Vowel Harmony, Vowel Reduction and Consonant Lenition

Andrew Nevins, University College London
a.nevins@ucl.ac.uk
EVELIN 2012
Vowel Patterns in Portuguese

• In a pronunciation such as escola \[ɛscɔla\]
• Vowel Harmony or Vowel Reduction?
• While I cannot resolve this question for every word in every dialect, I am to contribute to the project by offering remarks on both phenomena in natural language
Course Overview

• Unit 1: Vowel Harmony, as presented in Nevins 2010 (*Locality in Vowel Harmony*)

• Unit 2: Vowel Reduction and Diphthong Dissimilation

• Unit 3: Consonant Lenition and Element Theory
Iterative Harmony

(1) Avrupa- lı- las- tir- a- ma- yacak- lar- imiz- dan- mi- 
Europe- from- become- CAUS- ABIL- NEG- FUT- PL- 1PL- ABL- Q- 
y- di- niz 
cop- PAST- 2PL
‘Were you one of those whom we are not going to be able to turn into Europeans?’

(2) Akdeniz- li- leș- tir- e- me- yecek- ler- imiz- den- 
Mediterranean from- become- CAUS- ABIL- NEG- FUT- PL- 1PL- ABL- 
mi- y- di- niz 
q- cop- PAST- 2PL
‘Were you one of those whom we are not going to be able to turn into Mediterraneans?’
Closest Relevant Element

(4) Ifẹ Yoruba vowel harmony skips the irrelevant second vowel (Ola Orie 2001)

a. ọrúkọ 'name'
b. èlùbọ 'yam flour'
c. ẹùrẹ 'goat'
d. ọdíde 'parrot'
e. ọtítọ 'truth'

---

Natura semper agit per vias brevissimas.
(Nature always acts through the shortest pathways.)
—Edwin A. Burtt
The Need for a New Model of Locality

<table>
<thead>
<tr>
<th>Strict Locality</th>
<th>(9) Khalkha Mongolian (Svantesson et al. 2005, 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>too Strict to</td>
<td>a. poor-ig-o ‘kidney-ACC-REFL’</td>
</tr>
<tr>
<td>deal with</td>
<td>b. xɔɔlʒ-ig-ɔ ‘food-ACC-REFL’</td>
</tr>
<tr>
<td>transparency</td>
<td>c. muur-ig-a ‘cat-ACC-REFL’</td>
</tr>
<tr>
<td></td>
<td>d. suulʒ-ig-e ‘tail-ACC-REFL’</td>
</tr>
</tbody>
</table>

| Agreement-by-   | (10) Defective intervention in Khalkha rounding harmony |
| Correspondence  |---------------------------------------------|
| too Lax to deal | a. tor-o:d ‘be.born-PERF’                    |
| with Defective  | b. ɔr-ɔ:d ‘enter-PERF’                       |
| Intervention    | c. tor-u:l-e:d ‘be.born-CAUS-PERF’           |
|                 | d. ɔr-u:l-a:d ‘enter-CAUS-PERF’               |
The Search Procedure

(5) Harmonic Search-and-Copy procedure, in two steps: \((\tau, \delta, F)\)

a. Find: \(x = \) the closest \(\tau\) to the recipient \(y\) in the direction \(\delta\)

b. Copy: the value of \(F\) on \(x\) onto \(y\), where \(x, y\) are segments, \(F\) is a feature, \(\tau\) is a predicate over segments.

(7) Accusative suffix begins Back-Harmonize in [ip-i]

\[
\begin{array}{ccc}
  x_1 & x_2 & x_3 \\
  \text{+voc} & \text{+voc} \\
  \text{+high} & \text{lab} & \text{+high} \\
  \text{+back} & \text{cont} & \\
  \text{+rd} & \text{nas} & \\
\end{array}
\]

(8) Accusative suffix finds [−back] on \(x_1\) and finds [−round] on \(x_1\)

\[
\begin{array}{ccc}
  x_1 & \leftarrow x_2 & x_3 \\
  \text{+voc} & \text{+voc} \\
  \text{+high} & \text{lab} & \text{+high} \\
  \text{+back} & \text{cont} & \text{+back} \\
  \text{+rd} & \text{nas} & \text{+rd} \\
\end{array}
\]

(9) Accusative suffix copies [−back] and [−round] to itself

\[
\begin{array}{ccc}
  x_1 & \uparrow x_2 & x_3 \\
  \text{+voc} & \text{+voc} \\
  \text{+high} & \text{lab} & \text{+high} \\
  \text{+back} & \text{cont} & \text{+back} \\
  \text{+rd} & \text{nas} & \text{+rd} \\
\end{array}
\]
Bidirectional Search in Woleaian

Bidirectional harmony that succeeds only when both sides [-low] would be very cumbersome to express in spreading theory.

Woleaian thematic formative morpheme must:
- Low-Harmonize: \( \delta = \text{left and right}, F = [\pm \text{low}] \)
- Failure results in default insertion of [+low]

\( \text{(43) } \) Woleaian theme vowel begins Low-Harmonize in [ülüümemi]

\[
\begin{array}{cccccc}
\text{[+voc]} & \text{[−voc]} & \text{[+voc]} & \text{[−voc]} & \text{[+voc]} \\
+\text{rd} & \text{lab} & −\text{rd} & \text{lab} & −\text{rd} \\
+\text{high} & −\text{cont} & −\text{high} & −\text{cont} & −\text{high} \\
−\text{low} & +\text{nas} & −\text{high} & +\text{nas} & −\text{back} \\
−\text{back} & & & & \\
\end{array}
\]

\( \text{(44) } \) Woleaian theme vowel finds [−low] on \( x_1 \) and on \( x_5 \)

\[
\begin{array}{cccccc}
\text{[+voc]} & \text{[−voc]} & \text{[+voc]} & \text{[−voc]} & \text{[+voc]} \\
+\text{rd} & \text{lab} & −\text{rd} & \text{lab} & −\text{rd} \\
+\text{high} & −\text{cont} & −\text{high} & −\text{cont} & −\text{high} \\
−\text{low} & +\text{nas} & −\text{high} & +\text{nas} & −\text{back} \\
−\text{back} & & & & \\
\end{array}
\]

\( \text{(45) } \) Woleaian theme vowel copies [−low] from \( x_1 \) and from \( x_5 \)

\[
\begin{array}{cccccc}
\text{[+voc]} & \text{[−voc]} & \text{[+voc]} & \text{[−voc]} & \text{[+voc]} \\
+\text{rd} & \text{lab} & +\text{rd} & \text{lab} & +\text{rd} \\
+\text{high} & −\text{cont} & +\text{high} & −\text{cont} & +\text{high} \\
−\text{low} & +\text{nas} & +\text{low} & +\text{nas} & +\text{low} \\
−\text{back} & ü & m & e & m \\
\end{array}
\]

Chapter 2
Copying from Two Different Sources

Apparent vowel disharmony in a word like mesgül'düm readily understandable in target-centric search

Needy vowel doesn’t ‘wait’ to find everything from a single source

(78) Turkish accusative suffix copies [-back]

\[
\begin{array}{cccc}
  x_1 & x_2 & x_3 & x_4 \\
  +\text{voc} & -\text{voc} & -\text{voc} & +\text{voc} \\
  +\text{high} & +\text{son} & \text{cor} & +\text{high} \\
  +\text{back} & -\text{nas} & -\text{cont} & -\text{back} \\
  +\text{rd} & +\text{lat} & -\text{nas} & +\text{voc} \\
\end{array}
\]

(79) Turkish accusative suffix finds [+round]

\[
\begin{array}{cccc}
  x_1 & x_2 & x_3 & x_4 \\
  +\text{voc} & -\text{voc} & -\text{voc} & +\text{voc} \\
  +\text{high} & +\text{son} & \text{cor} & +\text{high} \\
  +\text{back} & -\text{nas} & -\text{cont} & -\text{back} \\
  +\text{rd} & +\text{lat} & -\text{nas} & +\text{voc} \\
\end{array}
\]

(80) Turkish accusative suffix copies [+round]

\[
\begin{array}{cccc}
  x_1 & x_2 & x_3 & x_4 \\
  +\text{voc} & -\text{voc} & -\text{voc} & +\text{voc} \\
  +\text{high} & +\text{son} & \text{cor} & +\text{high} \\
  +\text{back} & -\text{nas} & -\text{cont} & -\text{back} \\
  +\text{rd} & +\text{lat} & -\text{nas} & +\text{voc} \\
\end{array}
\]
Chumash sibilants: the root harmonizes

\[ s + \text{apitš}^h o + \text{us} + \text{waš} \quad \text{ṣapitš}^h \text{oluşwaš} \quad \text{‘they had a stroke of good luck’} \]

Thus far we have modeled harmony in terms of a ‘needy’ affix or epenthetic vowel initiating a search, but in this case we know that each fricative bears its own specification for [±distr]:

\[
\begin{align*}
    f_1 & = [+\text{cons}, \text{cor}, +\text{cont}, -\text{ voi}, -\text{asp}, +\text{distr}] \\
    f_2 & = [+\text{cons}, \text{cor}, +\text{cont}, -\text{ voi}, +\text{asp}, -\text{distr}] \\
    f_3 & = [+\text{cons}, \text{cor}, +\text{cont}, -\text{ voi}, -\text{asp}, +\text{distr}] \\
    f_4 & = [+\text{cons}, \text{cor}, +\text{cont}, -\text{ voi}, -\text{asp}, -\text{distr}]
\end{align*}
\]
Post-cyclic deletion of all non-final $[\pm \text{distr}]$

All fricatives except the last one undergo deletion. Harmony as a repair.

<table>
<thead>
<tr>
<th>$f_1$</th>
<th>$f_2$</th>
<th>$f_3$</th>
<th>$f_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>+cons</td>
<td>+cons</td>
<td>+cons</td>
<td>+cons</td>
</tr>
<tr>
<td>cor</td>
<td>cor</td>
<td>cor</td>
<td>cor</td>
</tr>
<tr>
<td>+cont</td>
<td>+cont</td>
<td>+cont</td>
<td>+cont</td>
</tr>
<tr>
<td>-voi</td>
<td>-voi</td>
<td>-voi</td>
<td>-voi</td>
</tr>
<tr>
<td>-asp</td>
<td>+asp</td>
<td>-asp</td>
<td>-distr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$f_1$</th>
<th>$f_2$</th>
<th>$f_3$</th>
<th>$f_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>+cons</td>
<td>+cons</td>
<td>+cons</td>
<td>+cons</td>
</tr>
<tr>
<td>cor</td>
<td>cor</td>
<td>cor</td>
<td>cor</td>
</tr>
<tr>
<td>+cont</td>
<td>+cont</td>
<td>+cont</td>
<td>+cont</td>
</tr>
<tr>
<td>-voi</td>
<td>-voi</td>
<td>-voi</td>
<td>-voi</td>
</tr>
<tr>
<td>-asp</td>
<td>+asp</td>
<td>-asp</td>
<td>-distr</td>
</tr>
</tbody>
</table>

Prior to the application of the postcyclic process of harmony, they have deleted voice assimilation in consonant clusters in Serbo-Croatian (e.g., Chumash postcyclic word must:

- $\text{f}_1$ = [+cons cor +cont -voi -asp]
- $\text{f}_2$ = [+cons cor +cont -voi +asp]
- $\text{f}_3$ = [+cons cor +cont -voi -asp]
- $\text{f}_4$ = [+cons cor +cont -voi -asp]

In a word such as /s\, the postcyclic process that distributed.

Chumash must:

- $\text{f}_1$ = [+cons cor +cont -voi -asp]
- $\text{f}_2$ = [+cons cor +cont -voi +asp]
- $\text{f}_3$ = [+cons cor +cont -voi -asp]
- $\text{f}_4$ = [+cons cor +cont -voi -asp]

Halle and Vergnaud (1987) is that cyclic processes apply in a single pass of the Search Principle. The application of Distr-Harmonize to each non-final fricative, from right to left, must harmonize. All elements contrastive for tense a‰xes are underlyingly fully specified for the Search-and-Copy algorithm of this chapter, provided a postcyclic step in the deletion of features on nonfinal elements; Cho (1990) treats the process of deleting all nonfinal elements.
Interaction with Local Apicalization \((t,l,n)\)

\[
\text{s+ış+lu+sisin } \quad \text{şişlusisin } \quad \text{‘they two are gone awry'}
\]

Surface disharmony results from derivation in which each fricative copies from closest source.

(101) Application of local apicalization

\[
\begin{array}{c|c|c|c|c|c}
\text{f}_1 & \text{f}_2 & \text{l} & \text{f}_3 & \text{f}_4 \\
\hline
+\text{cons} & +\text{cons} & +\text{cons} & +\text{cons} & +\text{cons} \\
\text{cor} & \text{cor} & \text{cor} & \text{cor} & \text{cor} \\
+\text{cont} & +\text{cont} & +\text{cont} & +\text{cont} & +\text{cont} \\
-\text{voi} & -\text{voi} & +\text{lat} & -\text{voi} & -\text{voi} \\
-\text{distr} & -\text{distr} & -\text{distr} & -\text{distr} & -\text{distr}
\end{array}
\]

(102) First nonfinal fricative searches for \([\text{±distributed}]\)

\[
\begin{array}{c|c|c|c|c|c}
\text{f}_1 & \text{f}_2 & \text{f}_3 & \text{f}_4 \\
\hline
+\text{cons} & +\text{cons} & +\text{cons} & +\text{cons} \\
\text{cor} & \text{cor} & \text{cor} & \text{cor} \\
+\text{cont} & +\text{cont} & +\text{cont} & +\text{cont} \\
-\text{voi} & -\text{voi} & -\text{voi} & -\text{voi} \\
-\text{distr} & -\text{distr} & +\text{distr} & +\text{distr}
\end{array}
\]

(103) Initial fricative searches for \([\text{±distributed}]\)

\[
\begin{array}{c|c|c|c|c|c}
\text{f}_1 & \text{f}_2 & \text{f}_3 & \text{f}_4 \\
\hline
+\text{cons} & +\text{cons} & +\text{cons} & +\text{cons} \\
\text{cor} & \text{cor} & \text{cor} & \text{cor} \\
+\text{cont} & +\text{cont} & +\text{cont} & +\text{cont} \\
-\text{voi} & -\text{voi} & -\text{voi} & -\text{voi} \\
-\text{distr} & -\text{distr} & +\text{distr} & +\text{distr}
\end{array}
\]
Harmony as a Repair to Feature Deletion

- Vowel harmony affecting unstressed root vowels (of the BP type) is not extensively treated in the book.

- I contend that the Chumash-style derivation would be a promising option within the target-oriented Search model.

- Particularly considering the effects of neighboring consonants in *bunɛca, tumada, sibola* etc.
Nonfinal vowel harmony

- Canadian French (Poliquin 2006): all non-final vowels agree in laxness with last one: ɪ.ɪ.ɪ.ɪ

- Ikan’e in Russian: unstressed /a/ becomes [i] if a [+high,-back] consonant precedes. We can see vowel reduction as deletion of features, followed by harmony (leftward in this case) as a repair.
Some Questions at this point

• What features is this system compatible with?

• How do we know *minino* is harmony, not straight reduction?

• How do we deal with optionality?
Vowel Reduction: Initial Focus

- Asymmetries where symmetric behavior might be expected
BP Vowel Reduction

- Post-tonic Reduction always more obligatory than Pre-tonic Reduction
- moleke > moleki, muleki, *muleke
- Why should this asymmetry exist?
- Foot structure:
  - Reduce /e/ to [i] everywhere except strong position of foot
  - mo(le_s.ke_w), (mo_s)(le_s.ke_w)
Asymmetric Footing Requirements

• Reduce /e/ to [i] except strong head of foot
• Vowel reduction is obligatory, but foot structure assignment variable
• Optionality of foot structure assignment to pretonic vowels. Degenerate foot possible
• mo(les.Ke₃) or (mo₃)(les.Ke₃) ➔
• mu(les.Ke₃) or (mo₃)(les.Ki₃)
• ‘Angry/slow’ speech: (mo₃).(les).(Ke₃)
Trochaic Parsing Again

• Consider footing of two pretonic syllables
• Asymmetry in which one can reduce without the other doing so:
  • \textit{mi.xi.rica, mexi.rica,*mi.xe.rica}
  • No footing: \textit{mi.xi.(ri_s.ca_w)}
  • Footing: \textit{(me_s.xi_w).(ri_s.ca_w)}
  • Impossible footing: *\textit{mi.(xe_s).(ri_s.ca_w)}
Interim Conclusions

- Pretonic vs post-tonic asymmetry
- Pretonic vs pre-pre-tonic asymmetry
- Both due to footing, not to inherent properties of the reduction rule
- We will continue to develop the relationship between reduction and footing
Cape Verdean Vowel Coalescence
(Macedo 1989 Boston Univ. PhD)

- gatu > got, branku > bronk
- sidadi > sided, pai > pe
- Evidence for |A|+|U| = o
- Evidence for |A|+|I| = e
Vowel systems

- Most common 3-vowel system: [i, u, a]
- Most common 5-vowel system: [i,u,a,e,o]
- (Note that the actual phonetic values of some of these vary, e.g. ɪ, ɐ, ɛ]
- The mid vowels [e,o] pattern as ‘more complex’ than the corner vowels
The corner vowels

- Dispersion theory (Lindblom 1990) looks at the maximal distance between vowels in the acoustic space, and finds [i,u,a] to be maximally dispersed.

- Quantal theory (Stevens 1989) looks at the articulation-to-acoustics mapping, and finds that [i,u,a] have the most stable relation between slight variation in articulatory...
\(|A|\): the mAss spectrum

- mass of high energy in middle of spectrum (1kHz);
- lower energy at lower and higher edges of spectrum
|U|: the bUmp spectrum

- Higher energy in lower part of spectrum than in higher part
- Energy rapidly drops off right after 1KHz
|||: the dlp spectrum

- Lowest energy in the middle of the spectrum
# Peaks and Troughs

|    | $|I|$ | $|U|$ | $|A|$ |
|----|-----|-----|-----|
| **peaks** | low, high | low | central |
| **troughs** | central | central, high | low, high |
Combinations thereof
NEBP Pretonic Reduction to [ɛ]

- It is said that [tɛlɛvisão] and other such cases in NEBP reflect the fact that [ɛ] is the default mid-vowel

- But how do we encode the notion of default in a more principled manner?
Lax mid vowels as default in Italian

- Eleonòra, hypocoristic: èle
- Edoardo, hypocoristic: èdo
- Robèrto, hypocoristic: Ròbe
- Clotilde, hypocoristic: Clòti

- Vowels pronounced as open in CERN, ONU, GEPI, DOC, COMIT, even when they correspond to closed vowels (olimpico, organizazzazione, editoriale)
Italian Loanwords

• dòberman, èdison, bèbysitter, kimòno, las vègas

• Kenstowicz 2010: Higher sonority vowels make better peaks of stressed syllables
Kenstowicz: “Examination of the charts showing how the seven stressed vowels are distributed in F1/F2 vowel space reveals that the closed mid vowels are very near to the high vowels while the open mid vowels are relatively well separated from the single low vowel”.

In other words e is |l,A| while è is |l,A|
Ambiguity in Headedness: e, o default

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Headedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>u</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>e</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>o</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>ε</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
<tr>
<td>a</td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Pretonic mid vowels prefer the unheaded set (South)
Ambiguity in Headedness: ε,ɔ default

\[
\begin{align*}
i & | I | & u & | U | & \text{(NE)} \\
e & | I, A | & o & | U, A | \\
ɛ & | I, A | & o & | U, A | \\
a & | A | & \text{Pretonic mid vowels prefer the unheaded set}
\end{align*}
\]
Dialectal Correlations?

Dialects (South), Neutralization of $|X,A| \rightarrow |X,A|$: more reduction of nasal ã

e $|l,A|

ε $|l,A|

GetValue
 GetValue

$\ddot{a} |\underline{A},L|

a $|\underline{A}|

GetValue
 GetValue
Dialectal Correlations?

Dialects (NE), Neutralization of $|X, I| \rightarrow |X, A|$: more reduction of nasal êj

$e |I, A|$

$\varepsilon |I, A|$

$a |A|$

$\ddot{a} |A, L|$

$\ddot{o} |U, A|$

$\ddot{u} |U, A|$
Donegan’s View of Vowel Targets

/i/ and /u/ most ‘colorful’ vowels (extreme in articulatory and acoustic F2 space)

/i/ and /u/ are located at the extremes of the articulatory and acoustic F2 space, making them the most 'colorful' vowels.

/i/ and /u/ can undergo raising, which results in a gain in color and a loss of sonority.

Raising: gain in color, loss of sonority

/i/ can raise to /u/.

/u/ can raise to /i/.

Lowering: gain in sonority, loss of color

/e/ and /o/ are involved in lowering. Lowering results in a gain in sonority and a loss of color.

/a/ is the most sonorant vowel.

Donegan 1978
Ohio State PhD
|I| higher than |U|

- Bisol 1989: formiga > furmiga
- but veludo \(*\) veludo
- |I| can raise |U| but not vice versa
- This can be seen as a kind of parasitic harmony (Freitas 2010)
- Fails & Clegg, Kenstowicz & Sandalo data show /i~u/ height difference with F1 values
Plural Formation with $<$l$>$-final nouns

• Claim: BP plural allomorph is /-is/ after C-final stems, e.g. [flor-is, rapaz-is]

• Input: /anɛw+is/

• *a.nɛ.wis: constraint against [w] as onset

• Choice between [a.nɛws] and [anɛjs].

• [js] preferred to [ws] all else being equal...
All Else not Equal: Monosyllables keep the \([w]\)

181 speakers, 89 nonce items
Speakers choose CV.Cɛjs > CV.Cɛws
Speakers choose Cɛws > Cɛjs
Chapéjs vs. Musêws
181 speakers, 89 nonce items
Speakers choose [ɛjs] > [ɛws]
Speakers choose [ews] > [ejs]

Becker, Clemens & Nevins 2011 (on Lingbuzz)
[js] preferred to[ws], all else being equal

- But Diphthongal Dispersion exerts a force:
- [e,j] very close in color and sonority
- [ɛ, j] more distant in sonority
- [e,w] close in sonority but not color
- [ej] a bad diphthong: its halves are too close. So /ewis/ ➔ [ews] instead of [ejs].
- But /ɛwis/ ➔ [ɛjs] because it’s a decent diphthong
Interim Conclusions

- Diphthongs exhibit dispersion/dissimilation effects in their two halves
- The choice of [ɛjs] over [ejs] in derived words reflects computations made over the vowel space
Russian Vowel Reduction

/e/ loses sonority, while /o/ loses color
A Mirror Image but Unattested Reduction

/o/ loses sonority, while /e/ loses color

The ‘pull’ towards /u/ is never stronger than the pull towards /i/
Diphthongs: /ai/ vs /au/

- English asymmetry between these
- ripe, like, bribe, rife, hive, time
- *roup, louk, broub, souf, houv, town
- [au] very restricted: only allowed before coronals
- Diphthongization of [i:] and [u:] in Great Vowel Shift did not follow parallel courses
- Parallel asymmetries in Japanese (Kubozono 2001)
Diphthongs and Umlaut
Sri Lankan Portuguese Creole

- ‘ɒːbrə ‘profession’ ob're:ru ‘worker’
- ‘nɒːmi ‘name’ nomi'na: ‘nominate’
- ‘pæːdərə ‘stone’ pedri'ya:du ‘covered w/stone’
- ‘fæːru ‘iron’ fe're:ru ‘ironsmith’
- ‘baːjlu ‘dance’ bəjl'doːr ‘dancer’
- ‘baːrvə ‘beard’ bər've:ru ‘barber’
SLPC: Vowel Reduction as Loss of Headedness

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Headedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>I</td>
</tr>
<tr>
<td>u</td>
<td>U</td>
</tr>
<tr>
<td>e</td>
<td>I,A</td>
</tr>
<tr>
<td>o</td>
<td>U,A</td>
</tr>
<tr>
<td>æ</td>
<td>I,A</td>
</tr>
<tr>
<td>ø</td>
<td>A</td>
</tr>
<tr>
<td>a</td>
<td>A</td>
</tr>
</tbody>
</table>
Acoustic signatures of vowels

**e**: f1 and f2 separated but mass concentrated in central region

All vowel formant patterns can be seen as modulations of a carrier signal

**o**: marked skewing of energy towards lower half of spectrum, but shifted towards central region
Two Patterns of Vowel Reduction

• Centripetal: vowels drawn into centralized region of vowel space, removing all modulation patterns.

• Centrifugal: vowels dispersed into far corners of space, simplifying their modulation pattern.
Lenition as Information Loss

• Consider the various patterns of lenition found in English: flapping (US) and glottalling (UK). Both have dramatically different realizations, but the same effect on representation $|R,?,h|$

• $|R,h|$: a little bi[$s$]

• $|?|$: ci[$?]y

• $|R|$: ci[$r$]y
Liquids

- |R,ʔ|: lateral; |R|: rhotic
- |R,ʔ,l|: palatal lateral

Effects on lh: loss of |R,ʔ,l|: mu[j]er, mu[l]er

More common post-tonically?

Effects on r: rhotacization in complex onsets and in codas (praia, branco; vorta)
Why Lenition?
(Kingston)

• Lenition is not governed by how far articulators have to travel but instead by the difference in intensity the speaker wishes to create between the affected segment and its neighbors.

• Consonants lenite inside prosodic constituents and not at their edges, and lenition therefore conveys to the listener that the current constituent is continuing rather than ending or a new one beginning.

• Lenition thus complements the fortition observed at phrase edges that reduces signal intensity and interrupts the signal more.
Fortition as Dissimilation

• Perhaps one of the most recurrent cases of fortition is glide strengthening in onset position, e.g. [jo] > [ʒo] in Argentinian Spanish

• This can be seen as a move towards polarization to the most consonant-like of consonants and the most vowel-like of vowels of Jakobson’s *Why mama and papa*
Stressed Vowels and Effects on Consonants

- The auditory nerve response to a vowel-like sound which is preceded by either silence or of a sound with little intensity is greater than the response to a stimulus preceded by a period of equal intensity.

- Onset-sensitive stress languages: lower sonority (less intense) onsets such as voiceless consonants and obstruents are heavier than higher sonority ones.

- The idea is that onset-sensitive stress, odd in itself, and odder because it is sensitive to the lowness of sonority of the consonant, is about enhancing the vowel by de-hancing the consonant that precedes it.
Conclusions

• Integration of prosodic constituency and segmental processes

• Representational primitives in syntagmatic and paradigmatic processes

• Fortition and lenition affecting vowels and consonants