Edgy articulation: the kinematic profile of Accentual Phrase boundaries in Seoul Korean

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Korean is an edge-prominence language, in which phrasal prominence is marked by the means of prosodic phrasing. For instance, the focused word consistently starts an Accentual Phrase (AP) or a higher phrase, and any following AP boundaries up to the end of the Intonational Phrase (IP) is known to undergo elimination, or possibly attenuation, referred to as dephrasing [1]. APs, with a proposed underlying tonal pattern of THLH (where the type of T depends on the AP-initial segment [2]), serve as the basic intonational unit in Korean (see [3, 4]). Despite this functional load of APs in the language's prosody, findings are scarce on the phonetic dimensions of these prosodic boundaries. The present study aims to examine the kinematic manifestation of constriction gestures at the left edge of APs encoding different types of focus information. Specifically, test words vary with respect to focus status. They are 1) focused, being initial in a focused AP, 2) unfocused, but not dephrased, being initial in a pre-focal AP, or 3) unfocused and expected to be dephrased, by virtue of following a focused AP. We predict gestures under focus to be longer, larger, and faster, based on previous articulatory research on phrasal prominence mainly in head-prominence languages [5] and limited work on Korean ([7], see [8] for a review). However, the stretch of speech affected by the focus effect as well as the kinematic manifestation of dephrasing are still unclear issues. One hypothesis is that the tonal attenuation observed in dephrasing is accompanied by articulatory attenuation, i.e., shorter and smaller AP-initial gestures as compared to their unfocused counterparts, i.e., effects similar to those of de-accentuation in stress languages (e.g., [9]).

Seven native Seoul Korean speakers (5F, 2M) participated in an Electromagnetic Articulography study. Test word /minami/ was embedded in stimuli sentences (Table 1). Position of (contrastive) focus was varied, as prompted by mini dialogues, so as to yield the following focus types on the test word: 1) focused, when focus is on the test word, 2) unfocused, when focus is on the AP following the test word, and 3) dephrased, when focus is on the initial AP. Example of the dephrased condition is shown in Table 1. Eight repetitions of each condition, randomized along with other stimuli examining other aspects Korean prosody, were collected, except for one speaker, by whom five repetitions were recorded due to technical reasons. The acquired data were checked for their prosodic rendition, which, among other dimensions, confirmed tonal attenuation due to dephrasing. Consonant (C) gestures of the test prosodic word /minami/ was measured. Lip aperture was used for measuring /m/ and tongue tip vertical displacement for /n/. A semi-automatic procedure was used to detect the points in time in which each C gesture reached its onset, peak velocity, maximum position, and release. The following kinematic measures were calculated based on these time-points: formation duration (interval between onset and release), displacement (spatial difference between max and onset), and formation's peak velocity. The retrieved data were normalized within each C gesture and analyzed by linear mixed effects analysis with Type (Focused, Unfocused, Dephrased) as a fixed factor and Speaker as a random factor using the *lme4* package in R. Pairwise comparison was done by the means of the *emmeans* package.

Results are summarized in Figure 1. There was a main effect of Type in all three kinematic dimensions—formation duration, displacement, peak velocity. Pairwise comparisons confirmed that gestures under focus were longer, larger, and faster than their unfocused and dephrased counterparts, as predicted based on previous findings (e.g., [5, 7]). The focus-induced prominence effect spanned over the measured C gestures, indicating that the scope of the effect is not local to the boundary but extends at least three syllables away, possibly affecting the whole AP-initial word. With respect to dephrasing, initial (C1) and medial (C2) C gestures differentiated between the unfocused and dephrased conditions: C1 was larger and C2 was faster in dephrased condition as opposed to unfocused ones (Figure 1). These results are contrary to our prediction of articulatory attenuation in dephrasing, and is possibly attributable to a spillover effect from focus on the immediately preceding AP.

Overall, findings indicate that the kinematic profile of phrasal prominence marking in an edge-prominence language like Korean is similar to that of head-prominence languages: prominent gestures are larger, longer and faster with the scope of the effect expanding beyond the boundary-adjacent and

stressed syllable respectively [10]. Also, results suggest that dephrasing is more of a tonal attenuation than articulatory attenuation. Instead, dephrased gestures might undergo some focus-induced spillover strengthening effect.

Table 1. Example dialogue reflecting the dephrased condition, i.e., focus on the initial AP. Focused words are in bold and measured intervals are underlined.

Type	*Example dialogue*
Dephrased	(Participants were asked to imagine a situation where there are two Uncle Minams, one in a magic club and another in a secrecy club.) Prompt sentence: 'It's not the one in the magic club.' Test sentence: [$_{AP}$ **pimilpu**] [$_{AP}$ minami gomopuga] [$_{AP}$ nɛmaŋminam]? 'Uncle Minam of **the secrecy club** is the handsome guy from Nemang?'

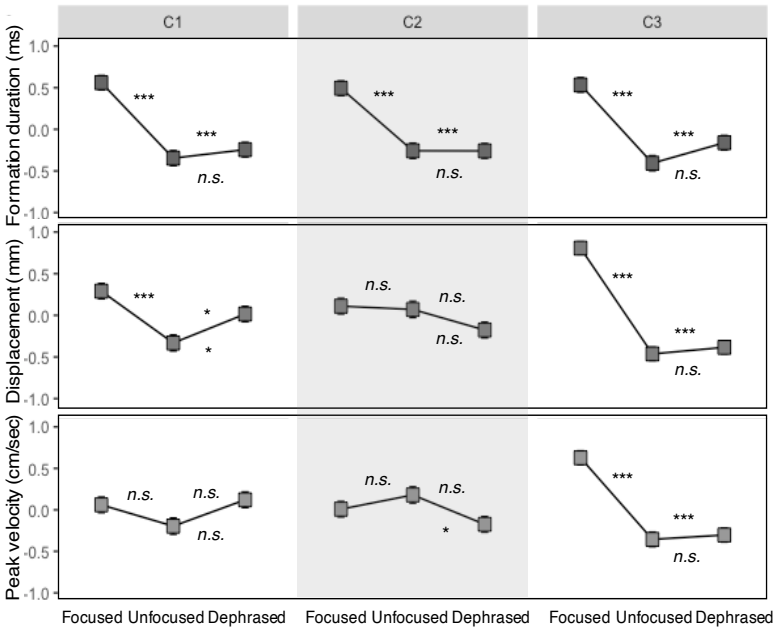

Fig. 1 Normalized duration, displacement, and peak velocity of C gestures by AP Type. Asterisks indicate results of pairwise comparisons: ***='p<0.001', *='p<0.05', *n.s.* = 'p>0.05'.

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