

Utterance planning and articulatory duration

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Variation in word duration can occur as a result of the speaker's communicative intentions, for example the need to emphasize or accent some words over others. At the same time, numerous findings suggest that word duration may vary as a function of the need to plan subsequent words. The timing of lexical planning can vary according to word length (Griffin, 2003). Word duration is lengthened when upcoming information is less predictable (e.g., Bell et al., 2009). These findings seem to suggest that speakers are doing at least some incremental planning. Other evidence suggests that the scope of planning is flexible (Wagner, Jescheniak, & Schriefers, 2010). We tested the hypothesis that variation in word duration is modulated by variation in the scope of planning.

Previous studies provide little evidence on this question. Ferreira & Swets (2002) argue that utterance duration is lengthened when the speaker experiences conceptual difficulty but only under time pressure to start speaking. Furthermore, on some accounts, e.g. Ferreira (2007), planning of upcoming material does not affect word duration. Our first goal was to find if individual word duration was adjusted because of planning difficulty. Our second goal was to test whether the timing of Word2 planning modulates this phenomenon.

We examined these questions in 3 two-picture naming experiments. We used an experimental paradigm that has shown evidence of a small scope of planning. Following Griffin (2003) we asked participants to name pairs of pictured objects from left to right without pausing. We manipulated the difficulty of the second word in terms of its frequency (High vs. Low). For example, the speaker would say e.g. *toaster giraffe* in the low frequency condition and *toaster chicken* in the high frequency condition. We predicted a lengthened Word1 when Word2 was low frequency. Would the extent of lengthening depend on the timing of Word2 planning?

In all experiments we measured speech initiation time and word duration; in Exps. 2 and 3 we also measured the right picture eye-voice span (e.g., Griffin & Bock, 2000). We analyzed the spoken word duration of word 1, depending on a) the frequency of the following word (word 2), and b) evidence of the extent to which word 2 was pre-planned, i.e. speech onset time and eye-voice span. In mixed effects regression models we controlled for variables that can influence word duration (sex, number of syllables, pause duration). We also excluded utterances with pauses longer than 200ms.

Results from all experiments show that Word1 is lengthened when Word2 is difficult, whereas speech onset time does not change. Experiment 2 and 3 provide evidence that the scope of planning modulates the degree of Word1 lengthening. Trials with pre-speech looks to the right object had shorter Word1 duration than those with post-speech looks. This effect was stronger in the high frequency than low frequency condition.

Our results suggest that speakers use relatively longer Word1 durations according to two scenarios: (1) when they cannot estimate Word2 planning difficulty because they never looked at the right object pre-speech, (2) when they can estimate Word2 planning difficulty because they looked at the right object pre-speech, and Word2 is difficult to plan. Both scenarios provide evidence that word duration is modulated by the scope of planning.

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