

Cognitive Effort Influences Acoustic Prominence: The Impact of Memory Resources
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For every word uttered, speakers must decide how acoustically prominent it should be, as realized through features like duration, pitch, and intensity. This choice has been linked to meaningful distinctions like whether the referent has been previously mentioned or is salient in the preceding discourse (e.g., Bard & Aylett, 1999; Dahan et al., 2002). Acoustic prominence can also indicate accent, which can signal the focus structure of the utterance (e.g., Ladd, 1996).

An alternate view suggests that acoustic prominence is not entirely driven by meaningful properties of the message, but rather is also influenced by speaker-internal processing constraints. For example, speaker disfluency (which occurs when production is effortful) co-occurs with longer durations on surrounding words (Bell et al., 2003). However, disfluency itself is correlated with discourse properties that have been linked to variation in acoustic prominence, like previous mention of the word (Arnold & Tanenhaus, in press). This raises questions about whether acoustic prominence also varies with nonlinguistic sources of cognitive effort.

We test this question by manipulating memory load (0, 2, or 3 digits to be recalled), while speakers performed a referential production task. Speakers viewed a two-panel cartoon about either one (e.g., Mickey) or two characters (e.g., Mickey and Daisy). They heard and repeated the first line of a story, and generated a second line based on the second panel of the cartoon. The experiment was designed to test the speaker's lexical choices for referring to the main character (pronoun vs. name). As predicted, speakers produced more pronouns in the no-load condition than under memory load.

Here we used *Praat* to examine those items where speakers used names to assess the effect of memory load on word duration, as one measure of acoustic prominence. The discourse context was controlled by limiting our analysis to the two-character condition (where names were common). The results were normalized through a log transformation and submitted to a mixed model with both subjects and items as random effects, including the factors memory load (load vs. no load), speaker digit span; target word (e.g., Mickey, Daisy), and length of utterance, as well as control variables (list, sequence in experiment, block; order of the load conditions across blocks).

Results revealed a significant effect of load, where names tended to be shorter in the no-load (325 msec) than load conditions (335 msec). We also found that durations were longer in the context of longer utterances, where planning and production processes are likely to be more effortful. These results join a growing set of findings that cognitive effort affects acoustic prominence (see also Christodoulou & Arnold, 2007; Watson et al., in press). These findings raise questions about whether the acoustic prominence that occurs in conditions of low referent accessibility or linguistic focus may be in part the result of increased effort in these conditions, and emphasize the need to take effort into account in the meaningful interpretation of acoustic prominence.

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