Aging, Parafoveal Preview, and Semantic Integration in Sentence Processing: Testing the Cognitive Workload of Wrap-up

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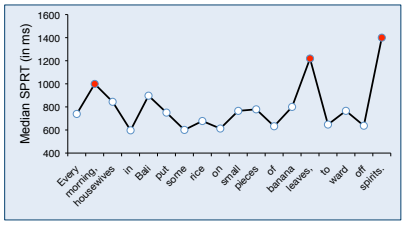
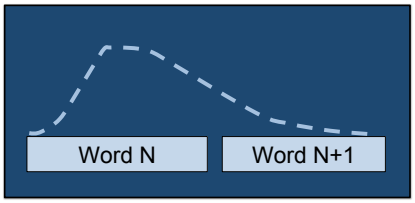
Rationale

• Age deficits are most pronounced in aspects of language comprehension that are highly effortful (e.g., retaining message-level semantics).
  • However, the mechanisms underlying these effects are not well understood.

• Wrap-up has been proposed as a mechanism associated with online integrative semantic processing during reading.
  • Reflected in relative increases in processing at clause and sentence boundaries (Rayner et al., 1989, 2000).



• ***Two views of the wrap-up effect:***
  • *Dwell-Time View (*Hirotani et al., 2006; Hill & Murray, 2000*):* Wrap-up reflects low-level processes
    •Oculomotor hesitation to visual cues
    •Implicit monitoring of prosody
    •Demands no attentional resources
  • *Semantic Integration View* (Just & Carpenter, 1980; Rayner et al., 2000):
    • Reflects time to organize and integrate meaning across clausal units.
    • Wrap-up is an effortful and demanding process (Payne et al., 2012; Stine-Morrow, et al., 2010).
• ***The Preview Benefit as an Index of Cognitive Workload***
  • *Perceptual span:* The field of useful information that can be processed during a given fixation.
  • 3-4 characters to the left of fixation to 14-15 characters to the right of fixation.



  • *Preview Benefit:* Amount of parafoveal information extracted from the word to the right of fixation. Measured via the *Boundary Change* Paradigm. (~30-40 ms)

•***Two major goals of this study:***
  • Test the notion that wrap-up increases cognitive workload by examining the degree to which wrap-up influences the magnitude of the preview benefit on the following word.

  • Test the idea that wrap-up is more demanding for older readers.

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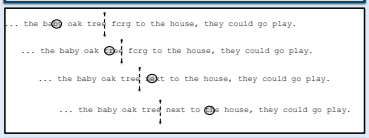
Methods

Measures	Younger Adults *N* = 24	Older Adults *N* = 22
Age	20.87 (.57)	68.36 (1.28)
Education	15 (.31)	16 (.31)
Vocabulary*	-.53 (.10)	.55 (.22)
Reading Span*	4.39 (.39)	3.49 (.17)

Apparatus and Paradigm

• 19-in. ViewSonic P225f monitor set to a resolution of 1,024 x 768
• Refresh rate: 120 Hz.
• Head-mounted eye-tracking system (SR Research Eye-Link II). Monitored right eye (500 Hz).
• Three letters subtended 1° visual angle.
• Gaze-contingent boundary-change paradigm (Rayner, 1975)



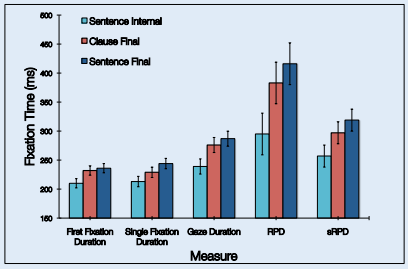
Materials, Design, and Analysis

• 36 experimental items.
• 3 (Word Position: SI, CF, SF) x 2 (Parafoveal Preview: valid, non-word) x 2 (Age: young, old) design.
• General(ized) Linear Mixed Effect Models (GLMM) with participants and items as crossed random effects. Significance tests via Likelihood ratio tests. Analyses using SAS Proc MIXED & SAS Proc GLIMMIX.

WP	Sentence
SI	After the children watered the baby oak *tree* (fcrg) next to the house, they could go play.
CF	After the children watered the baby oak *tree,* (fcrg) next on their list was watering the garden.
SF	The children had watered the baby oak *tree.* (Fcrg) Next on their list was watering the garden.

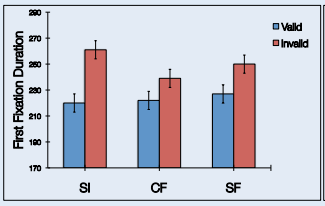
Results: Word *N*

Wrap-up Effects on Word N Fixation Time

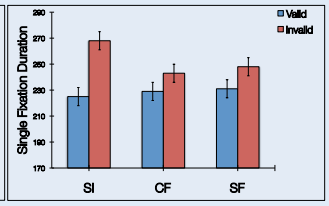


Results: Word N+1

Early Effects of Wrap-up on the Preview Benefit:

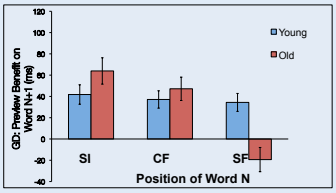


Clause Wrap-up X Preview: FFD (p = .02).
Sentence Wrap-up X Preview: FFD (p = .14).



Clause Wrap-up X Preview: SFD (p = .05).
Sentence Wrap-up X Preview: SFD (p = .08).

Late Effects of Wrap-up on the Preview Benefit:

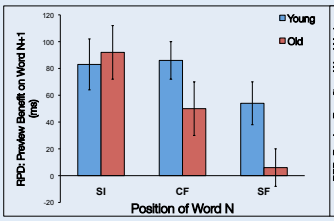


OA: Sent X Preview (p < .001)
YA: Sent X Preview (p = .8)

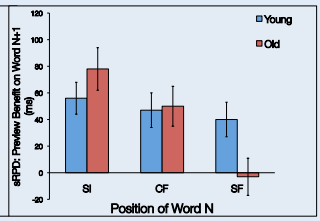
GD, RPD & sRPD

• Age differences in the effects of wrap-up on the preview benefit.

• Significant Age X Sentence Wrap-up X Preview for all three measures



OA: Sent X Preview (p < .001)
YA: Sent X Preview (p = .18)



OA: Sent X Preview (p < .001)
YA: Sent X Preview (p = .31)

Conclusions

The findings from the current study suggest that this wrap-up effect is resource demanding and that semantic integration at sentence boundaries may be less efficient with age, thus, resulting in a greater cognitive-processing load.

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For more information, see: Payne, B.R. & Stine-Morrow, E.A.L (2011, in press). Aging, parafoveal preview, and semantic integration in sentence processing: Testing the cognitive workload of wrap-up. *Psychology and Aging.*