AGING AND THE EFFECTS OF SEMANTIC FIT DURING READING

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RATIONALE

Recent research examining older adults' ability to take advantage of context to process individual words has typically measured contextual constraint as cloze probability (i.e., predictability of the upcoming word; cf. Federmeier et al., 2002; Rayner et al., 2006). Semantic fit or plausibility (i.e., the degree to which a word can be meaningfully integrated with the sentence context regardless of its predictability) can also affect reading processes, though the effects tend to be more downstream (e.g., after the initial fixation; Rayner et al., 2004). Age differences in the effects of semantic fit on reading processes have not been extensively examined. Using words that were age-equated on perceptions of semantic fit (Little et al., 2004), we used both eye-tracking and the moving window paradigm to test the hypothesis that older readers would be differentially facilitated by semantic fit.

METHODS

Participants

	Young		Old	
N	19		19	
Age Range	18-32		60-80	
Age †*	21.37	(0.70)	67.53	(1.39)
Verbal WM Span †*	5.56	(0.29)	4.54	(0.27)
WAIS-R Vocabulary †	47.84	(1.81)	51.11	(1.33)
Education (yrs) †*	14.37	(0.41)	15.89	(0.56)

† Means reported w/ standard errors in parentheses
* significant group difference, p<.05

Design, Procedure & Apparatus

After 25% of the trials, participants answered yes/no questions to ensure comprehension. 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 in Courier New font so that 2-3 characters equaled roughly 1° of visual angle. Moving window data were collected on a separate computer controlled by SuperLab experimental software, in 20-pt. Courier New font.

Materials

Each participant read a total of 48 experimental sentences containing a low, medium, or high semantic fit target word, drawn from the Little et al. (2004) materials (see table below). These 48 sentences included 24 containing either a low or high fit word, and 24 containing either a medium or high fit word (with each pair matched closely on word frequency and length). Only target words whose ratings of semantic fit were age-equivalent were used in the current study. These sentences were intermixed with 48 unrelated filler sentences (N = 96 total) and randomized for presentation.

	Semantic Fit	
	Low	**High**
Example 1: Low/High (L/H)	Carrying only a backpack, the *pilgrim* went on his way.	Carrying only a backpack, the *tourist* went on his way.
	Medium	**High**
Example 2: Medium/High (M/H)	The bride was happy to see her *nephew* had arrived.	The bride was happy to see her *sister* had arrived.

REFERENCES

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CONCLUSIONS

Using materials normed for both younger and older adults, we showed that readers slow down when encountering a relatively implausible concept, though this adjustment does not appear to occur on the initial processing of the word itself but rather downstream.

Older adults required differentially more time to resolve highly implausible concepts, while showing reading patterns more similar to the young when sentence content could be more easily integrated.

Results suggest the source of age-graded differences in language processing of semantic fit as being likely due to older adults' increased tendencies to re-read implausible words, and thus fixate on them for longer periods of total time; initial fixations on the word appear age-equivalent.

Eye tracking allowed a more sensitive assessment of such post-interpretive effects, relative to computer-based paradigms, detecting the age-interaction for semantic fit that the moving window paradigm did not.

RESULTS

Moving Window (MW) Measures

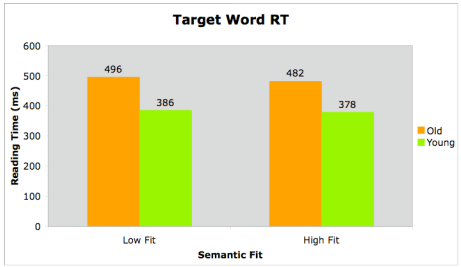

Figure 1. MW Target Word RT for L/H Comparisons

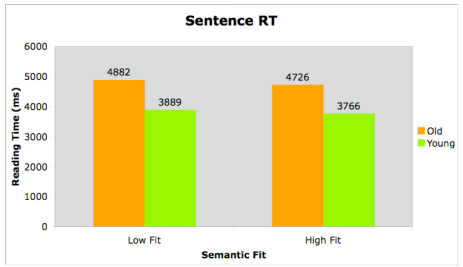

Figure 2. MW Sentence RT for L/H Comparisons

There was no evidence that semantic fit facilitated target word processing time for the L/H or M/H sets, and semantic fit did not interact with age (**see Figure 1** for L/H comparisons).

Older adults' RTs on the target word were longer than those of the young for the L/H set and the M/H set.

Semantic fit tended to decrease total sentence RT in the more extreme L/H comparison (M_L = 4385ms, SE = 135; M_H = 4286ms, SE = 136), but not for the M/H comparison (**see Figure 2** for L/H comparisons).

Semantic fit did not interact with age, though total sentence RT was longer for older adults in the L/H and M/H sets.

Eye-Tracking (ET) Measures

First Fixation Duration

Similar to the MW Target Word RT, the First Fixation Duration showed no semantic fit effects on the target words, for the L/H or M/H set, though it also showed no effects of age.

Total Fixation Duration

Total time spent on target words showed a main effect of semantic fit for the L/H set (M_L = 501, SE = 23; M_H = 357, SE = 17), but was only marginal for the M/H set (M_M = 434, SE = 21; M_H = 404, SE = 19).

The effect of fit on target words was moderated by Age for the L/H comparisons, (**see Figure 3**), which indicates that older adults were somewhat more disrupted than the young by low semantic fit, as evidenced by differentially greater time spent on low-fit target words. For the M/H set, there were no effects or interactions with age.

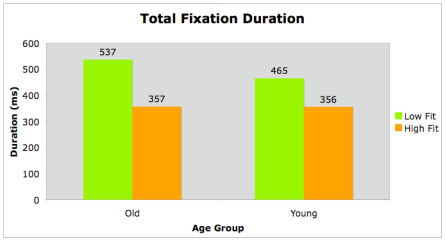

Figure 3. ET Total Fixation Duration for Old & Young

***F*-values Table**

Low-High Comparisons

		Moving Window		Eye-Tracking			
		Target Word RT	Sentence RT	FFD target	TFD target	Sentence RT	Regn In
F_1 (1,36)	Age	**9.59, *p*<.01**	**13.59, *p*<.01**	<1, *ns*	1.09, *ns*	<1, *ns*	1.41, *ns*
	Semantic Fit	1.18, *ns*	**6.41, *p*<.05**	<1, *ns*	**52.67, *p*<.001**	**14.54, *p*<.01**	**27.90, *p*<.001**
	Age x SF	<1, *ns*	<1, *ns*	<1, *ns*	**3.24, *p*=.08**	<1, *ns*	**5.81, *p*<.05**
F_2 (1,23)	Age	**159.80, *p*<.001**	**203.58, *p*<.001**	1.01, *ns*	2.58, *ns*	**4.07, *p* = .06**	**3.76, p=.06**
	Semantic Fit	<1, *ns*	<1, *ns*	<1, *ns*	**15.59, *p*<.01**	**12.94, *p*<.01**	**31.42, *p*<.001**
	Age x SF	<1, *ns*	<1, *ns*	<1, *ns*	**3.98, *p*=.06**	**5.25, *p*<.05**	**4.44, *p*<.05**

Medium-High Comparisons

		Moving Window		Eye-Tracking			
		Target RT	Sentence RT	FFD target	TFD target	Sentence RT	Regn In
F_1 (1,36)	Age	**10.02, *p*<.01**	**11.92, *p*<.01**	<1, *ns*	<1, *ns*	<1, *ns*	<1, *ns*
	Semantic Fit	<1, *ns*	<1, *ns*	2.26, *ns*	**3.40, *p*=.07**	<1, *ns*	<1, *ns*
	Age x SF	<1, *ns*	<1, *ns*	3.19, *ns*	<1, *ns*	**7.14, *p*<.01**	1.58, *ns*
F_2 (1,23)	Age	**135.31, *p*<.001**	**175.63, *p*<.001**	2.63, *ns*	<1, *ns*	<1, *ns*	1.59, *ns*
	Semantic Fit	**4.69, *p*<.05**	<1, *ns*	1.09, *ns*	1.05, *ns*	<1, *ns*	<1, *ns*
	Age x SF	<1, *ns*	<1, *ns*	1.02, *ns*	<1, *ns*	1.83, *ns*	<1, *ns*

Sentence RT

Similar to MW Sentence RT, sentences containing a low semantic fit target word were read more slowly overall than sentences that were high in semantic fit (M_L = 3930ms, SE = 168; M_H = 3400ms, SE = 129); this effect did not depend on age for the subjects analysis but was reliable for the items analysis: older adults' (M_L = 4054ms, SE = 351; M_H = 3387ms, SE = 261) sentence reading times were reliably longer than those of younger adults' (M_L = 3706ms, SE = 282; M_H = 3402ms, SE = 242) for sentences containing the low semantic fit word. For M/H comparisons, main effects were not reliable, though the interaction was reliable for the subjects analysis, showing effect of fit was reliable for older adults (M_M = 3397ms, SE = 181; M_H = 3252ms, SE = 194), but not significant for younger adults (M_M = 3263ms, SE = 144; M_H = 3458, SE = 195).

Regressions

Further evidence for sensitivity to low semantic fit is found in the qualitative eye movement regression patterns. These data show a Fit x Age interaction: the increase in older adults' total fixation durations on the low-fit words was due to an increased likelihood of regressing back to them in reading **(see Figure 4).** For M/H comparisons, there were no main effects of Fit or Age, nor any interactions.

Figure 4. Proportion of Trials w/ Regression to Target Word for Old & Young

ILLINOIS

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