[1]. Research from 1980’s by Clements, Halle, and others suggested that features are organized into a hierarchy. This general line of study was called Feature Geometry.

[2] root node: gross sound class: [consonantal], [sonorant]

cavity: pharyngeal, supralaryngeal

articulators: Labial, Dorsal, Coronal; Soft Palate, Tongue Root, Glottal (Halle 1982)

terminal features: [nasal], [voice], [anterior], [back], etc.

[3] stricture features of [continuant], [strident], and [lateral] are problematic;

- [lateral] and [strident] are almost exclusively dependents of the Coronal articulator
- most sounds have multiple articulators: e.g. [m]: Labial, Soft-Palate, Glottal
- stricture (manner) features like [continuant] must be linked to the major articulator for proper phonetic interpretation
- Halle-Sagey arrow was a device that assigned manner features to a particular articulator

[4] evidence for the hierarchy
• OCP (Obligatory Contour Principle: Leben 1973)
• Bans two successive segments that are “identical”
• Arabic root constraints defined over major articulators (McCarthy 1991): labial, coronal obstruent, coronal sonorant, dorsal, guttural
• articulators are located on separate tiers; [m b t] and [m t b] both violate OCP and so in order to fall under the *X-X rubric, the [m] must see past the [t] to be penalized by the [b]

a. labials [f, b, m]
b. coronal sonorants [l, r, n]
c. coronal stops [t, d, T, D]
d. coronal fricatives [θ, ð, s, z, S, Z, ʃ]
e. dorsals [g, k, q]
f. gutturals [x, ɣ, h, ʕ, h, ʔ]

adjacent consonants (C₁, C₂ and C₃) in triliteral C₁ C₂ C₃ roots

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>196</td>
<td>121</td>
<td>125</td>
<td>138</td>
<td>82</td>
<td>151</td>
</tr>
<tr>
<td>b</td>
<td>118</td>
<td>153</td>
<td>7</td>
<td>26</td>
<td>29</td>
<td>105</td>
</tr>
<tr>
<td>c</td>
<td>116</td>
<td>211</td>
<td>58</td>
<td>5</td>
<td>89</td>
<td>168</td>
</tr>
<tr>
<td>d</td>
<td>118</td>
<td>167</td>
<td>66</td>
<td>105</td>
<td>1</td>
<td>79</td>
</tr>
<tr>
<td>e</td>
<td>211</td>
<td>252</td>
<td>148</td>
<td>182</td>
<td>81</td>
<td>11</td>
</tr>
</tbody>
</table>

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[5] assimilation as spreading

• Single terminal feature: voicing in cat[s] vs. dog[z]; nasal in Korean /kuk-min/ > kuɲmin ‘(Korean) people’,
• Complete assimilation: last time Tigrinya t-, Berber n-
• Intermediate node (Clements 1985)

English coronal stops and nasal assimilate the minor place features of following coronal

<table>
<thead>
<tr>
<th></th>
<th>[t]</th>
<th>[d]</th>
<th>[n]</th>
</tr>
</thead>
<tbody>
<tr>
<td>θ</td>
<td>eighth</td>
<td>hundredth</td>
<td>tenth</td>
</tr>
<tr>
<td>θ</td>
<td>eight shoes</td>
<td>eight gems</td>
<td>insure</td>
</tr>
<tr>
<td>r</td>
<td>tree</td>
<td>dream</td>
<td>enroll</td>
</tr>
<tr>
<td>s</td>
<td>hats</td>
<td>reads</td>
<td>ensure</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>manner</th>
<th>[-contin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>cavity</td>
<td>Oral</td>
</tr>
<tr>
<td>Place</td>
<td>Coronal</td>
</tr>
<tr>
<td>/</td>
<td>[+/-anter] [+/-distr]</td>
</tr>
</tbody>
</table>
Anc. Gk: assimilation of [voice] and [spread gl] dependents of Glottal articulator

b. 
   trib-o  tetrip-tai  ‘rub’
   grap^h-o  gegrap-tai  ‘write’
   pemp-o  epemp-h-t^h'en  ‘send’
   trib-o  etrip^h-t^h'en  ‘rub’
   klept-o  kleb-den  ‘steal’
   grap^h-o  grab-den  ‘write’

root  [-sonor]  [-sonor]
   |
   cavity  |  |  Pharyngeal  Pharyngeal
   articular  |  |  Glottal  Glottal

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[6] Reduction as elimination of parts of tree

- s > h; Caribbean Spanish: me[h], mes-e[h]  ‘month’
- t > ?; English glottaling of t?

root
   [ + cons]
   |
   striucture  [ - contin]
   cavity  |  |  Oral  Pharyngeal
   articulator  |  |  *Coronal  Glottal
   terminal  [ + anter]  [ + constr gl]

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[7]. Problems: features that spread together might not form a constituent in the articulator model

Odden 1991  Mari (Eastern Cheremis)

<table>
<thead>
<tr>
<th></th>
<th>i</th>
<th>ü</th>
<th>e</th>
<th>ö</th>
<th>a</th>
<th>ø</th>
<th>o</th>
<th>u</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>low</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>back</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>round</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

- back and round spread but not height
- Acoustically based: color features of [back] and [round] reflected in F2 (second formant)

üp-sö  his hair  surt-šö  his house  kit-še  his hand
šös-žö  his milk  boz-šö  his wagon  šužar-žë  his sister
bokten-žë  beside it
[8] spreading details

- Oral place nodes Labial, Coronal, Dorsal look past one another in Arabic OCP and hence are located on different tiers
- Padgett’s (1991) Generalization: stricture features of [± cons] and [± contin] always spread along with place features in place assimilation: #f > #t, *st; #nw > #w, *mw
- Stricture features do not spread by themselves: #s -/- > #s
- Sudanese Arabic (Hamid 1984)

(1) kitáab ‘book’ bit ‘daughter’ sámak ‘fish’

kitáa[p] Samír bī[s] Samír sáma[k] Samír
kitáa[p] Šaríf bī[s] Šaríf sáma[k] Šaríf
kitáa[p] Xáalíd bī[t] Xáalíd sáma[x] Xáalíd

[9] From the OT perspective, much of the work performed by feature classes and nodes is taken over by markedness constraints

Padgett (1994, 2002) Turkish vowel harmony

(18) a. i ü u u i e ü ō u o a
    e ō a o high + - + - + + -
    back - - - - + + +
    round - - + + - + + -

b. noun pl. acc.
   dal dal-lar dal-u ‘branch’
   kol kol-lar kol-u ‘arm’
   kuz kuz-lar kuz-u ‘daughter’
   kul kul-lar kul-u ‘slave’
   yel yel-lar yel-i ‘wind’
   göl göl-lar göl-ü ‘sea’
   diş diş-lar diş-i ‘tooth’
   gül gül-lar gül-ü ‘rose’

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- high vowels assimilate [round] and [back]; nonhigh vowels only [back]
- traditionally two separate rules: palatal and labial harmony
- but most Turkic lgs have reflexes of both, suggesting a single process
- feature classes are indicated by co-indexing: [back] and [round].


Ident. Since the vowels \(o,ö\) are preserved in roots by IdentRt, this constraint must be highest.

References therein for extensive motivation of the root as a cross-linguistically privileged position.

The reader is referred to Beckman and

NT into

arate constraint is given below. The reader is referred to Beckman and

earlier analysis.

of that vowel. Compare these forms to those in (27)b, which behave as expected according to my

the plain and palatalized lateral; compare (27)b. The palatalized lateral not only bears the feature

differently:

•

ear

Padgett, Jaye. "On the Characterization of Feature Classes in Phonology." Language 78, no. 1 (2002): 81-110. © Linguistic Society of America. All rights reserved. This content is excluded from our Creative Commons license. For more information, see http://ocw.mit.edu/help/faq-fair-use/.

• spread of color features but dominated by markedness constraint \^*[-high, + round]

<table>
<thead>
<tr>
<th>UR: /son-lAr/</th>
<th>(+[\text{rnd, -hi}])</th>
<th>Spread(Color)</th>
<th>Ident</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. {[son-]<em>{+R}}</em>{+B} {[son-lor]<em>{+R}}</em>{+B}</td>
<td>!*</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>b. {[son-]<em>{+R}}</em>{+B} {[son-lor]<em>{+R}}</em>{+B}</td>
<td>!*</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>c. {[son-]<em>{+R}}</em>{+B} {[son-lor]<em>{+R}}</em>{+B}</td>
<td>!*</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>d. {[son-]<em>{+R}}</em>{+B} {[son-lor]<em>{+R}}</em>{+B}</td>
<td>!*</td>
<td>**</td>
<td>**</td>
</tr>
</tbody>
</table>

positional faithfulness for root

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(24)

<table>
<thead>
<tr>
<th>UR: /pul-lAr-In/</th>
<th>IdentiR</th>
<th>(+[\text{rnd, -hi}])</th>
<th>Spread(Color)</th>
<th>Ident</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. {[pul-lar-un]<em>{+R}}</em>{+B}</td>
<td>!*</td>
<td>**</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td>b. {[pul-lar-un]<em>{+R}}</em>{+B}</td>
<td>!*</td>
<td>**</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td>c. {[pul-lar-un]<em>{+R}}</em>{+B}</td>
<td>!*</td>
<td>**</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td>d. {[pul-lar-un]<em>{+R}}</em>{+B}</td>
<td>!*</td>
<td>**</td>
<td>****</td>
<td></td>
</tr>
</tbody>
</table>

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• In many languages nasals assimilate in place to a following stop. But before a fricative

they may delete (Lithuanian), harden the fricative to a stop (Kpelle), lenite the nasal to a

nasalized continuant (Polish), or fail to assimilate (English). The following typology

emerges:

5
Lithuanian: * [+ nasal, + contin], Ident-[contin], Agree-Place » Max-Nasal

<table>
<thead>
<tr>
<th></th>
<th>Agree-Place</th>
<th>* [+ nasal, + contin]</th>
<th>Ident-contin</th>
<th>Max-Nasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>/san-buris/</td>
<td>&gt; samburis</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/san-ska../</td>
<td>&gt; sa:-ska...</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>saš-ska</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sanska</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>santska</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Kpelle: * [+ nasal, + contin], Agree-Place, Max-Nasal, » Ident-[contin]

<table>
<thead>
<tr>
<th></th>
<th>Agree-Place</th>
<th>* [+ nasal, + contin]</th>
<th>Max-Nasal</th>
<th>Ident-[contin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>/N-polu/</td>
<td>mbolu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/N-tia/</td>
<td>ndia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/N-kɔɔ/</td>
<td>ŋkɔɔ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/N-fela/</td>
<td>ɱvela</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/N-sua/</td>
<td>ndʒua</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| /N-sua/   | > ndʒua     | *                     |           |               |
|           | nʃua        | *!                    |           |               |
|           | sua         | *!                    |           |               |

Polish: Agree-Place, Max-Nasal, Ident-[contin] » * [+ nasal, + contin]

<table>
<thead>
<tr>
<th></th>
<th>Ident-[contin]</th>
<th>Max-nasal</th>
<th>* [+ nasal, + contin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ząb</td>
<td>zamp</td>
<td>tooth</td>
<td></td>
</tr>
<tr>
<td>waygiel</td>
<td>[венг’ел]</td>
<td>coal</td>
<td></td>
</tr>
<tr>
<td>maż</td>
<td>[мовьж]</td>
<td>husband</td>
<td></td>
</tr>
<tr>
<td>węçh</td>
<td>[вевх]</td>
<td>smell</td>
<td></td>
</tr>
</tbody>
</table>

| /monʃ/     | > mowʃj       | *          |                       |
|           | mowʃj         | *!         |                       |
|           | montʃ         | *!         |                       |

1 Nasal fricatives are cross-linguistically marked since significant oral airflow is needed to produce a (strident) fricative but nasal sounds shunt air into the nasal cavity.
English: *[+nasal, +contin], Max-Nasal, Ident-[contin] » Agree-Place

in-ert, im-possible, im-bue, in-finite, in-valid

<table>
<thead>
<tr>
<th>/invalid/</th>
<th>Ident-[cont]</th>
<th>Max-nasal</th>
<th>*[+nasal, +contin]</th>
<th>Agree-Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>invalid</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>im-balid</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>invalid</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iwvalid</td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
</tr>
</tbody>
</table>

[11] timing within the segment

- In the classic Jakobsonian feature matrix all features in the segment are simultaneous
- But order is needed for affricates and prenasalized stops while in labio-velars like kp the two constrictions are simultaneous; a given instance of time cannot be both [+F] and [−F] but two simultaneous closures by different articulators are possible

```
  o   o
 / \  / \  / \ 
[−contin] [+contin] [+nasal] [−nasal] Dorsal
                  Labial

[tʰ]   [ʷb]   [kp]
```

[12] Steriade (1993) represents stops and affricates as having two phases: closure followed by release

```
stop
affricate
fricative
approximant
unreleased stop

[t]   [tʰ]   [s]   [l]   [i̞]
```

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- Release phase is attachment site for laryngeal features like [spread gl] and [constr gl]
- Loss of release entails loss of these features: cf. Korean patʰ-il ‘field, acc’, pat’ citation; nac-íl [dʰ] ‘day, acc., nat’ citation
- The left face of an affricate behaves like a stop while right-face behaves like a fricative: cf. English in-justice bush-iz [ʃɪz] crutch-iz [tʃiz]
Yucatec Mayan

\[
/k + k / \rightarrow [h + k], \quad /t + t^l/ \rightarrow [h + t^l], \quad /t^l + t / \rightarrow [s + t], \quad [t^l + t / \rightarrow [ʃ + t]
\]


- a speech sound involves a constriction in the vocal tract
- Gesture is a representation of the constriction in terms of three simultaneous specifications

  Active articulator: tongue tip, lips, tongue dorsum, etc
  Constriction site: dental, alveolar, postalveolar, etc
  Constriction degree: max, min, etc.

  • Pairs of adjacent gestures can stand in several degrees of overlap:

  • A precise characterization of the extent of overlap can be given if each constriction has a specified time course, and temporal landmarks: onset, target attainment point, release, offset.

  The extent of overlap is determined by the alignment of landmarks of one gesture to landmarks of another. Below: glottal abduction’s target aligned to the release of oral closure, as in \( p^h \):

  • given that a gesture is single entity, assimilation involves extending the entire unit in time relative to an adjacent gesture
  • the simultaneous spread of place and constriction stipulated in Padgett’s Generalization then follows necessarily
  • also the fact that stricture features never spread independent of place also follows: xt \( \rightarrow \rightarrow kt \); we don’t find xt \( > kt \); but there can be dissimilation for stricture features as in tt \( > st \)
  • Vowel copy within the same syllable has been represented as the “unveiling” of a vocalic articulation that occurs simultaneously with the onset consonant

  Dorsey’s Law in Winnebago CRVC > CVRVC

  \( ʃ \)-wa-3ok \( > \) ʃawa3ok you mash
hikroho -> hikoroho he prepares

- Cf. Slavic polnoglasie: CVRC > CVRVC berz-a ‘birch’ berez-a Russian
- The fact that the copying is most likely to happen across a liquid/sonorant could have its roots in simple co-articulation with the sonorant reflecting the formants of the adjacent vowel

Selected References


