The role of memory resources during language processing: data from ERPs and oscillations

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Previous psycho and neurolinguistic literature has highlighted the role of verbal working memory during on-line sentence processing, such that variation in individual memory abilities modulates (aka decreases) the typical neurophysiological signatures observed during semantic (N400) and grammatical (P600) sentential processing (Kin et al.. 2018).

The goal of the present study was to move forward from a correlational approach and explicitly manipulate verbal working memory. Two groups of monolingual English speakers participated. For both groups the task consisted of a sentence processing task in which participants saw sentences presented one word at the time on the screen (for 300ms per word + 300ms ISI). Sentences were presented in three conditions: 1) correct ("The cat drinks the milk"); 2) semantically incorrect ("The cat drinks the shoe"); 3) grammatically incorrect ("The cat drink the milk"). Participants' task was to read each sentence, and perform an end of the sentence acceptability task by button press. Critically, one group performed the task without any external memory load (n=14), while the other group performed the task with a concurrent memory load. More specifically, participants in the memory group were shown three words before each sentence and were required to monitor their presence, and press a button every time they saw one of the words. In addition, they were randomly asked to recall is one of the three words was present (or not) in the sentence.

We predicted that if taxing verbal working memory capacities during on-line sentence processing changes the neurophysiological signature of sentential processing, we should observe a relative reduction of the typical P600 and N400 components. Our results support these predictions, in that the data show a significant reduction in mean amplitude for both components in the memory load group (see Figure 1 and 2 on next page). While the ERP portion of the data analysis is completed, we are currently finalizing the analysis looking at changes in the oscillatory signature. Following previous data from our lab, we predict that the oscillatory behavior of the memory group will show a decrease in alpha and beta oscillations.

References

Kim, A. E., Oines, L., & Miyake, A. (2018). Individual differences in verbal working memory underlie a tradeoff between semantic and structural processing difficulty during language comprehension: An ERP investigation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *44*(3), 406.

Figure 1: The P600 effect in the no memory group (black line) and memory group (red line)