Aging and Text Integration across Sentence Boundaries: An Eye-Movement Study

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INTRODUCTION

An incremental view of text processing suggests readers use the collective contextual cues in the unfolding discourse to preactivate syntactic and lexical-semantic information of upcoming words (Clifton et al., 2003; DeLong et al., 2005; Federmeier & Kutas, 1999). Unclear is how aging impacts the ability to use rich contextual information to facilitate the immediate interpretation of word meanings in discourse (Federmeier & Kutas, 2005; Stine-Morrow et al., 2008). We investigated this question in an eye-movement paradigm in which younger, middle-aged, and older participants read texts in which a single target word was constrained by varying levels of cues from the surface form, propositional content (i.e., textbase) and situation model (see Table 2).

METHODS

Participants

Table 1 Participant Characteristics

Age Group	Young		Middle-aged		Old	
	Mean	SD	Mean	SD	Mean	SD
n	31	-	29	-	26	-
Age range	18-26	-	30-59	-	60-81	-
Age	21.3	2.6	44.5	10.2	68.1	5.9
Educational Level*	15.0	1.7	16.6	2.4	17.6	3.1
WM†	4.52	1.36	4.41	1.40	3.85	0.85
Speed**	0.20	0.70	0.19	0.91	-0.45	0.71
Verbal Fluency†	44.65	8.57	45.24	10.75	39.96	8.76
Vocabulary***	7.68	3.57	10.23	3.58	12.51	4.20
Exposure to print***	4.90	3.68	10.21	4.32	13.38	4.12

† *p<.10; *p<.05; **p<.01; ***p<.001.*

Materials and Design

Texts were 64 multiple-sentence passages varying in the level of contextual constraint imposed by the first sentence for a target word in the last sentence (Yang et al., 2007) (Table 2). Distance between the context sentence and the target word was manipulated by adding a short filler sentence in between to investigate the potential effects of differential decay rates of surface form, textbase and situation model.

Table 2 Samples of Experimental Materials

	Passages (target words are italicized; filler sentence is in parentheses)	Contextual cues		
		Surface form	Textbase	Situation Model
Repetition	After being dropped from the plane, the bomb hit the ground and exploded. (The aircraft arrived at the base on time.) The *explosion* was quickly reported to the commander.	X	X	X
Paraphrase	After being dropped from the plane, the bomb hit the ground and blew up. (The aircraft arrived at the base on time.)The *explosion* was quickly reported to the commander.		X	X
Inference	After being dropped from the plane, the bomb hit the ground right on target. (The aircraft arrived at the base on time.) The *explosion* was quickly reported to the commander.			X
Baseline	After the bomb was stored safely on the ground, the plane dropped off the crew and left. (The aircraft arrived at the base on time.) The *explosion* was quickly reported to the commander.			

Procedure

Participants read passages on a computer screen while their eye movements were monitored by an Eye-Link II eye-tracker. Immediately after reading each passage, participants answered a comprehension question.

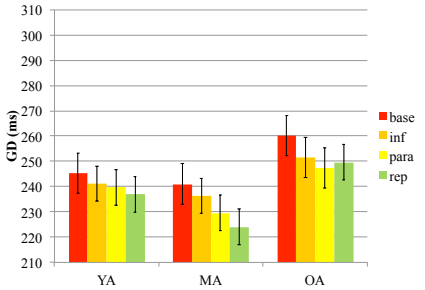
RESULTS

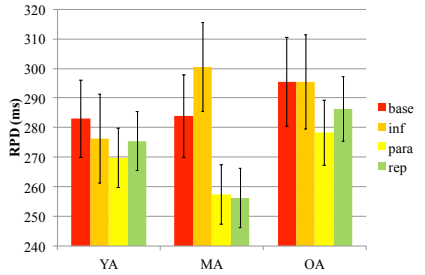
Hierarchical linear modeling was used to analyze the measures of reading time; t-values for coefficients are reported.

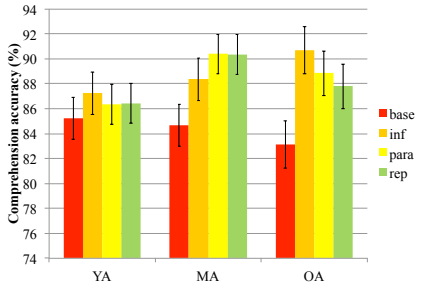
Gaze Duration (GD) on the target showed a significant linear trend such that GD decreased with incremental contextual constraint, t=3.02, p<.001. Neither the effect of age, t=1.60, nor distance, t<1, was significant, nor did either of these variables moderate the effect of context, t<1.

Regression path duration (RPD) on the target was shorter for repetition, and paraphrase condition than for the baseline control, t=2.65, p<.01; t=3.08, p<.01, respectively, which did not differ from the inference condition, t<1. Neither the main effect of age, t<1, nor distance, t=1.04, was significant. Middle-aged readers showed faster RPD when the target word was explicitly introduced (i.e., paraphrase and repetition) relative to when it was implicitly introduced (i.e., inference and baseline), p<.01. Older readers showed a similar trend, p<.15, but young did not.

Comprehension Accuracy for the control condition was lower than that for the other three conditions, F(3,255)=4.48, p<.01. Middle-aged, p<.05, and older, p<.01, readers showed relatively better comprehension when the context explicitly introduced, or strongly implied, the target concept.







CONCLUSIONS

Consistent with the incrementality hypothesis, readers used the cumulative amount of contextual information to facilitate the fast interpretation of incoming words in discourse processing as measured by GD. There were no age differences in the use of context in this early measure of processing.

As measured by RPD, middle-aged readers, and to some extent older readers, allocated more time to fully integrate the target word when the concept was not explicitly introduced into the discourse (i.e., the baseline and inference conditions).

Perhaps as a consequence of the greater effort allocated to integration, middle-aged and older readers showed relatively better comprehension when the discourse was more coherent.

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