

Prosodic influences on acoustic correlates of lexical stress in Kuwaiti Arabic

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Much of the research on the acoustic correlates of lexical stress in stress-accent languages has focussed on Germanic languages like English and Dutch (Sluijter & van Heuven, 1996). While Arabic shares a similar stress-accent system, it is unknown how the presence of phonological length in Arabic may constrain the duration and loudness cues that typically interact with lexical and prosodic structure. Stress in Arabic is phonetically implemented through articulatory and acoustic strengthening of heavy, strong, syllables (Watson, 2002). We address the potential use of duration and correlates of loudness, spectral emphasis and overall intensity, in Kuwaiti Arabic by examining speech production data from the IVAr corpus (Hellmuth & Almbarak, 2019), collected from 12 speakers, focusing on read sentences. We consider potential lexical and prosodic influences on the use of duration and loudness. First, Kuwaiti Arabic, like other Arabic dialects, may constrain the use of duration for stressed short vowels (e.g., Vogel et al., 2017), since extra duration may compromise their phonological length; thus, loudness cues may compensate for the weak durational lengthening. Second, prosodic word boundaries are widely reported to interact with lexical stress, leading to greater durational lengthening (White & Turk, 2010); however, it is unknown whether word boundary may also boost loudness. Lastly, either duration or loudness could be exaggerated at the phrase-level accents, thus, the effect of pitch accents was accounted for in our study. Bayesian linear mixed effects analyses showed compelling evidence for a role of duration in lexical stress contrast, for both stressed long and short vowels, but not for loudness cues, suggesting different phonetic implementation of lexical stress than Germanic languages. Phrasal accents showed strong lengthening effects of stressed long vowels but weak effects for stressed short, while overall intensity only influenced stressed short vowels, potentially compensating for the weak accentual lengthening. Phrase-final boundaries showed strong lengthening of long vowels only, and word-level boundaries showed no lengthening effects. Stressed and unstressed vowels in word-final position tended to have higher loudness levels than non-final vowels, while phrase-final position was associated with lower loudness levels, potentially serving as a cue for different prosodic boundary levels. These results suggest that distinct acoustic patterns function as robust cues to signal the various levels of the prosodic structure in Kuwaiti Arabic and interact with word level phonological length contrasts.

References

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