Focus-induced articulatory prominence on velum actions in nasal geminates

Miran Oh and Dani Byrd
Department of Linguistics, University of Southern California, Los Angeles, CA USA

A close examination of articulation under focus production is a valuable route to deciphering how prosodic prominence is achieved. The seminal work of [1] first illuminated the dynamical mechanisms underlying the articulation of prominence, and numerous other studies have since examined the oral articulation of both consonants and vowels under focus in order to paint a picture of how speakers control the spatiotemporal properties of articulatory actions realizing prosodic salience. However significant lacunae remain in our knowledge when the segments under consideration are more complex. We endeavor to flesh out this understanding for multi-gesture structures having non-oral gestural components and complex internal temporal organization by examining the articulation of prominence for nasal geminates.

Geminates have a longer duration than singletons, but they do not consistently have a larger displacement or tighter constriction than singletons [2, 3], though such hyperarticulation can be notoriously difficult to observe for stop consonants given that once closure occurs only a small amount of compression can further result from hyperarticulation. Additionally for geminate segments comprising multiple gestures, the target of any lengthening associated with prominence is unclear. Therefore nasal geminates—with their (non-constriction) velum lowering component and inherent length due to gestural concatenation—are a valuable gestural structure for investigating the spatiotemporal articulatory implementation of focus.

This study examines nasal juncture geminates in Korean using real-time MRI (rtMRI) data. Target consonants are alveolar oral/nasal stops occurring as singletons and as a geminate across an Accentual Phrase boundary: singleton onset /V#**n**/, singleton coda /**n**#p/, and geminate /**n**#**n**/; with utterances occurring with boundary-initial focus either present or absent. RtMRI data were acquired from a single native speaker using the speech production protocol in [4, 5]. A centroid tracking analysis [6] and a region-of-interest image sequence analysis [7] were performed to provide kinematic trajectories of Tongue Tip (TT) constriction formation and Velum (VEL) lowering and raising gestures. For each gesture, we examine duration (plateau, oral constriction, & velum lowering), magnitude (TT constriction degree & Velum vertical displacement), and intergestural timing lag (between TT & VEL).

Findings show that singletons and geminates are best distinguished by TT and VEL gestural plateau duration (Fig. 1-2: left) and that these durations greatly lengthen under focus in geminates but not in singletons. The focus effect of TT constriction duration lengthening (Fig. 1-2: center) is similar across singletons and geminates, and VEL lowering duration increases under focus in singleton coda and geminates but not in the singleton onset. For TT constriction degree (Fig. 1: right) singleton codas have intrinsically lesser constriction degree than onsets and geminates and show some increase in constriction degree under focus. VEL lowering magnitude (Fig. 2: right) is larger in codas and geminates than in onsets, and onsets tend to reduce lowering and codas increase lowering under focus, while no focus effect on VEL lowering is seen for geminates. Lastly, intergestural timing between the TT and VEL lowering onsets (Fig. 3: left) is stable across segments and across focus conditions. However, TT onset to VEL raising onset lag (Fig. 3: right), which can be an index of nasality, increases notably under focus, particularly for geminates.

In conclusion, geminates and singleton nasals are distinguished by their constriction plateau duration as well as timing between TT and VEL raising onsets. These same features that most saliently distinguish the singletons and geminates become lengthened substantially under focus, with the velum remaining in its lowered position longer for geminates under focus than for singletons, suggesting the possibility of a degree of subtle degemination of the juncture geminates at a boundary under focus. [Supported by NIH DC03172 & DC007124]

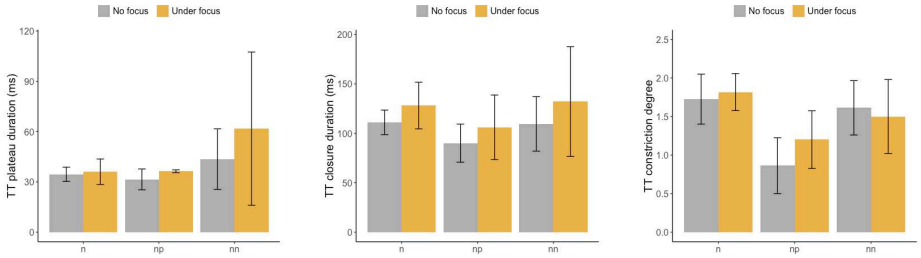

Fig. 1. *TT plateau duration (left), constriction duration (center), and constriction degree (right) for /#n, n#, n#n/ under focus (yellow) and no focus (grey).*

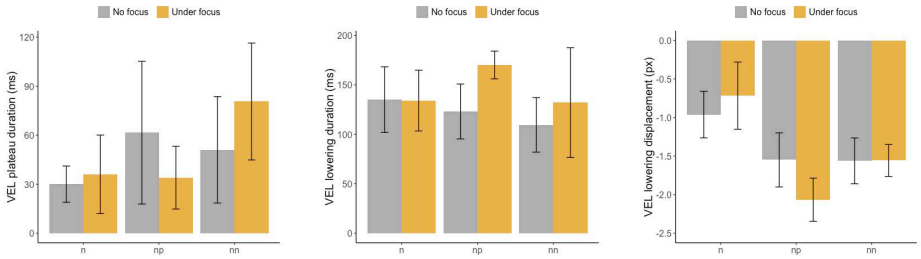

Fig. 2. *VEL plateau duration (left), lowering duration (center), and lowering magnitude (right) for /#n, n#, n#n/.*

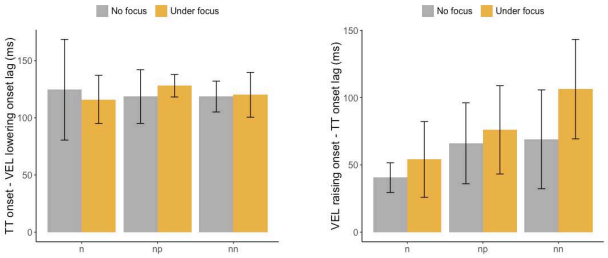

Fig. 3. *TT onset - VEL lowering onset lag (left) and VEL raising onset - TT onset lag (right).*

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