This study examines the articulatory robustness of secondary dorsal /Cʲ Cˠ/ contrasts in Irish, across different word/syllable positions, using ultrasound imaging. We find that /Cʲ Cˠ/ contrasts are more articulatorily distinct in onset position than in coda position, and speculate that syllable-based differences in the articulation of /Cʲ Cˠ/ may help explain why /Cʲ Cˠ/ contrasts are preferentially realized in onset position across languages.

Every consonant in Irish is either contrastively palatalized /Cʲ/ or contrastively velarized /Cˠ/. These /Cʲ Cˠ/ contrasts occur both word-initially and word-finally (1). Word-final /Cʲ Cˠ/ contrasts can also mark morphosyntactic distinctions, such as plural vs. singular inflection (2).

(1) /bʲɔːnˠ/ ‘peak’ /bˠɔːnˠ/ ‘white’
/pʲɔːnˠ/ ‘pen’ /pˠɔːnˠ/ ‘pawnshop’
/bˠrˠɔːdʲ/ ‘neck’ /bˠrˠɔːdˠ/ ‘drizzle’
/sˠkˠɔːlʲ/ ‘shadow’ /sˠkˠɔːlˠ/ ‘supernatural being’

(2) /kˠatʲ/ ‘cats’ /kˠatˠ/ ‘cat’
/bˠɔːdʲ/ ‘boats’ /bˠɔːdˠ/ ‘boat’

Work on the typology of /Cʲ Cˠ/ contrasts has shown that such contrasts are more susceptible to loss in word/syllable-final position [1, 2], particularly for labials. Word-final /Cʲ Cˠ/ contrasts seem to be less perceptible than word-initial /Cʲ Cˠ/ contrasts in both Russian and Irish [3-6], possibly due to differences in the availability and robustness of acoustic cues in each of these contexts [7]. However, there is relatively little work examining possible articulatory bases for these perceptual asymmetries, and none on Irish. Kochetov [2, 8] found that the palatalization gesture of [pj] is reduced and differently timed in onset position compared to coda position. These articulatory differences may contribute to the perceptual and typological asymmetries noted above regarding /Cʲ Cˠ/ contrasts across word/syllable contexts.

Our study considers comparable contrasts in Irish. We test the hypothesis that sound changes affecting /Cʲ Cˠ/ contrasts, and the resulting typography, stem from patterns of articulatory reduction and coordination, likely working in tandem with perceptual asymmetries across syllabic contexts. Specifically, we expect that dorsal positions reflecting /Cʲ Cˠ/ contrasts will show less articulatory separation in coda (word-final) compared to onset (initial) contexts.

We’ve collected ultrasound data from 7 Irish speakers, representing all major dialects (Ulster, Connacht, Munster). We present data from 4 speakers here, and will analyze data from the remaining 3 speakers prior to the conference. Speakers uttered 5 repetitions of a list of C-initial and C-final Irish words. Target consonants were all stops (labial, coronal, velar), paired for secondary articulation (/Cʲ/ vs. /Cˠ/), syllabic position (onset vs. coda), and vowel context (adjacent to [iː], [uː], or [ɔː]). All target consonants were in word-initial stressed syllables; target onsets were always word-initial, and target codas always word-final. In each pass through the list, words were presented in random order, embedded in the carrier phrase [ˈdˠuːrtʲ ˈiːfˠə ___ əˈnˠuˠrə] ‘Aoife said ___ last year’. Ultrasound data was collected using a Terson T3000 ultrasound system with a model 8MC3 probe, mounted in an Articulate Instruments Ultrasound Stabilization Headset [9], at 60 frames/second. The tongue surface in these images was traced with EdgeTrak [10] (Fig. 1).
All three measures find that /Cʲ Cˠ/ contrasts are more widely separated in word-initial (onset) position than in word-final (coda position). This is especially true for labials and dorsals. Consonants show more coarticulation with neighboring vowels when in coda position; this is again especially true for labials. These observations hold whether we compare onsets vs. codas at C release, or instead compare onsets at CV transition with codas at VC transition. We conclude that typological asymmetries in the distribution of /Cʲ Cˠ/ contrasts are reflected in articulatory asymmetries in the production of these contrasts in the synchronic phonetics of Irish.

Fig. 1: tracings for [b'] in word-initial (left) vs. final (right) position adjacent to [u:], C offset.

Fig. 2: loess-smoothed comparisons; peak dorsal position; RMSSD measures (Csapó et al. 2017)

References