Aging and the Effects of Metacognitive Judgments on Memory Performance

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RATIONALE

In the "judgment of learning" (JOL) paradigm, learners estimate their current level of learning on each study trial. Some have suggested that this type of metacognitive control is itself resource-consuming so that monitoring may draw attention away from the cognitive processes that support performance (Dunlosky & Thiede, 2004; Thiede & Dunlosky, 1999). We examined age differences in the effects of making JOLs on learning efficiency as subjects read sentences (e.g., Miles & Stine-Morrow, 2004).

- If memory monitoring is resource-consuming, then participants who make JOLs should show reduced efficiency in learning relative to controls.
- Given that older adults show declines in fluid abilities, their learning may be more negatively impacted by memory monitoring relative to younger adults.
- Assuming that a goal of high recall accuracy (relative to low recall accuracy) is especially taxing for controlled processing, these effects of judgment type and age may be exaggerated when goal stringency is increased.

METHODS

Participants

	Young	Old
N	59	53
Age Range	19-26	51-84
Age † *	20.78 (1.49)	65.32 (8.19)
Working Memory † * 1	5.46 (1.12)	4.16 (1.00)
Vocabulary † 2	46.80 (7.02)	50.60 (9.76)
Education (yrs.) †	14.25 (1.47)	15.90 (2.78)

† Means reported with standard deviations in parentheses
* Significant group difference
1 Average listening and reading span (Stine & Hindman, 1994)
2 Wechsler Adult Intelligence Scale-Revised (Wechsler, 1987)

Design

Judgment type was manipulated between-subjects; and Goal within-subject (see Figure 1). Materials were counterbalanced across goal condition and the order of goal condition was counterbalanced across subjects.

	JOL "How well have you learned this information?" (0%, 20%, 40%, 60%, 80%, 100%)	JOI "How interesting was this information" (0,1,2,3,4,5)
High Accuracy "Read accurately: aim to remember 80 to 100%…"	N = 33 Old 40 Young	N = 20 Old 19 Young
Low Accuracy "Read rapidly: aim to remember 40 to 60%…"	N = 33 Old 40 Young	N = 20 Old 19 Young

Figure 1. 2 (Judgment Type: JOI vs. JOL) x 2 (Goal: High vs. Low Accuracy) design with the latter variable as between-subjects.

Materials

Younger and older adults read 36 18-word sentences about topics in nature, science, and history, in a self-paced fashion on a computer so that reading time could be measured. Sentences varied in propositional density, including 12 "low density" sentences (5-7 propositions), 12 "medium density" sentences (8 propositions), and 12 "high density" sentences (9-10 propositions). Each sentence was followed by a second "filler" sentence, related to the first, which ensured accurate estimates of encoding time for the first sentence.

Procedure

Participants either made estimates of their memory performance (JOL; N = 73) or estimates of their interest in the text (JOI; N = 39) just prior to recall (see Figure 2).

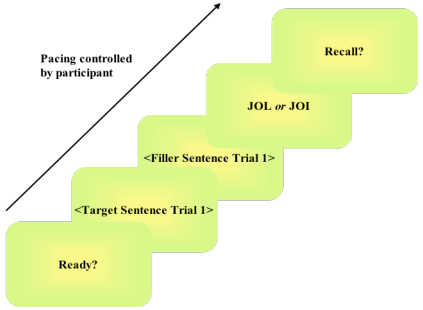


Figure 2. Illustration of stages in a JOL paradigm. This sequence was performed twice for each sentence.

RESULTS

Recall

A three-way Judgment x Age x Trial interaction, $F(1,108) = 13.49$, $p < .001$, showed that while younger adults' performance improved more across trials when they were monitoring learning, older adults' performance improved more when monitoring interest. This effect did not vary by reading goal.

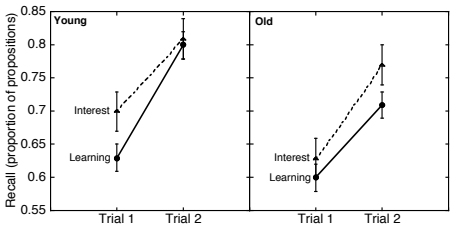


Figure 3. Recall performance for young and old as a function of judgment type and trial.

Effective Reading Time

Effective Reading Time (ERT) was computed as the time needed to encode one proposition (i.e., ms/prop recalled). Older adults were disproportionately inefficient at encoding low- and high-density sentences when making JOLs, $F(2,216) = 3.39$, $p < .05$, for the Judgment x Age x Density interaction (Figure 4).

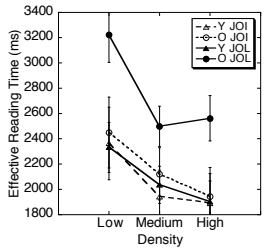
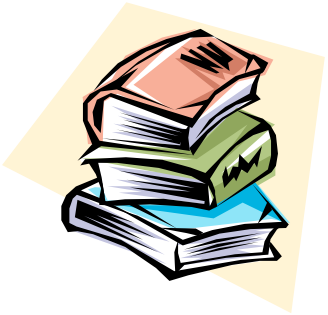


Figure 4. Effective Reading Time for young and old as a function of judgment type and propositional density.



Self-Regulation of Effort

The use of a discrepancy reduction (DR) heuristic (i.e., allocating more time to unlearned items) was assessed as the Pearson correlation between proportion of propositions recalled on the first trial and reading time allocated on the second trial. The marginal Goal x Judgment interaction, $F(1,108) = 3.43$, $p = .07$, shown in Figure 5, suggested that the effect of goal on the use of DR depended on the focus induced by the type of judgment. Whereas the level of DR did not vary with goal when readers were monitoring their levels of learning with JOLs (cf. Shake et al., submitted), subjects who monitored their affective response to the material with JOIs showed varied levels of DR under the accuracy goals. These participants' use of DR was relatively low under a High Accuracy goal, but relatively high under a low-accuracy goal.

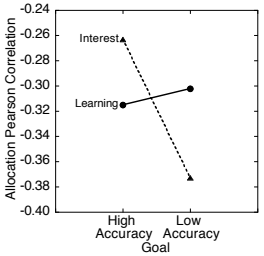


Figure 5. Allocation of study time as a function of judgment type and goal.

CONCLUSIONS

JOLs may to some extent draw resources away from encoding processes, thus depressing recall performance in some conditions, especially for older adults.

However, the type of judgment had no effect whatsoever on reading times, suggesting that JOLs affected performance primarily by depressing efficiency of encoding.

Accuracy goal did not exacerbate judgment effects on recall performance, but it did enhance discrepancy reduction for participants focused on learning (JOL). This may be a consequence of the compatibility between the memory goal and the focus induced by monitoring. Under a High Accuracy cognitive goal, participants must use considerably more controlled execution and consistently monitor the memory representation; this attention may be drawn away somewhat by a focus on more affective metacognitive cues (JOIs).

It is possible that JOIs are not entirely cognitively neutral, such that focusing the reader's attention on affective responses to the material could potentially increase performance, which is a fruitful area for further research.

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