

**Title:** The Effect of Task on Sentence Processing in the Language and Multiple Demand Brain Networks

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**Abstract:**

How do tasks interact with a person's ability to interpret language? What role does language have in other high-level cognitive functions? In order to successfully answer these questions, the effect of task on sentence processing must be investigated. The primary objective of this study is to determine how different tasks influence the activations in the brain during language processing. Additionally, this study was designed to dispel any lingering skepticism of using different tasks to localize the language system in the brain. In order to determine how language interacts with other cognitive functions, we focus on the language and multiple demand (MD) brain networks; the language system responds primarily to language, while the MD system responds to tasks that require high levels of cognition such as math, music, and logic.

Using fMRI, we collected the brain activity of thirty-one subjects for five different tasks. Subjects had to read either a sentence or sequence of nonwords, which are the two conditions, and then complete a task. Nonwords are pronounceable sequences of letters but are not words. The five different tasks are a button press, memory probe of any word ('was this word in the preceding sentence?'), memory probe of the last word ('was this the last word in the preceding sentence?'), yes/no comprehension question after reading a sentence, and a judgement of the sentiment of a sentence ('was the overall meaning of the sentence positive or negative?'). The first three tasks and the last two tasks are matched on the number of words presented. All but one of subject completed at least three tasks, and fourteen completed all five tasks.

In the analysis of the brain activations, we found that the language system responds consistently higher to the sentence than the nonword condition. In addition, tasks with more linguistic input (i.e. more words) elicited a stronger response. Critically, the same regions of the brain respond to the sentence condition regardless of the task and the activation patterns in these regions are highly correlated with each other across the different tasks. In contrast to the language system, only the cognitively demanding tasks elicited a strong activation in the MD system. The passive reading task with a button press evoked little to no activation in the MD system. Overall, these results elucidate the interaction between language and cognition.