

Age Differences in Detection of Textbase or Situational Inconsistency during Narrative Comprehension

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INTRODUCTION

It has been suggested that older adults are exceptionally attuned to situation model processing, whereas they tend to neglect proposition-based semantic analysis, so that the result is a less distinctive textbase representation (e.g., Radvansky et al., 2001; Stine-Morrow et al., 2008). However, very few studies have explored age differences in textbase and situation model representations that are constructed during comprehension.

Eye tracking methodology enabled us to study online reading processes and examine whether younger and older readers construct and integrate textbase and situation model representations differently.

In the current study, we compared younger and older readers' eye movements when encountering a target sentence that was inconsistent either with an idea explicitly given by the text (textbase inconsistency) or the implied narrative situation (situation model inconsistency).

HYPOTHESES

If older readers are less likely than younger readers to construct the textbase representation, we expected younger adults to slow down and show more regressive eye movements to textbase-inconsistent targets relative to older adults.

If older readers are more likely than younger readers to construct the situational representation, we expected older adults to slow down and show more regressive eye movements to targets inconsistent with the situation model.

METHOD

Participants

	Young	Old
N	29	42
Age Range	19-30	60-90
Age [†]	22.00 (2.98)	70.62 (1.10)
Education [†]	15.18 (1.85)	16.43 (2.66)
Vocabulary [†]	48.29 (4.85)	48.12 (7.49)
Working Memory ^{†b}	5.00 (1.09)	3.97 (1.29)

[†] means are provided with standard deviations in parentheses

* significant group difference

^a Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1987)

^b reading span (Stine & Hindman, 1994)

Materials

Fifteen short narrative passages were created so as to provide introductory context that was either consistent (neutral condition) or inconsistent with the subsequent target information. Inconsistent versions were: (a) textbase inconsistency---the explicit detail of the set-up was inconsistent with the target and (b) situational inconsistency---the situation described in the set-up implied inconsistency with the target.

Apparatus and Procedure

Eye movements were recorded using a head-mounted SR Research EyeLink II system with a sampling rate of 500 Hz. Passages were shown on a 19-inch CRT monitor with a resolution of 1024 x 768 pixels in 16-bit high color; the font was sized so that 2-3 characters equated to roughly 1 degree of visual angle. Each passage was presented on an entire screen, with 1.5 line spacing.

The 15 experimental passages were interspersed with 15 filler passages that contain no inconsistency so that each participant read a total of 30 short narratives.

Participants answered yes/no to comprehension questions after each passage to ensure active comprehension.

Sample Passage

Introduction Ted took his girlfriend on a date to her favorite restaurant.	
Situation-inconsistent condition (SM) This was the night that he had been planning to propose to her. Ted had put a lot of thought into this special event. He had a family heirloom redesigned to her tastes. He knew that the design of the piece would please her. He was excited that he would soon give it to her.	ROI 1
Textbase-inconsistent condition (TB) This was the night that they would celebrate her recent promotion. Ted had put a lot of thought into this special event. He asked her friend for advice and got a nice gift for her. He knew it would create a pleased expression on her face. He was excited that he would soon give her the purse.	ROI 1
Neutral condition (NT) This was the night that they would celebrate her recent promotion. Ted had put a lot of thought into this special event. He asked her friend for advice and got a nice gift for her. He knew it would create a pleased expression on her face. He was excited that he would soon give it to her.	ROI 1
Filter paragraph After he waited for ten minutes, his girlfriend arrived at the restaurant. She looked especially glamorous in the dim light of the candles. After ordering their food, he thought it was a good time to talk. Ted began to chat about his day as she sipped her drink. She placed her glass down on the table as she listened to him.	
Target Ted presented his girlfriend with the watch.	ROI 2
Posttarget He thought it was a perfectly lovely evening.	
Closing She looked very happy and content the whole time.	ROI=region of interest

Design

- 1 Between-Subjects Factor
 - 2 Age Groups: Young, Old
- 1 Within-Subjects Factor
 - 3 Inconsistency Conditions: Neutral (NT), Textbase (TB), and Situation Model (SM)

CONCLUSIONS

Counter to the idea that older readers do not construct a distinctive proposition-based representation, we found that older adults were more likely to be affected by textbase inconsistency than were younger adults. Older adults allocated more time to inspecting an earlier text when encountering textbase inconsistency in the target sentence, which led to an increased total fixation duration. Younger adults allocated more time to resolving situational inconsistency as shown by their increased total fixation duration and regression-path duration when detecting situational inconsistency.

However, there was no evidence that the older adults were more likely than the younger adults to revisit the set-up region and to allocate more effort to resolve the textbase inconsistency than were younger adults. This suggests the possibility that older adults experienced some difficulty in exactly locating the source of the inconsistency during regressions.

Our data provide evidence that older readers construct an accurate textbase representation that is retained at least over the course of reading short narratives.

RESULTS

Eye-tracking data were analyzed using a 2 (Age) X 3 (Inconsistency: NT, TB, SM) mixed-model analysis of variance.

Passage Reading Time

Total passages reading times were longer in both inconsistency conditions than in the NT condition, for a main effect of Inconsistency, $F(2, 138)=3.82, p<.05, \eta_p^2=.05$.

Set-up Paragraph (ROI 1)

Number of Regression-In: the number of regressive movements landing on the region.

A main effect of Inconsistency, $F(2, 138)=5.17, p<.01, \eta_p^2=.07$, indicated that readers were more likely to regress into the set-up paragraph in the TB inconsistency condition compared to the NT condition.

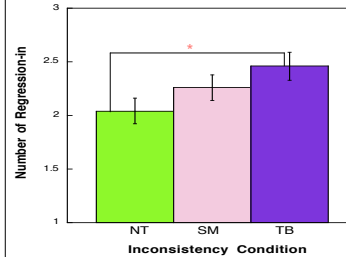


Figure 1. Number of regressions entered into the set-up region as a function of Inconsistency Condition. $p<.05$

Reinspection Duration: the sum of the rereading time spent in the region after the first-pass reading.

A main effect of Inconsistency, $F(2, 138)=2.98, p=.06, \eta_p^2=.04$, indicated that relative to the NT condition, reinspection times were longer in the two inconsistency conditions.

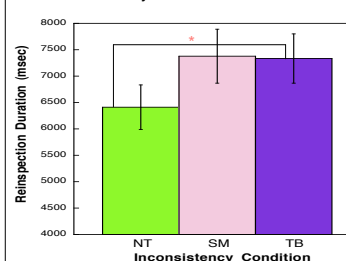


Figure 2. Total reinspection durations in set-up region as a function of Inconsistency Condition. $p<.05$

Target Sentence (ROI 2)

Total Fixation Duration: the sum of all fixation times spent in the region.

A significant Age x Inconsistency interaction, $F(2, 138)=3.98, p<.05, \eta_p^2=.06$, suggested that age groups were differentially affected by inconsistency conditions.

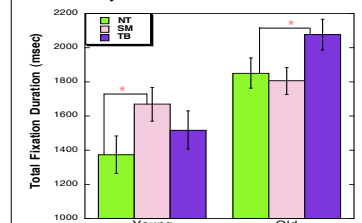


Figure 3. Total fixation durations in target sentence region as a function of Inconsistency Condition. $p<.05$

Regression-path Duration: the sum of all fixations from first entering a region until exiting in the forward direction, including any fixations made to reread earlier portions of the text.

A main effect of Inconsistency, $F(2, 134)=3.75, p<.05, \eta_p^2=.05$, did not vary with age, $F(2, 134)=1.80, p=.17, \eta_p^2=.03$. However, there was a trend that older adults were more influenced by TB inconsistency condition than the NT condition.

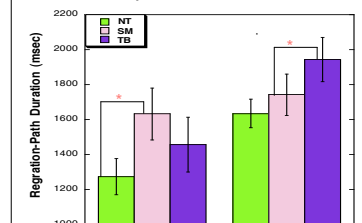


Figure 4. Regression-path durations in target sentence region as a function of Inconsistency Condition. $p<.05$

Total Number of Regression-Out: the total number regressive movements launched from the region.

TB inconsistency led to more frequent regressions launched from the target sentence than in the NT condition, for a main effect of Inconsistency, $F(2, 138)=3.98, p<.05, \eta_p^2=.06$.

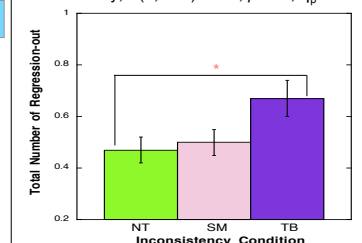


Figure 5. Total number of regression-out launched from target sentence region as a function of Inconsistency Condition. $p<.05$

References

- Radvansky, G. A., Zwaan, R. A., Curiel, J. M., & Copeland, D. E. (2001). Situation models and aging. *Psychology and Aging, 16*, 145-160.
- Stine-Morrow, E. A. L., Miller, L. M. S., Gagne, D. D., & Hertzog, C. (2008). Self-regulated reading in adulthood. *Psychology and Aging, 23*, 131-153.