Two experiments explore whether the lexical meaning of a word influences its acoustic-phonetic realization. It is known that extra-linguistic meaning, such as the emotional state of the speaker, can influence the prosody of a production [1]. We explore whether this effect extends beyond extra-linguistic meaning to lexical meaning, with the goal of gaining insight into the architecture of the language production system.

Recent evidence has demonstrated that meaning can influence prosodic form in ways that go beyond typical effects of pragmatics and discourse [2, 3]. For example, in one study [2], participants’ descriptions of a moving dot were shorter when the dot moved quickly, suggesting that the speed of the dot influenced the acoustics of the description. This suggests that message-level meaning can influence the dynamics of articulation.

Here, we explore whether these effects extend to lexical semantics. If the meaning of a word influences its acoustic-phonetic realization, then we might expect words like “yelling”, whose meaning is associated with high vocal effort, to be more forcefully articulated than words like “chatting”, whose meaning is associated with lower vocal effort.

In Experiment 1 (N=36), participants read aloud words that were semantically related to vocalization but differed in the associated amount of effort (e.g. “yelling” and “chatting”). Acoustic measures that correlate with acoustic prominence (i.e. F0, intensity, and duration) were analyzed using a mixed effects linear model with subject and item as random intercepts. Word frequency and length were also included in the model as controls. Reliable differences were obtained for Minimum F0: as predicted, high-effort vocal words were produced with greater Minimum F0 (M=146.90 Hz) than low-effort vocal words (M=138.38 Hz; p<0.05).

This result suggests that the amount of effort associated with the semantics of a word contributes to the activation of articulatory representations. The situated cognition literature suggests that perceptual experiences are simulated in corresponding motor representations [4]. This predicts that lexical semantics will only activate motor representations related to the meaning of the word. If true, words that have no vocal effort associated with their meanings should not activate articulatory representations and should be produced less prominently than vocalization words.

In Experiment 2 (N=63), participants read aloud words associated with vocalization (e.g. “yelling”) and words associated with foot motor activity (e.g. “kicking”). Reliable differences were obtained for Intensity: as predicted, foot-related words (M=51.57 dB) were produced with less intensity than vocalization words (M=53.95 dB; p<0.01). Furthermore, we subdivided the vocalization words into low- and high-effort words: low-effort vocalization words were produced with greater intensity than foot-related words, but with less intensity than high-effort vocalization words (Fig. 1).

Together, these data suggest that the lexical semantics of a word influences its acoustic-phonetic realization.
acoustic-phonetic realization. This suggests either that there are direct connections between message-level processes and articulation or that semantic features are passed from the message level through the production system to be interpreted at articulation. Critically, both possibilities require modifications to current models of language production.

References: