Age-Related Differences in Memory for Modified Words, Competitors, and Related Lures

Jaden Zinn, Hossein Karimi (Mississippi State University)

Introduction: Research on long-distance structural and referential dependency resolution has shown that modified noun phrases (e.g., *hungry bear*) are retrieved more easily from memory during sentence comprehension compared to unmodified counterparts (e.g., *bear*; [7, 9]). Though there are several potential mechanisms underlying this effect, one of the most popular explanations is that modifications result in complex and semantically distinct noun representations [6, 11]. Previously, the modification benefit has only been shown for long-distance dependency resolution within sentences, where retrieval is almost immediate. Given semantic richness has been shown to improve word recognition [3, 10], one could expect that the benefit may endure to long-term memory. Further, because the modification benefit is thought to act through semantic distinctiveness and the semantic memory of older adults stays relatively constant across the lifespan [1, 12], the benefit may persist into old age. To the extent that it does, it may also buffer against inhibition deficits classically seen in older adults [4].

Method: Sixty-six younger adults and fifty-seven older adults, all native English speakers, engaged in a self-paced reading task where they read 60 critical sentences containing modified or unmodified target nouns (e.g., *It was the [hungry and injured] bear that the hunters chased in the cold forest*). Each experimental list also included 100 fillers. Immediately after the experiment was over, participants completed a surprise recognition memory task where they had to make a binary choice about 300 words as to whether there were “Old”, meaning they had seen them in any of the sentences they had just read, or “New”, meaning that they had not seen them during reading. The memory words could either be the target (*bear*), a competitor which had been in the same sentence as the target (*hunters*), and three lures that were either semantically related to the target (*moose*), phonologically/orthographically related to the target (*beer*), or unrelated to the target (*screw*). Manipulation checks to confirm the validity of our semantically and phonologically related stimuli were done using word vectors and Levenshtien distances, respectively. Moreover, none of the memory words were present in any of the fillers.

Results: We used a logistic mixed-effects regression model to analyze raw recognition accuracy for target and competitor words, with age, modification, word type, and their interactions as fixed effects, while allowing for random slopes and intercepts for participants and items. Results in Table 1 show that modifications enhanced memory accuracy for the target and reduced accuracy for the competitor (Figure 1). To analyze recognition data for target words versus the lures, we used d-prime as the dependent variable to control for response bias that can differ across age [5, 2]. Results in Table 1 show that older adults were less likely to distinguish targets from semantic lures (Figure 2), while modifications led both age groups to better distinguish targets from phonological lures (Figure 3). No other effects were significant.

Discussion: The results suggest that older adults are more susceptible to semantic interference, which is consistent with the Inhibition Deficit Hypothesis [4], and that the modification benefit does not protect against it. Further, although semantic distinctiveness can explain the modification-induced retrieval benefit, modifications only prevented false memories for phonological lures, implying that modifications may result in more robust encoding of the surface form of associated nouns. Finally, the modification benefit for the target came at a cost for competitor words, offering support to models maintaining that extra activation for a memory item lowers activation for competing memory traces within the memory space [8].

Table 1. Significant Effects for Accuracy & D-Prime Analyses

Effect	*SE*	*t*	*p*
Raw Acc. - Target vs. Competitor			
Word Type	0.135	-2.919	0.004*
Word Type * Modification	0.097	-2.275	0.023*
D-Prime - Target vs. Semantic lure			
Age	0.052	-2.365	0.019*
D-Prime - Target vs. Phonological lure			
Modification	0.027	2.397	0.018*

References

[1] Cosgrove, Kenett, Beaty, & Diaz (2021). Quantifying flexibility in thought: The resiliency of semantic networks differs across the lifespan. *Cognition*, *211*, 104631. https://doi.org/10.1016/j.cognition.2021.104631 **[2]** Fraundorf, Hourihan, Peters, & Benjamin (2019). Aging and recognition memory: A meta-analysis. *Psychological Bulletin*, *145*(4), 339–371. https://doi.org/10.1037/bul0000185 **[3]** Hamilton, & Rajaram (2001). The concreteness effect in implicit and explicit memory tests. *Journal of Memory and Language*, *44*(1), 96–117. https://doi.org/10.1006/jmla.2000.2749 **[4]** Hasher, Stoltzfus, Zacks, & Rypma (1991). Age and inhibition. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *17*(1), 163–169. https://doi.org/10.1037//0278-7393.17.1.163 **[5]** Hautus, Macmillan, & Creelman, (2021). *Detection theory: A user's guide* (3rd ed.). Routledge. https://doi.org/10.4324/9781003203636 **[6]** Hofmeister (2011). Representational complexity and memory retrieval in language comprehension. *Language and Cognitive Processes*, *26*(3), 376–405. https://doi.org/10.1080/01690965.2010.492642 **[7]** Hofmeister, & Vasishth (2014). Distinctiveness and encoding effects in online sentence comprehension. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.01237 **[8]** Just, & Carpenter (1992). A capacity theory of comprehension: individual differences in working memory. *Psychological review*, *99*(1), 122. **[9]** Karimi, & Ferreira (2016). Informativity renders a referent more accessible: Evidence from eyetracking. *Psychonomic Bulletin & Review*, *23*(2), 507–525. https://doi.org/10.3758/s13423-015-0917-1 **[10]** Lau, Goh, & Yap (2018). An item-level analysis of lexical-semantic effects in free recall and recognition memory using the megastudy approach. *Quarterly Journal of Experimental Psychology*, *71* (10), 2207–2222. https://doi.org/10.1177/1747021817739834 **[11]** Nairne, (1990). A feature model of immediate memory. *Memory & Cognition*, *18*(3), 251–269. https://doi.org/10.3758/BF03213879 **[12]** Nilsson (2003). Memory function in normal aging. *Acta Neurologica Scandinavica. Supplementum*, *179*, 7–13. https://doi.org/10.1034/j.1600-0404.107.s179.5.x

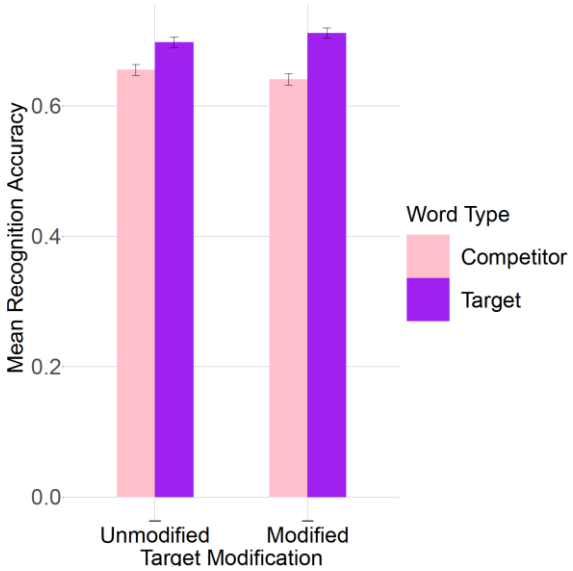

Figure 1. Recognition Accuracy for target words vs. competitors

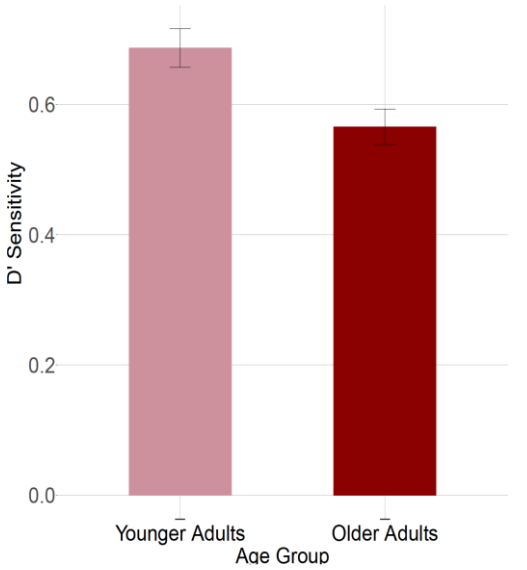

Figure 2. Recognition sensitivity for target words vs. semantic lures

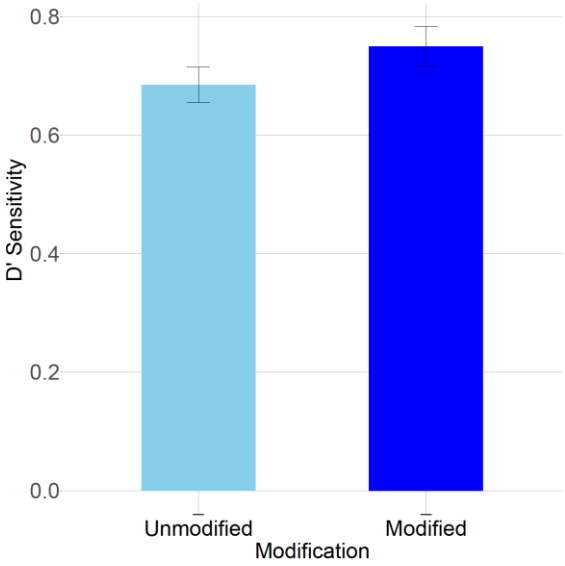

Figure 3. Recognition sensitivity for target words vs. phonological lures