Prosodic encoding of focus and edge-prominence: an articulatory study of Seoul Korean

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It is well established that phrase-level prominence is marked by pitch events, namely *pitch accents* associated to phrase heads as in head-prominence languages and *boundary tones* associated to either or both edges of a prosodic unit as in edge-prominence languages [1]. Accumulated evidence shows that prominence is also encoded supra-laryngeally: articulatorily, gestures become *stronger*, i.e., longer, larger, and faster, under prominence (cf. [2]; see [3, 4] for Korean specifically). However, limited data, mainly from head-prominence languages, suggests that this articulatory strengthening does not simply correspond to a prominent vs. non-prominent distinction, but that it encodes focus structure instead, with the phonetic effects increasing not just from unfocused to focused units, but also – roughly – from broad focus to narrow focus, and then to contrastive focus [5, 6, 7, 8, 9]. Here, we expand this investigation to Seoul Korean, an edge-prominence language. In Korean, the focused linguistic unit starts an Accentual Phrase (AP) or a higher phrase [10, 11], with its initial gestures being longer, larger, and faster than their unfocused counterparts [4]. However, it is unclear whether focus types are phonetically differentiated from one another, and if so, whether a similar hierarchy of focus structure emerges as the one observed in head-prominence languages.

To address this question, an electromagnetic articulography study of Seoul Korean that controlled for focus type was conducted. As captured in Table 1, pairs of contextualizing and test sentences were used to yield the following five focus types in IP-medial target words: contrastive focus (CF); narrow focus (NF); broad focus (BF); unfocused post-focally with contrastive focus on a preceding word (UC); and unfocused post-focally with narrow focus on a preceding word (UN). The target prosodic words had either three (/mapu-lul/, /napi-lul/, and /katɕi-lul/) or five syllables (matɨritɨ-lul/, /namunulpo-lul/, and /katɕitɕʰiki-lul/) and represented three places of articulation word-initially. Data from 6 native speakers of Seoul Korean have been analyzed to date. Formation duration, displacement, and peak velocity of the initial consonantal gesture of the target words were measured. The retrieved data were analyzed in R by linear mixed effects analysis with *Focus Type* and *Word Length* as fixed factors and *Place of Articulation* and *Speaker* in the random structure.

A main effect of *Focus Type* was significant in formation duration ($F(4, 1456) = 91.4$, $p < 0.001$), displacement ($F(4, 1456) = 16.5$, $p < 0.001$), and peak velocity ($F(4, 1456) = 7.0$, $p < 0.001$). Figure 1 shows the results on each kinematic dimension on the left and schematizes the corresponding significant comparisons on the right. As Figure 1 illustrates, kinematic dimensions differentiated among focus types, and did not simply mark in-focus vs. out-of-focus linguistic units. However, dimensions differed in the number of focus types, and thus degrees of prominence they distinguished. Formation duration presented three degrees of prominence: CF, NF > BF > UN, UC (Fig. 1d). Displacement showed two degrees: CF, NF > BF, UN, UC (Fig. 1e). Peak velocity also distinguished two degrees, but with BF not being significantly different from either CF/NF or UN/UC (Fig. 1f). *Focus Type* did not interact with *Word Length*, and thus the latter factor is not addressed further here.

These results indicate that Korean encodes focus structure prosodically. Although kinematic dimensions do not show the same granularity, the hierarchical ordering of focus types remains the same, ranging from out-of-focus to broad focus and then to narrow and/or contrastive focus. These findings corroborate previous research in head-prominence languages (e.g., [5, 7, 9]), suggesting that a hierarchy of prominence might emerge from the interface of prosodic structure with focus structure and that this might be a property that holds across categories of prosodic typology.

Table 1. Sample stimuli sentences per *Focus Type* for target word /mapu-lul/. Target words are underlined and focused words are in bold.

Focus	Example sentences
CF	A: 'Did Minam visit the farmer?' B: mi.nam.i.ka **ma.pu.**lul paŋ.mun.he.sʌ Minam-NOM **horseman**-ACC visit-PAST 'Minam visited **the horseman**.'
NF	A: 'Who did Minam visit?' B: mi.nam.i.ka **ma.pu.**lul paŋ.mun.he.sʌ Minam-NOM **horseman**-ACC visit-PAST 'Minam visited **the horseman**.'
BF	A: 'What happened?' B: mi.nam.i.ka ma.pu.lul paŋ.mun.he.sʌ Minam-NOM horseman-ACC visit-PAST 'Minam visited the horseman.'
UN	A: 'Who visited the farmer?' B: **mi.nam**.i.ka ma.pu.lul paŋ.mun.he.sʌ **Minam**-NOM horseman-ACC visit-PAST '**Minam** visited the horseman.'
UC	A: 'Did Junseok visit the farmer?' B: **mi.nam**.i.ka ma.pu.lul paŋ.mun.he.sʌ **Minam**-NOM horseman-ACC visit-PAST '**Minam** visited the horseman.'

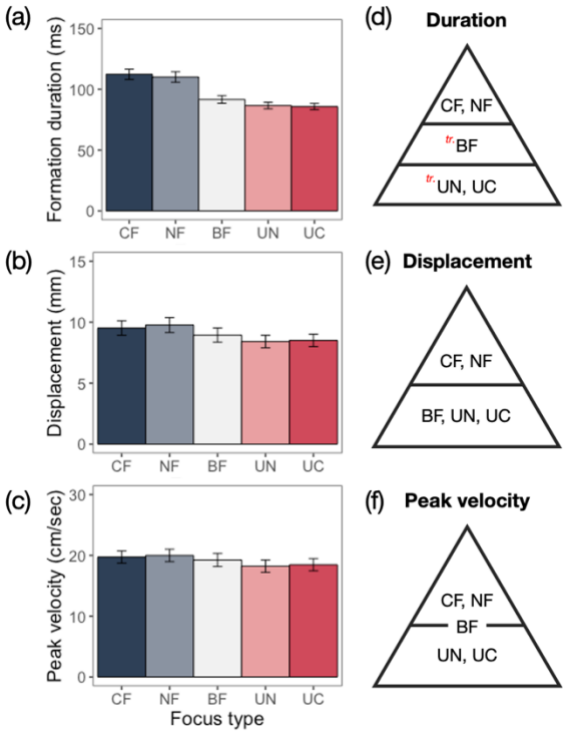

Figure 1. (a-c) Results on duration, displacement, and peak velocity. (d-f) Schematic representation of categorized focus types by kinematic parameter. All comparisons $p < 0.05$, except BF vs. UN in duration noted with superscript *tr*. ($0.05 < p < 0.08$).

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