



Information Foraging and Learning from Text across the Adult Lifespan

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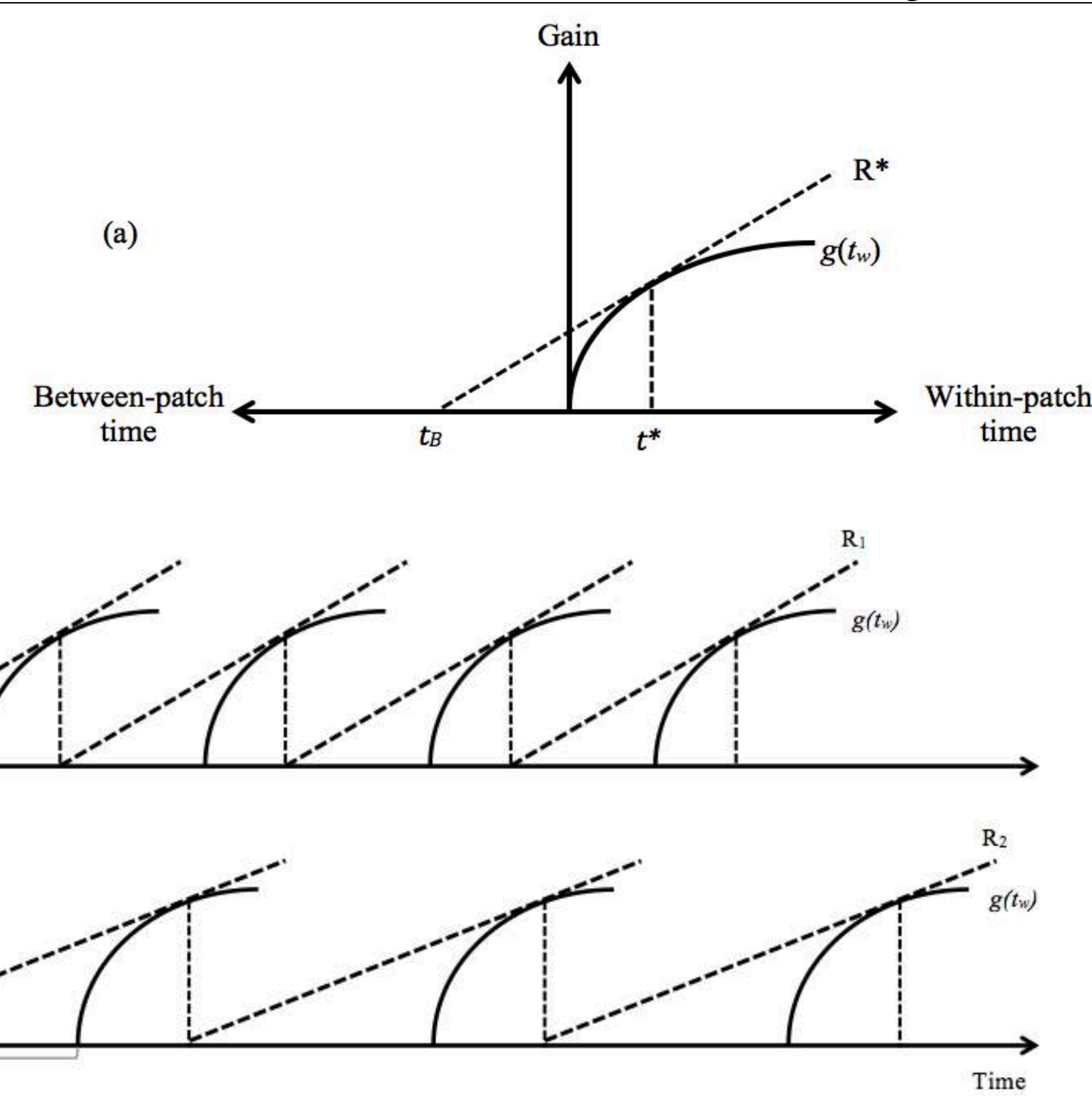
INTRODUCTION

- Older readers require more time than the young to encode ideas from text, but there are individual differences in whether in the extent to which attentional resources are allocated to support memory (Stine-Morrow et al., 2006). Age differences in text memory are generally smaller when readers can self-pace, with variation in the effect (Hartley et al., 1994; Johnson, 2003).
- With the rise of electronic media, the ecology of literacy places more demands on self-regulation. Confronted with multiple sources, readers freely select and allocate effort to texts, but have to manage the costs of exploring and switching among texts (e.g., time delay after selecting texts).
- Theories of self-regulated learning (SRL) from both metacognitive and ecological perspectives predict how readers select and allocate their time to texts (Table 1), but only the ecological approaches (e.g., Information Foraging (IF) model) predict how readers adapt to switch costs in learning environment (Figure 1).

Table 1. Theories of SRL

Theory	Predictions in reading	
	Selection	Adaptation to Switch Cost
Discrepancy Reduction (Dunlosky & Thiede, 1998)	Complex first	N/A
Region of Proximal Learning (Metcalf, 2002)	Simple first	N/A
Information Foraging (IF) (Pirulli & Card, 1999)	Simple first	More to high cost in environment (Fig. 1)

Figure 1. Demonstration of Charnov's marginal value theorem (1976) that suggests (a) the optimal within-patch foraging time, t^* , under basic situation, and (b) the effect of switch cost on searching between patches (adapted from Pirulli & Card, 1999)



Questions:

Using a novel paradigm on iPad, in which readers can adapt their SRL strategies based on different environmental constraints:

- Do readers of varying age use similar strategy to select texts?
- Do readers increase perseverance in reading and memory performance with increased switch cost? Are there any age differences?

This research was supported by grants R01 AG13935 from the National Institute on Aging and IBSS 1328545 from the National Science Foundation. Request for more info to xl85@illinois.edu or eals@illinois.edu.

METHOD

- Younger, middle-aged, and older adults (n=24 per group) from the community were matched on education and vocabulary.
- Materials: Sentences (n=21 per set) about Connecticut and Rhode Island with 7 in each of three elaboration levels (low: 2-4, medium: 6-8, high: 10-12 propositions). See Table 2.

Table 2. Sample texts from Connecticut

Elaboration	Sample text
Low	Samuel Colt was a gunsmith from Connecticut.
Medium	The Mountain Laurel is a flower that swathes the hills in pink and white, mostly in the spring.
High	After the first exploration in 1614, Dutch fur traders sailed up Connecticut River and built a fort at Hartford, which was called "House of Hope."

- Procedure: Participants selected and read texts on an iPad with the goal to learn as much about each state as possible (Figure 2), and there was a delayed cued recall task after each state.
- Switch cost (SW) was operationalized as variation in loading time (short: 0-2sec, long: 6-8sec).
- There was an 11-minute limit to learn about each state.

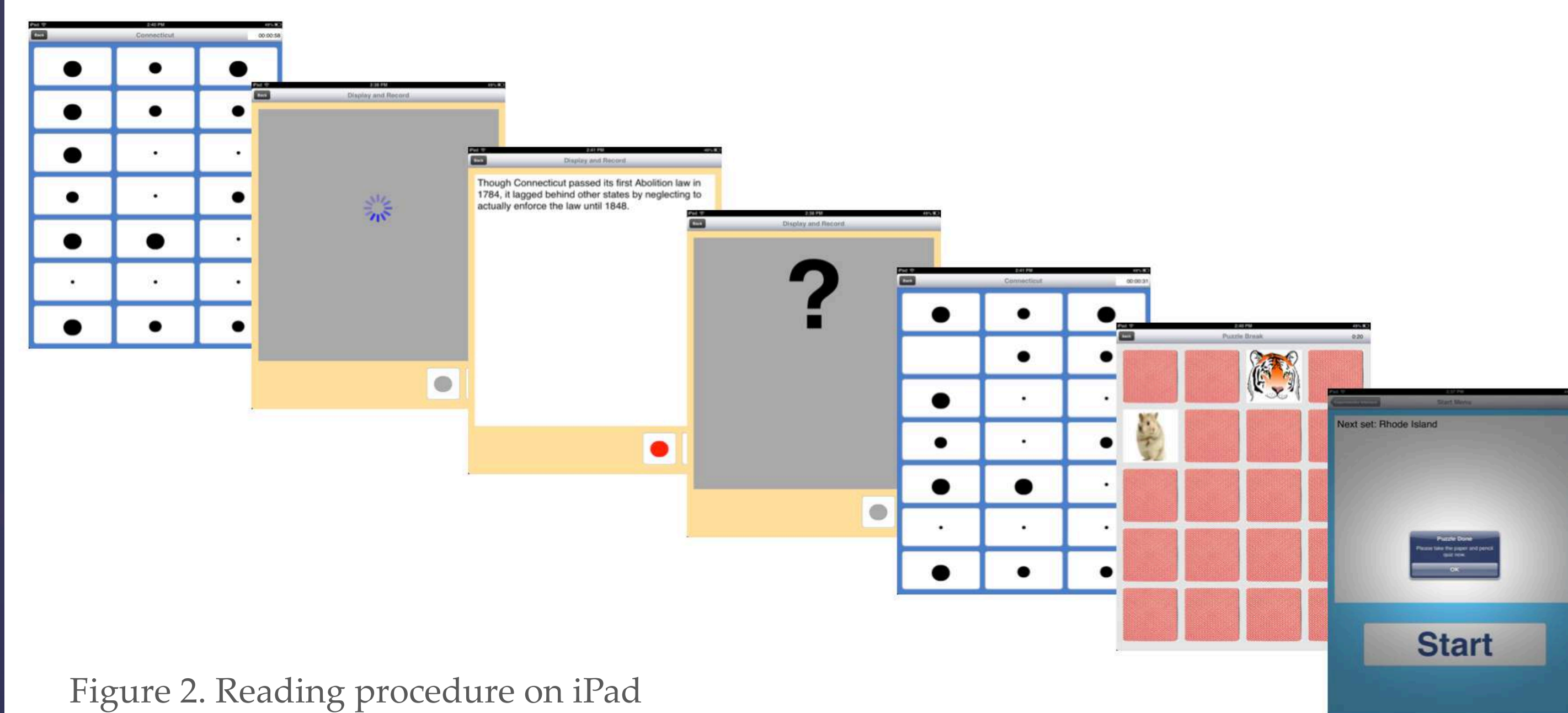


Figure 2. Reading procedure on iPad

RESULTS

Text Selection:

- No age differences in the total number of sentences selected.
- All participants selected less informative texts first and then moved progressively to more informative ones (Figure 3).

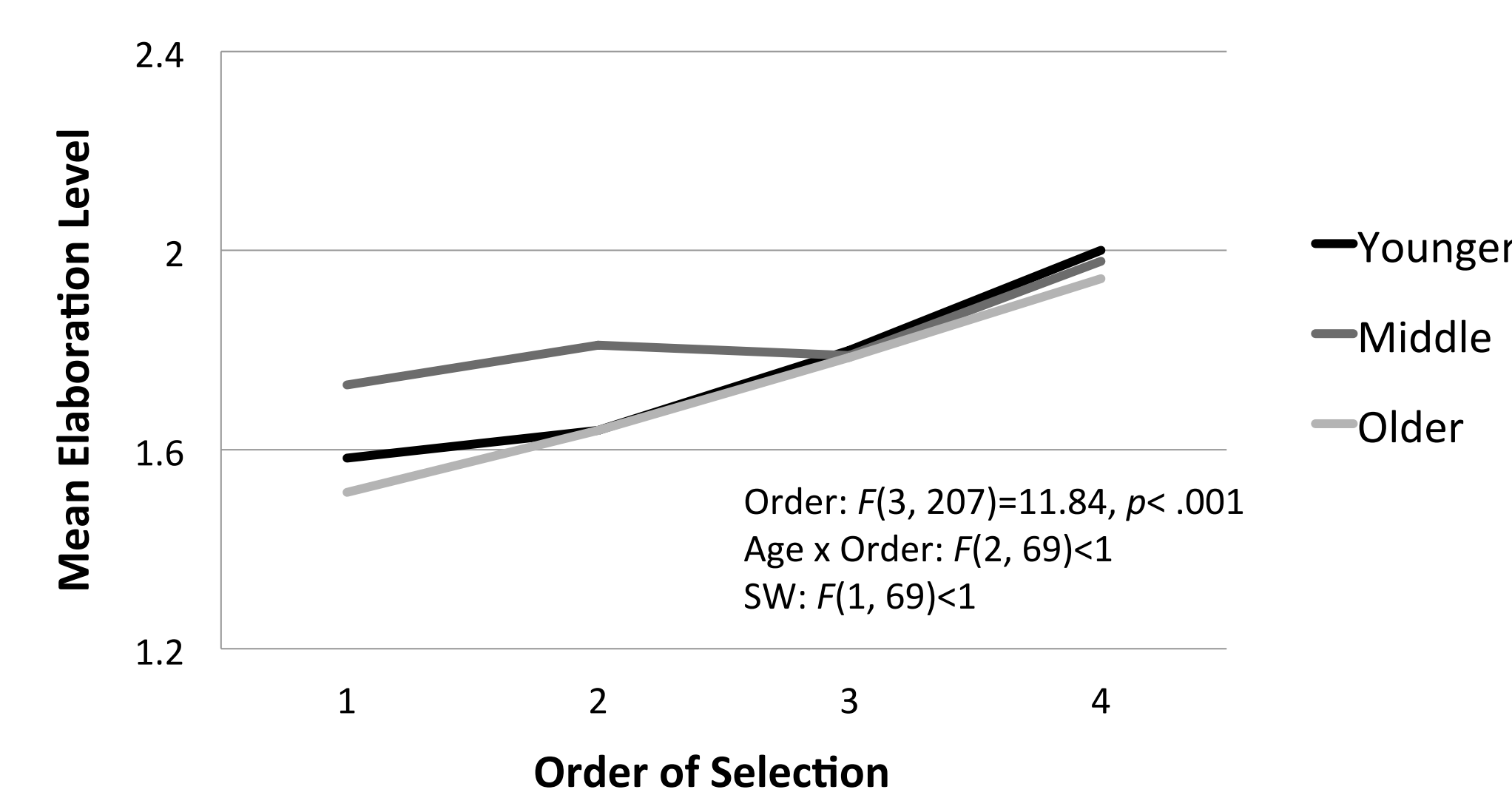


Figure 3. Mean elaboration level of younger, middle-aged, and older readers' first 12 selections grouped into 4 groups, collapsed across switch-cost conditions

RESULTS (Cont'd)

Persistence in Reading and Text Memory:

- Participants persisted longer in reading when SW was large (Fig 4a).
- Increased SW also promoted better immediate recall (Fig 4b) and memory retention of texts (Fig 4c)
- Although older adults allocated more time to read and recalled less from immediate recall, they performed equally well as younger and middle-aged adults in delayed cued recall task when SW was large.

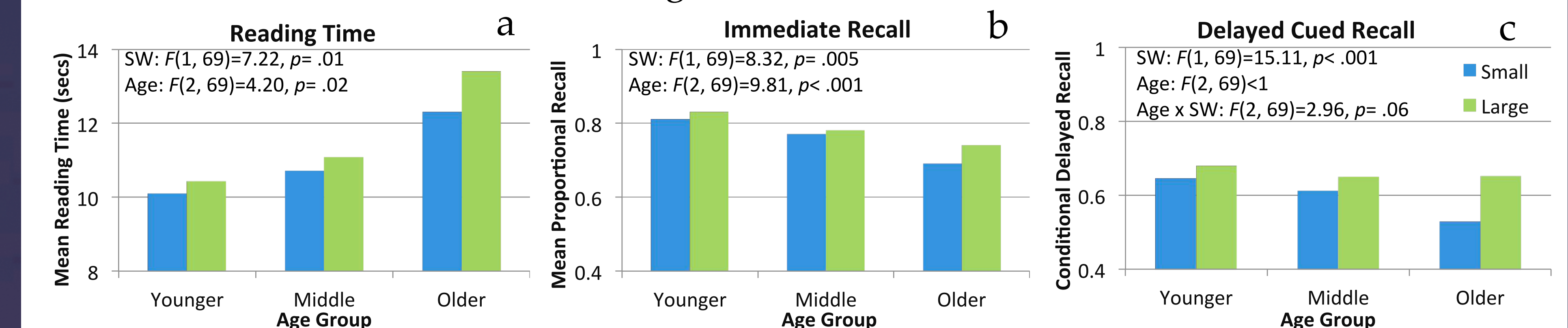


Figure 4. Mean reading time, proportional immediate recall, and conditional delayed cued recall as a function of age and switch cost.

Adaptation in Reading Ecology:

- As shown in Figure 5, participants adapted to increased SW by shifting their reading time allocation (in each ecology) to less informative texts, particularly for older adults; and, this adaptation led to the same pattern of text memory (immediate recall).

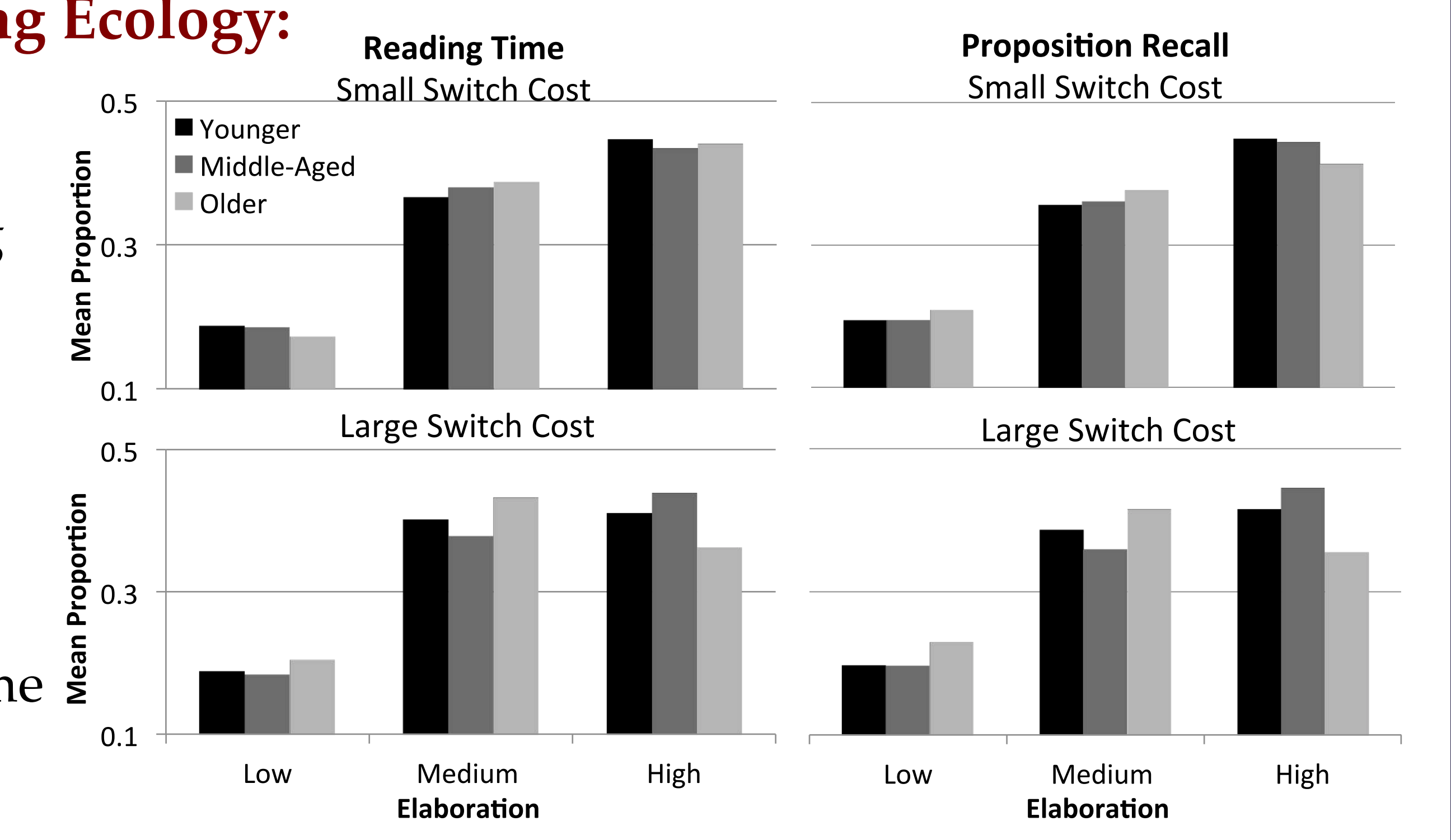


Figure 5. Three-way interaction of mean proportion of reading time allocated to and propositions recalled from texts.

DISCUSSION

- Participants used the same text selection strategy by prioritizing less informative texts.
- Consistent with IF model, high SW was beneficial to learning in terms of increasing perseverance and enhancing text memory, and the effect was stronger among older adults. This effect of SW can be applied to educational settings.
- SW affected how people manage their resources in the ecology. The pattern of shifting time allocation and immediate recall suggested that older readers were more influenced by the increased SW to adapt their learning strategies.
- The results are consistent with the idea that human SRL strategies are to some extent grounded in foraging mechanisms (cf. Metcalfe & Jacobs, 2010).

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