Semantic and Syntactic Cues in Sentence Comprehension by Older Adults under Normal and Visual-Noise Conditions

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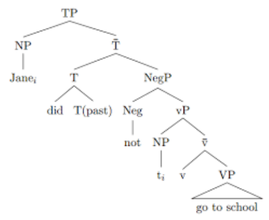
Background

Language comprehension

Algorithmic computation:
- Based on **syntactic** structure
- Precise
- Complete
- Compositional



'Good-enough' representations (Ferreira et al., 2002):
- Based on **semantics**: word meanings and world knowledge
- Fast
- Fuzzy

- Language comprehenders rely on 'good-enough' processing a lot.
  - E.g., Ferreira & Stacey, 2000:

  Sentences like '*The dog was bitten by the man*' rated as plausible in 25% trials.

- Older adults demonstrate more difficulties with complex syntax and greater effects of lexical predictability and context (Kemper et al., 2001; Waters & Caplan, 2001; Wingfield et al., 2003, 2011, Dubno et al., 2000)

Research question #1:

Is the reliance on 'good-enough' processing further increased by older age?

- Older adults demonstrate increased vulnerability to noise, including in visual modality (Gao et al., 2012, West, 1999, Wais et al., 2011)

Research question #2:

Is the reliance on 'good-enough' processing increased by visual noise, and more so in older than younger adults?

Method

Participants

• 61 younger (Mage = 24.2, SD 4.7, range 18-38 years; 47 female)

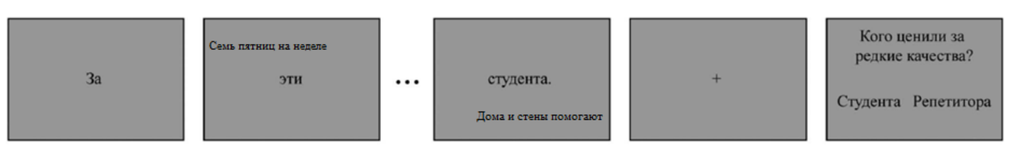
• 36 older participants (Mage = 65.0, SD 7,8, range 55-91 years; 25 female)

• Data collection in progress: target (pre-registered) sample size: 80 younger, 40 older)

Task

- Self-paced reading with comprehension questions
- Two sessions for each participant: (1) Normal processing conditions,

  (2) Visual distraction (short idioms appearing in random parts of the screen)



Stimuli

Russian grammatically complex (unambiguous) sentences:

Semantically plausible (syntax = semantics):

(1) *Rimma dressed **the child**$_{Acc,fem}$ of the writer$_{Gen,fem}$ **who was babbling**$_{Acc,fem}$ incomprehensible words. Who was babbling?*

(2) *Rimma dressed the child$_{Acc,fem}$ of **the writer**$_{Gen,fem}$ **who published**$_{Gen,fem}$ an interesting novel. Who published a novel?*

vs. Semantically implausible (syntax ≠ semantics):

(3) *Rimma dressed **the child**$_{Acc,fem}$ of the writer$_{Gen,fem}$ **who published**$_{Acc,fem}$ an interesting novel. Who published a novel?*

(4) *Rimma dressed the child$_{Acc,fem}$ of **the writer**$_{Gen,fem}$ **who was babbling**$_{Gen,fem}$ incomprehensible words. Who was babbling?*

If lower accuracy in implausible than plausible -> reliance on good-enough processing (lexico-semantic heuristics rather than syntax)

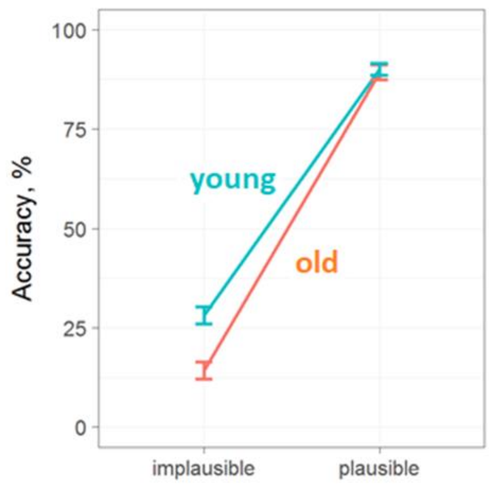
Results

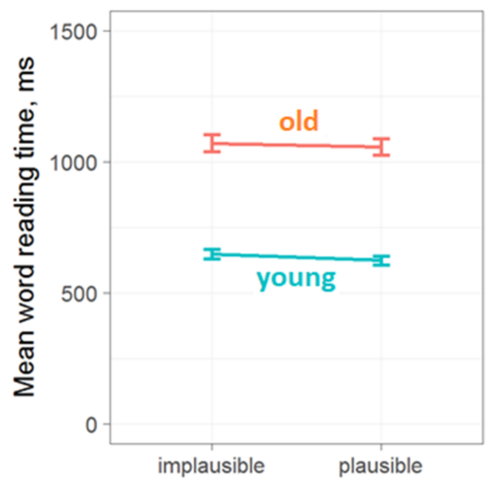
- Linear mixed-effects model (lme4 package in R) on question response accuracy and mean word reading time

	Response accuracy	Mean word reading time
Age	p = .18	***p* < .001**

- Generally, **older people** read slower but were not less accurate in comprehension

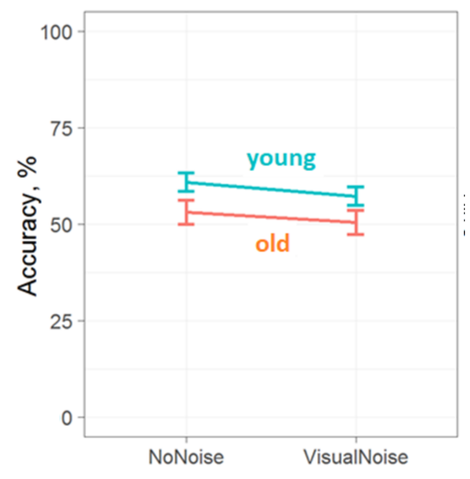
	Response accuracy	Mean word reading time
Plausibility	***p* < .001**	p = .09
Age x Plausibility	***p* = .003**	p = .20

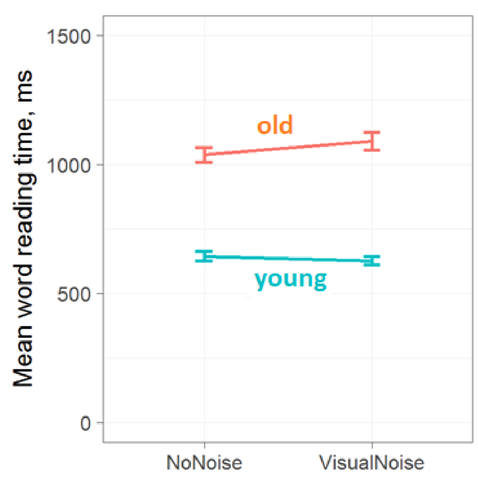




- Both younger and older adults were affected by **plausibility** -> reliant on good-enough processing
- But plausibility had a greater effect in older adults -> older adults **more** reliant on good-enough processing

	Response accuracy	Mean word reading time
Noise	***p* = .005**	p = .99
Age x Noise	p = .91	***p* = .03**





- Comprehension was less accurate in **visual noise** in both age groups
- Older and younger adults behaved differently in noise:
  - Older adults slowed down, younger did not

Discussion

- Research question #1: **Yes**, older adults showed **greater reliance on good-enough processing**.
  - That is, age-related changes in sentence comprehension are qualitative: **syntactic-to-semantic shift** (Beese et al., 2018)
  - Why?
    - Increased world knowledge, experience and expectations for common ground?
    - Syntactic difficulties?
    - Attempt to spare cognitive resources?

- Research question #2: **No**, comprehension accuracy was **not** more disadvantaged **by visual noise** in older than younger adults.
  - However, only older adults slowed down in noise. Compensatory strategy?
  - The signal-to-noise ratio too high in this study?

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This project is supported by the Russian Foundation for Basic Research (grant #18-012-00640)