Age Differences in the Effects of Text Complexity on Self-Regulated Reading

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RATIONALE

Elaboration in discourse, while adding complexity, also provides contextual support for the encoding of individual ideas. Such elaboration may differentially benefit older adults' memory for text (Johnson, 2003), in part, because such contextual support may allow situation model processing to "bootstrap" encoding of the textbase (Miller & Stine-Morrow, 1998; Stine-Morrow et al., 2004), and thereby improve recall of the content. Using a "judgment of learning" (JOL) paradigm, we examined age differences in the processes and outcomes of self-regulated reading as a function of the degree of elaborative content.

Assuming that less elaborated text requires the reader to focus on textbase processing, while more elaborated text affords situation model processing, we tested the idea that such texts require different processing mechanisms (Stine-Morrow, Miller, & Hertzog, 2006) that would evoke task-switching costs when interspersed; given that task-switching may be particularly difficult for older adults (Kray & Lindenberger, 2000), we expected that such conditions would create particular difficulty for older readers relative to when texts with

METHODS

Participants

	Young	Old
N	45	46
Age †*	18-29 20.22 (1.70)	55-82 65.78 (7.12)
Working Memory †*1	5.34 (.14)	4.55 (.20)
Vocabulary †2	46.36 (.98)	48.70 (1.16)
Education †*	13.60 (.15)	16.00 (.36)

† Means reported with S.E. or S.D. in parentheses
* Significant group difference
1 Average listening and reading span
2 Wechsler Adult Intelligence Scale-Revised

Materials

Stimulus materials consisted of 45 factual sentences about Connecticut (CT) and 45 about Rhode Island (RI), covering topics on nature, history, and tourism. The sentences differed in the number of propositions or "idea units" they contained (Kintsch & van Dijk, 1978), varying in both word length and amount of elaborative material about the topic. Sentence characteristics (e.g., syllables, new concepts, propositions) were matched within elaboration levels and across state.

Elaboration Level	*Sample Sentence*
Connecticut	
No elaboration/ "Factoid"	The cotton gin was invented in Connecticut.
Low Elaboration	The Mountain Laurel is a popular flower because it swathes the hills in pink and white, mostly in the spring.
High Elaboration	The low, eroded hills of western Connecticut begin in the far north as rugged bedrock with dramatic, glacier-cut ravines where streams rush through the clefts.
Rhode Island	
No elaboration/ "Factoid"	The Hasbro Toy Company was founded in Rhode Island.
Low Elaboration	Although there are older carousels in America, none are as stunning as the Crescent Park Carousel in East Providence, which features 62 hand-carved figures.
High Elaboration	In Bristol, Rhode Island, the state's largest aquarium, which is sponsored in part by the Audubon Society, features a life-size model

Design & Procedure

Participants were asked to learn about one state and then another (CT and RI) by reading a series of otherwise unrelated sentences. For one state, participants read all sentences in a random order so that different levels of elaboration were interspersed (i.e., unblocked); for the other state, sentences appeared in descending or ascending order of elaboration (i.e., blocked). Participants read each set under instructions to learn as much about each state as possible. Materials (CT or RI) were counterbalanced across blocking condition, and the order of the conditions was counterbalanced across subjects.

Younger and older adults read each sentence twice, in a self-paced fashion on a computer, with sentence reading times recorded. After each sentence had been read, participants made a judgment of learning (JOL) in which they estimated their learning of the material on a continuous scale from "Not at All" to "Complete Mastery" (*Figure 1*). Participants repeated this process twice for all 45 sentences for a state, and after a brief distractor task, were asked to recall all of the information they could remember about that state.

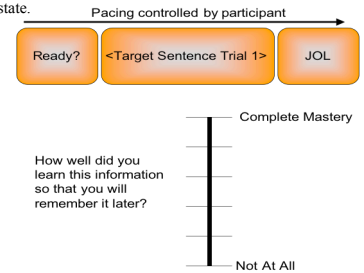

Figure 1. Illustration of stages in the JOL paradigm, along with an illustration of the continuous JOL used. This sequence was performed twice for each sentence.

RESULTS

Residual Reading Times

Controlling for length of sentences in syllables, residual reading times showed that both young and old participants allocated less time to factoids relative to elaborated discourse (M_{FCT} = -625.39, SE = 68.20; M_{LO} = 206.54, SE = 46.01; M_{HI} = 117.72, SE = 32.04), $F(2,90)$ = 52.92, $p < .001$, and less time when sentences were blocked (M_{BL} = -712.70, SE = 149.28; M_{UB} = 543.18, SE = 162.40), $F(1,90)$ = 16.31, $p < .001$, though the blocking effect was only reliable on the second trial, $F(1,90)$ = 37.61, $p < .001$ (see Figure 2).

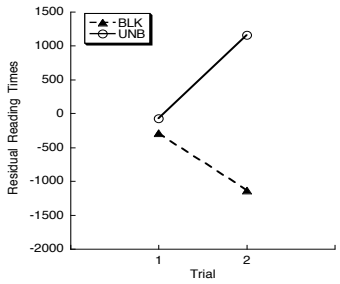

Figure 2. Residual Reading Times by Blocking as a function of Trial.

Memory Monitoring

A main effect of Elaboration, $F(2,132)$ = 4.27, $p < .05$, indicated that participants' monitoring was best for simple factoids, but did not differ across the two levels of discourse (M_{FCT} = .45, SE = .04; M_{LO} = .33, SE = .04; M_{HI} = .34, SE = .03).

Younger adults were better at monitoring than older adults, $F(1,66)$ = 5.64, $p < .05$, however, a Blocking x Age interaction, $F(1,66)$ = 7.45, $p < .01$ (see Figure 4), showed that older adults' monitoring accuracy was differentially impaired by frequent strategy switching.

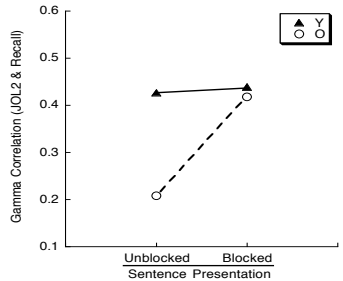

Figure 4. Mean Gamma correlations (JOL2 & Recall) for young and old as a function of sentence blocking.

Recall

The Elaboration x Age interaction on proportion of sentences recalled, $F(2,89)$ = 21.17, $p < .001$ (see Figure 3, left panel), showed that older adults differentially benefited from the highly elaborated passages, while the younger adults showed best memory for simple facts.

A significant Blocking x Age interaction, $F(1,89)$ = 4.39, $p < .05$ (see Figure 3, right panel), showed that while blocking did not affect younger adults' memory for text, $t(44)$ = 1.51, p = .14, older adults benefited from text the blocked presentation, $t(45)$ = 2.33, $p < .05$.

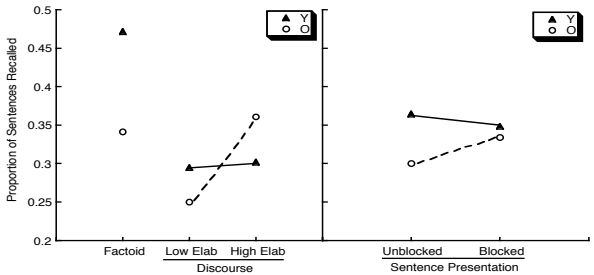

Figure 3. Recall performance for young and old as a function of text elaboration (left panel) and sentence blocking (right panel).

CONCLUSIONS

We found no differences in reading time allocation as a function of elaborative content, but this similarity in allocation policy did not lead to age-equivalence in memory for elaborated text.

Relative to the young, older readers took better advantage of discourse context to efficiently encode textbase content.

We found evidence that sentences varying in elaborative content engaged different reading strategies across trials, requiring sets that could be disrupted.

Age deficits in memory monitoring only appeared when encoding strategy was disrupted, and this disruption led to poorer memory for the text.

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