Vowel colouring patterns in Bzhedugh Adyghe
Evidence for cumulative constraint interaction

Ludger Paschen
(Leipzig University)

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Console XXIV, York
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2 Background II: Vowel colouring and coarticulation
3 Vowel colouring in Bzhedugh Adyghe
4 Accounting for the rounding and backing patterns
   - Basic Assumptions
   - Why Standard OT fails to account for the backing pattern
   - A Harmonic Grammar Account
5 Discussion
6 Conclusion
Bzhedugh Adyghe

Adyghe:
- One of the four languages belonging to the Northwest Caucasian family
- 100,000 speakers in Russia (stable), 300,000 in Turkey (dwindling)
- Bi-/Trilingualism (Höhlig, 1997)

Bzhedugh:
- One of the four main dialects of Adyghe
- 15,000 speakers in 20 villages along the Pshish and Psekupe rivers in Adygea (Russia) (Sitimova, 2004)
Caucasian languages

taken from Gippert (2010),

http://titus.uni-frankfurt.de/didact/karten/kauk/kaukasf.jpg
Typological profile of Bzhedugh Adyghe

- Rich consonant inventory
- Small vertical vowel phoneme inventory
- Lack of lexical tone and stress
- Polysynthetic verbal morphology
- Absolutive/Ergative Alignment
### Consonant inventory

<table>
<thead>
<tr>
<th>b</th>
<th>p</th>
<th>pʰ</th>
<th>p'</th>
<th>p'ʷ</th>
<th>f</th>
<th>w</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>d</td>
<td>t</td>
<td>tʰ</td>
<td>t'</td>
<td>t'ʷ</td>
<td>r</td>
<td>n</td>
<td></td>
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<tr>
<td>z</td>
<td>dʒ</td>
<td>s</td>
<td>ts</td>
<td>tsʰ</td>
<td>ts'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ʒ</td>
<td>ʒ</td>
<td>j</td>
<td>jʰ</td>
<td>ʒ</td>
<td>tʃ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ž</td>
<td>žʷ</td>
<td>džʷ</td>
<td>ʃ</td>
<td>ʃʷ</td>
<td>tʃʷ</td>
<td>ʃ</td>
<td>ʃʷ</td>
</tr>
<tr>
<td>ʒ</td>
<td>ʒ</td>
<td>l</td>
<td>l'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ž</td>
<td>ž</td>
<td>f</td>
<td>f'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ž</td>
<td>ž</td>
<td>g</td>
<td>gʰ</td>
<td>k</td>
<td>kʰ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ž</td>
<td>ž</td>
<td>ɣ</td>
<td>ɣ</td>
<td>q</td>
<td>qʰ</td>
<td>q</td>
<td>qʰ</td>
</tr>
<tr>
<td>ž</td>
<td>ž</td>
<td>h</td>
<td>h</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ž</td>
<td>ž</td>
<td>ϴ</td>
<td>ϴ'</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Bzhedugh

Colouring

The pattern

An account

Basic Assumptions

OT

Harmonic Grammar

Discussion

Conclusion

References
Vowel inventory

- Vowel phonemes: /ə, ɛ, a/ (Sitimova, 2004; Smeets, 1984)
- But: rich allophony
Vowel space
Vowel colouring and prosodic boundaries

- Coarticulation: overlapping of articulatory movements associated with separate sound segments (Hardcastle, 2006)
- Consonant-vowel interactions: consonants and vowels frequently assimilate or dissimilate in place to one another (Padgett 2011 a.o.)
- Degree of (phonetic) coarticulation and likelihood of (phonological) CV interactions decrease if prosodic boundaries intervene
Prosodic domains and prosodic boundaries

The prosodic hierarchy:

- Prosodic structure consists of prosodic categories of different types
- Prosodic categories are ordered in a hierarchy
- Competing theories about domains and labels (Jun, 2005; Nespor and Vogel, 2007; Selkirk, 1986)
Vowel colouring and prosodic boundaries

- Postboundary (domain-initial) vowels are coarticulated less with preceding vowels across a higher prosodic boundary (IP) than across a lower prosodic boundary (ip, Wd) (Cho, 2004)

- Lack of across-syllable coarticulation facilitates Wd boundary recognition (Mattys, 2004)

- Articulatory strengthening at prosodic domain boundaries (Fougeron and Keating, 1997)

- Single acoustic cues vs. subjective perceived boundary strength (Mann and Repp, 1981)
Vowel space: Bzhedugh vowel phonemes
Contextual allophony: preceding consonants in literary (Terek) Kabardian (Choi, 1991)
Vowel space

- Contextual allophony: preceding consonants in Turkish Kabardian (Gordon and Applebaum, 2006)
ATB neutralisation in Ubykh (Colarusso, 1988)

Vowel Space for one Ubykh speaker, (F₂ vs. F₁)

/ə/ = /a/
Vowel colouring in Bzhedugh Adyghe

- Field trip to the village of Vochepshiy (Очэпцы/Вочепший), Russia, in July 2014
- Investigating the acoustic properties of /ə, e/ in various phonetic environments
- Main findings:
  - Labialised consonants induce rounding of adjacent vowels in the same syllable
  - Coronal and palatalised consonants cause fronting of adjacent following vowels
  - Posterior consonants cause backing of adjacent preceding vowels
- On closer inspection, the backing pattern was found to depend on several different factors
Rounding, fronting and backing

(1)  
\( /\hat{s}^w\check{e}\check{e}/ \rightarrow [\hat{s}^w\check{y}\check{z}i] \)  
‘woman’

b.  
\( /q\hat{e}\check{q}/ \rightarrow [q\check{y}q] \)  
‘stutterer’

c.  
\( /d\check{e}v^w/ \rightarrow [d\check{e}\check{v}^w] \)  
‘good (predicative form)’

d.  
\( /d\check{e}v^w\check{e}/ \rightarrow [d\check{e}.\check{v}^w\check{e}] \)  
‘good (attributive form)’

- Various processes can apply simultaneously, e.g. fronting and rounding in (1-a)
Rounding, fronting and backing

(1) a. \(/\text{šwəzə/} \rightarrow [\text{šw}\text{γ.zi}]\)
   ‘woman’

   b. \(/\text{qəq/} \rightarrow [\text{qəq}]\)
   ‘stutterer’

   c. \(/\text{dəv}^w\text{/} \rightarrow [\text{dəv}^w]\)
   ‘good (predicative form)’

   d. \(/\text{dəv}^w\text{ə/} \rightarrow [\text{dэ.v}^w\text{ə}]\)
   ‘good (attributive form)’

* Rounding* is sensitive to the σ domain: heterosyllabic labialised consonants do not trigger rounding (1-d)
Rounding, fronting and backing

(1)  
a. /sʰəzə/ → [ʃʰə.zə]  
‘woman’
b. /qəq/ → [qəq]  
‘stutterer’
c. /deβw/ → [dœβw]  
‘good (predicative form)’
d. /deβwə/ → [dəβwə]  
‘good (attributive form)’

- A single adjacent uvular is not sufficient to trigger backing (1-c), and progressive fronting takes precedence over regressive backing (1-d)
Backing: complications

(2)  

(a) \( /\chi^w\omega\epsilon/ \rightarrow [\chi^w\omega.\epsilon] \)
   ‘became’

(b) \( /\chi\epsilon k^w/ \rightarrow [\chi\epsilon k^w] \)
   ‘land (predicate form)’

(c) \( /\beta^w\epsilon g^w\epsilon/ \rightarrow [\beta^w\epsilon.g^w\epsilon] \)
   ‘way (attributive form)’

(d) \( /\beta^w\epsilon g^w/ \rightarrow [\beta^w\epsilon.g^w] \)
   ‘way (predicative form)’

**Backing** can apply when there is one posterior consonant in the same syllable and an adjacent one in a different syllable (2-a)
(2) a. /χʷəɾə/ → [χʷoɾə]  
   ‘became’

b. /xekʷ/ → [xəkʷ]  
   ‘land (predicate form)’

c. /βʷegʷə/ → [βʷə.gʷə]  
   ‘way (attributive form)’

d. /βʷegʷ/ → [βʷoɡʷ]  
   ‘way (predicative form)’

However, this applies only to uvulars; two velars cannot trigger *backing* even when they are in the same syllable (2-b)
Backing: complications

(2)  
   a. /χwəɾə/ → [χwəɾə]  
      ‘became’  
   b. /xəkʷ/ → [xəkʷ]  
      ‘land (predicate form)’  
   c. /bʷəɡʷə/ → [bʷəɡʷə]  
      ‘way (attributive form)’  
   d. /bʷəɡʷ/ → [bʷəɡʷ]  
      ‘way (predicative form)’

When there are both a velar and a uvular adjacent to a non-low vowel, backing is triggered only if they are in the same syllable ((2-c)-(2-d))
Acoustic evidence: Rounding
Acoustic evidence: Backing
Acoustic evidence

Average acoustic data from 2 speakers x 4 tokens:

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Stimulus</th>
<th>Gloss</th>
<th>F1_av</th>
<th>F1_std</th>
<th>F2_av</th>
<th>F2_std</th>
</tr>
</thead>
<tbody>
<tr>
<td>ə</td>
<td>şeklin əzə</td>
<td>woman</td>
<td>408</td>
<td>19</td>
<td>1750</td>
<td>141</td>
</tr>
<tr>
<td>ə</td>
<td>χınənə</td>
<td>became</td>
<td>440</td>
<td>40</td>
<td>771</td>
<td>62</td>
</tr>
<tr>
<td>ə</td>
<td>ənənə</td>
<td>way.ATTR</td>
<td>528</td>
<td>46</td>
<td>1270</td>
<td>190</td>
</tr>
<tr>
<td>ə</td>
<td>ənənə</td>
<td>way.PRED</td>
<td>516</td>
<td>64</td>
<td>956</td>
<td>101</td>
</tr>
</tbody>
</table>

- Qualities of the allophonic variants are clearly distinct and not simply the results of coarticulatory effects.
Basic Assumptions

- **Feature Geometry**: Segmental features are organised in a hierarchical structure, each structural node instantiates a separate tier (Clements and Hume, 1995; McCarthy, 1988; Morén, 2003)

- **Optimality Theory (OT)**: Competition of several output candidates from a single input, licensing of winner candidate is governed by ranked and violable constraints (Prince and Smolensky, 1993)

- **Harmonic Grammar**: Adding weights to constraints (Pater, 2009)
Feature Geometry: Underlying representations

Representation of vowels:

```
               V
              / \  
             C_{PL}  MAN  LAR
               |     /  
              V_{PL} [open]  
                         /  
                        [closed]
```
Feature Geometry: Underlying representations

Representation of velars:

```
        k
       
      C_{PL}  MAN  LAR
     /   \   /   \\
  DOR [closed] MAN LAR
```

Cumulative effects in Bzhedugh

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Feature Geometry: Underlying representations

Representation of uvulars:
Representation of pharyngeals:
Representation of labialised consonants:

\[ \begin{align*}
&\text{C}^w \\
&\text{C}_{PL} \\
&\text{V}_{PL} \\
&\text{LAB} \\
&\ldots \\
&\text{MAN} \\
&\text{LAR} \\
&\text{[closed]} 
\end{align*} \]
Feature Geometry: Spreading

**Spreading of LAB from left to right:**

```
  C^w
     /\    /
     \  /
      \ /
       V
       |
      C_{PL}
     /   |
    /    |
   /     |
  LAB   V_{PL}
       /|
       V
       |
       C_{PL}
       .|
       .|
  ```
Feature Geometry: Spreading

Spreading of LAB from right to left:
Feature Geometry: Spreading

Spreading of DOR only from right to left:

```
V  q
  |
  C_{PL}
  |
  V_{PL}  DOR
  |
  [post]
  ...
  ...
```
Constraints

(3) \( \text{DEP}^{\text{V}_{\text{PL}}} \): Count one * for each epenthetic association line between a \( \text{V}_{\text{PL}} \) node and a segmental feature ("do not spread") (Trommer, 2011)

(4) \( \text{Crisp(Edge)} \): Count one * for each phonetically visible association line that links two elements dominated by different \( \sigma \) ("do not spread across syllable boundaries") (cf. Basri, Broselow, and Finer 1999)

(5) \( \text{A(gree)}(X) \): Count one * for each adjacent VC or CV sequence that does not agree in X specifications

(6) \( \text{A(gree)}(X) \)-[p(osterior)]: Count one * for each pair of adjacent VC or CV sequences that do not agree in X and posterior specifications (cf. Kimper 2011)
**Standard OT: Rounding**

- *Rounding* (spread of $\text{LAB}$ from one $V_{\text{PL}}$ node to another) always applies within a syllable, but never across a syllable boundary.

- Constraint ranking:
  \[ \text{CRISP} \gg A(\text{LAB}) \gg \text{DEP}^{V_{\text{PL}}}_F \]

<table>
<thead>
<tr>
<th></th>
<th>$\chi^{w\text{eke}}$</th>
<th>CRISP</th>
<th>$A(\text{LAB})$</th>
<th>$\text{DEP}^{V_{\text{PL}}}_F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>$\chi^{w\text{eke}}$</td>
<td><em>!</em>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>$\chi^{w\text{o\text{ke}}}$</td>
<td>**</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c.</td>
<td>$\chi^{w\text{o\text{ke}}}$</td>
<td>*!</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>d.</td>
<td>$\chi^{w\text{o\text{ke}}}$</td>
<td><em>!</em></td>
<td>*</td>
<td>**</td>
</tr>
</tbody>
</table>

Table (7)
Standard OT: Backing

- **Backing** (spread of **DOR** from one **C**\textsubscript{PL} node to a **V**\textsubscript{PL} node) never applies if no [post] features are present (i.e. if only velars are involved).
- Constraint ranking:
  \[ \text{DEP}_{F}^{V_{PL}} \gg A(DOR) \]

<table>
<thead>
<tr>
<th>(8)</th>
<th>( x\epsilon k^{w} )</th>
<th>CRISP</th>
<th>A(LAB)</th>
<th>( \text{DEP}<em>{F}^{V</em>{PL}} )</th>
<th>A(DOR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>( x\omega k^{w} )</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>b</td>
<td>( x\epsilon k^{w} )</td>
<td></td>
<td></td>
<td></td>
<td>!</td>
</tr>
</tbody>
</table>
Standard OT: Backing

- **Backing** always applies if two dorsal consonants carrying [post] features (i.e. uvulars) are adjacent to a vowel, regardless of syllable boundaries.

- Constraint ranking:
  \[ \text{A(Dor-[p])} \gg \text{Crisp} \]

<table>
<thead>
<tr>
<th>Example</th>
<th>A(Dor-[p])</th>
<th>Crisp</th>
<th>Dep ( V_{PL} )</th>
<th>A(Dor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( \chi^w\emptyset\emptyset\emptyset)</td>
<td><em>!</em>!**</td>
<td></td>
<td></td>
<td>***</td>
</tr>
<tr>
<td>b. ( \chi^w\emptyset\emptyset\emptyset)</td>
<td>*!</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c. ( \chi^w\emptyset\emptyset\emptyset)</td>
<td>*</td>
<td>*</td>
<td>**</td>
<td></td>
</tr>
</tbody>
</table>

- Problem: ranking predicts overapplication (the same problem would arise if the two constraints were ranked the same)
Standard OT: Backing

- **Backing** always applies if two dorsal consonants carrying [post] features (i.e. uvulars) are adjacent to a vowel, regardless of syllable boundaries.

- Alternative constraint ranking:
  \[ \text{CRISP} \gg A(\text{Dor}–[p]) \]

<table>
<thead>
<tr>
<th>(10)</th>
<th>&lt;wəɾe&gt;</th>
<th>CRISP</th>
<th>A(\text{Dor}–[p])</th>
<th>DEP</th>
<th>A(\text{Dor})</th>
</tr>
</thead>
<tbody>
<tr>
<td>🧐 a.</td>
<td>&lt;wəɾe&gt;</td>
<td></td>
<td>***</td>
<td></td>
<td>***</td>
</tr>
<tr>
<td>😊 b.</td>
<td>&lt;wəɾe&gt;</td>
<td>*!</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>&lt;wəɾe&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>&lt;wəɾe&gt;</td>
<td>*!</td>
<td></td>
<td>**</td>
<td></td>
</tr>
</tbody>
</table>

- Problem: ranking predicts underapplication.
Harmonic Grammar

- Harmonic Grammar (HG): a connectionist model allowing for the implementation of cumulative effects (Legendre, Miyata, and Smolensky, 1990; Pater, 2009)
- Constraints are not ranked, but bear weights
- Harmonic weights are calculated into harmony scores
- The harmony score of a candidate is the sum of a candidate’s violations multiplied by the weight of the respective constraint:

$$H_X = \sum_{i=1}^{n} v_X(C_i) \times w(C_i)$$
Velars are not enough: No change in quality when a vowel is surrounded by one or two velar consonants in the same $\sigma$

\begin{tabular}{|c|c|c|c|c|}
\hline
(12) & xεk$^w$ & DEP$^{V_{pl}}$ & CRISP & A(DOR−[p]) & A(DOR) \\
     & 'land.PRED' & $w=3$ & $w=1.5$ & $w=1.5$ & $w=1$ \\
\hline
\(\rightarrow\) & a. xœk$^w$ & & & & -2 & -2 \\
\hline
\(\rightarrow\) & b. xœk$^w$ & -1 & & & -3 \\
\hline
\end{tabular}
Deriving backing: uvulars I

- Two uvulars cause change in quality to a vowel when in the same syllable

<table>
<thead>
<tr>
<th>(13)</th>
<th>qəp</th>
<th>DEP ( v_{PL} )</th>
<th>CRISP</th>
<th>A(DOR--[p])</th>
<th>A(DOR)</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>qəp</td>
<td>( w=3 )</td>
<td>( w=1.5 )</td>
<td>( w=1.5 )</td>
<td>( w=1 )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a.</td>
<td></td>
<td></td>
<td>-2</td>
<td>-2</td>
<td>-5</td>
</tr>
<tr>
<td></td>
<td>b.</td>
<td>qəp</td>
<td>-1</td>
<td></td>
<td></td>
<td>-3</td>
</tr>
</tbody>
</table>
Vowel quality is affected by a uvular and a velar only if both are in the same syllable as the vowel.

<table>
<thead>
<tr>
<th></th>
<th>Vowel Quality</th>
<th>Dep</th>
<th>Crisp</th>
<th>A(Dor−[p])</th>
<th>A(Dor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(14)</td>
<td>v^w əg^w</td>
<td>w=3</td>
<td>w=1.5</td>
<td>w=1.5</td>
<td>w=1</td>
</tr>
<tr>
<td>a.</td>
<td>v^w əg^w</td>
<td></td>
<td></td>
<td>-1</td>
<td>-2</td>
</tr>
<tr>
<td>b.</td>
<td>v^w əg^w</td>
<td></td>
<td></td>
<td>-1</td>
<td>-3</td>
</tr>
</tbody>
</table>

| (15) | v^w əg^wə    |   w=3 | w=1.5 | w=1.5     | w=1    | H  |
| a. | v^w əg^wə    |       |       | -1         | -2     | -3.5|
| b. | v^w əg^wə    |       |       | -1         | -4.5   |     |
Gang effect: Two uvulars cause quality change to a vowel even when not in the same syllable

(16) \( \chi'^{w\text{əe}} \) ‘became’

\[
\begin{array}{|c|c|c|c|c|}
\hline
& \text{DEP} \downarrow_{F} & \text{CRISP} & A(\text{Dor} - [p]) & A(\text{Dor}) \\
\hline
\text{w=3} & \text{w=1.5} & \text{w=1.5} & \text{w=1} & \text{H} \\
\hline
\text{a. } \chi'^{w\text{əe}} & & -2 & -2 & -5 \\
\text{b. } \chi'^{w\text{o.e}} & -1 & -1 & & -4.5 \\
\hline
\end{array}
\]
## Cumulative interactions: summary

<table>
<thead>
<tr>
<th>(17)</th>
<th>( \text{xe} \text{k}^w )</th>
<th>DEP ( w = 3 )</th>
<th>CRISP ( w = 1.5 )</th>
<th>A(DOR-[p]) ( w = 1.5 )</th>
<th>A(DOR) ( w = 1 )</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( \text{V}_{\text{pl}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( \text{F} )</td>
<td>( w = 3 )</td>
<td>( w = 1.5 )</td>
<td>( w = 1.5 )</td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>( \text{x@k}^w )</td>
<td></td>
<td></td>
<td>-2</td>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>( \text{xck}^w )</td>
<td>-1</td>
<td></td>
<td></td>
<td>-3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(18)</th>
<th>( \text{p@p} )</th>
<th>DEP ( w = 3 )</th>
<th>CRISP ( w = 1.5 )</th>
<th>A(DOR-[p]) ( w = 1.5 )</th>
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<td>( \text{F} )</td>
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The case of pharyngeals and glottals

Pharyngeals and glottals cause backing in most varieties of Circassian, cf. the following examples from literary Adyghe (Colarusso, 1988; Smeets, 1984):

(22) a. /ŋən/ → [ŋən] ‘carry’
    b. /ŋe/ → [ŋe] ‘dog’
    c. /ʔe/ → [ʔe] ‘hand’

In Bzhedugh, however, no such CV interaction is attested:

(23) a. /ŋən/ → [ŋən] ‘carry’
    b. /ŋe/ → [ŋe] ‘dog’
    c. /ʔe/ → [ʔe] ‘hand’
Bzhedugh has been characterised as having a rather conservative phonology, both in terms of inventory and processes (Sitimova, 2004)

One possible account: different underlying representations for posterior sounds in literary Adyghe and Bzhedugh (see Sylak-Glassman 2014 for detailed discussion of related cases)

Alternatively, one could also derive the divergent pattern by adjusting the constraint weights for each dialect:

Literary Adyghe: \( \text{w}(A(PHAR)) > \text{w}(\text{DEP}_{PL}^{\text{F}}) \)

Bzhedugh Adyghe: \( \text{w}(A(PHAR)) < \text{w}(\text{DEP}_{PL}^{\text{F}}) \)
Possible interaction types: excitatory/inhibitory, sequential/simultaneous (Müller, 2013)

Inhibitory simultaneous interaction: Crisp $\gg A(X)$ would block spreading over a syllable boundary in Standard OT

Excitatory simultaneous interaction: gang effect of markedness constraints ($A(dor)$ and $A(dor)–[p]$) on faithfulness constraints ($CrISP$, $Dep$) in Harmonic Grammar

Excitatory sequential interaction: Apocope gives rise to resyllabification and therefore feeds backing

Vowel colouring in Bzhedugh seems to be opaque and transparent at the same time
Summary and outlook

- CV interactions in Bzhedugh are sensible to both segmental place features and prosodic domains
- Cumulative effects can be modelled within the theory of Harmonic Grammar
- Global and parallel evaluation of both local and non-local phenomena
- More acoustic data needed to further explore the phonetic details of the observed patterns


References II


