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Verbal WM Capacities in Sentence Comprehension: Evidence from Aphasia

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Introduction

Sentence comprehension often requires the ability to link non-adjacent constituents. Studies with healthy individuals implicate an associative, direct-access mechanism in this operation (McElree et al, 2003), which has been taken as evidence against a role for working memory capacity in comprehension. However, prior studies with aphasic patients support a role for semantic (but not phonological) STM in maintaining word meanings prior to integration (Martin et al., 1994). A recent study with healthy young subjects found evidence for a role for semantic but not phonological STM in resolving interference from semantically related nouns (Tan et al., unpub.). Neither STM capacity was related to the ability to resolve syntactic interference, though reading span was related. The results were interpreted as suggesting separable capacities for maintaining semantic and syntactic information. The present study examines interference resolution in aphasic patients, who show dramatic variation in their semantic and phonological STM capacities.

Method

Semantic and syntactic interference were manipulated in a 2 x 2 design, varying the semantic plausibility of the intervening noun as the subject of the main verb and varying the syntactic role of the intervening noun (subj vs. obj; cf. Van Dyke, 2007). Both manipulations increase the difficulty in linking the head noun to the main verb.
Example (Semantic manipulation in brackets):
LoSyn: The jockey who had challenged the unbeatable [record/champion] yesterday will win.
HiSyn: The jockey who claimed that the [record/champion] was unbeatable yesterday will win.

Ten aphasic patients with varying semantic and phonological STM capacities and seven controls were assessed on whole sentence reading times and on time and accuracy to answer comprehension questions (e.g. Will the jockey win?“). Interference effects were calculated as difference scores for RT and accuracy for low vs. high interference conditions.

Results and Discussion

For log reading times, the semantic and syntactic interference effects for each patient were within control range. For comprehension accuracy, a significant correlation was obtained between patients' semantic STM span and the size of the semantic interference effect, $p = .03$. However, correlations between phonological STM and semantic interference were not close to significance nor were there

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any correlations between syntactic interference effects and either semantic or phonological capacity. (See Figure)

The results indicate that semantic STM supports the ability to resolve semantic but not syntactic interference, and phonological STM is not critical for resolving either type of interference. These results suggest that individuals vary in the decay rate for different types of verbal information. Poor maintenance of semantic information leads to difficulties in resolving semantic interference.

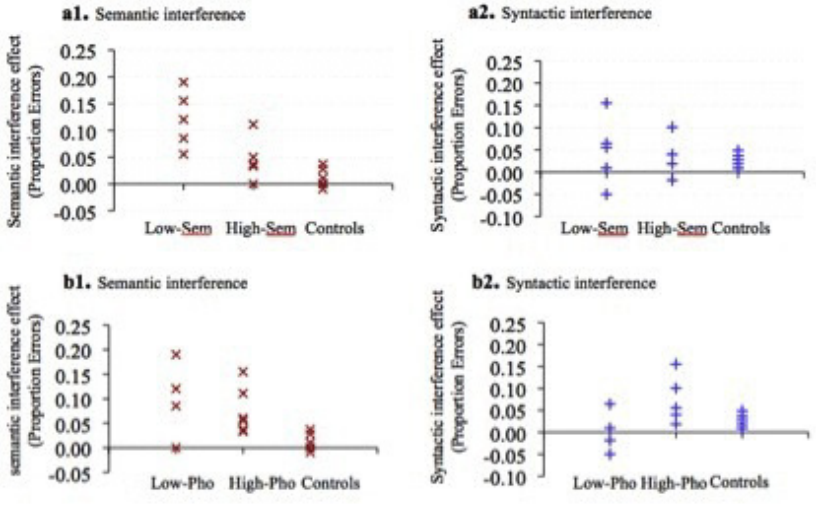

Figure 1. Semantic and syntactic interference effects for accuracy of comprehension question. a1. Semantic error effects in low semantic STM span group and relative high semantic STM span group. a2. Syntactic error effects in low semantic STM span group and relative high semantic STM span group. b1. Syntactic error effects in low semantic STM span group and relative high semantic STM span group. b2. Syntactic error effects in low syntactic STM span group and relative high semantic STM span group.

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