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The Importance of Distinguishing Item and Order Memory for Understanding Short-Term Memory Deficits in Brain-Damaged Patients

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Introduction

Selective verbal short-term memory (STM) deficits are rare and are often associated with a history of aphasia, raising doubts about the selectivity of these deficits. We explore here the distinction between STM for item information (the items and their phonological and semantic characteristics) and STM for order information (the order of items within a list) to separate STM and language impairment. Recent models of STM consider that STM for item information depends upon activation of the language system (Majerus & D'Argembeau, 2011), and hence item STM deficits should be associated with language impairment. By contrast, STM for order information is considered to recruit a specific system, distinct from the language system. Hence, order STM should be impaired in patients with language-independent STM deficits. We applied this rationale to the exploration of STM profiles of two patients with a history of aphasia, MB and CG.

Methods & Results

At the time of this study, patient MB showed poor digit and word STM spans associated with a mild impairment at the level of phonological input processing. Patient CG showed poor STM spans with no residual language impairment.

A first experiment assessed STM for order and item information, using order and item probe recognition tasks. Patient MB showed severely impaired performance in the item condition ($Z=-4.71$; $p<.001$), but a milder deficit in the order condition ($Z=-2.17$; $p<.05$). CG, on the other hand, showed perfectly preserved performance for the item condition ($Z=-0.43$), but significantly slowed response times for the order condition ($Z=-2.20$; $p<.05$).

In a second experiment determining item and order error proportions in an immediate serial recall task for six-word lists, MB showed a significantly increased proportion of item errors ($Z=-3.24$ and -2.6 for positions 5 and 6, respectively; $p<.05$) but not of order errors ($Z=-1.47$), while CG showed perfectly preserved item recall ($Z=0.22$) but an increase of order errors, especially in final list positions ($Z=-2.57$ for position 6; $p<.05$).

A third experiment assessed reconstruction of serial order for digit lists, showing perfectly preserved performance in patient MB ($Z=1.32$) but severely impaired performance in patient CG ($Z=-3.49$; $p<.05$). A final experiment assessed new word learning performance, given that STM for order has been shown to be a critical

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determinant of vocabulary acquisition in children and adults. CG showed impaired new word learning performance in a paired associate word-nonword learning experiment ($Z=-3.29$; $p<.05$) but not in a word-word learning control experiment ($Z=0.13$), while MB showed a more general verbal learning impairment (word-nonword: $Z=-3.09$, $p<.05$; word-word: $Z=-4.8$, $p<.05$).

Discussion

This study provides the first demonstration of a dissociation between STM for order and STM for item information in patients with a history of aphasia, and further shows that patients with residual language impairment are more likely to present impaired STM for item information, which is considered to depend on the integrity of the language system. Order STM deficits, on the other hand, may represent what is commonly referred to as selective STM impairment, highlighting the importance of distinguishing between item and order STM processes when exploring STM deficits in persons with aphasia.

Reference

Majerus, S., & D'Argembeau, A. (2011). Verbal short-term memory reflects the organization of long-term memory: Further evidence from short-term memory for emotional words. *Journal of Memory & Language*, 64, 181-197.