

Effects of articulatory constraints on gestural restructuring in Korean /j/-vowel sequences

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This study examines gestural dynamics of Korean /j/-vowel sequences, motivated by the phonological status of /j/ and /w/. Although Korean phonotactics prohibits onset consonant clusters, /j/ and /w/ are exceptions [1,2]. This raises the question of whether they form true onset clusters or are integrated into the following vowel. Evidence from [3] supports the latter for /w/. Tongue-dorsum trajectories in /w/-vowel sequences diverge systematically from their plain-vowel counterparts, indicating gestural restructuring beyond low-level coarticulation of /w/. This suggests a possible restructuring of /j/, adhering to the single-onset constraint. However, it remains unclear whether /j/-vowel sequences undergo similar restructuring as /w/. /j/ and /w/ differ in articulatory characteristics, which may constrain the vowel gesture differently. Specifically, /j/, with its narrower palatal constriction, requires greater spatial precision. This likely increases its coarticulatory resistance and simultaneously exerts a stronger influence on the following vowel than /w/ (cf. [4,5]). These differences suggest that /j/-vowel sequences may have different restructuring patterns than /w/. Therefore, this study examines how the articulatory constraints of /j/ condition its gestural organization in /j/-vowel sequences and how they compare with those reported for /w/ in [3].

We analyzed EMA data [6] from 48 Korean speakers (24F, 24M) with four /j/-vowel sequences and their plain-vowel counterparts produced in isolation (/ju/-/u/, /jo/-/o/, /ja/-/a/, /jʌ/-/ʌ/; 768 tokens: 8 items × 2 repetitions × 48 speakers). Analyses focused on (1) horizontal and vertical tongue-dorsum trajectories over time to capture dynamic behavior and (2) tongue-dorsum positions averaged across vowel midpoint and offset to approximate the vocalic target. Data were extracted using MVIEW [7] with windows spanning from acoustic onset to offset, and tongue-dorsum target differences were statistically assessed using MANOVAs.

We first compared the endpoints of tongue trajectories for vowels produced with and without a preceding /j/. Since low-level coarticulation typically affects vowel onsets, endpoint divergences indicate integrated gestural organization rather than mechanical carryover. The results show precisely this pattern. In all /j/-vowel sequences (Fig. 1), trajectory endpoints (empty circles) are pulled toward /j/, resulting in distinct vocalic targets from their plain-vowel counterparts, as confirmed by MANOVA results (Table 1). This divergence is also shown in /w/-vowel sequences [3], particularly for the back vowels /a/ and /ʌ/ in the lower-right region of Fig. 2. However, the /j/-vowel sequences reveal a different gestural organization from /w/-vowel sequences. In the /j/-vowel data (Fig. 1), the plain-vowel target, the shifted /j/-vowel target, and the /j/ constriction lie along an articulatory path that forms a linear interpolation between /j/ and the vowel (indicated by a red arrow). By contrast, /w/-vowel sequences (Fig. 2) do not show such linear alignment: their vowel endpoints do not fall along a straight trajectory toward /w/, especially for /a/ and /ʌ/.

In summary, we propose that the constriction degree shapes the gestural organization of these sequences, yielding distinct trajectory patterns. Drawing on [3,8], we propose that /j/, due to its tighter constriction degree, has greater blending strength and less coarticulatory flexibility than /w/. Consequently, /j/ induces a stronger shift in the vowel target but forgoes the complex gestural restructuring found in /w/, where /w/ modifies its own articulation depending on the blending strength of neighboring vowels. Thus, even within a putative natural class, gestural organization is not uniform but is shaped by intrinsic articulatory properties. More broadly, the /j/-/w/ contrast reveals that subtle articulatory asymmetries can shape the pathways of gestural restructuring and potentially sound change (cf. [9]). This highlights how broader speech dynamics are emergent from the fine-grained physical constraints of gestures involved.

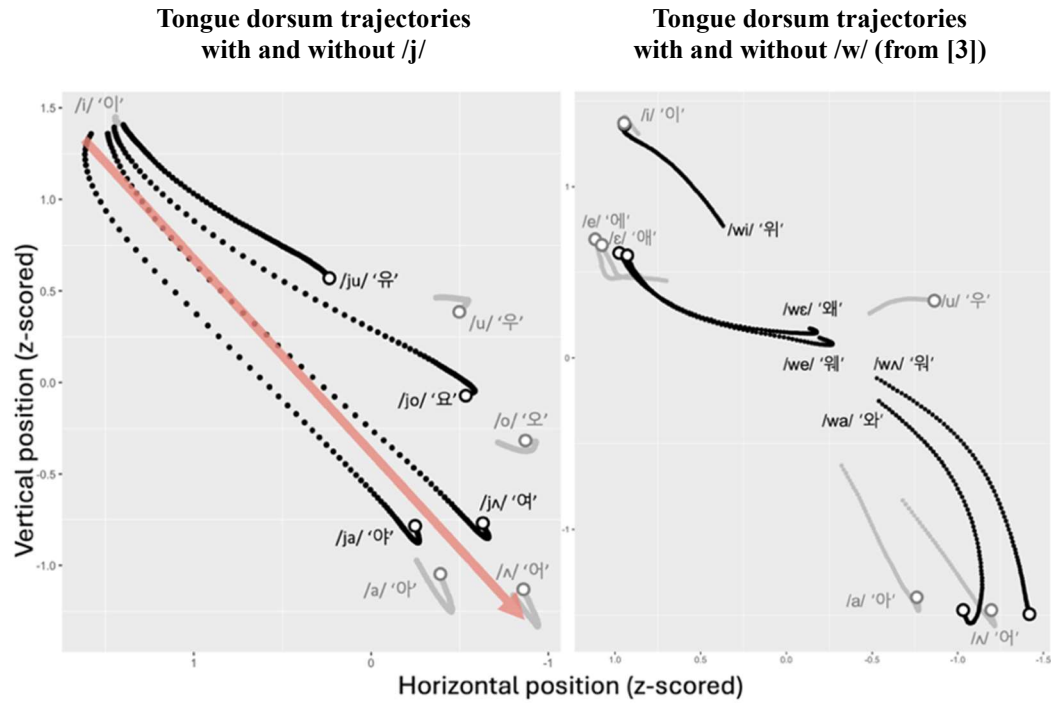


Fig. 1. Averaged tongue dorsum trajectories of /j/-vowel sequences (black) and their plain vowel counterparts (grey) across all speakers, pooled across dialects (Seoul, North Gyeongsang Korean) and genders (female, male). The empty circles indicate the endpoints of the trajectories.

Fig. 2. Averaged tongue dorsum trajectories of /w/-vowel sequences (black) and their plain vowel counterparts (grey) across all speakers, pooled across dialects (Seoul, North Gyeongsang Korean) and genders (female, male). The empty circles indicate the endpoints of the trajectories (reproduced from [3]).

Table 1. Summary of the model outputs of the MANOVA with the vertical and horizontal position values of vowel midpoint and offset of the nuclei of /j/-vowel sequences and their plain vowel counterparts as the multivariate dependent variables.

Pairs	Pillai	<i>F</i>	<i>p</i>
/ju/ - /u/	0.413	129.02	< 0.001 ***
/jo/ - /o/	0.271	68.31	< 0.001 ***
/ja/ - /a/	0.229	54.43	< 0.001 ***
/jʌ/ - /ʌ/	0.369	107.08	< 0.001 ***

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