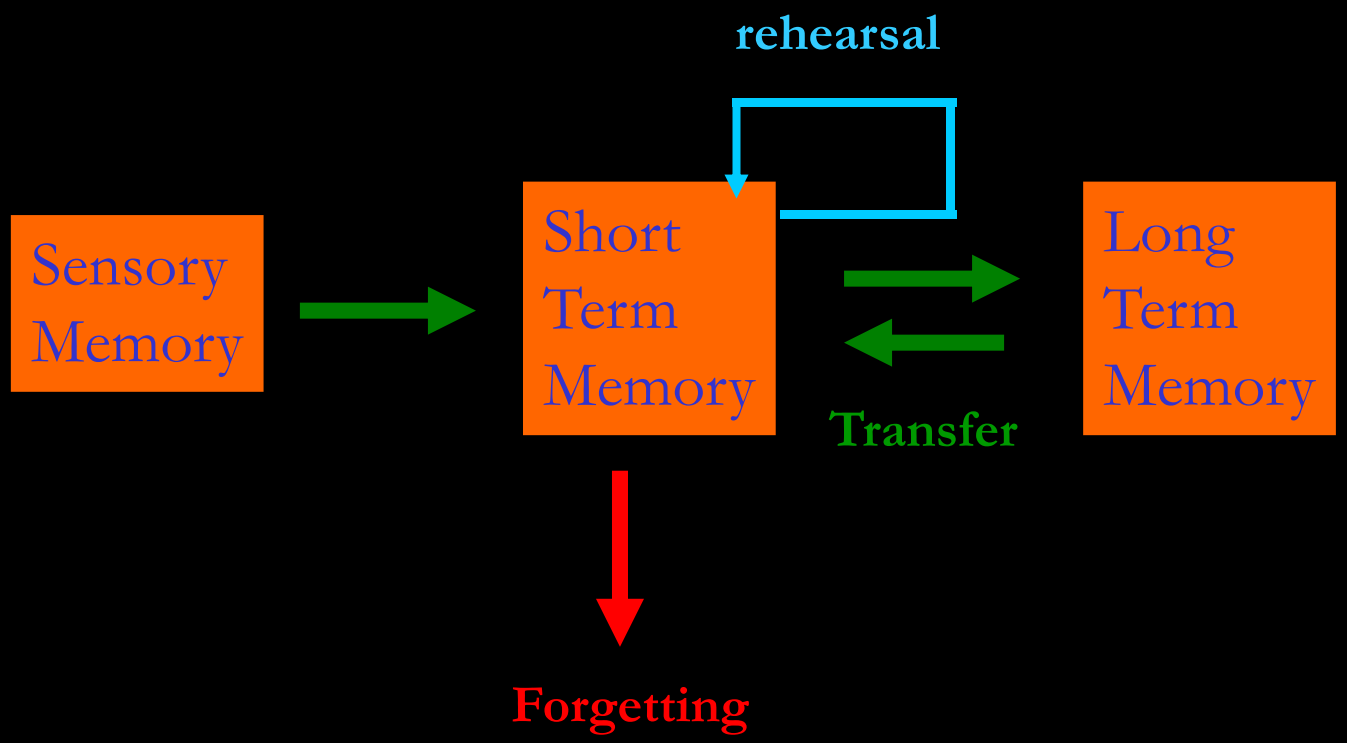
SHORT-TERM MEMORY and/or WORKING MEMORY

Atkinson-Shiffrin Model



STM vs. WM

STM:

- Emphasis on *input*
- Older term
  - remembering phone numbers

WM:

- Emphasis on *process*
- Newer term
  - doing math in your head

Classic Research on STM

- Capacity
  - Digit span
- Duration
  - Brown-Peterson Paradigm
- Retrieval and Forgetting
  - Serial Position

Capacity of STM

Magical number 7 (plus or minus2)

- **Digit Span** (Jacobs, 1887):
  - Presentation of a succession of digits, and subjects has to report them back.
  - Stops when you make an error, and that is your Digit Span

Digit Span

It helps:

- when you recite the numbers rhythmically

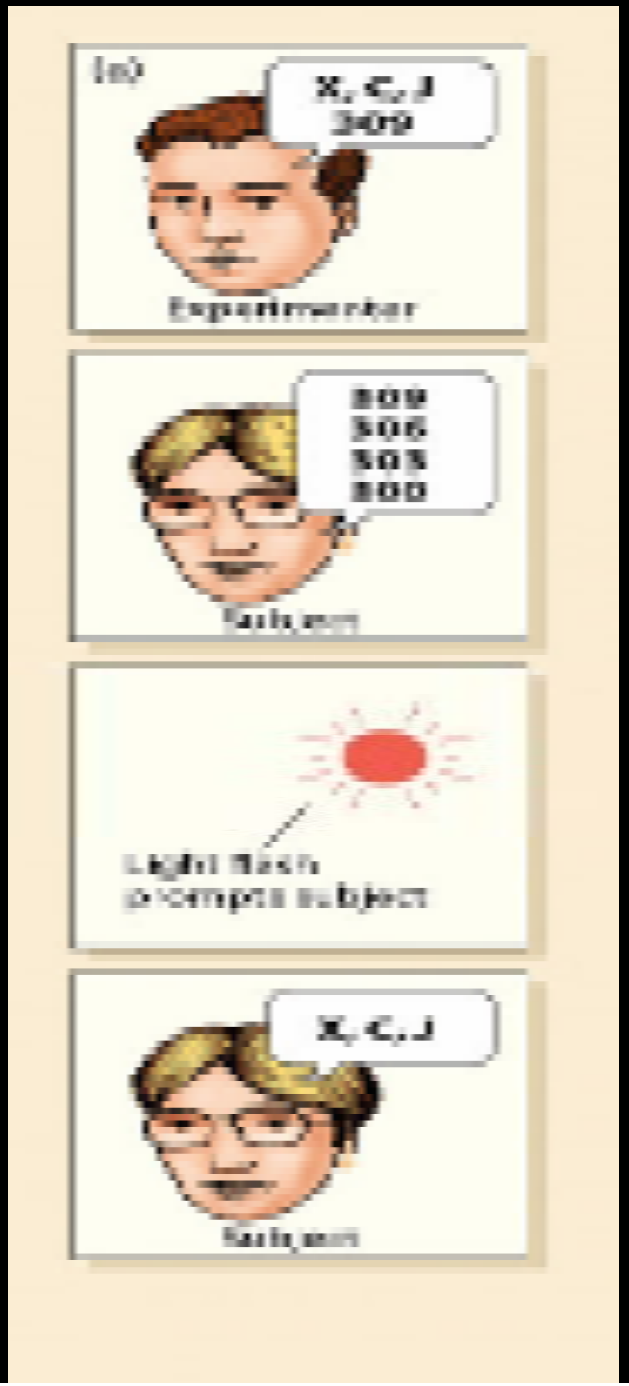
Digit Span

It helps:

- when you ***chunk*** the material into groups

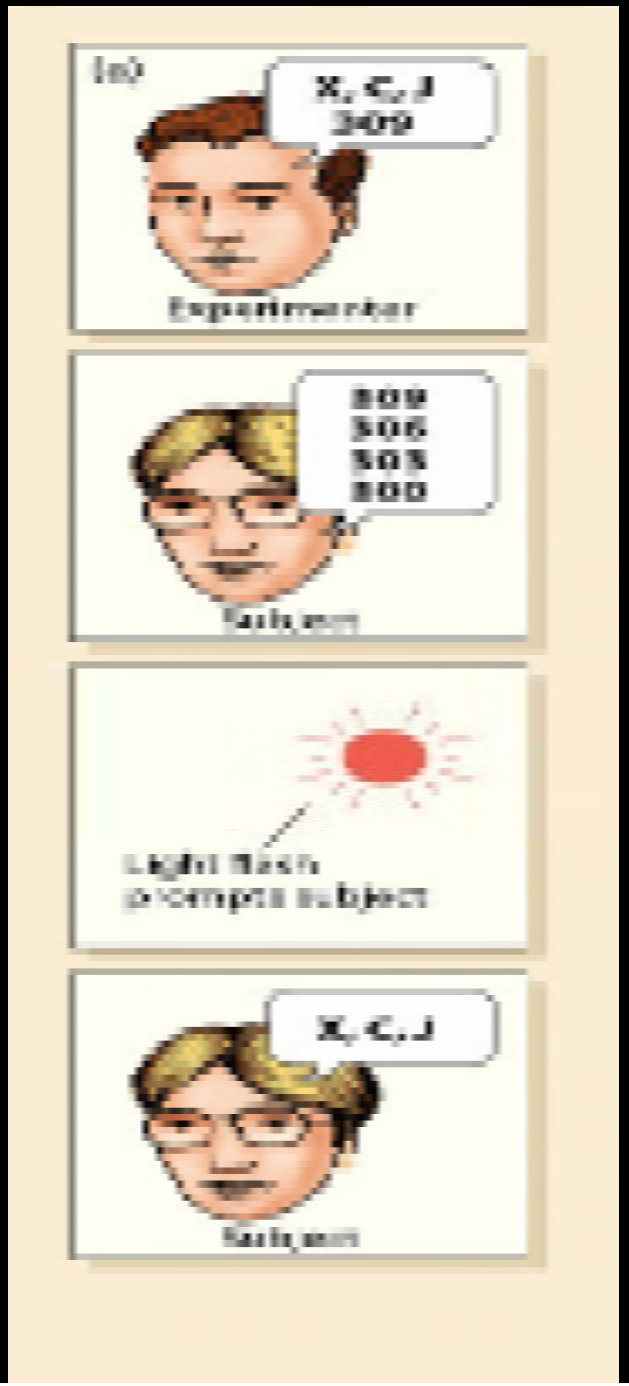
Brown-Peterson Task

- Determine how long non-rehearsed information stays in STM

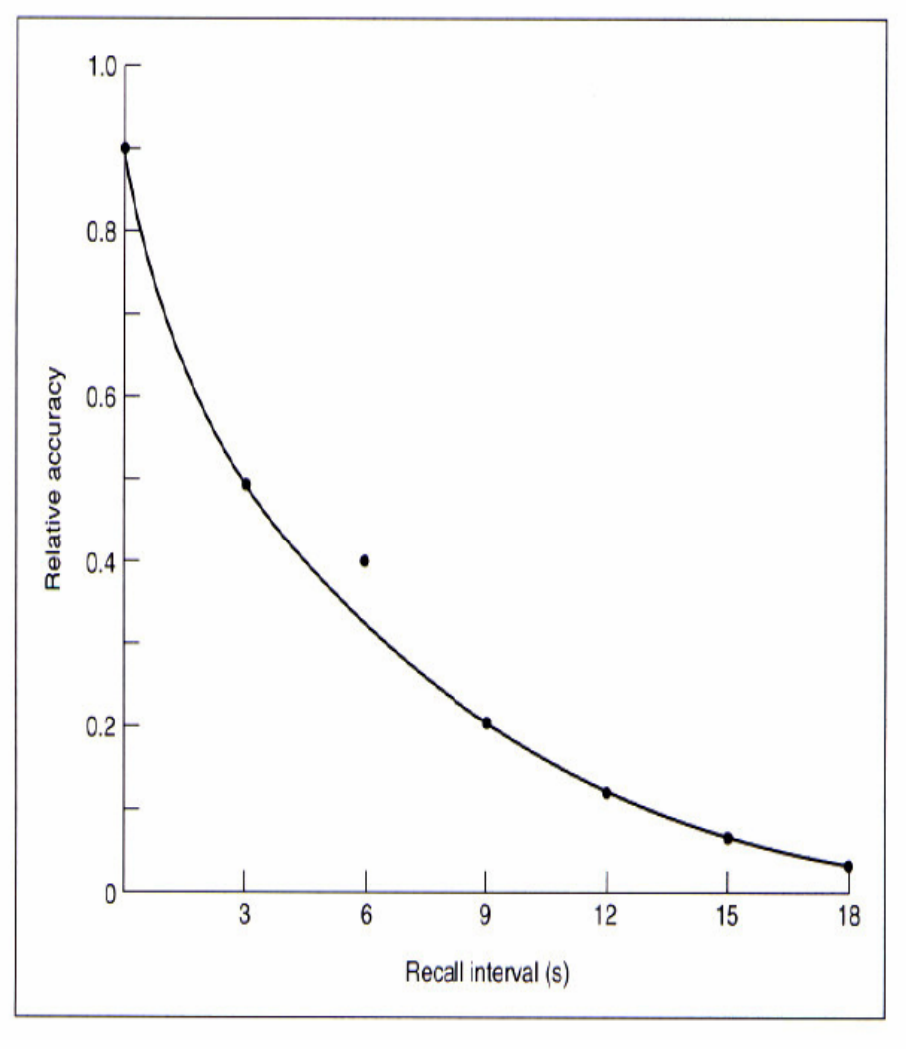


Brown-Peterson Task

- Stimuli given
  - A,B,C 428
- Count backwards in 3s
- Recall the letters

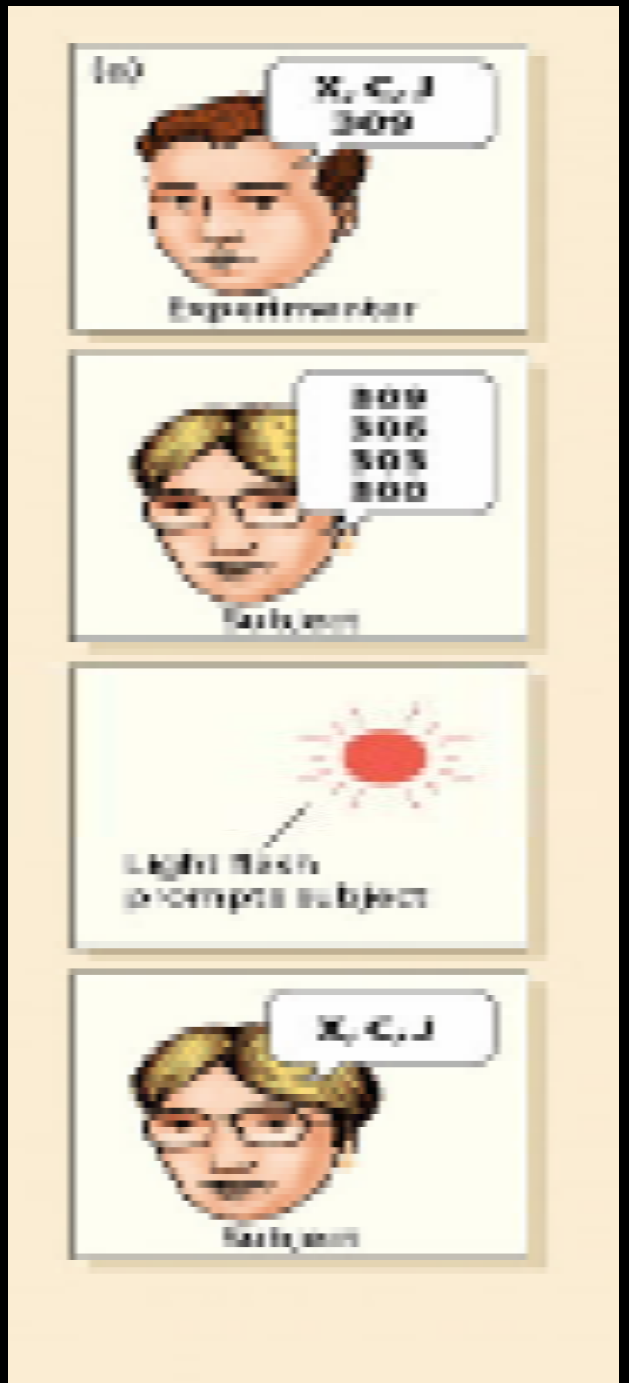


Results - Brown-Peterson Task

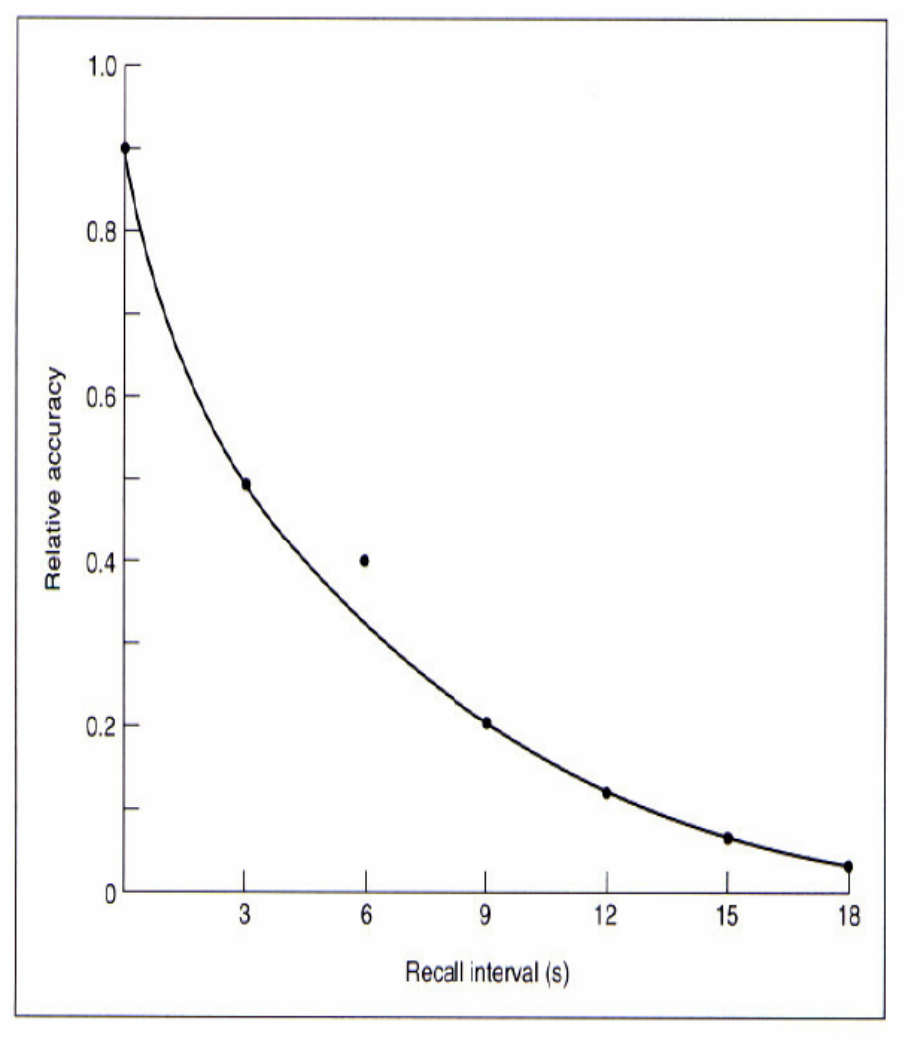


Brown-Peterson Task: A Variation

- Stimuli given
  - cat, dog, cow 428
- Count backwards in 3s
- Recall the words

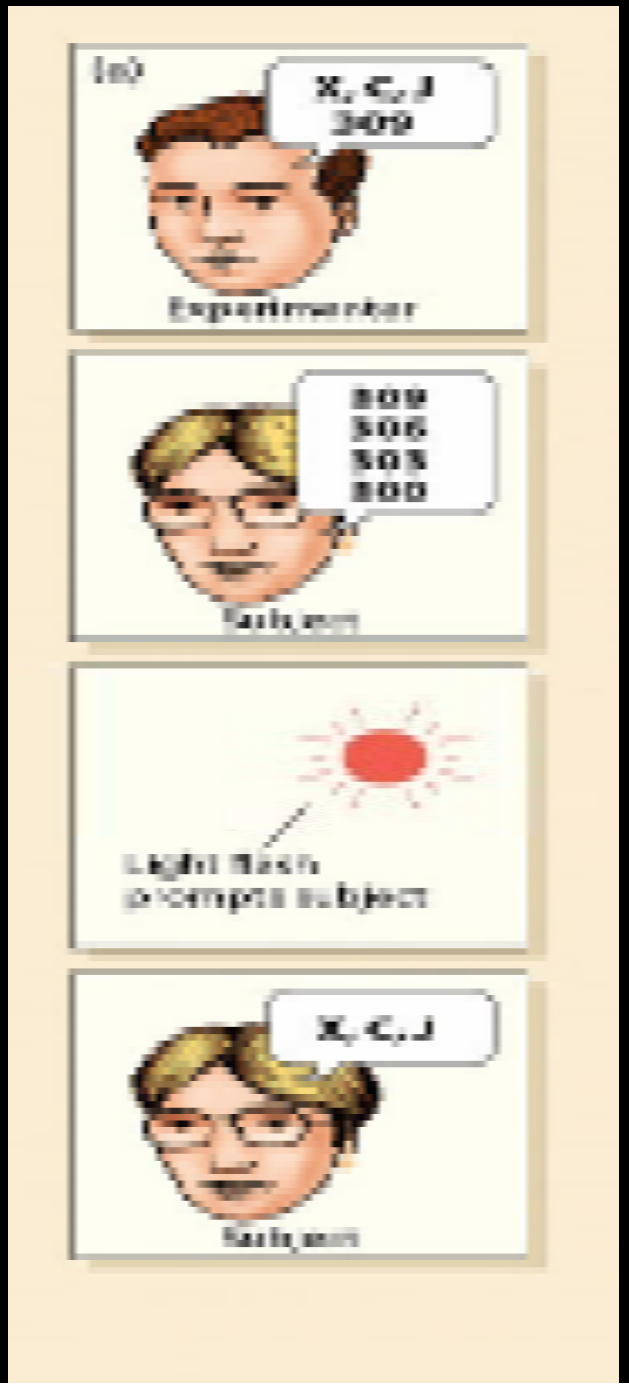


Results - Brown-Peterson Task

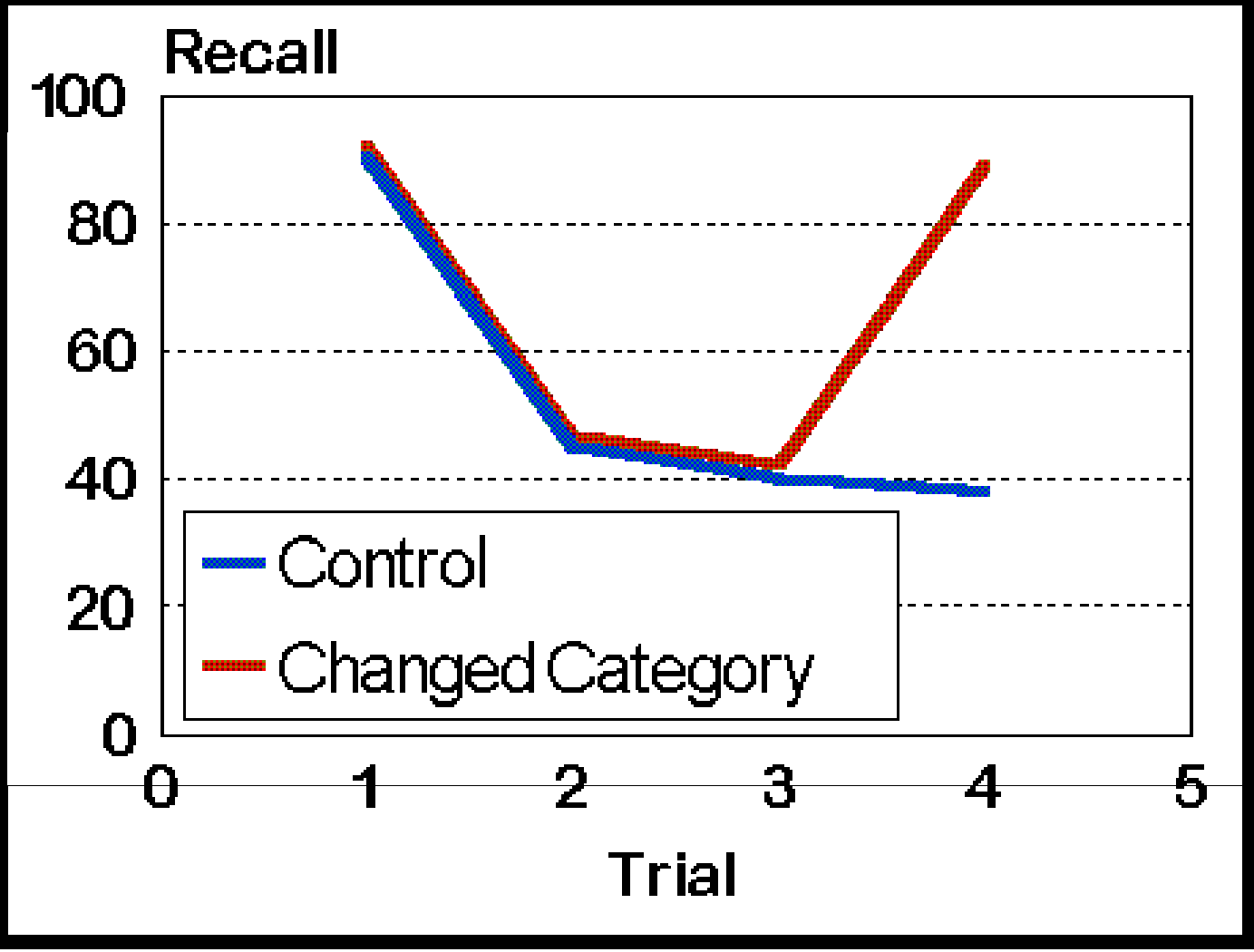


Brown-Peterson Task: Another Variation

- Stimuli given
  - cat, dog, cow 428
  - bear, lion, fox 345
  - rabbit, goose, camel 135
  - cherry, banana, apple 246
- Count backwards in 3s
- Recall the words



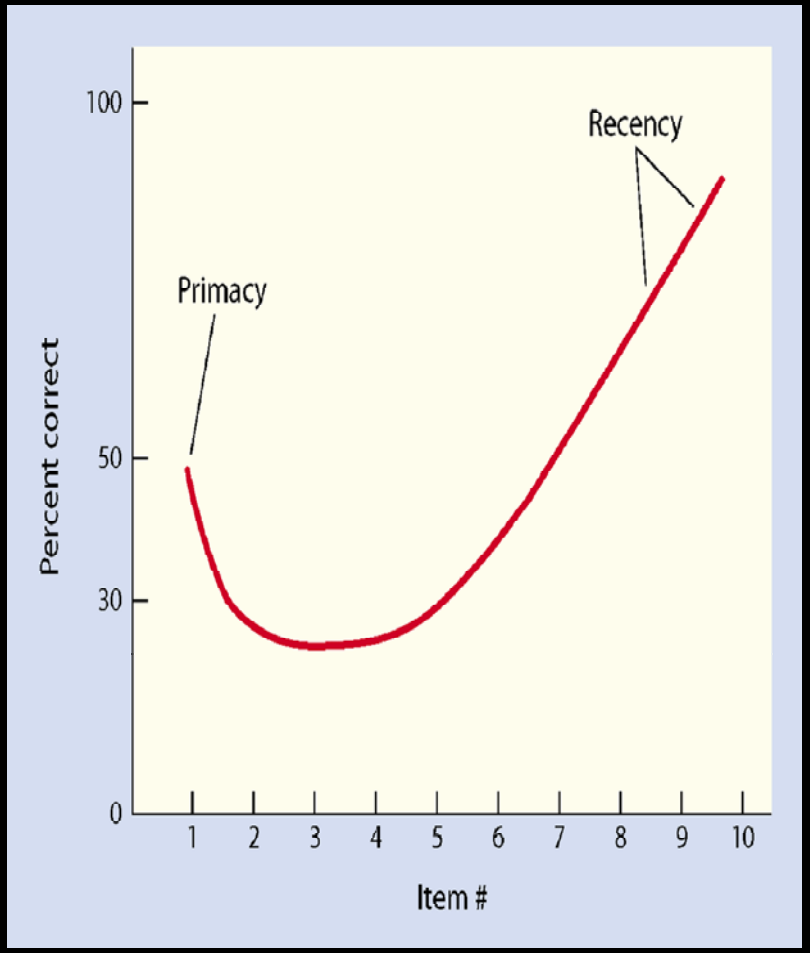
Results - Brown-Peterson Task



Serial Position

- Read a list of words
- Remember them in any order you want to

Serial Position



Recency

- Some people say your STM capacity is 4 items
  - Since it is how much you can hold as a result of recency effect

WORKING MEMORY

- Rather than a passive storage of information, working memory is like a *workbench*
  - Information is being combined and transformed continuously.

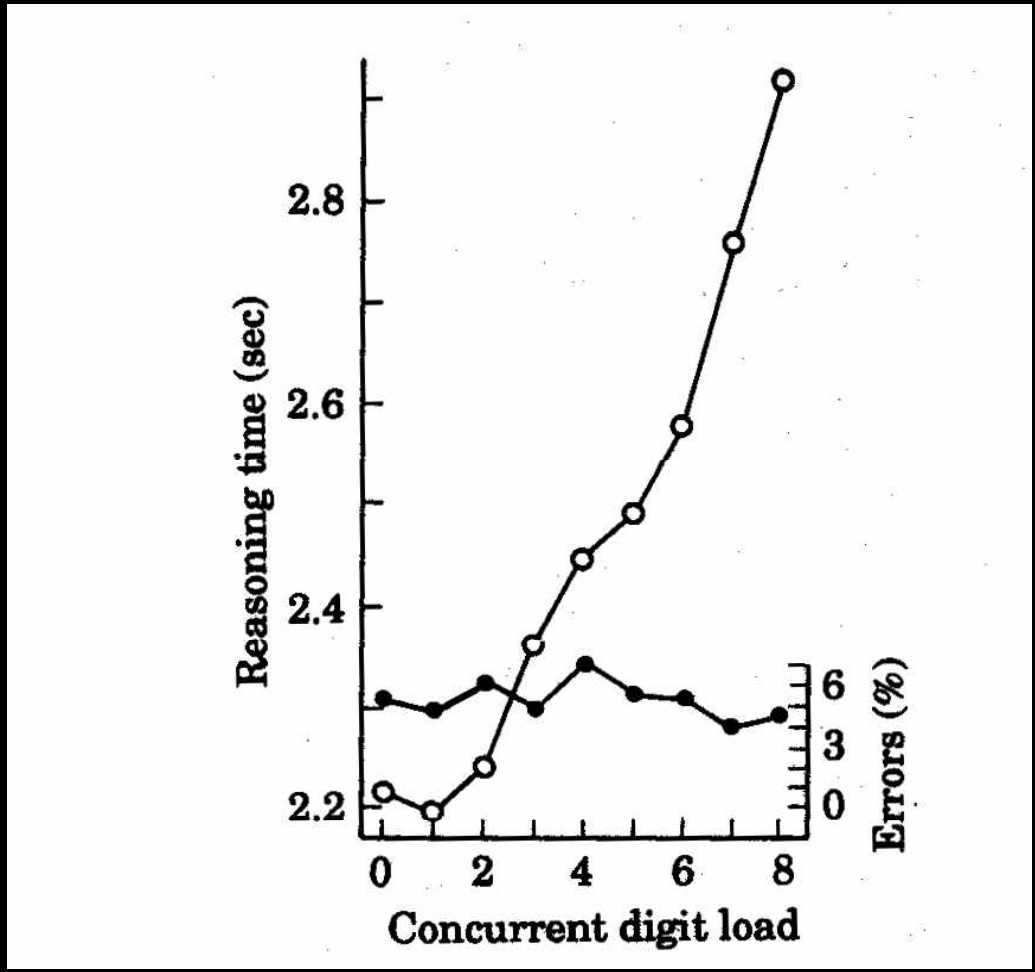
Ss remember (and overtly rehearse) sequences of 0-8 digits

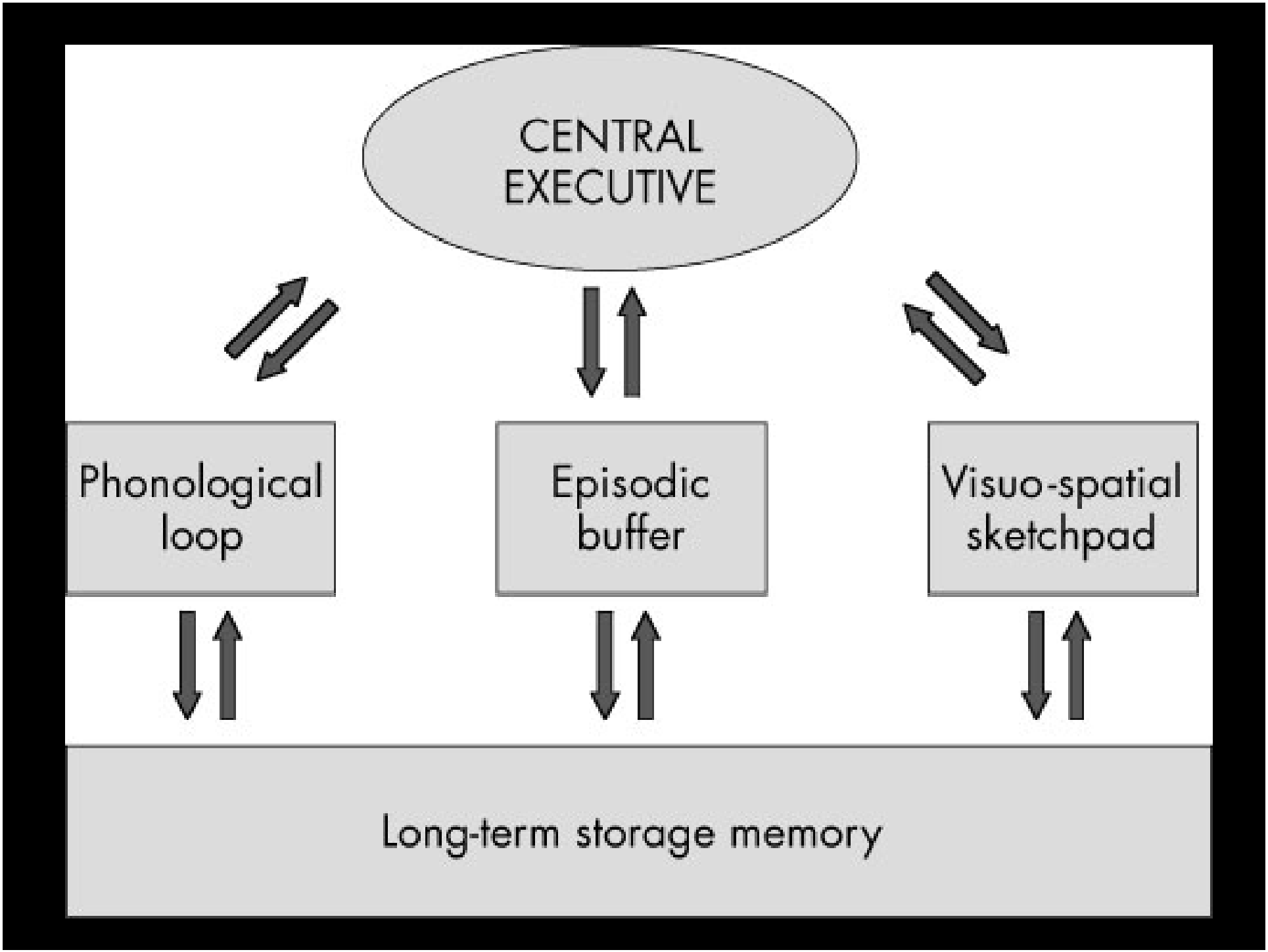
At the same time subjects perform a simple reasoning task

A precedes B: AB
(TRUE)
B is not preceded by A: AB
(FALSE)

Reasoning time increases.

Error rate remains at a mere 5%.




CENTRAL EXECUTIVE
Phonological loop
Episodic buffer
Visuo-spatial sketchpad
Long-term storage memory

The Phonological Loop

- Speech coding
- Rehearsal

- A slave system that takes care of these aspects
- Evidence from three areas:
  - Phonological similarity effect
  - Irrelevant speech effect
  - Word length

Phonological similarity Effect

- Errors tend to be phonologically similar to the target item.
  - More errors are observed if similar speech sounds are used in to-be-remembered material
- Exp:

DBCTPJ → harder

KVYLMH → easier

Irrelevant Speech Effect

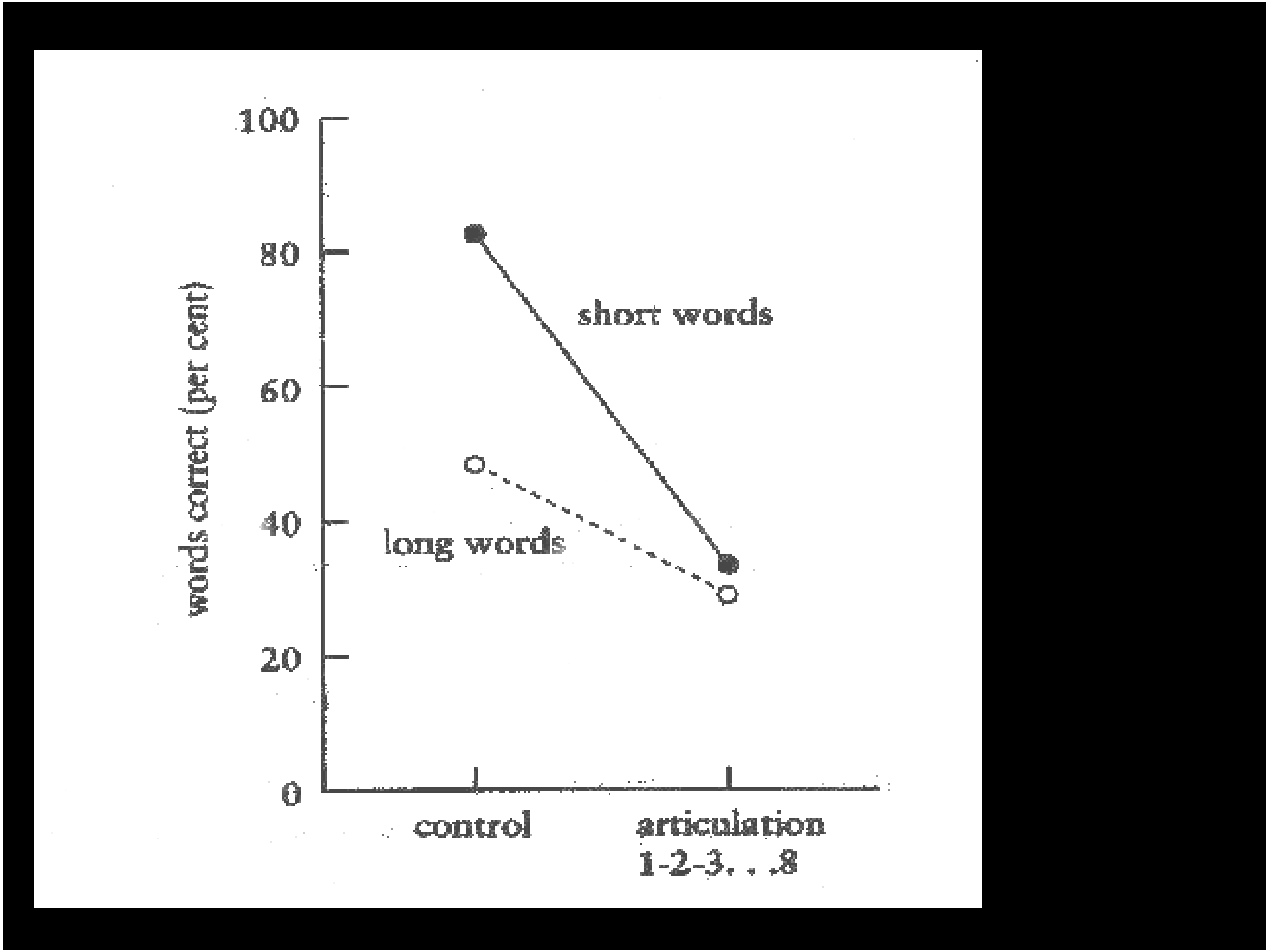
- Speech sounds disrupt performance
  - Even if they are in another language
- Non-speech noise does not have an effect
  - Even if it is VERY loud.

Word Length Effect

- Link between word-length and memory performance
  - Easier to recall a list of shorter words than a list of longer words

Testing the Word Length Effect

- Prevent subjects from rehearsal
  - saying "the the the the" outloud while doing the task
- Got rid of the word length effect.


100
80
60
40
20
0
words correct (per cent)
short words
long words
control
articulation
1-2-3. . .8

Articulatory Suppression

- Preventing the subjects from rehearsing by making them generate speech repeatedly.
  - Gets rid of
    - Word length effect
    - Phonological Similarity effect
    - Irrelevant speech effect

Phonological Loop

- Considering the evidence at hand, a system that helps us rehearse by sub vocal speech seems to exist.

Individual Differences

- People who speak faster are better rememberers of short-term information

Language	Articulation Rate	Digit Span
Chinese	265ms/digit	9.9
English	321ms/digit	6.6
Welsh	385ms/digit	5.8

(Hoosain & Salili, 1988; Ellis & Hennelly, 1980)

Why do we need a PL?

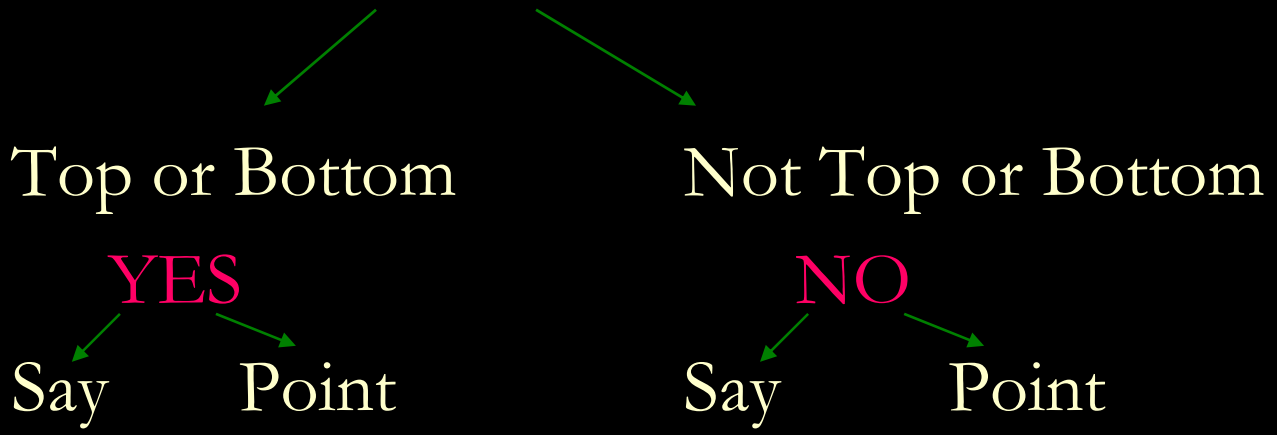
- What is the advantage?
  - Counting
  - Reading
    - More so, when you are first learning to read, or reading difficult-to-understand texts
  - Language Acquisition

Visuo-Spatial Sketch Pad

- Visual Imagery
  - How we store images in our mind.
  - How we manipulate these images.

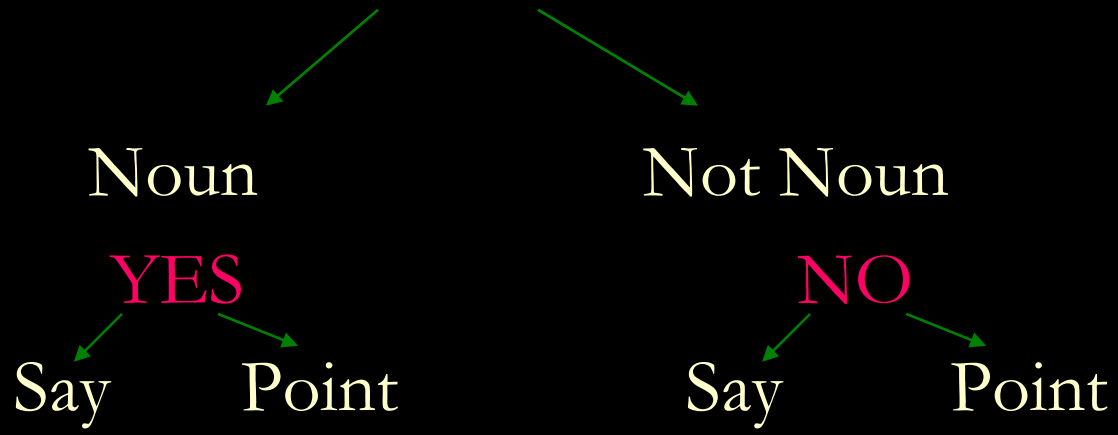
Imagery and WM

- **Study by Brooks (1968):**
  - Hold letter **F** in your mind's eye.
  - Classify each corner



Imagery and WM

- **Study by Brooks (1968):**
  - Sentence: "A bird in the hand is not in the bush."
  - Classify each word



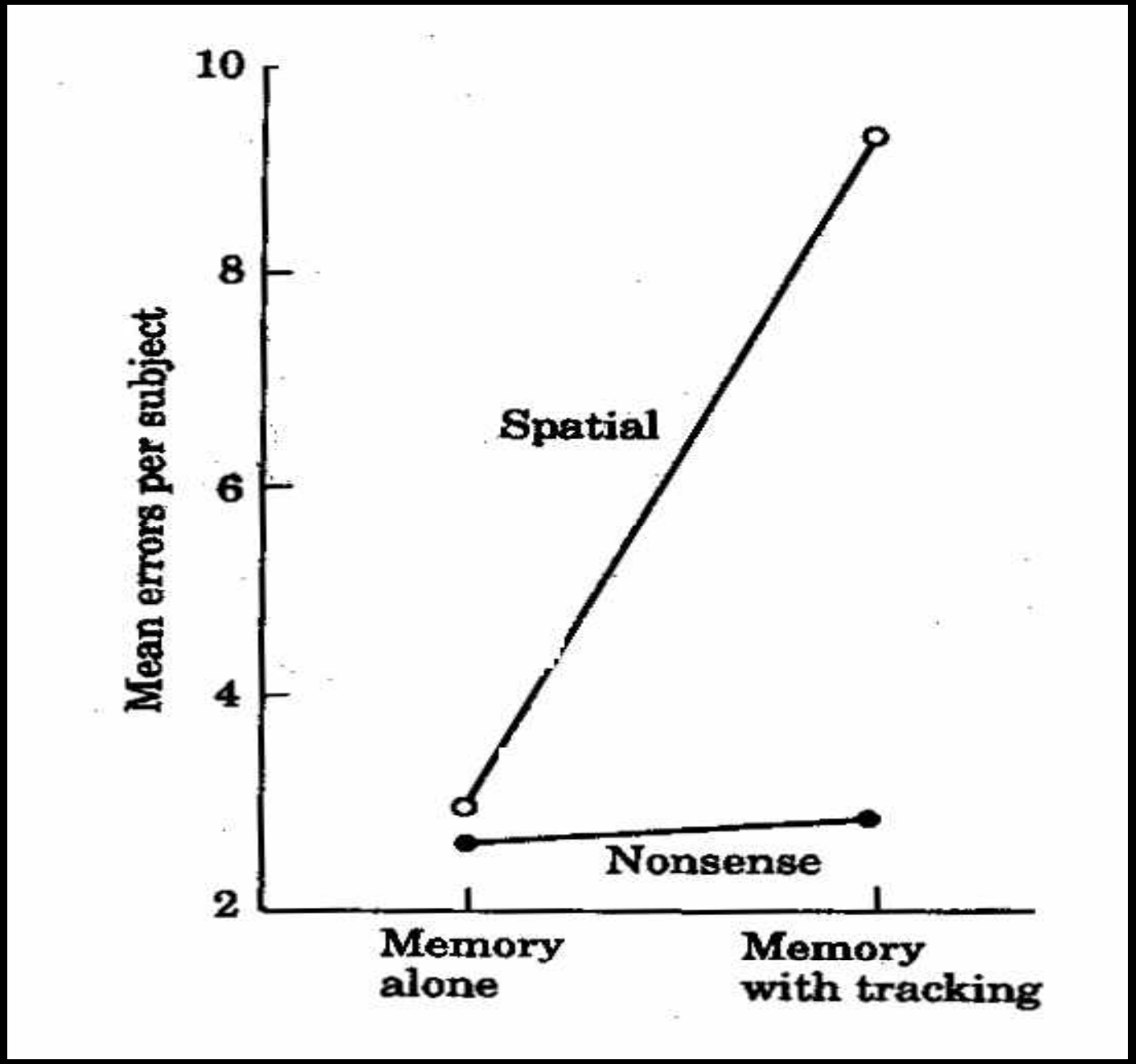
Results of Brooks (1968)

		Response Mode	
		Pointing	Speaking
Task	sentence	9.8	13.8
	diagram	28.2	11.3

- Pointing interferes with the visual task, since it uses capacity from visuo-spatial sketch pad

Baddeley et al (1973)

- Tracking a moving light with a laser while engaging in the Brooks task.
  - Great difficulty tracking while engaging in the imagery.


10
8
6
4
2
Mean errors per subject
Spatial
Nonsense
Memory alone
Memory with tracking

The Central Executive

- Most complex and least understood component of WM
  - A limited-capacity attentional system that controls the other slave systems
  - Relates them to LTM
  - Suppresses irrelevant information

Episodic Buffer

- Temporary storehouse where information in gathered from PL, VS, and LTM and combined
  - Limited capacity
  - Information can be either auditory or visual

Working Memory Span

… is correlated with:

- reading comprehension
- reasoning skill
- speed of processing


Viewer
THE END