Articulatory-based subfeatural representations: tongue-tip perturbation made by high vowels

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1. TRIGGER OF CORONAL PALATALIZATION

- Definition of (full) palatalization (Bateman 2011)
  - A consonant changes its primary place of articulation, while moving toward the palatal region of the vocal tract when adjacent to a high and/or front vocoid.
- Cross-linguistically, **high vowels** tend to trigger coronal palatalization (Bhat 1978; Bateman 2007; Kochetov 2011).
- Co-articulatory prediction
  - Non-front high vowels will trigger coronal palatalization at least as frequently as a high front vowel does, if not more so.
- In fact, however,
  - Non-front high vowels trigger coronal palatalization only when front high vowels are also triggers (Bateman 2007).
  - Implicational hierarchy: **front high V > non-front high V**

High vowels		Languages
Front	Non-front	
✓		Amharic, Apalai, Basque, Breton, Carib, Eastern Ojibwa, Fanti, Fongbe, Japanese, Korean, Mandarin, Mina, Navajo, Nupe, Sanuma, Tiwa, Watjarri, Western Shoshoni, Yimas
✓	✓	Coatzospan Mixtec (women), Maori, Sentani, Tohono O'Odham
	✓	None

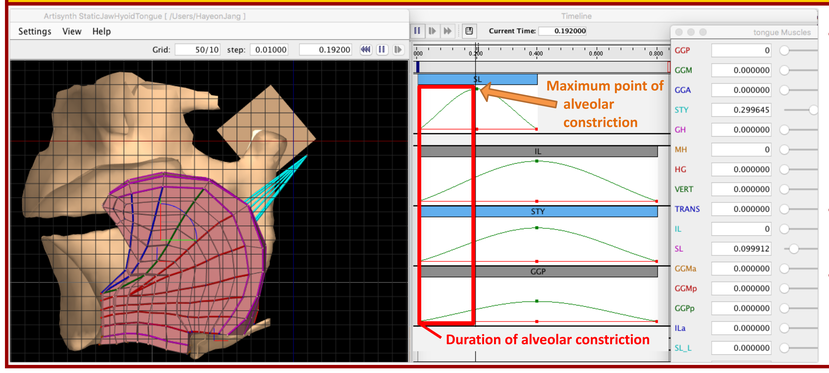
RESEARCH ISSUE

- Lack of explanation for the typological asymmetry of triggers of coronal palatalization

THE AIM OF THIS STUDY

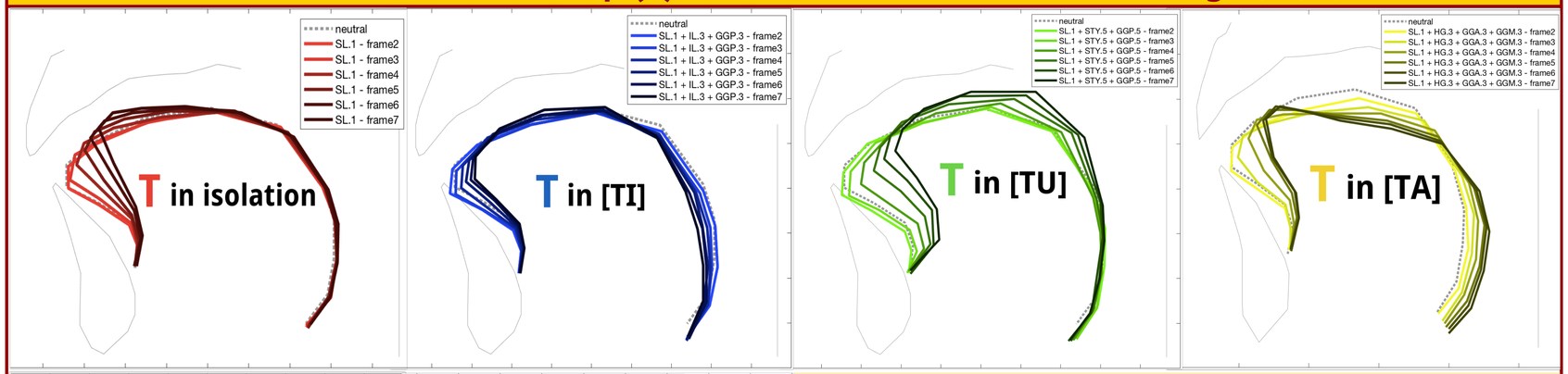
- To provide a functional account of the implicational hierarchy among high vowels as triggers of coronal palatalization
- Using articulatory simulations, to show how the articulation of high vowels (/i, u/) affects an overlapping alveolar constriction.

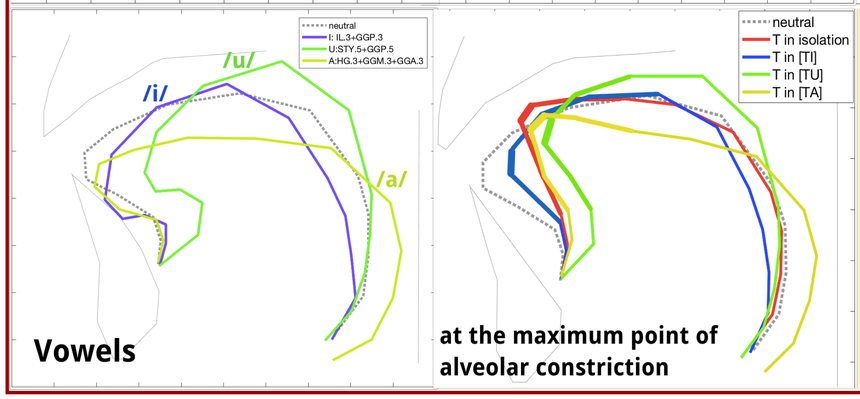
2. ARTICULATORY SIMULATIONS: biomechanical 3D tongue model of Artisynth



- The simulations were conducted by manipulating the activation values of tongue muscles in Artisynth (Lloyd et al. 2010).
  - In the static jaw-hyoid-tongue model, eleven muscles control the deformation and movement of the tongue.
  - Tongue muscles were selected based on anatomical studies of the tongue (Hardcastle 1974; Epstein et al. 2002)
- An alveolar constriction and the following vowel were simulated to begin synchronously (Löfqvist & Gracco 1999).
- The activation duration of tongue muscles for the following vowel was set to double the length of that of an alveolar constriction (Fowler 1980).

3. RESULTS: alveolar stop (T) in isolation vs. with the following /i, u, a/





- Perturbation of tongue tip constriction by high vowels
  - **Alveolar C with the following /i, u/: lowering the tongue tip**
  - ➢ **Tongue tip lowering → coronal palatalization**
    - Change the contact point of the tongue (tip → blade)
    - Change in the place of articulation (→ more posterior place)
  - ➢ **High vowels as triggers of coronal palatalization**
- Different degree of perturbing influence on an alveolar constriction of the following high vowels
  - **Greater degree of tongue tip lowering with /i/ than /u/**
  - ➢ **The implicational hierarchy among high vowels:**
    Front high vowels is more likely to trigger coronal palatalization than non-front high vowels.

4. FORMAL ANALYSIS: subfeature ⟦*x* distributed⟧ for high vowels

- **Articulatorily distinct subfeatures ⟦*x* distributed⟧ (0< *x* <1)** (Lionnet 2016, 2017) for high vowels
  - The feature [distributed] represents sounds that are produced with the blade or front of the tongue (Halle & Clements 1983).
  - Both front and non-front high vowels are featurally unspecified for [distributed], but subfeaturally, they are ⟦distributed⟧.
  - **The subfeatural values of front high vowels are higher than those of non-front ones**.
    - $[+high, -back]_{⟦x\ distributed⟧}$ & $[+high, +back]_{⟦y\ distributed⟧}$, where $x > y$
- **Subfeatural co-occurrence constraints** that refer to subfeatural values of high vowels **in a stringent way**
  - *⟦<1dist⟧⟦≥*x* dist⟧ No ⟦dist⟧ sequences with values lower than 1 and equals/exceeds *x*.
  - *⟦<1dist⟧⟦≥*y* dist⟧ No ⟦dist⟧ sequences with values lower than 1 and equals/exceeds *y*.
- Typology of coronal palatalization
  - Front high vowels as triggers: *⟦<1dist⟧⟦≥*x* dist⟧ >> IDENT[dist] >> *⟦<1dist⟧⟦≥*y* dist⟧
  - High vowels as triggers: *⟦<1dist⟧⟦≥*y* dist⟧ >> IDENT[dist], *⟦<1dist⟧⟦≥*x* dist⟧

(Where $0 < y < x < 1$)

		*⟦<1dist⟧⟦≥x dist⟧	IDENT[dist]	*⟦<1dist⟧⟦≥y dist⟧
/ti/	a. $t_{⟦0\ dist⟧}{}^{i}{}_{⟦x\ dist⟧}$	*!		*
	☞ **b.** $\widehat{t\int}_{⟦1\ dist⟧}{}^{i}{}_{⟦x\ dist⟧}$		*	
/tu/	☞ **a.** $t_{⟦0\ dist⟧}{}^{u}{}_{⟦y\ dist⟧}$			*
	b. $\widehat{t\int}_{⟦1\ dist⟧}{}^{u}{}_{⟦y\ dist⟧}$		*!	

		*⟦<1dist⟧⟦≥y dist⟧	IDENT[dist]	*⟦<1dist⟧⟦≥x dist⟧
/ti/	a. $t_{⟦0\ dist⟧}{}^{i}{}_{⟦x\ dist⟧}$	*!		*
	☞ **b.** $\widehat{t\int}_{⟦1\ dist⟧}{}^{i}{}_{⟦x\ dist⟧}$		*	
/tu/	a. $t_{⟦0\ dist⟧}{}^{u}{}_{⟦y\ dist⟧}$	*!		
	☞ **b.** $\widehat{t\int}_{⟦1\ dist⟧}{}^{u}{}_{⟦y\ dist⟧}$		*	