THE IMPACT OF AGING AND HEARING STATUS ON VERBAL SHORT-TERM MEMORY

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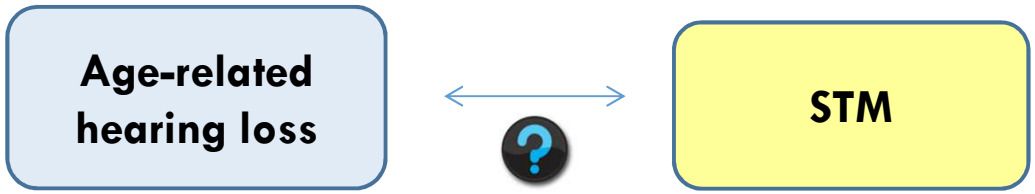
INTRODUCTION

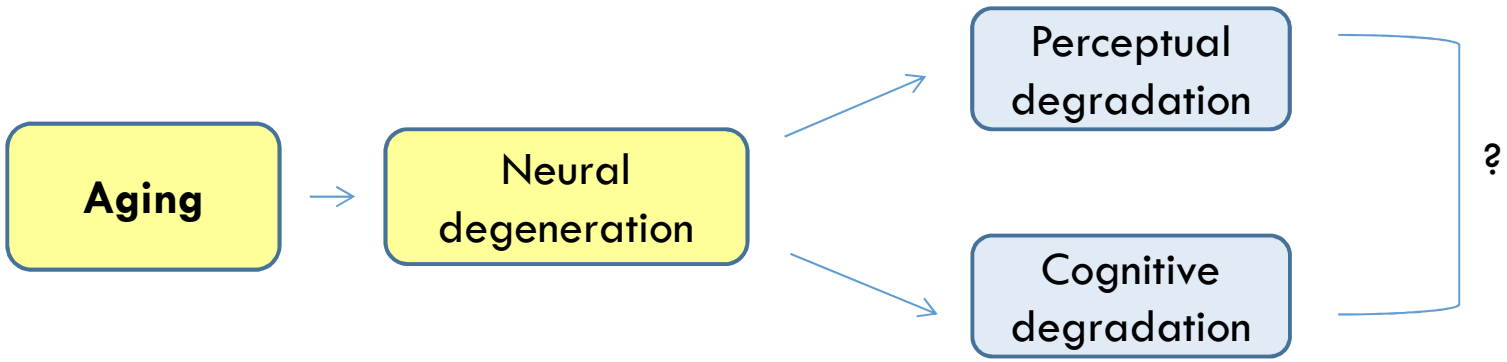
- Cognitive decline in older adults
  - Short-term memory (e.g., Maylor, 1999)
- Decrease in hearing acuity

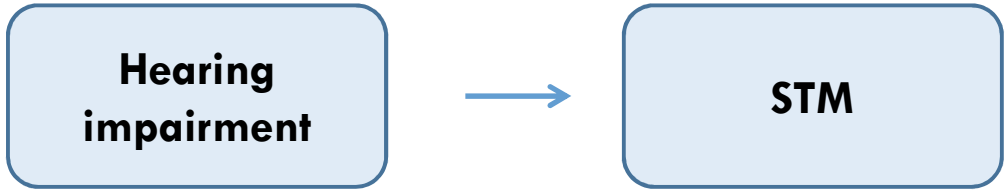


- Surprenant (2007):
- Adults > 70 years
  - 1/3 : clinically significant hearing loss
  - Almost 100% : mild hearing loss

- Standard STM tasks:
  - span tasks → items presented auditorily

- Baltes and Lindenberger (1997); Lindenberger and Baltes (1994):
  - Cognitive functioning ⟷ Sensory functioning (vision and hearing)
  - Especially old age

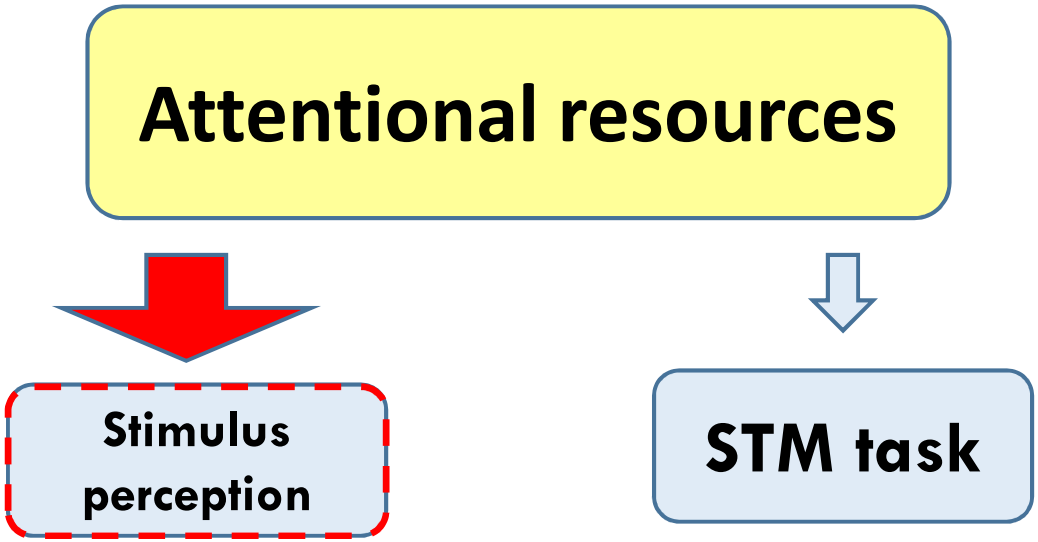




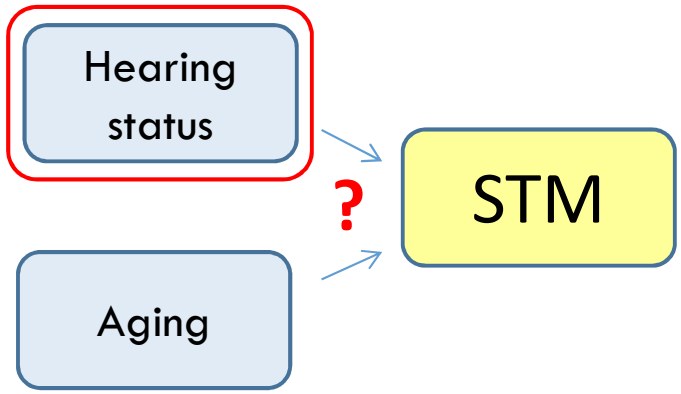
Rabbit (1991) : old participants with a mild hearing loss recalled fewer words than old participants with a good hearing

How could hearing impairment interfere with STM capacities?

- *The effortfulness hypothesis* (Rabbit 1968; 1991)



Hypotheses



- Older participants with a hearing loss
- Young participants with a hearing loss, matched for hearing thresholds
- Young participants with no hearing loss

METHODS

Participants

Variable	Controls	Young hearing-matched	Elderly
Number of participants	16	16	16
Age (years)	18-30	18-30	60-75
Gender (M/F)	6/10	5/11	5/11
Hearing threshold (dB HL)	7.12 (2.16)	17.20 (5.34)	18.76 (5.56)
Vocabulary level Mill Hill (proportions)	0.77 (0.09)	0.77 (0.08)	0.86 (0.09)
Processing speed (ms).	395.64 (80.18)	398.47 (62.14)	475.410 (110.94)

Participants

- Matched for academic background : ≥ 12 years of schooling
- Native French speakers
- Corrected or normal vision
- No hearing aid
- No
  - dementia (Mattis Scale > 130/144)
  - neurological, neuropschological, psychiatric disorders
  - medication use

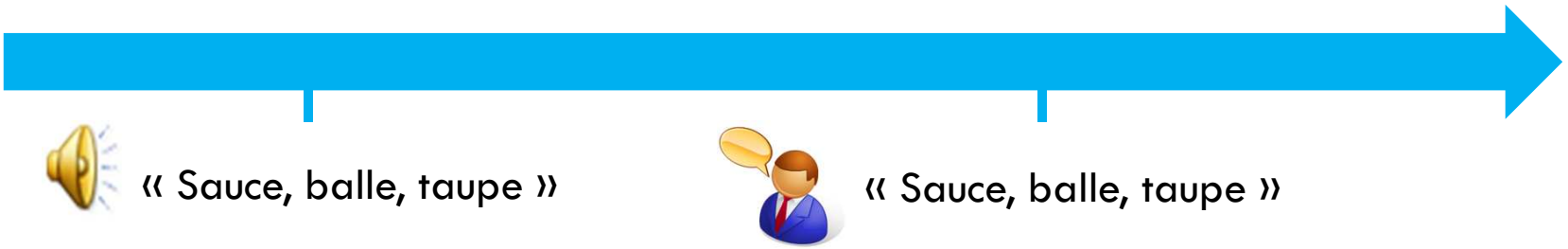
Materials:

- STM memory tasks
  - Immediate serial recall of high frequency words
  - Immediate serial recall of similar and dissimilar words
  - Serial order reconstruction task

- Online phonological processing
  - Speeded nonword repetition task

Materials: Immediate Serial Recall (ISR)

- **ISR of high frequency words (Majerus, 2006)**
  - High frequency CVC words (Content, Mousty, & Radeau, 1990)
  - Lists with increasing length (1 to 6 items)



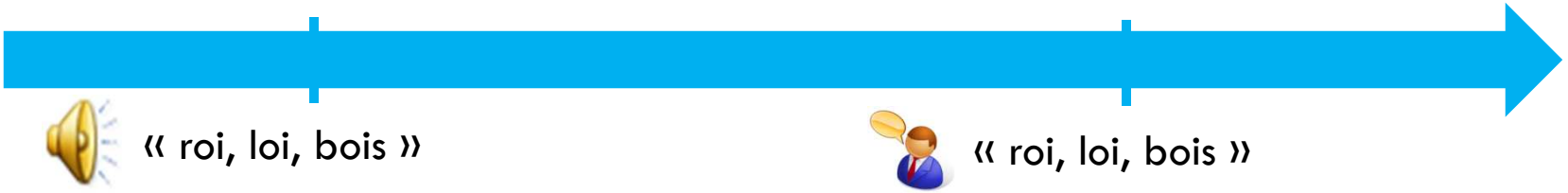
➢ % words correctly recalled in their order of presentation

⇧ Phonological processing

- Words not known in advance
- Open pool
- New on every trial

Materials: Immediate Serial Recall

- **ISR of similar and dissimilar words (Majerus, 2005)**
  - 8 similar and 8 dissimilar words of moderate frequency (Content et al., 1990)
  - Matched for imageability
  - Lists with increasing length (2 to 8 items)
  - Similar words: differed only by the onset phoneme (e.g., ***b***ois-***r***oi)



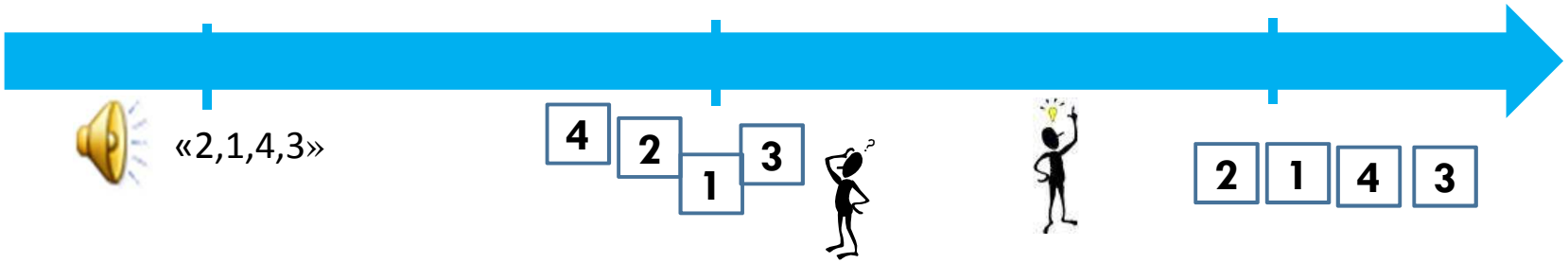
- % words correctly recalled in their order of presentation

Similar condition : ⇧ Phonological processing : almost identical words

Materials: serial order reconstruction

Serial order reconstruction task (Majerus, 2005)

- Digits from 1 to 9
- Lists with increasing length (3 to 9)



- % digits correctly replaced in their order of presentation

⇧ Focused on the order of the items presented

⇩ Phonological processing

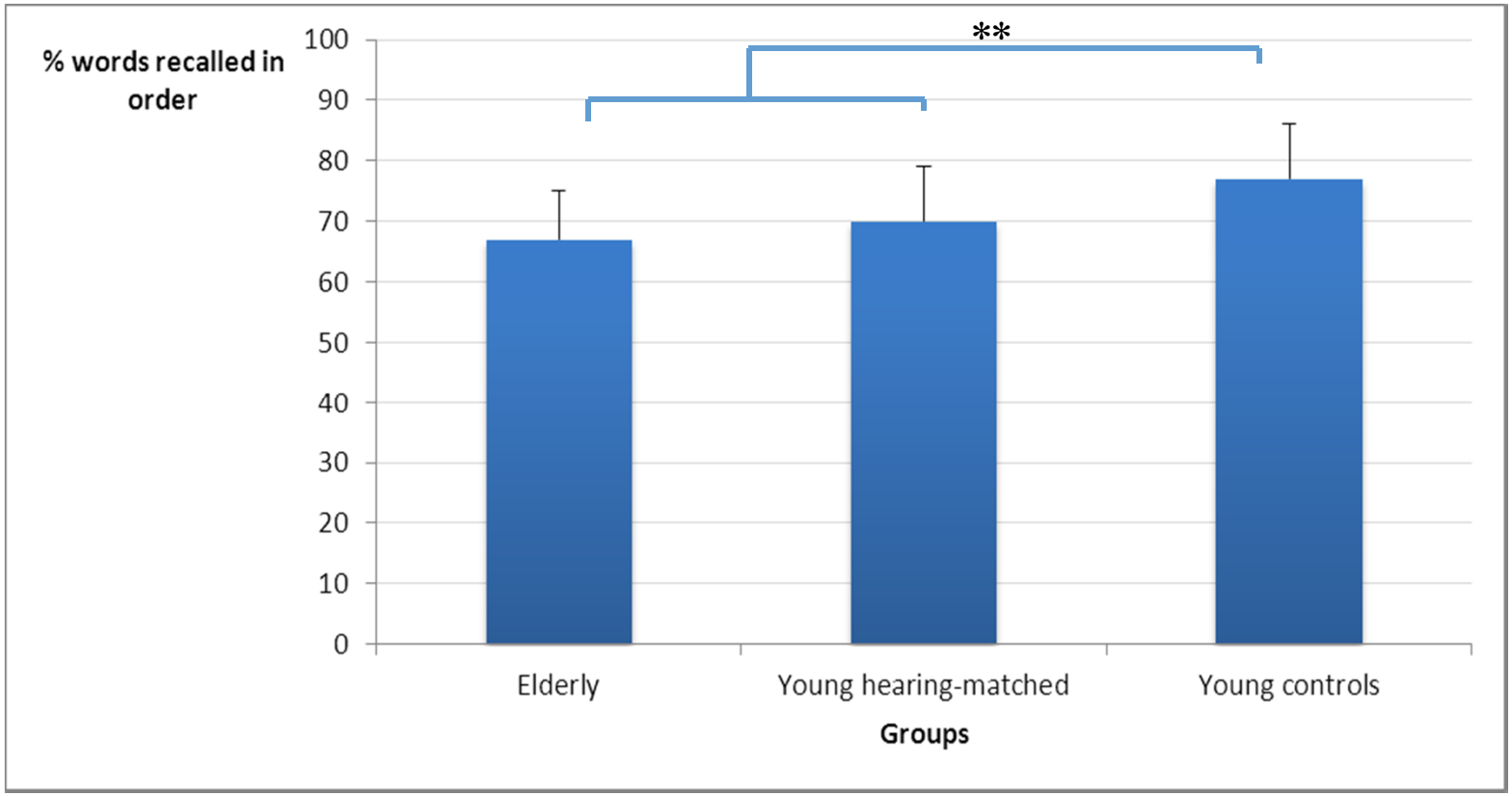
- Highly familiar stimuli
- Known in advance
- Provided at recall (cards representing digits were given)

Materials: phonological processing

- **Speeded nonword repetition task**
  - Impaired performance in STM →items mispercieved?
  - Online phonological processing of auditory items
  - Minimal STM load
  - Nonwords presented in isolation
  - Task = recall the nonwords
  - CVC – low phonotactic frequency (Tubach & Boë, 1990)

RESULTS

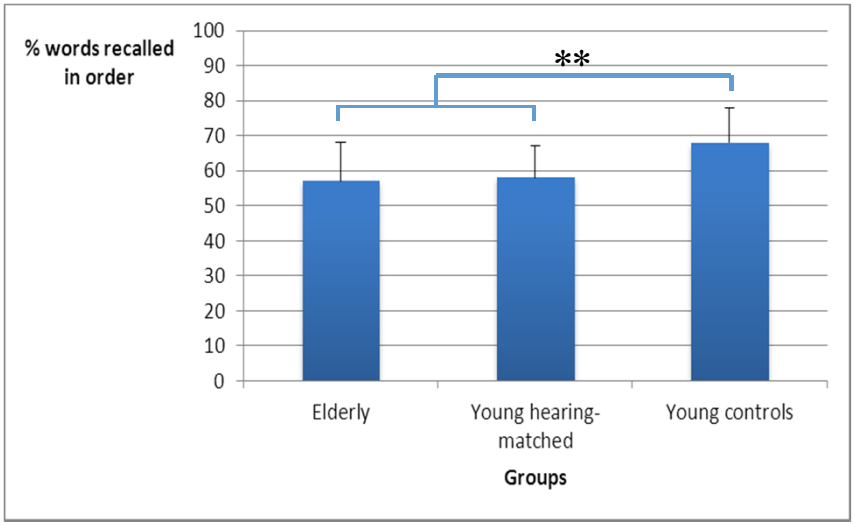
ISR of high frequency words



$F(2,45)=5.60$, $p<.01$, $\eta^2=.19$

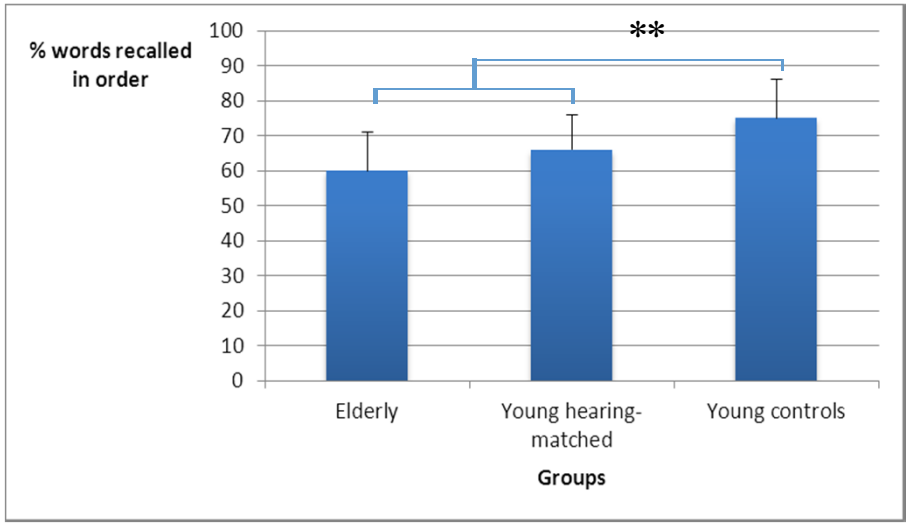
ISR of phonologically similar and dissimilar words

Similar condition



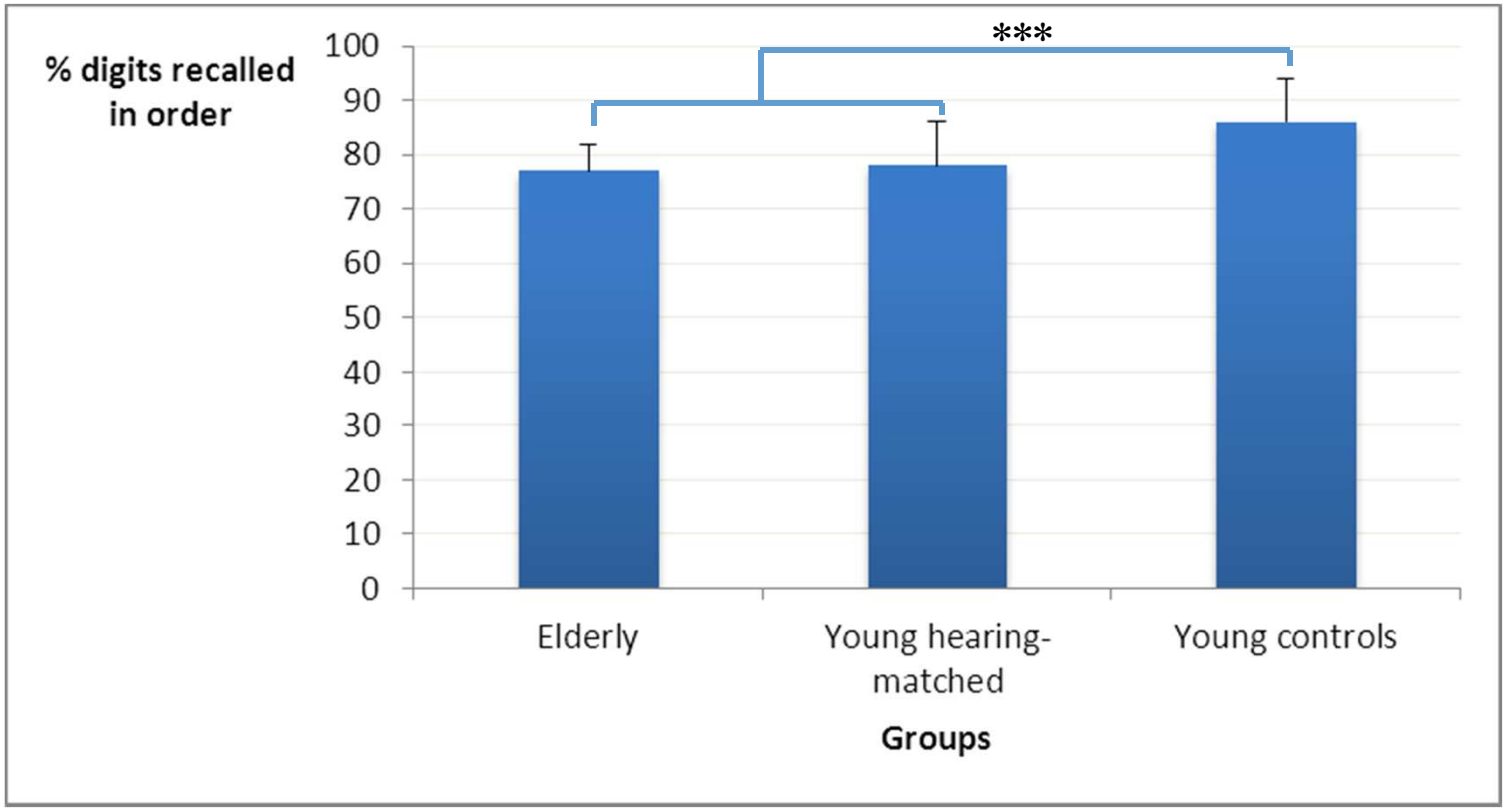
$F(2,45)=6.89$, $p<.01$, =.23

Dissimilar condition



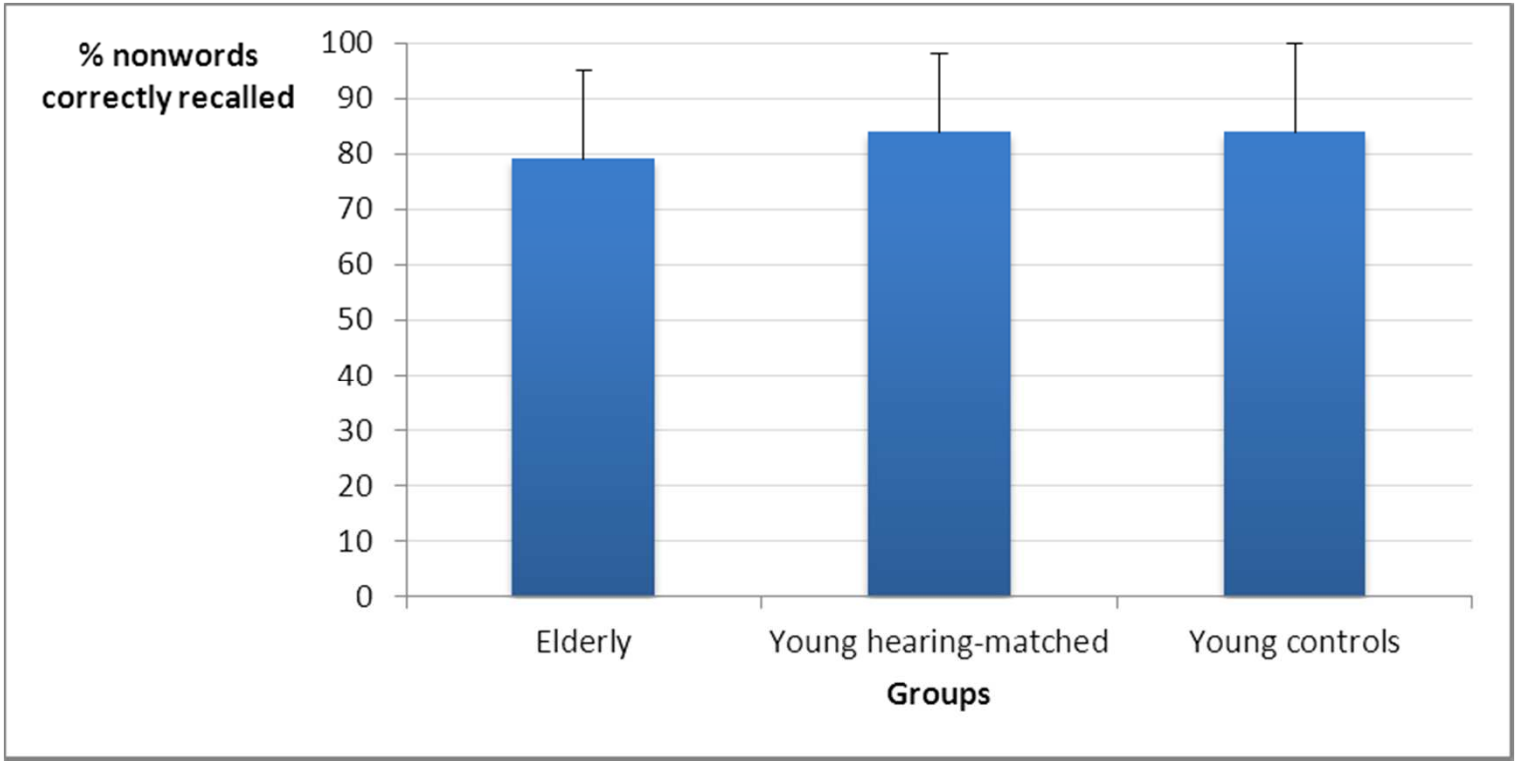
$F(2,45)=7.99$, $p<.01$, =.26

Serial order reconstruction task



$F(2,45)=7.55$, $p<.001$; =.25

Speeded nonword repetition task

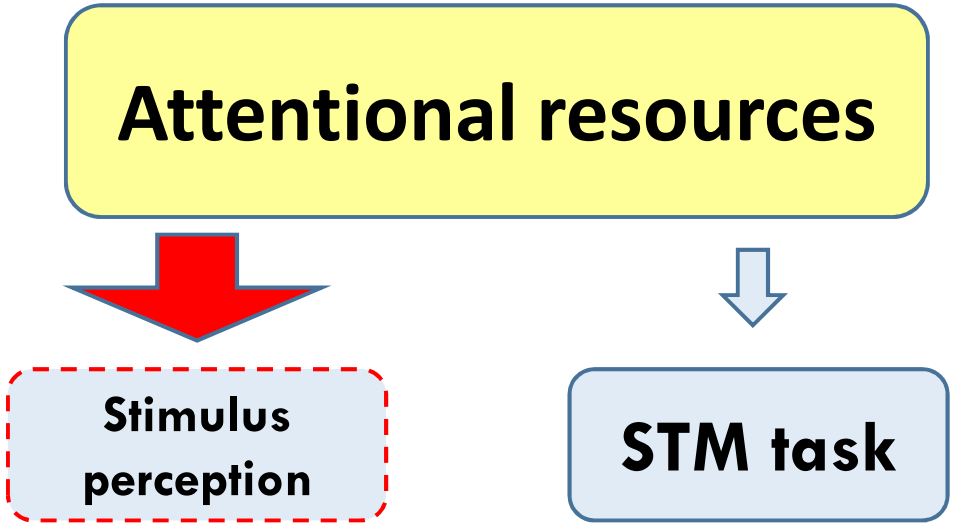


$F(2,45)=.48$, ns.

DISCUSSION

- Speeded nonword repetition task: items well percieved
- In STM tasks, performance decreased. Why?

- *The effortfulness hypothesis* (Rabbit 1968; 1991)

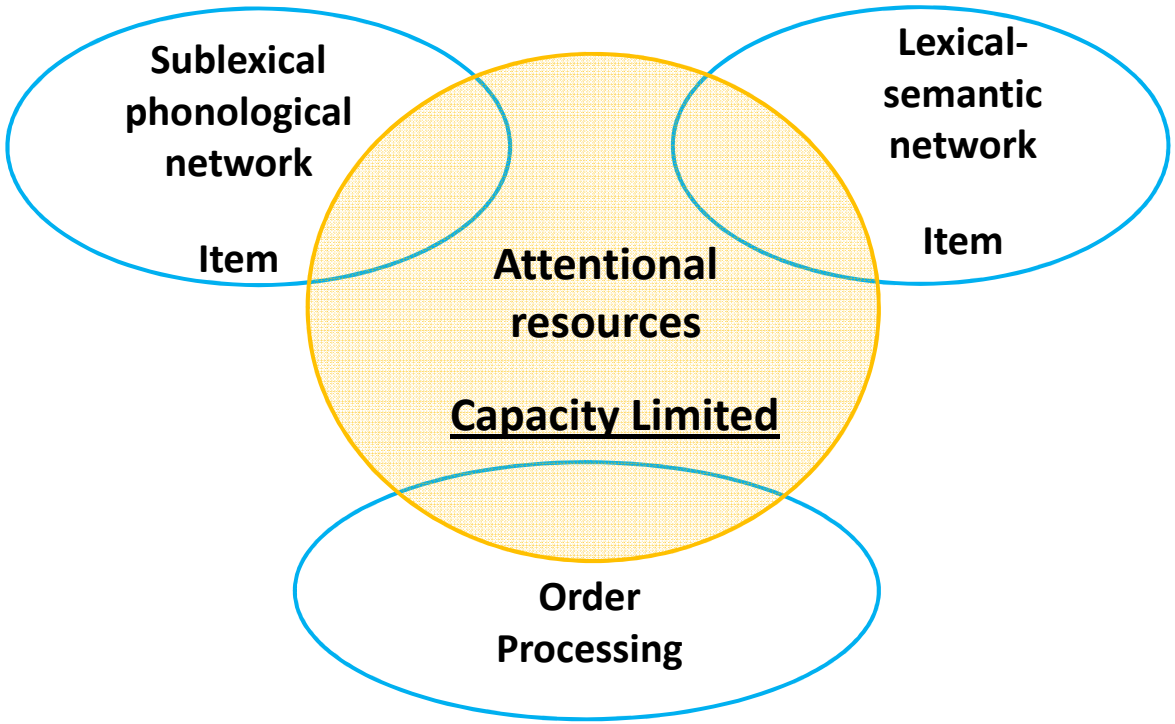


STM for serial order and STM for item information

- In typical STM tasks (e.g., digit span tasks), simultaneous storage of:
  - ✓ **Item information**: phonological and semantic properties
  - ✓ **Order information:** sequential order of the items

- Different mechanisms for the storage of item and order information
  - Experimental studies (e.g., Saint-Aubin & Poirier, 1999; Majerus et al., 2006b; Nairne & Kelly, 2004)
  - Neuropsychological data (e.g., Brock et al., 2004; Majerus et al. 2006a, 2007b)
  - Neuroimaging data (e.g., Majerus et al., 2006c, 2007a)

Majerus (2008); Majerus, Heiligenstein, Gautherot, Poncelet, and Van der Linden (2009); Majerus (2010)



Conclusions…

- Auditory factor influences STM more than does aging
- Auditory impairment → Attentional resources that would be otherwise available for STM

THANK YOU FOR YOUR ATTENTION