More Than Words: The Effect Of Multi-Word Frequency And Constituency On Phonetic Duration

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There is mounting evidence that language users are sensitive to the distributional properties of multi-word sequences [e.g.,1,2]. Such findings undermine the traditional distinction between stored and computed forms and call for processing models that can represent larger chains of relations. Previous findings suggest that production is sensitive to multi-word frequency: children show phonetic reduction for higher frequency phrases [3] while adults are more likely to omit material in more frequent linguistic contexts [4]. Here, we go beyond previous findings by asking if the effect of multi-word frequency on phonetic duration is modulated by syntactic constituency. We show that (a) that multi-word statistics affect phonetic duration in adults in spontaneous speech, and (b) that the effect is not modulated by constituency: duration is shorter for higher frequency sequences within and across syntactic boundaries.

We looked at the effect of multiword frequencies and constituency on phonetic duration in spontaneous speech in two studies (both using the time-aligned portion of the Switchboard corpus). In the first study, we contrasted two three-word syntactic structures: (a) subject-auxiliary-verb sequences (e.g., *everybody was trying*) – which are not constituents (Marantz 1981), and (b) verb-determiner-noun sequences (e.g., *saw the boy*) -- which are constituents. If constituency plays a significant part in the retrieval and production of multiword sequences, we should see a smaller (or no) effect of frequency on the duration of trigrams in non-constituent sequences compared to trigrams in constituent sequences.

We removed sequences more of less than 2.5sds from the mean duration (N=2515 for constituents, N=2289 for non-constituent). We controlled for various phonetic and phonological variables (log(speaker-speech-rate), log(number-of-syllables), end-of-phrase) as well as for unigram and bigram frequencies. Trigram frequency emerged as a significant predictor regardless of constituency: phonetic duration was reduced in higher frequency sequences for both constituents (β=-0.004, $p < 0.01$) and non-constituents (β=-0.007, $p < 0.05$). In the second study – to ensure our findings were not limited to the two specific constructions used in Study 1 - we examined duration in a variety of three-word constituent and non-constituent structures all extracted from the same post-verbal position (e.g., *once a year* in *pruning once a year* vs. *this to you* in *doing this to you*). Using the same procedure as in Study 1, we again found that phonetic duration was reduced in higher frequency sequences regardless of constituency (constituents: β=-0.003,$p < 0.05$, non-constituents: β=-0.005, $p < 0.05$, and no interaction, $p > 0.6$).

This is, to our knowledge, the first study to systematically investigate the interaction of multi-word statistics and constituency. The findings show that sensitivity to surface distributions (multi-word frequency) is <u>not</u> affected by the higher order properties of the sequence in question (constituency). While the reported findings are limited to production, and may be driven by prosodic, rather than syntactic factors, they highlight speakers' sensitivity to multi-word frequency and open up a novel set of questions about the interaction between surface distributions and higher order properties, and the resulting need (or lack thereof) to incorporate higher order properties into processing models.

References

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