Working memory

PSY 200

Greg Francis

Lecture 16

A problem with IQ tests.

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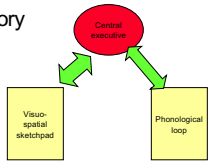
1

Working memory

- Current thought, awareness
  - extension of short-term memory
  - small capacity
  - rapid forgetting
- Processor of information
  - not a storage device
  - hypothesizes mechanisms that lead to memory properties



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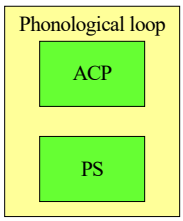
2

Phonological loop

- Two components
  - Articulatory control process (ACP)
    - » converts non-speech information into speech code
    - » rehearsal / refresh
  - Phonological store (PS)
    - » similar to how we first described STM (items decay from memory)
    - » Refresh restarts the decay process



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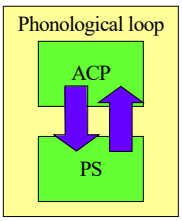
3

Loop capacity

- How many items can be kept in the phonological loop?
- Depends on two factors
  - Duration before decay from PS
  - Speed of rehearsal
- Spinning coins!



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Magic number?

- We earlier noted that memory span was about 7 items (+/- 2)
- The phonological loop suggests that it is not the *number* of items but their rehearsal duration
- To recall a list of items you must rehearse them *all* before any of them fade
  - The duration of decay in the PS
- Memory span should follow the equation
  - Span = (Rehearsal Rate) X (PS decay time)
- Measure memory span (s): around 7 items
- Measure verbal rehearsal rate (r): around 4 items per second for English speakers
- Estimate duration of decay in PS (d)
  - d=1.75 seconds

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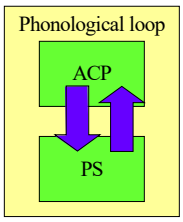
Effect of rehearsal rate

- Capacity of the phonological loop depends on the rate of rehearsal (r)
- A set of items that takes *longer* to rehearse should be *harder* to remember
  - more likely that some items will drop out before you get back to the first item



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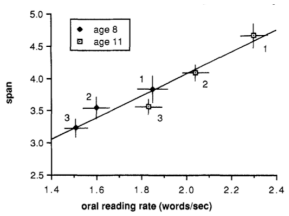
Effect of rehearsal rate

- Explains differences across groups of people
- Age effects in children
  - Hitch, Halliday & Littler (1989)
- This implies that it is not the loop size that changes with age, but the rate of rehearsal

Span=1.68(Oral Reading Rate)+0.71



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7

Word length effect

- Memory span is related to the length of words
  - Number of syllables
- Nicely matched by changes in reading speed
  - Rate of rehearsal

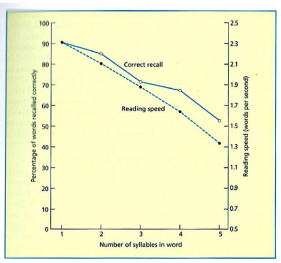

Figure 2.5 The relationship between word length, reading rate, and recall. Long words take longer to rehearse and also produce lower memory spans. From Baddeley, Thomson, and Buchanan (1975). Copyright © Elsevier. Reproduced with permission.

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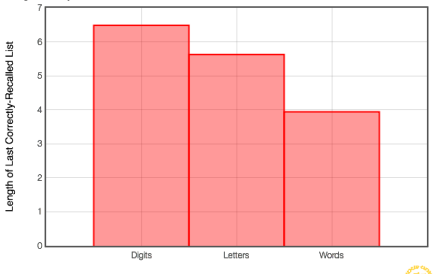
8

CogLab data

- The CogLab experiment on memory span shows data in agreement with our expectations (169 subjects)



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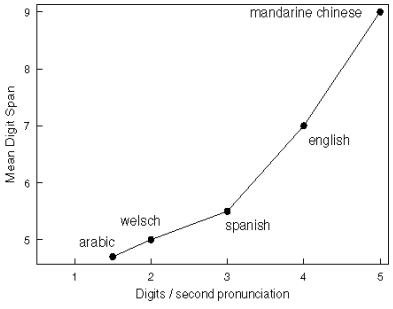
9

Language effects

- Some languages are spoken more quickly than others
- Should allow larger memory span
  - it does



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10

Relation to IQ

- Ellis & Henley (1980)
  - investigated complaints about WISC intelligence scores
  - Welsch children tended to score lower than English children
- Part of the exam checks memory span
  - and the slower rate of speech in Welsch partly explains the difference
  - bilingual Welsch students tested in English got better scores than when tested in Welsch

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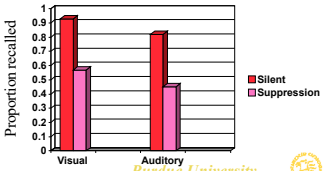
11

Articulatory suppression

- Subject sees (hears) a list of phonemes
- Also repeats a phrase over and over
  - e.g., "tippy-toe, tippy-toe, tippy-toe,...
- Recall is worse
  - True for both auditory and visual presentation
  - (Recall for visual may be better than auditory because there is some information in the visuospatial sketchpad as well)



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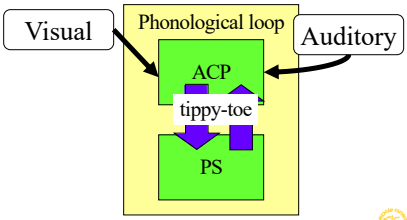
12

Articulatory suppression

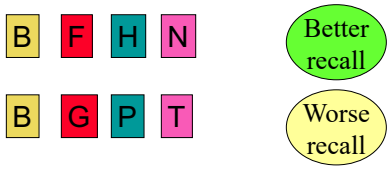
- Repeating phrase ties up the ACP
  - Without rehearsal more forgetting occurs



13

Phonological similarity

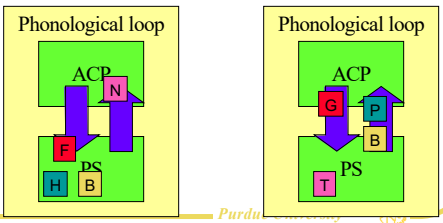
- Memory of a list of items is worse when the items sound the same



14

Phonological similarity

- All items are stored in phonological loop
  - similar sounding items interfere with each other in the phonological loop
  - two possibilities:
    - » **1) harder to rehearse (effect in the ACP)**
    - » 2) fade more quickly (effect in the PS)



15

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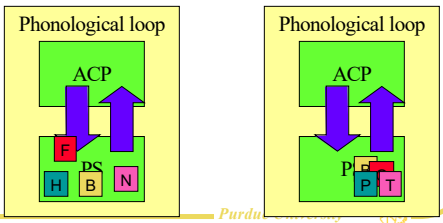
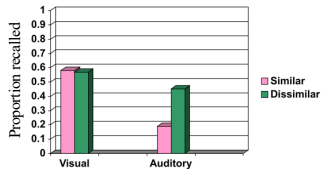


16

Locus of similarity effect

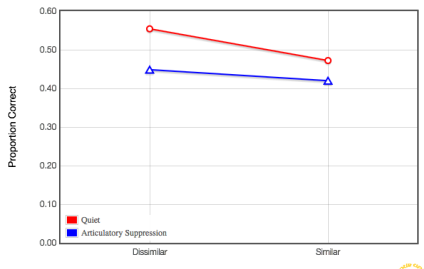
- Studies find a phonological similarity effect for auditory stimuli under articulatory suppression
  - We suggested two possibilities:
    - » 1) harder to rehearse (effect in the ACP)
    - » 2) fade more quickly (effect in the PS)
- Since the phonological similarity effect is there even when the ACP is not involved, it must be possibility 2 (in the PS)



17

CogLab data

- The CogLab experiment on phonological similarity shows data in (somewhat) agreement with our expectations (161 subjects)
  - Ideally want parallel lines



18

Irrelevant speech effect

- Does irrelevant "background" sound affect memory?
  - E.g., studying with the TV on
- Three groups of subjects recall consonants
  - 1) no background
  - 2) background = nonsense words
  - 3) background = noise bursts

best

worst

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Irrelevant speech effect

- The presence of *phonemes* in the background is critical to the effect
  - strong effect when background is spoken in German, even for English speakers
- Suggests that background phonemes interfere in the PS
- Study with classical music if you need something!

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20

Conclusions

- Data accounted for by phonological loop
  - word length effect
  - phonological similarity
  - articulatory suppression
  - irrelevant speech effect
- Don't listen to lyrical music while studying
  - Classical music is fine

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21

Next time

- Review for Exam 2
- After exam 2
- Encoding specificity
- CogLab on Encoding specificity due
- *What to do if you are drunk while studying for an exam.*

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22