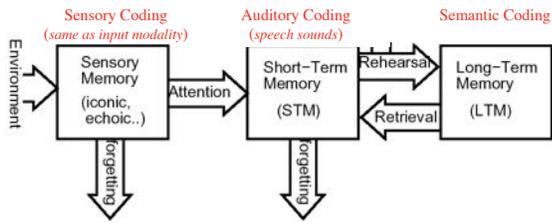
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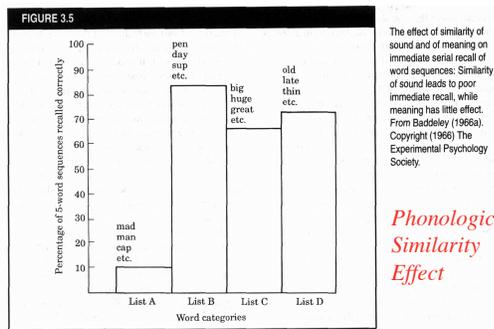


# Coding Assumed by Modal Model

*"Coding" = Format of the mental representation.*



# Evidence for Auditory Coding in STM



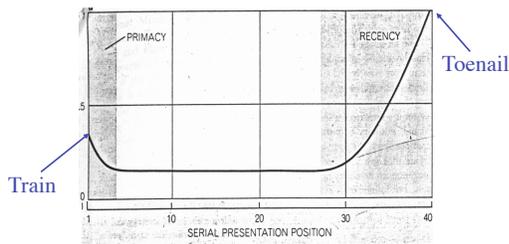
# How else is information encoded in STM?

- Auditory Coding
- Visual Coding
- Semantic Coding
- What types of information are represented by these different codes?





# Serial Position Effects



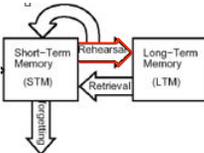
# Primacy Effect

ITEM PRESENTED	ITEMS REHEARSED (REHEARSAL SET)
1 REACTION	REACTION, REACTION, REACTION, REACTION
2 HOOF	HOOF, REACTION, HOOF, REACTION
3 BLESSING	BLESSING, HOOF, REACTION
4 RESEARCH	RESEARCH, REACTION, HOOF, RESEARCH
5 CANDY	CANDY, HOOF, RESEARCH, REACTION
6 HARDSHIP	HARDSHIP, HOOF, HARDSHIP, HOOF
7 KINDNESS	KINDNESS, CANDY, HARDSHIP, HOOF
8 NONSENSE	NONSENSE, KINDNESS, CANDY, HARDSHIP
...	...
20 CELLAR	CELLAR, ALCOHOL, MISERY, CELLAR

**OVERT-REHEARSAL** experiment by Dewey Blandin shows the effect of rehearsal on transfer into long-term storage. The subject rehearsed aloud. A serial listing of items rehearsed in one instance shows typical result: early items receive more rehearsals than later items.

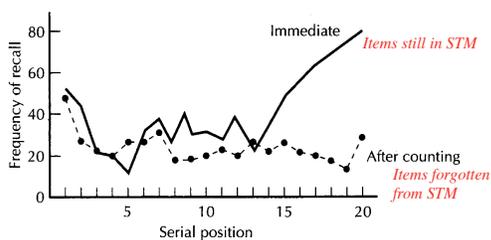


**EFFECT OF REHEARSAL** is demonstrated by comparison of an item's probability of recall (black) with the total number of rehearsals that receive (color). The two are related in pattern reflecting rehearsal from long-term storage (converting memory system). That is, long-term memory entry depends on number of rehearsals and is reflected in rehearsal.



- Earlier items are **rehearsed** more.
- Facilitates transfer to LTM

# Recency Effects



Serial position functions for free recall tests given immediately after the presentation of a 20-word list as compared to a test given after a 30-second delay, during which subjects were counting backward.

Source: Postman & Phillips, 1965.

# Serial Position Curves

- Primacy Effect
  - Better memory for beginning of study list.
  - More rehearsal facilitates LTM encoding.
- Recency Effect
  - Better memory for end of study list.
  - Last few items still in STM.

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# Working Memory

- Phonological Loop
- Visuospatial Sketchpad
- Central Executive

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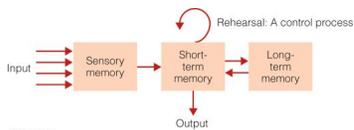
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# Working Memory



- Early theorizing on short term memory posited it was simply a short-term storage system.
- But we can see that STM needs to encode and retrieve information to/from LTM.
- Thus, STM is not just passive storage, memory has the capacity to do **work!**



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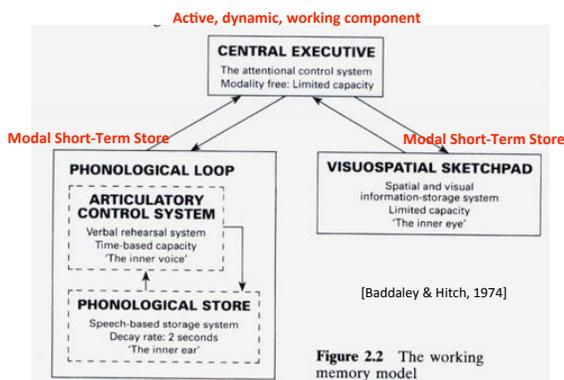
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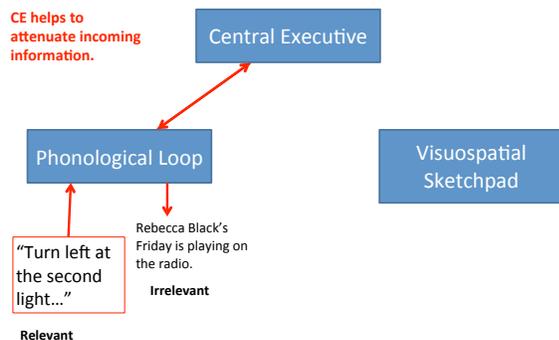
# Working Memory

- Work: (physics) is the amount of energy transferred by a force acting through a distance in the direction of the force.
- How can we explain (1) the dynamic processes involved in cognitions such as understanding language and (2) the fact that people can carry out two tasks seemingly simultaneously?

## Baddeley's Model of "Working" Memory



## Doing Work in Memory









Excerpts from  
Expedition ins Gehirn  
(Beautiful Minds  
A Voyage into the Brain)

Colourfield Productions  
Dortmund, Germany

## Central Executive

- Controls WM systems
  - Phonological loop (PL) & visuospatial sketchpad (VS).
- Mental Arithmetic Example:
  - Both PL and VS can help solve problem.
  - Central executive controls access and information sharing among the PL & VS.
- Poorly Understood

$$\begin{array}{r} 37 \\ \times 28 \\ \hline 296 \\ + 740 \\ \hline 1036 \end{array}$$

## Relating Memory Concepts to the Brain

- Working memory/STM deficits are specifically related to damage to the prefrontal cortex (PFC).
- Patients with PFC damage verbalize the most appropriate social response for situations, yet, in reality, they instead pursue behavior that is aimed at immediate gratification or habit driven.





