Noun Phrase Complexity vs. Word Retrieval Fluency in Sentence Production: Further Evidence for a Phrasal Scope of Planning

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INTRODUCTION

In research on the scope of planning in sentence production, some researchers have argued for a phrasal scope of planning whereas others have argued for incremental, word-by-word planning.

Smith and Wheeldon (1999) provided evidence for a phrasal scope of planning in a moving pictures paradigm. Subjects produced sentences with the same words, but varied on the initial noun phrase complexity. Subjects were about 70-100 ms slower to begin producing the complex-simple sentences than the simple-complex sentence.

Complex-simple: "The fork and the kite move above the dog"
Simple-complex: "The fork moves above the kite and the dog"

In contrast, Griffin (2001) found that gaze durations and onset latencies were affected by manipulations of the first, but not the second, picture when producing a complex-simple sentences. However, Griffin (2003) found longer onset latencies in a two-noun utterance if the first noun was monosyllabic than if it was multisyllabic. She attributed this to the desire to maintain fluency once speech began. Planning was thus unrelated to phrasal structure.

Smith and Wheeldon's results might be due to the desire to maintain fluency. Speakers may begin speaking sooner on simple-complex sentences because the second content word is easy to retrieve, being uttered many times. In contrast, in the complex-simple case, the second content word is a noun that varies and thus is more difficult to retrieve. Thus ease of retrieval of the second content word, rather than phrasal scope, may be the source of the effect of complexity of the first noun phrase.

Martin and Yang (2003) provided evidence in favor of the phrasal scope account. They showed the complexity effect persisted in the moving pictures paradigm when controlling retrievability by having the subjects produce "yellow" before the second noun and by varying the verb.

However, aspects of the design of the Smith & Wheeldon and Martin & Yang studies may be problematic: 1) the movement of the two pictures in the complex-simple sentences may have caused some interference in focusing on the left object to begin an utterance, and 2) the displays were removed shortly after speech onset, which may have unduly encouraged a greater than normal planning scope.

EXPERIMENT 1

Retrieval Fluency

Experiment 1 was intended to address the retrieval fluency hypothesis while controlling for the possibly problematic aspects of the design of Martin & Yang (2003). Stationary displays were used which remained on the screen until the utterance was complete. As in Martin & Yang, in one version, subjects were presented with displays which were uncolored (Figure 1A). In another version, the middle object was colored yellow (Figure 1B). If retrieval fluency is the source of the phrasal complexity effect, it should be reduced or eliminated in the version with the yellow object.

Figure 1A

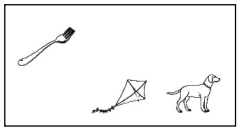
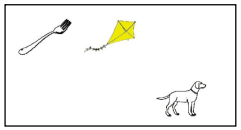


Figure 1B



Methods

12 Rice University undergraduate students participated in the standard version and 12 in the yellow version. Subjects were presented with displays varying complexity (complex-simple, simple-complex) and displacement (up-down, down-up). Subjects were instructed to describe the displays from left to right, producing sentences such as:

Standard Version:
"The fork **is above** the kite and the dog"
"The fork and the kite **are above** the dog"

Yellow Version:
"The fork **is above** the yellow kite and the dog"
"The fork and the yellow kite **are above** the dog"

There were 96 experimental trials (half using "above" and half "below") and 48 filler trials. In filler trials, three pictures appeared at the top/bottom/right/left of the screen in a row and subjects produced sentences such as "The fork, kite, and dog are all at the top/bottom/left/right." Subjects saw each triplet in both a simple-complex and complex-simple version.

Results

Onset Latencies

	Standard	Yellow
Complex-simple	1109	1115
Simple-complex	1076	1068
Difference	33	47

The complexity effect was significant in both the standard ($t_1(11) = 2.29$, $p = 0.042$; $t_2(47) = 2.53$, $p = 0.015$) and yellow versions ($t_1(11) = 2.91$, $p = 0.013$; $t_2(47) = 3.28$, $p = 0.002$). There was no interaction between the size of the effect and version (F (1, 22) = 0.45, $p = 0.510$). If anything, the effect was somewhat larger in the yellow version.

The results support the phrasal scope hypothesis, rather than the word retrieval fluency account.

EXPERIMENT 2

Visual Configuration

Even though Experiment 1 sought to control possible grouping effects from movement by using stationary displays, visual grouping of the pictures within a phrase due to their being aligned horizontally could still affect utterances. The second object might be more visible and thus cause more interference when it is on the same level (as in complex-simple) than when it is offset (as in simple-complex). Experiment 2 was intended to test possible onset latency effects from the visual configuration by contrasting naming the pictures with producing sentences to the configurations.

Methods

12 Rice undergrads participated in the naming version and 12 in the sentence version. Subjects saw the same kinds of displays as in Experiment 1, but in one version they simply named the pictures from left to right, while in the other version the subjects produced sentences as in Experiment 1. There were 128 experimental trials and 64 filler trials.

Results

Onset Latencies

	Sentence	Naming
Complex-simple	1199	1255
Simple-complex	1137	1251
Difference	62	4

In the sentence version, the complexity effect was large and significant (($t_1(11) = 4.93$, $p < 0.001$; $t_2(47) = 5.14$, $p < 0.001$), whereas it was negligible and non-significant in the naming version ($t_1(11) = 0.09$, $p = 0.933$; $t_2(47) = 0.27$, $p = 0.787$). The interaction between the complexity effect in the sentence and naming versions was significant ($F(1, 22) = 8.05$, $p = 0.01$). The findings indicate that visual configuration was not the source of the phrasal complexity effect.

CONCLUSIONS

The results from Experiment 1 indicate that the effect of phrase complexity was not due to retrieval fluency, or to the potential experimental artifacts of movement and forcing subjects to plan ahead. The results from Experiment 2 indicate that the configuration of the pictures did not lead to the effect either. The results from both of these experiments support a phrasal scope of planning in sentence production.

References

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