Vowel harmony with QFLFP

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Introduction

- Vowel harmony transformations with neutral vowels utilize:
  - unbounded spreading
  - blocking
  - transparency

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  - unbounded spreading
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  - transparent vowels
- Unbounded spreading and blocking are QFLFP definable over multi-tiered autosegmental representations
  - when association is a total function

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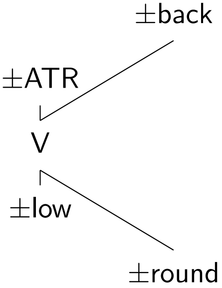
- Vowel harmony patterns with neutral vowels utilize:
  - unbounded spreading
  - blocking
  - transparent vowels
- Unbounded spreading and blocking are QFLFP definable over multi-tiered autosegmental representations
  - when association is a total function
- Harmony across transparent vowels may not be

Multi-tiered ARs

Bottle brush representation



Multi-tiered ARs

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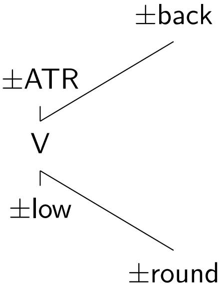
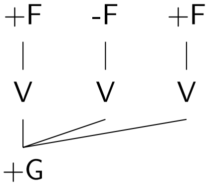
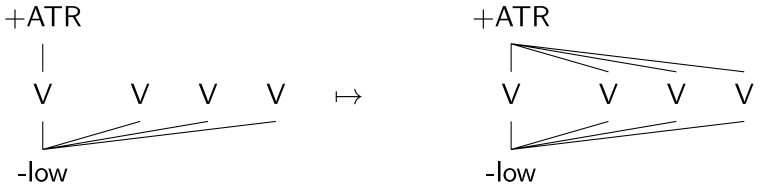


Obey OCP, NCC



Unbounded Spreading

An Akan-like pattern demonstrates unbounded spreading of ATR when all vowels are [-low]



Defining Multi-tiered ARs with QFLFP

Like strings, ARs can be defined with QFLFP

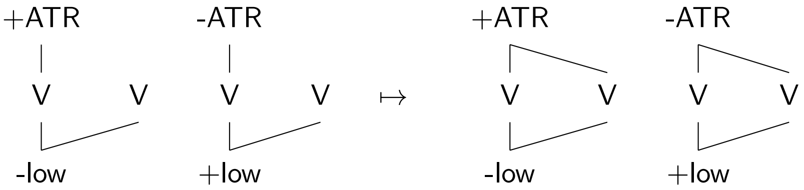
- Assume all features are present underlyingly
- Signature: $\langle D; p, \mathscr{A}, P_V, P_{+ATR}, P_{-low} \rangle$
- First, define the unary relations of each element in the output structure in terms of the input structure
  - $\mathrm{P}'_V(x) \stackrel{\text{def}}{=} \mathrm{P}_V(x)$
  - $\mathrm{P}'_{+ATR}(x) \stackrel{\text{def}}{=} \mathrm{P}_{+ATR}(x)$
  - $\mathrm{P}'_{-low}(x) \stackrel{\text{def}}{=} \mathrm{P}_{-low}(x)$

Defining the Association Relation

- Chandlee & Jardine (2019) introduce the binary association relation, which I define between each feature tier and the vowel tier
  - $\mathscr{A}'_{ATR}(x,y) \stackrel{\text{def}}{=} [lfp\mathscr{A}_{ATR}(x,y) \vee R(x',p(y'))](x,y)$
  - $\mathscr{A}'_{low}(x,y) \stackrel{\text{def}}{=} \mathscr{A}_{low}(x,y)$
    - x evaluated as a feature and y as a vowel

Blocking

In the same Akan-like pattern, a [+low] vowel blocks the spread of ATR

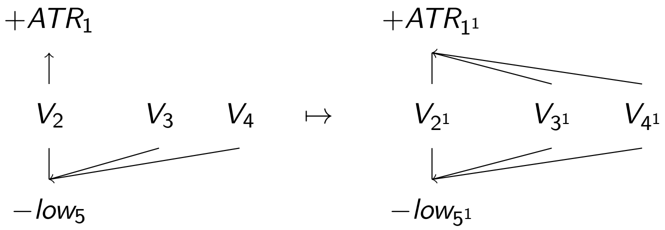


Defining Blocking

- Again, each element in the output is also present in the input
  - $\mathrm{P}'_V(x) \stackrel{\text{def}}{=} \mathrm{P}_V(x)$
  - $\mathrm{P}'_{+ATR}(x) \stackrel{\text{def}}{=} \mathrm{P}_{+ATR}(x)$ $\quad$ $\mathrm{P}'_{-ATR}(x) \stackrel{\text{def}}{=} \mathrm{P}_{-ATR}(x)$
  - $\mathrm{P}'_{+low}(x) \stackrel{\text{def}}{=} \mathrm{P}_{+low}(x)$ $\quad$ $\mathrm{P}'_{-low}(x) \stackrel{\text{def}}{=} \mathrm{P}_{-low}(x)$
- Blocking cannot be defined using the binary association relation
  - $\mathscr{A}'_{ATR}(x,y) \stackrel{\text{def}}{=} [lfp \mathscr{A}_{ATR}(x,y) \vee (R(x', p(y')) \wedge ...)](x,y)$
  - $\mathscr{A}'_{low}(x,y) \stackrel{\text{def}}{=} [lfp \mathscr{A}_{low}(x,y) \vee (R(x', p(y')) \wedge ...)](x,y)$
- Must introduce a new variable, which requires a quantifier, or
- refer to unassociated input vowels

Association Function

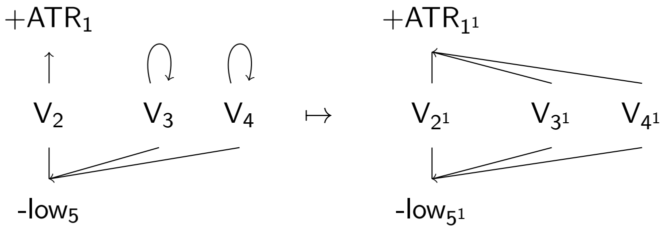
- Vowels cannot be associated to multiple feature values on the same tier
- Unidrectional association function
  - from vowel(s) to a feature: x evaluated as a vowel, y as a feature



- $\alpha'_{ATR}(x) \approx y \stackrel{\text{def}}{=} [lfp\alpha_{ATR}(x) \approx y \vee R(p(x'), y')](x, y)$
- $\alpha'_{low}(x) \approx y \stackrel{\text{def}}{=} [lfp\alpha_{low}(x) \approx y \vee R(p(x'), y')](x, y)$

Total Function

- "unassociated" input vowels associate to themselves
  - $\text{unspec}_{ATR}(x) \stackrel{\text{def}}{=} \alpha_{ATR}(x) \approx x$



Blocking with association function

$\langle D; p, \alpha_{ATR}, \alpha_{low}, \mathrm{P}_V, \mathrm{P}_{+ATR}, \mathrm{P}_{-ATR}, \mathrm{P}_{+low}, \mathrm{P}_{-low} \rangle$

- $\mathrm{P}'_V(x) \stackrel{\text{def}}{=} \mathrm{P}'_V(x)$
- $\mathrm{P}'_{+ATR}(x) \stackrel{\text{def}}{=} \mathrm{P}'_{+ATR}(x)$ $\quad \mathrm{P}'_{-ATR}(x) \stackrel{\text{def}}{=} \mathrm{P}'_{-ATR}(x)$
- $\mathrm{P}'_{+low}(x) \stackrel{\text{def}}{=} \mathrm{P}'_{+low}(x)$ $\quad \mathrm{P}'_{-low}(x) \stackrel{\text{def}}{=} \mathrm{P}'_{-low}(x)$
- $\alpha'_{ATR}(x) \approx y \stackrel{\text{def}}{=} [lfp(\alpha_{ATR}(x) \approx y \wedge \neg x \approx y) \vee (R(p(x'), y') \wedge unspec_{ATR}(x))](x, y)$
- $\alpha'_{low}(x) \approx y \stackrel{\text{def}}{=} \alpha_{low}(x) \approx y \wedge \neg x \approx y$

Transparency

Can the association function and QFLFP also be used to describe harmony across transparent vowels?

$$
\begin{tikzcd}[column sep=small]
+\text{back}_1 & -\text{back}_2 & & +\text{back}_3 & & +\text{back}_{1^1} & -\text{back}_{2^1} & & +\text{back}_{3^1} \\
V_4 \arrow[u] \arrow[d] & V_5 \arrow[u] \arrow[d] & V_6 \arrow[dl] & V_7 \arrow[u] \arrow[d] & \mapsto & V_{4^1} \arrow[u] \arrow[d] & V_{5^1} \arrow[u] \arrow[d] & V_{6^1} \arrow[ul] \arrow[dl] & V_{7^1} \arrow[u] \arrow[d] \\
+\text{low}_8 & -\text{low}_9 & & +\text{low}_1 0 & & +\text{low}_{8^1} & -\text{low}_{9^1} & & +\text{low}_{10^1}
\end{tikzcd}
$$

- If all features are present underlyingly, works same as blocking?

Thank you!

References

- Chandlee, J. & Jardine, A. (2019). Autosegmental input strictly local functions
- Clements, G. (1976). Vowel harmony in non-linear generative phonology: An autosegmental model. Bloomington, Indiana University Linguistics Club
- Goldsmith, J. (1976). Autosegmental phonology (PhD thesis). Massachusetts Institute of Technology