

Prosodic Phrasing and Function Word Pronunciation

Celeste Kidd (ckidd@bcs.rochester.edu)

T. Florian Jaeger (fjaeger@bcs.rochester.edu)

Department of Brain & Cognitive Sciences, University of Rochester
Rochester, NY 14627 USA

Abstract

Recent studies have revealed an intriguing link between redundancy and reduction: Words that are more predictable in their context are more commonly reduced (shorter and with less articulatory detail [1,2,3]). These studies have, however, also found a puzzling asymmetry. Content words are reduced when predictable given the previous word, but function words are reduced when predictable given the *following* word. We present evidence that this asymmetry may be an artifact of prosodic phrasing. We propose that once prosodic phrasing is accounted for, reduction may be attributed to three underlying causes: *redundancy avoidance* (predictable words are reduced), *strategic lengthening* before unavailable material, and joint storage and retrieval of *collocations*.

Study 1 replicates the effect of previous studies. We use mixed linear models to analyze the effect of redundancy on 5,700 instances of “a” from a spontaneous speech corpus (SWITCHBOARD), while controlling for factors that influence reduction (speaker differences, speech rate, presence of hesitations or disfluencies, phonological context, etc.). As expected [1,2], only backward-predictability of “a” (1b)—not forward-predictability (1a)—reached significance.

Further analysis revealed that the apparent backward-predictability effect is predominantly driven by frequent collocations. Over a fifth of the tokens after “a” are part of collocations, as in “a lot of”, that co-occur with “a” more than 70% of the time. This holds for less than 0.5% of all tokens *preceding* “a”. As would be expected if frequent collocations are retrieved together, “a” is pronounced significantly shorter in those collocations. Removing highly frequent collocations from the data set weakened the backward-predictability effect considerably.

Study 2 tests whether the remaining effect of backward-predictability is an artifact of strategic lengthening before unavailable material. Here we model the availability of an upcoming word by its frequency and contextual predictability. We add two probabilistic measures of availability to the model: the frequency of the word following “a” and its trigram predictability (1c). The availability-trigram improves the model and subsumes backward-predictability (once collocations are accounted for, see above). Thus the apparent effect of backward-predictability [2] may be driven by strategic lengthening, where “a” is strategically lengthened before unavailable words. We hypothesize that function words are more likely to be subject to strategic lengthening than content words due to their phrase-initial position. This hypothesis is consistent with the observation that word repetitions (“the, the, the...”) and filled pauses (“uh”, “um”) most often occur at phrase onsets [4].

If prosodic phrasing reflects (or is identical with) units of syntactic planning, strategic lengthening would be expected to occur at the onset of prosodic phrases. We are in the

progress of explicitly testing this hypothesis for our data. (Approximately 12% of the corpus used contains prosodic accent and phrasing annotation.)

In conclusion, the apparent asymmetry between the reduction of function and content words points toward a model of word pronunciation that unifies work on redundancy avoidance and strategic lengthening.

Examples

(1) **PRECEDING “a” FOLLOWING**

Your argument is pretty flimsy for a couple of reasons.

(1a) **Forward-predictability measure:** $\log P(a \mid \textit{for})$

(1b) **Backward-predictability measure:** $\log P(a \mid \textit{couple})$

(1c) **Availability-trigram measure:** $\log P(\textit{couple} \mid \textit{for a})$

References

- [1] Bell, A. et al. (2003). Effects of disfluencies, predictability, and utterance position of word form variation in English conversation. *Journal of the Acoustical Society of America*, 113(2), 1001-1024.
- [2] Pluymaekers, M., Ernestus, M., & Baayen, R. (2005). Articulatory planning is continuous and sensitive to informational redundancy. *Phonetica*, 62, 146-159.
- [3] Aylett, M. & Turk, A. (2004). The smooth signal redundancy hypothesis: A functional explanation for relationships between redundancy, prosodic prominence, and duration in spontaneous speech. *Language and Speech*, 47(1), 31-56.
- [4] Fox Tree, J. & Clark, H. (1997). Pronouncing "the" as "thee" to signal problems in speaking. *Cognition*, 62, 151-167.