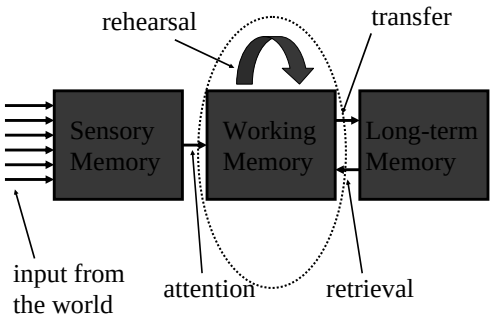
Chapter 5 – Short-term/Working Memory

Original Information Processing Model



Characterizing Memories

- ***Transfer***: How is information copied into the store?
- ***Capacity***: How much information can the store hold?
- ***Forgetting***: How does information get lost from the store?
- ***Representation***: What is the format of information in the store?
- ***Retrieval***: How is information recovered from the store?

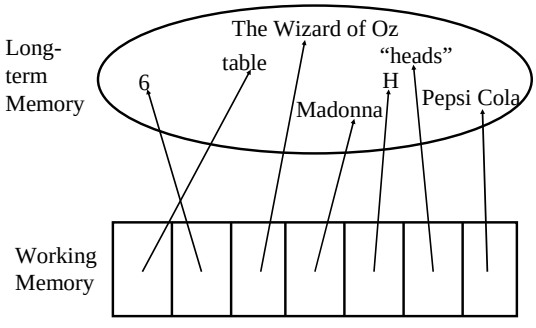
George Miller & Herb Simon

- Miller's (1956) analysis of short-term memory capacity (7 ± 2 chunks)
- Simon's (1974) analysis of the meaning of a chunk; definition

The Unit of Working Memory

- ***Chunk***: anything in working memory which has a unitary representation in *long-term* memory
- ***Recoding***: packing more information into each chunk, given that the number of chunks is limited
- ***Mnemonic***: a technique for improving memory (from the Greek, "mneme," meaning memory)

WM as a Pointer



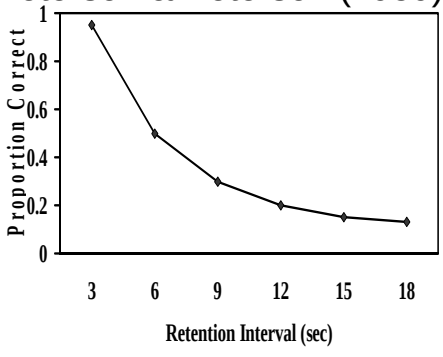
Forgetting in WM

- Is loss of information due to decay?

Practice counting backwards by 3

576

Peterson & Peterson (1959)



Waugh & Norman (1965)

6 2 9 3 1 4 6 9 7 5 8 3 1 5 7 3

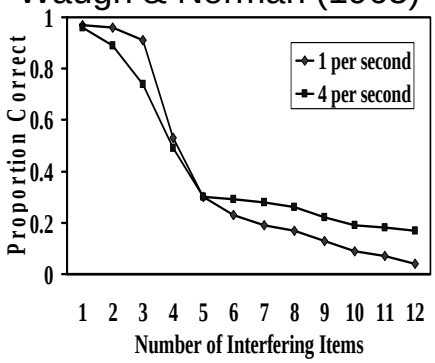
Probe: 4

Report: 6

Read at a rate of 1/s or 4/s

9 interfering items

Waugh & Norman (1965)

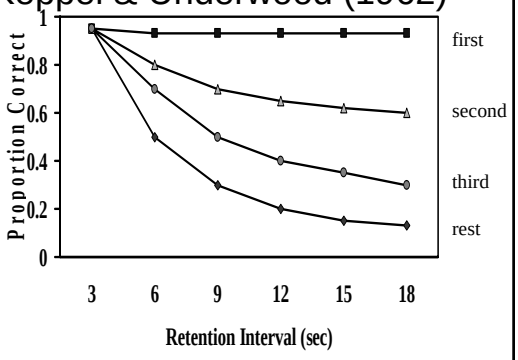


Interference

Alternative explanation: poor remembering caused by interference by the counting task.

RI – Retroactive interference – newer material interferes backward in time with your recollection of older items

Keppel & Underwood (1962)



Interference

Alternative explanation: poor remembering caused by interference by the counting task.

RI – Retroactive interference – newer material interferes backward in time with your recollection of older items

PI – proactive interference – when older material interferes forward in time with your recollection of the current stimulus

Wickens (1972): "Release from PI"

Trial 1: apple, pear, kiwi

Trial 2: peach, banana, strawberry

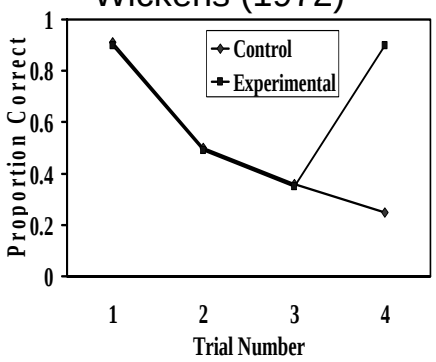
Trial 3: plum, raspberry, orange

Trial 4:

Control Group: pear, grapefruit, lime

Experimental Group: lawyer, dentist, engineer..

Wickens (1972)



Saul Sternberg

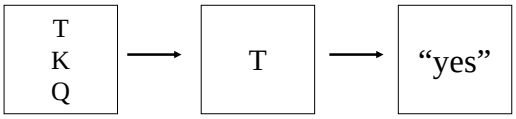
- key papers in 1966, 1969
- developed a way to measure working memory retrieval using recognition, not recall
- used response time (RT) because accuracy would be perfect

Scanning Working Memory

- study: present from 1 to 5 digits rapidly (1 second each)
- test: present a probe digit that either was or was not in the studied set (match or mismatch)
- record RT from onset of probe to press of YES or NO button

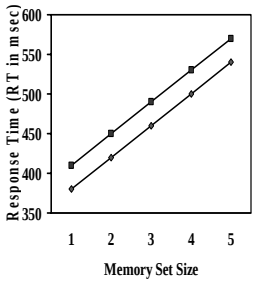
Retrieval from STM

The Sternberg (1966) paradigm:



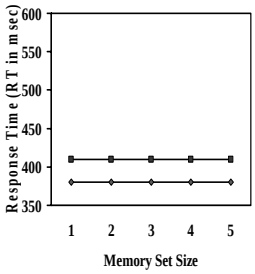
Memory Set	Test Probe	Response
(1-7 items)	(old or new)	(yes or no)

Sequential/Serial Scan



- if scanning is one at a time, one item after another, then RT should increase with set size
- if each comparison takes the same amount of time, then the increase should be linear

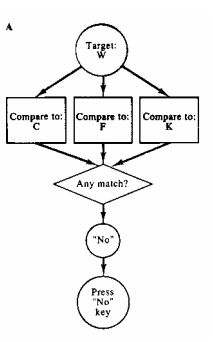
Parallel Scan

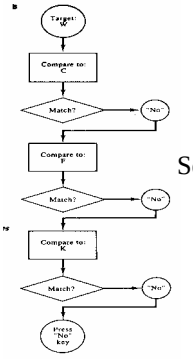


- if scanning examines all items at once, then RT should be constant over set size
- both accounts make the same prediction for NO and YES, but NO may be a little slower (checking)

Scan Models

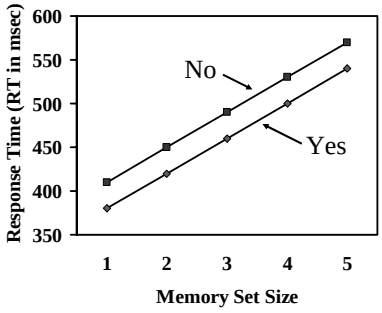
Parallel



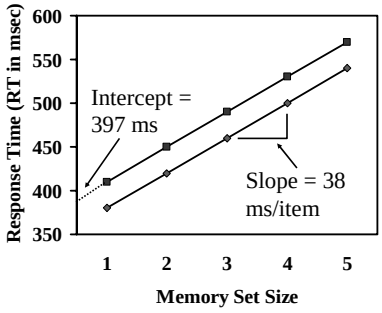


Serial

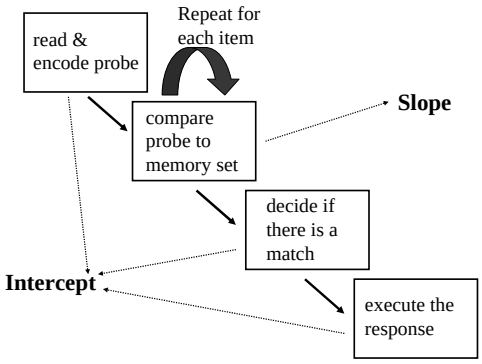
Scanning Working Memory



Scanning Working Memory



Additive Factors Model



Alan Baddeley

- Baddeley & Hitch (1974)
- shifted the emphasis from passive storage (short-term memory) to active processing (working memory)
- multiple components

Working Memory Operation

- ***Central Executive***: directs and controls all WM functions
- ***Visuo-spatial Sketchpad***: a slave system for holding visual information
- ***Phonological Loop***: a slave system for holding and recycling auditory/acoustic information
  - ***Rehearsal Loop***: a process for recycling, using subvocalization
  - ***Phonological Buffer***: a structure for holding acoustic information

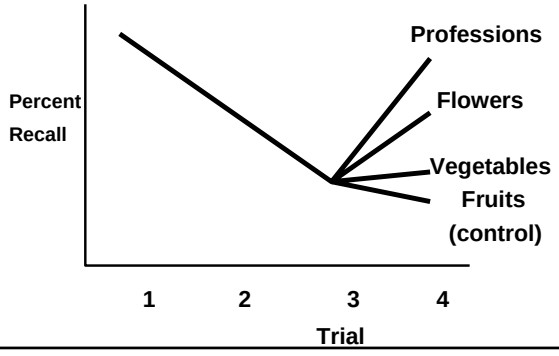
Recoding & Rehearsal

- Verbal information is recoded into acoustic (auditory) format in WM (even when visually experienced)
- Conrad (1965) - sound-alike errors
- Wickelgren (1965) – RI from rhyming distractor task
- ***Rehearsal***: the recycling of information in working memory, often in "the mind's ear"

Semantic Codes

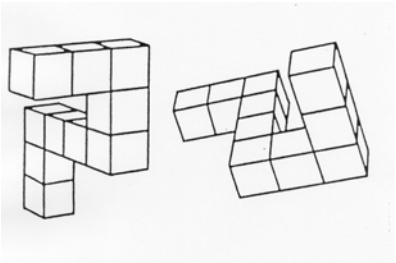
- Wickens' "release from PI" demonstrates importance of semantic codes in working memory

Working Memory: Semantic Codes

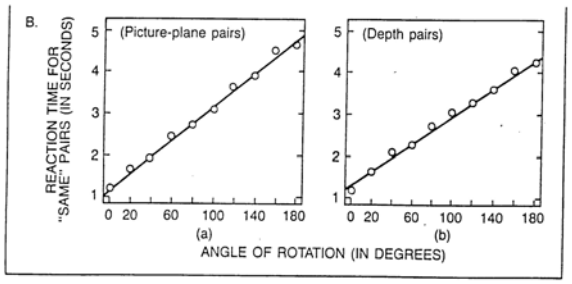


Mental Rotation

- Ability to mentally rotate images indicates visual coding in working memory



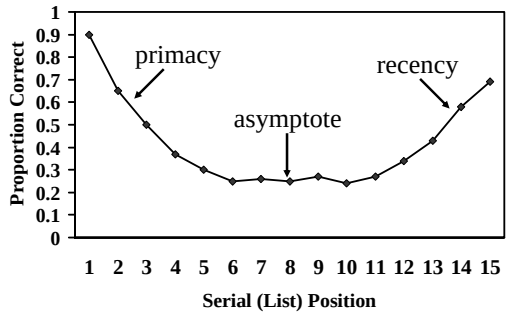
Shepard & Metzler (1971)



Are SM, WM different?

- SM – infinite capacity
  - forgetting due to decay
  - raw representation
- WM – 7 ± 2 capacity
  - forgetting due to interference (decay?)
  - largely phonological representation

The Serial Position Curve

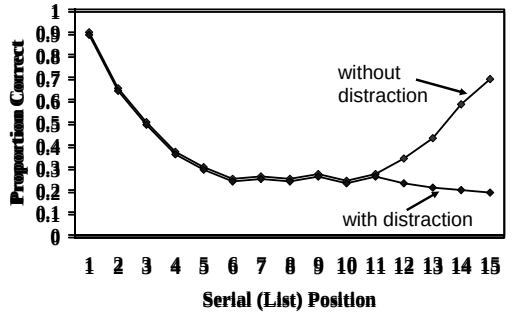


(e.g., Murdock, 1962)

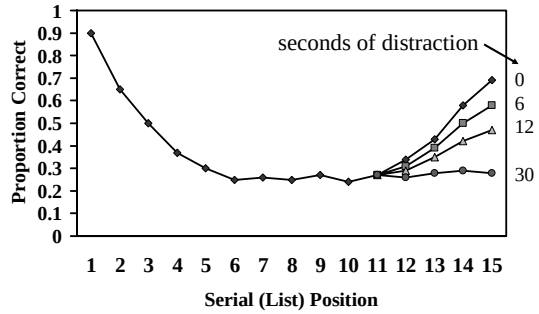
Serial Position Definitions

- ***Primacy***: Superior memory for the beginning information in a sequence
- ***Asymptote***: Average memory for information in the middle of a sequence
- ***Recency***: Superior memory for the ending information in a sequence

The Serial Position Curve

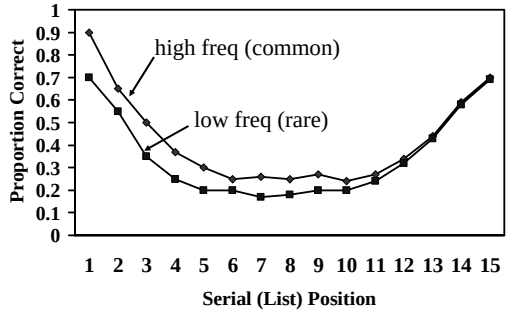


Varying Distraction



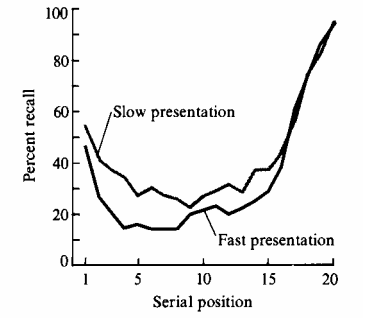
(e.g., Glanzer & Cunitz, 1966)

Word Frequency



(e.g., Sumby, 1963)

Rate of Presentation



The Concept of Dissociation

- ***Dissociation***: an independent variable affects one situation or theoretical entity differently from another (e.g., distraction affects WM but not LTM)
- ***Double Dissociation***: two situations or theoretical entities are affected in opposite ways by one or more independent variables (e.g., distraction affects WM but not LTM; rate of presentation and word frequency affects LTM but not WM)