Partial Transparency in Harmony: A Dynamic Gestural Model

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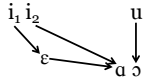
Introduction

- Coeur d'Alene Salish faucal harmony: vowels surface as retracted variants before faucal (uvular and pharyngeal) consonants (Doak 1992, Bessell 1998)

Non-Faucal Context	Faucal Context
[tsi̲ʃ-t] 'it is long'	[tsɛ̲ʃ-ɑlqʷ] 'he is tall'
[dlim] 'he galloped hither'	[tʃ-dlɑ̲m-ɑlqʷ] 'train'
[sɛ̲ttʃ-ntˢ] 'he twisted it'	[nɛʔ-sɑ̲ttʃ-ɛʔqs-n] 'crank (on a car)'
[ʔɛ-niʔ-ku̲s-ɛlstʃn] 'hair falls back from forehead'	[ʔɑt-kɔ̲s-qn] 'his hair is curled'

- Vowels retract to different degrees in domain of harmony:

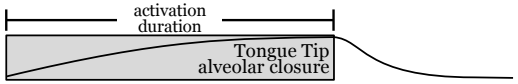


Proposals:

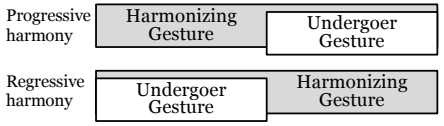
1) Mapping of /i/ -> [ɛ] in Coeur d'Alene faucal harmony represents a case of partial transparency to harmony
2) Partial transparency is result of competition between dynamically-defined gestures, as in Gestural Harmony Model (Smith 2016)

Representing Harmony with Gestures

- Gestures (Browman & Goldstein 1986, 1989): dynamically-defined, goal-based units of phonological representation



- Specified for multiple parameters:
  - Target articulatory state (x_0): constriction degree and location
  - Stiffness (k): how quickly target articulatory state is reached
  - Articulators: tongue tip, tongue body, velum, etc.
  - Blending strength (α): degree of ability to control vocal tract in case of intergestural competition
- Harmony-triggering gesture extends in duration and overlaps other gestures (targets/undergoers)



Gestural Blending & Transparency

- Antagonistic gestures: gestures with conflicting target articulatory states
- Antagonism resolved by blending goal articulatory states of concurrently active gestures according to Task Dynamic Model of Speech Production (Saltzman & Munhall 1989)

$$Target_1 * \alpha_1 + Target_2 * \alpha_2 = \text{Blended Target}$$

- Transparency to harmony is result of competition between concurrently active antagonistic gestures (Smith 2016)

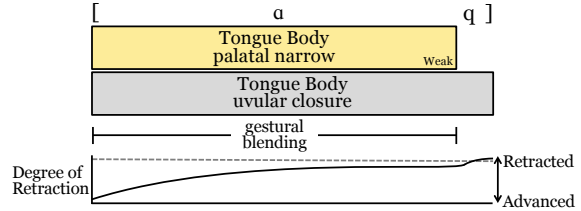
- Resulting state of vocal tract for some variable:

Gestural Analysis of Faucal Harmony

- Faucal harmony is result of overlap by uvular/pharyngeal consonant's harmonizing tongue body retraction gesture
- Overlap of palatal gesture of high front /i/ and harmonizing tongue body retraction gesture results in gestural antagonism
- Different degrees of faucal harmony retraction observed for /i_1/ and /i_2/ are result of different specified gestural blending strengths

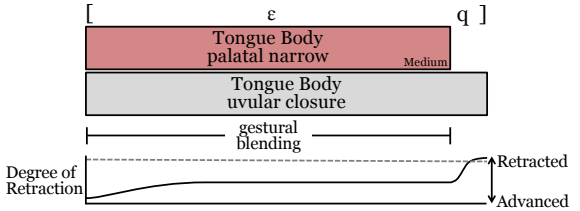
Tongue position for /i/ | Tongue position for /q/

- Weak /i/ fully overpowered by retraction gesture when gestural blending occurs



- Result: achievement of tongue body retraction gesture favored over achievement of palatal constriction

- Medium-strength /i/ partially resists (remains transparent to) effect of retraction gesture due to similar blending strengths



- Result: partial retraction of tongue body during production of /i/

Conclusion & Future Directions

Gestural analysis of Coeur d'Alene faucal harmony:

✓ Provides example of partial transparency to harmony that fulfills prediction of model of transparency as competition/resistance (Smith 2016)

✓ Avoids analysis of vowel quality shifts in faucal harmony as synchronic chain shift, avoiding need for additional grammatical architecture (e.g., constraint conjunction (Kirchner 1996))

✓ Provides unified account of segments that undergo phonological process to different degrees

✓ Accounts for contrast in faucal harmony susceptibility between /i_1/ and /i_2/ without relying on grammatical mechanisms for phonological exceptionality, including:
  - Opaque (counterfeeding) rule ordering and/or abstract underlying phonemes (cf. Cole (1987), Doak (1992))
  - Indexation to rules or constraints (e.g., Pater (2000, 2009))

Ongoing/future work: contrastive gestural strength as explanation of apparent exceptionality to phonological processes

References

Bessell, Nicola J. (1998) Local and non-local consonant-vowel interaction in Interior Salish. *Phonology*, *15*, 1–40.

Browman, Catherine P, & Goldstein, Louis (1986) Towards an Articulatory Phonology. *Phonology Yearbook*, *3*, 219–252.

Browman, Catherine P, & Goldstein, Louis (1989) Articulatory gestures as phonological units. *Phonology*, *6*(2), 201–251.

Cole, Jennifer (1987) *Planar Phonology and Morphology*. Ph.D. Dissertation, Massachusetts Institute of Technology.

Doak, Ivy G. (1992) Another look at Coeur d'Alene harmony. *International Journal of American Linguistics*, *58*(1), 1–35.

Kirchner, Robert (1996) Synchronic Chain Shifts in Optimality Theory. *Linguistic Inquiry*, *27*(2), 341–350.

Pater, Joe (2000) Non-uniformity in English secondary stress: the role of ranked and lexically specific constraints. *Phonology*, *17*, 237–274.

Pater, Joe (2009) Morpheme-Specific Phonology: Constraint Indexation and Inconsistency Resolution. In S. Parker (Ed.), *Phonological Augmentation: Essays on Evidence and Motivation* (pp. 123–154). London: Equinox.

Saltzman, Elliot, & Munhall, Kevin G. (1989) A Dynamical Approach to Gestural Patterning in Speech Production. *Ecological Psychology*, *1*(4), 333–382.

Smith, Caitlin (2016) A gestural account of neutral segment asymmetries in harmony. In G. Ó. Hansson, A. Farris-Trimble, K. McMullin, & D. Pulleyblank (Eds.), *Proceedings of the 2015 Annual Meeting on Phonology*. Linguistic Society of America.