Effects of prosodic structure on the relative timing of articulatory movements in English laterals

The production of /l/ by most American English speakers involves both raising of the tongue tip and retraction of the tongue dorsum (Giles and Moll, 1975). Research has shown that speakers produce coda /l/s with asynchronous articulator movement – tongue dorsum retraction systematically precedes tongue tip raising. However, these studies are inconsistent in their findings with respect to initial laterals – some data show synchronous gestures in initial /l/s (Browman and Goldstein, 1995), and others show that they are asynchronous (Sproat and Fujimura, 1993).

Some speaker-oriented accounts of speech production predict that, for efficiency, speakers organize articulator movement such that gestures forming tight constrictions are more likely to be located towards syllable edges, while those forming relatively open constrictions are more likely to be located towards the syllable center (Lindblom, 1983). Under this model, tongue tip raising should precede tongue dorsum retraction in syllable-initial /l/. Conversely, it has been suggested that perceptual recoverability of information vital to identifying syllable-initial multi-articulator sonorants is best when the gestures involved in their production are produced in synchrony (Gick et al., 2006). A listener-directed account of /l/ production therefore predicts that the gestures in initial /l/s should be produced simultaneously.

This study assesses relative timing relations between articulator movement in initial /l/s by varying the duration of the laterals. This speaker-oriented model predicts, all else being equal, an increase in duration of the /l/ should be accompanied by an increase in temporal distance between the two movements. On the other hand, the perceptually-based account predicts that the movements should occur synchronously, across the board. Here, prosody is used to manipulate lateral duration. Fougeron and Keating (1997) and Keating (2006) have shown that, for speech sounds produced with a single articulator, movement is larger both spatially and temporally at onsets of larger prosodic units. Thus, moving up the prosodic hierarchy, the speaker-oriented model outlined above predicts greater gestural asynchrony, while the listener-oriented approach predicts greater synchrony.

Data in this study are being collected by ultrasound imaging of speakers’ tongues during production of sentences containing initial /l/s at six levels of prosodic strength: utterance initial and final, phrase initial and final, and word initial and final. Data from two speakers has been analyzed to date, and is consistent with previous findings for syllable-final laterals – tongue tip raising followed tongue dorsum retraction, and the amount of delay is greater utterance-finally than word-finally. Additionally, tongue tip raising either precedes or occurs close to simultaneous with tongue dorsum retraction in syllable-initial position. However, these speakers behave differently with respect to the effects of prosodic position, though the data is consistent within speaker. While one speaker produced /l/s with more gestural synchrony in higher prosodic positions, the other produced /l/s in higher prosodic positions with more gestural asynchrony. These differences suggests that at least some speaker strategies may be speaker-specific: the second speaker’s data supports a speaker-oriented approach while the first speaker’s data is more consistent with a listener-oriented strategy, possibly at the expense of articulatory efficiency.
References


