Previous evidence suggests that the content words in initial phrases are planned at a lemma level prior to speech onset (Smith & Wheeldon, 1999), supporting a phrasal scope of planning. To the extent that phrasal planning draws on working memory resources, one would predict that the greater the number of content words in phrases, the greater the working memory load. The present study manipulated the hypothesized demands on working memory by varying the number ofprenominal adjectives (e.g., “new cup,” “new blue cup”) in an utterance. Phrase production was compared to the production of corresponding copular sentences (e.g., “the cup is new,” “the cup is new and blue”). As the sentences had only one content word in the initial phrase, greater demands on working memory for the initial phrase would be predicted for the phrasal versions. Moreover, even though the longest sentences contained two adjectives in the predicate adjective phrase, the corresponding phrasal versions contained two adjectives and a noun in one phrase. Thus, the maximal load per phrasal planning unit was always higher in the phrasal conditions. Importantly, greater lexical-semantic load for the phrase conditions contrasts with syntactic complexity, which would arguably be higher for the sentence conditions.

Phrase vs. sentence production was examined in brain-damaged patients with reduced short-term memory capacity and in an fMRI study using healthy student subjects. In both, single pictures were presented and participants were trained on the relevant adjectives to produce. One adjective dimension was color. The second was specific to particular objects (e.g., “open” vs. “closed” for “book” and “curtain”; “empty” vs. “full” for “basket” and “pitcher”). The one- and two-adjective phrase and sentence conditions were presented in a blocked fashion. Two non-fluent aphasic patients (ML and AR) with reduced lexical-semantic STM capacities were tested. Both showed lower accuracy in the phrase than sentence conditions (ML: 67% vs. 83%; AR: 77% vs. 89%) and longer onset latencies for the first content word in the phrase than sentence conditions (ML: 5698 vs. 4133 ms; AR: 6900 vs. 4170 ms). In addition, AR showed a significantly greater rate of pausing for the phrases (95% of utterances) than for the sentences (58%).

Ten students were tested in the fMRI study. They were scanned during the production of nouns, adjectives, phrases, and sentences. In a contrast comparing activation in the word vs. phrase vs. sentence conditions, the largest region of activation was in the left middle and left inferior frontal gyrus, centered in Brodmann’s area 46 (a region included in the patients’ lesions). Greater activation was seen in this region for the phrase than the sentence condition and in the phrase than the word condition, but there was no significant difference between the sentence and the word condition.

The results provide additional evidence consistent with a phrasal scope of planning and with a role for verbal working memory in maintaining content words during this planning. The fMRI data support this conclusion and further suggest that a left inferior/left middle frontal brain region supports this maintenance.

Reference