Partially Unique Variance in Reading Accounted for by Working Memory and Semantic Priming

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Introduction

Despite the influence of Baddeley's (see Baddeley, 2001) multiple components model of working memory (WM), criticism has arisen that the estimated capacities of the storage systems are too small to explain complex learning and comprehension activities. Ericsson and Kintsch (1995) argued that highly practiced complex skills, including language comprehension, cannot be explained by traditional WM capacity limits. To accommodate this need, comprehension has been hypothesized to require the activation and immediate availability of long term-memory (LTM) nodes.

Such explanations have prompted the proposal of alternative models of WM that include immediate access to LTM elements that are available for processing but are not actively maintained by attention processes (e.g., Anderson, 1983; Cowan, 1995; Ericsson & Kintsch, 1995).

Measuring the portions of LTM that are in a state of increased availability has primarily taken the form of priming measures. It was hypothesized that measures of semantic priming would account for unique variance in reading beyond that accounted for by WM measures.

Method

Fifty four undergraduate students completed measures of priming, reading comprehension and WM. Priming was measured using a semantic priming comparison task (Woltz, 1990). The task required participants to determine if two presented words were synonyms or not. The first presentation of a word meaning was the prime and the second the target. The 24 trials included twelve primes and twelve targets. Participants completed seven blocks of trials counter balanced across subjects.

The reading tasks were designed to task participants' attention-driven WM capacity. This task presented participants with nine passages each seven to 12 sentences long. After completing each passage the participants answered four multiple choice questions regarding the passage. Passages included either a list of characters or items that must be remembered to complete the multiple choice question correctly. Working memory was measured using the ABCD WM task (Kyllonen and Christal, 1990).

Results and Discussion

All three tasks correlated significantly with one another. In the regression analysis, ABCD WM was entered first followed by priming. In reading, ABCD WM accounted for 17% of the variance (R^2 = 17.4, F (1,52) = 10.97, p <.01). Eight percent of the variance in reading accounted for by ABCD WM was unique variance, while the remaining 9% of the variance was shared with ALTM. Priming accounted for another 26% of the variance in reading (R^2 = 25.6, F (1,51) = 22.89, p <.01). Together, ABCD WM and priming accounted for 43% of the variance in reading (R^2 = 43.0 F (2, 51) = 19.24, p <.01).

The analyses support the theoretical view that complex cognitive tasks require processing limits beyond the empirically derived limits of attention driven WM. Another important implication of the current analysis is that individual differences in the availability of LTM play a significant role in comprehension. Individual differences in availability of LTM information account for a large amount of variance in reading comprehension. This finding is compatible with theories of comprehension that include the availability of background knowledge as an integral portion of the comprehension process (e.g., Ericsson & Kintsch, 1995).

References

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