Phonology needs geometry: Implicit axioms in segmental representation

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Main Points

- Phonological features are organized into "motivated subsets".

- Can a specific feature be in multiple subsets (or classes), depending on the segment, or is all membership unique and absolute?

- The question here is not of implementation (e.g. sets vs. trees), but rather on the implicit axioms governing the definitions of the sets: is class membership globally assigned or locally (per segment)?

- (One aspect of) of Feature Geometry is the idea that segments have nontrivial structure.

- Evidence from cross-cateogry place interactions supports a segment-specific (geometric) model of segmental representation.

Definitions

Naturalness of Assimilation (NoA)
Output of assimilation includes two segments having the same feature (value):

$$X \to \alpha F / \left\{ \begin{array}{c} \underline{\quad}\alpha F \\ \alpha F \underline{\quad} \end{array} \right\} \qquad \text{Agree[F]}$$

X   Y
\ /
F

Geometry There exists organizational information about features that must be specified on a per-segment basis

Global Class Assignment (GCA)

$$(\forall f, g)\,[\texttt{label}(f) = \texttt{label}(g) \to (\neg\exists C)[C(f) \wedge \neg C(g)]]$$

"If two features f and g are the same (share a label), their class memberships are always identical."

Unpacking the GCA

- Feature organization is hierarchical (Clements 1985, Sagey 1986, a.o.)

- **Classes** refers to defined subsets of features, *agnostic* of dominating nodes vs. sets

Place   Place = {lab, cor, dors, ...}
/ | \
lab cor dors ...

- The GCA is an axiom (potentially) governing how the classes are defined, not how they are implemented structurally

- Given an indivual feature, is all class membership determined irrespective of any individual segment?

- Feature theories can be grouped into **those that obey the GCA** and **those that do not**

Case Study: [labial]

- To what extent are these groups of segments related phonologically?

Rounded vocalics	Plain labials
/ w u kʷ /	/ p k͡p /

Feature Class Theory: Obeys GCA

- "Disembodied" feature organization (Padgett 1995, 2002)

  – *Rounded vocalics*   = [+round]
  – *Plain labials*   = [labial]
  – Elsewhere in theory:
    [+round] ∈ V-Place
    [labial] ∈ (C-)Place

- Structure can be removed from individual segments *as long as class definitions obey GCA*

- Not all theories of FG can be translated into FCT (contra Cahill and Parkinson 1997)

- Rounded vocalics and plain labials **not** a natural class

- Other GCA-obeying theories (non-exhaustive): Chomsky and Halle (1968) (trivially), Ní Chiosáin and Padgett (1993), Halle et al. (2000)

Unified Feature Theory: Incompatible with GCA

- **Unified Feature Theory**: Rounded vocalics and plain labials form a natural class (Clements and Hume 1995)

Rounded vocalics
C-Place
/   \
...   V-Place$_C$
|
[labial]$_f$

Plain labials
C-Place
/   \
[labial]$_g$ V-Place$_C$
|
...

- The class membership of [labial] can vary segment to segment!

- Unified Feature Theory are incompatible with the GCA (and therefore with Feature Class Theory)

- Other GCA-breaking theories (non-exhaustive): Mester 1986, Padgett 1994, Dependency Phonology, Governmnet Phonology

Summary

- In order for rounded vocalics and plain labials to be a natural class, we must assume Unified Feature Theory

- Unified Feature Theory is incompatible with the GCA

- Is there phonological evidence for a natural class of plain labials and rounded vocalics?

Natural classhood of labials

- **Vietnamese**: k → k͡p / o,u __   (Kirby 2011 a.o.)

V↓ C→	Palatal	Velar	Labial-Velar
Front	[sec] 'slanting'	*[ek]	*[ek͡p]
Central	*[ac]	[sak] 'corpse'	*[ak͡p]
Back	*[oc]	*[ok]	[sok͡p] 'shock'

- **UFT**: Trigger and target of assimilation are both [labial]

  – [labial] V-place triggers [labial] C-place
  – Assimilation is natural

- **FCT**: Trigger is [+round], target is [labial]

  – [+round] triggers [labial]
  – Assimilation **not** natural

- Related processes:

  – **Mumuye**: [k͡p] ∼ [kʷ]   (Shimizu 1983)
  – **Aghem**: b → g͡b / o __   (Hyman 1979)

- In order to preserve Naturalness of Assimilation, rounded vocalics and plain labials must be a natural class.

- Natural classhood of labials is only possible assuming UFT.

- If we assume UFT, then the GCA cannot be maintained.

- Thus, organizational structure of these place features must be specified on a segment-specific basis.

- Thus, phonology needs geometry.

References and Acknowledgements

Thanks to the Wash U Linguistics Brown Bag audience, many others unnamed here. Cahill, Michael and Frederick Parkinson (1997). "Partial Class Behavior and Feature Geometry: Remarks on Feature Class Theory". In: Kiyomi Kusumoto, ed. *Proceedings of the North East Linguistic Society 27*. Amherst, MA: GLSA, pp. 79–91.Chomsky, Noam and Morris Halle (1968). *The Sound Pattern of English*. Cambridge, Massachusetts: The MIT Press.Clements, G. N. (May 1985). "The geometry of phonological features". In: *Phonology* 2.1, pp. 225–252.Clements, G. N. and Elizabeth V. Hume (1995). "The Internal Organization of Speech Sounds". In: John Goldsmith, Jason Riggle, and Alan C. L. Yu, eds. *The Handbook of Phonological Theory*. Blackwell Publishing.Halle, Morris, Bert Vaux, and Andrew Wolfe (2000). "On Feature Spreading and the Representation of Place of Articulation". In: *Linguistic Inquiry* 31, pp. 387–444.Hyman, Larry M. (1979). "Part 1: Phonology and Sound Structure". In: Larry M. Hyman, ed. *Aghem Grammatical Stricture*. Southern California Occasional Papers in Linguistics 7. Los Angeles: University of Southern California.Kirby, James (2011). "Vietnamese (Hanoi Vietnamese)". In: *Journal of the International Phonetic Association* 41.3, pp. 381–92.Mester, Armin (1986). "Studies in Tier Structure". PhD thesis. University of Massachusetts Amherst.Ní Chiosáin, Máire and Jaye Padgett (1993). "Inherent VPlace". Report LRC-93-09, Linguistics Research Center, University of California, Santa Cruz.Padgett, Jaye (1994). "Stricture and Nasal Place Assimilation". In: *Natural Language & Linguistic Theory* 3, p. 465.Padgett, Jaye (1995). "Feature Classes". In: Jill Beckman, S. Urbanczyk, and L. Walsh, eds. *Papers in Optimality Theory*. Amherst, MA: University of Massachusetts.Padgett, Jaye (2002). "Feature Classes in Phonology". In: *Language* 78, pp. 81–110.Sagey, Elizabeth (1986). "The Representation of Features and Relations in Non-Linear Phonology". PhD thesis. Massachusetts Institute of Technology.Shimizu, Kiyoshi (1983). *The Zing Dialect of Mumuye: A Descriptive Grammar : with a Mumuye-English Dictionary and an English-Mumuye Index*. Hamburg: H. Buske. 288 pp.