The Effects of Resource Allocation and Cognitive Ability in Text Memory Among Older Adults

Soo Rim Noh, Xuefei Gao and Elizabeth A. L. Stine-Morrow
Department of Educational Psychology and Beckman Institute, University of Illinois at Urbana-Champaign

INTRODUCTION

Successful text memory is selectively associated with the allocation of attentional resources to conceptual processing (i.e., textbase strategy) that supports memory for content (e.g., Stine-Morrow, Miller, Gagne, & Hertzog 2008). Recent studies, however, suggest that older adults may achieve similar memory performance as their younger counterparts through strategy training to focus attention on conceptual integration (Stine-Morrow, Noh, & Shake, in press) and through greater reliance on verbal ability, which engenders attentional effort to conceptual processing (Stine-Morrow et al., 2008).

In the present study we investigated the effects of fluid ability, verbal ability, and conceptual processing on text memory within a sample of older adults (Schaie, 2005) of varying ages.

METHOD

Participants

☑ 197 community-dwelling adults were categorized into young-old (YO), old (O), and oldest-old (OO) groups. The three groups did not differ in terms of years of formal education completed, but the YO group scored higher on the MMSE test than the OO group ($p<.01$).

Age Group	N	Age Range	Mean Age	Education	MMSE*
Young-Old (YO)	91	60-70	65.3	15.7 (2.5)	28.7 (1.0)
Old (O)	74	71-80	75.2	15.4 (2.8)	28.4 (1.2)
Oldest-Old (OO)	32	81-94	84.5	15.7 (2.5)	27.9 (1.4)

*$p<.05$

Cognitive Measures

INSTRUMENT	SOURCE	α
Fluid Ability Composite		.85
Letter Comparison	Salthouse (1991)	
Pattern Comparison		
Letter/number sequencing	Wechsler (1997)	
ETS-KFT Finding As	Ekstrom et al. (1976)	
Identical Pictures		
Letter Sets		
Number Series		
Letter Series		
Word Series		
Different Uses		
Opposites Test		
Card Rotation		
Hidden Patterns		
FAS-Verbal Fluency	Benton & Hamsher (1978)	
Verbal Ability Composite		.92
ETS-KFT Advanced Vocab	Ekstrom et al. (1976)	
Extended Range Vocab		
North American Adult Reading Test	Uttl (2002)	

We are grateful for support from the National Institute on Aging (Grant R01 AG013935 and R01 AG029475) Contact Information: srn@brandeis.edu

METHOD (continued)

Text Materials

☑ The stimulus materials consisted of 24 sentences covering topics involving nature, science, and history (Stine-Morrow et al., 2001). Each of these sentences contained 18 words and they were similar in lexical and syntactic complexity.

☑ Each target sentence was followed by a short filler sentence, related to the first, to ensure that our reading time estimates for the critical target sentences reflected comprehension and encoding processes rather than retrieval planning.

Sample Stimulus Sentence

•Every morning housewives in Bali put some rice on small pieces of banana leaves to ward off spirits (Target). The rice is considered to have magical properties (Filler).

Procedure

☑ Participants read sentences word-by-word in a self-paced fashion in a moving window paradigm, and they recalled sentences on a randomly selected third of the trials.

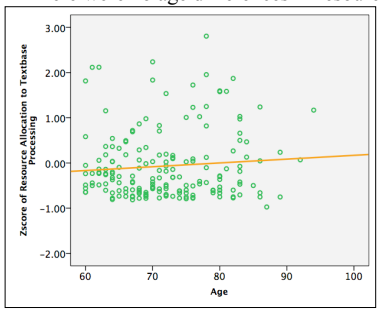
Resource Allocation to Textbase Processing

☑ Individual regression analysis of word-by-word reading times was used to isolate resources allocated to textbase-level features, while controlling for word-level processing (orthographic decoding, lexical access), as well as the right-to-left sweep to a new line of text (dummy coded indicator for occurrence of words at a new line).

Texbase-level Variable	Theoretical Process
New Concept (0/1 coding for incidence)	Immediate processing of new conceptual information
Cumulative conceptual load at sentence boundaries	Conceptual integration

☑ A composite score reflecting textbase-level processing was created by averaging the standardized Z-scores of corresponding coefficients.

☑ There were no age differences in resource allocation to textbase processing, $F<1$.



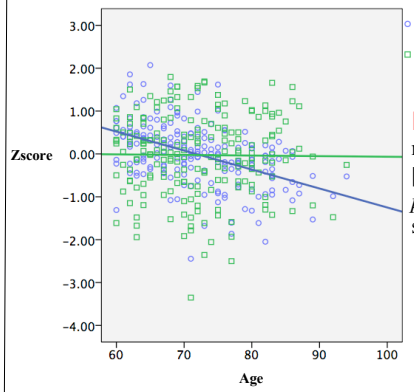
Role of Individual Differences in Textbase Strategy and Cognitive Ability on Text Recall

☑ We conducted hierarchical regressions separately for the three age groups to further examine the relative contributions of textbase strategy and individual differences in cognitive ability within each of the age groups.

☑ For the YO and O groups, the textbase strategy predicted their recall, and verbal ability contributed to recall above and beyond the textbase strategy. However, the recall of the OO group was predicted only by fluid ability.

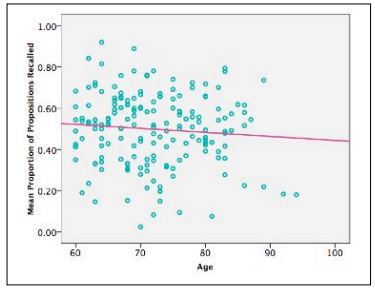
RESULTS

Fluid and Verbal Abilities in Relation to Age



☑ While fluid ability showed monotonic declines with age [YO>O>OO; $F(2, 194)=24.34$, $p<.001$], verbal ability was relatively stable [$F(2, 194)=1.45$, $p=.24$].

Text Recall Performance



☑ For each participant, recall of the probed target sentences (8 sentences in total) was scored using a gist-based method of propositional scoring (Turner & Greene, 1978) in which idea units were scored with a 0 if no information was recalled from the original proposition, and a 1 if the idea was recalled from that proposition.

☑ The proportion of idea units recalled from each sentence was calculated as an index of memory performance. There were no significant age differences in text memory, $F(2, 180)=1.72$, $p=.18$.

	Predictor	Increment Adj. R^2	β	t
	Young-Old			
Step 1				
	Textbase	.16	.40	4.0**
Step 2				
	Fluid Ability	.20	-.05	-.42
	Verbal Ability		.48	4.34*
	Old			
Step 1				
	Textbase	.06	.27	2.21*
Step 2				
	Fluid Ability	.28	.07	.55
	Verbal Ability		.51	4.17**
	Oldest-Old			
Step 1				
	Textbase	.04	.28	1.44
Step 2				
	Fluid Ability	.38	.47	2.68*
	Verbal Ability		.31	1.82

p<.01**, p<.05*

CONCLUSIONS

☑ Resource allocation to conceptual processing and text recall remained stable across the older adult life span.

☑ Regression data suggested that textbase strategy and age-related growth in verbal ability may support text memory among older readers, but that among the oldest-old, fluid ability may be the limiting factor in remembering text.