

Vowel Harmony is Local

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Introduction

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- ▶ A unified theory of surface markedness constraints captures a variety of vowel harmony patterns
- ▶ Vowel harmony as a phonotactic constraint rather than a transformation from an underlying form into the surface form (Goldsmith, 1976; Clements, 1976; a.o.)
- ▶ Transparent vowels don't rely on underspecification

- ▶ Attested patterns are captured by static surface well-formedness constraints: forbidden substructure constraints (FSCs) (Jardine 2016, 2017)

Locality

- ▶ Attested patterns are captured by static surface well-formedness constraints: forbidden substructure constraints (FSCs) (Jardine 2016, 2017)
- ▶ FSCs over autosegmental representations use one of two relations: association ($|$) and successor (\rightarrow)

Autosegmental Representations (ARs)

- ▶ Tone patterns have been represented with two autosegmental tiers (Goldsmith, 1976; Jardine, 2016, 2017, etc.)

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(3)

± high

|

V

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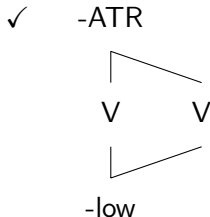
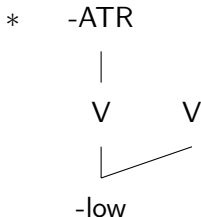
± back

Representational Assumptions

Full Specification (FS):

- ▶ each featural element must be associated to at least one vowel

(4) Full Specification

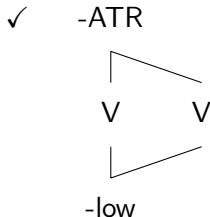
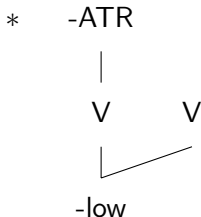


Representational Assumptions

Full Specification (FS):

- ▶ each featural element must be associated to at least one vowel
- ▶ each vowel must be associated to at least one element on each feature tier

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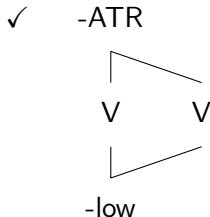
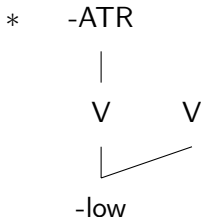


Representational Assumptions

Full Specification (FS):

- ▶ each featural element must be associated to at least one vowel
- ▶ each vowel must be associated to at least one element on each feature tier
- ▶ consonants are not associated to vowel features

(6) Full Specification



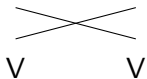
Representational Assumptions

No Crossing Constraint (NCC):

- association lines between the segmental tier and a feature tier never cross

(7) No Crossing Constraint

* +ATR → -ATR



-low

✓ +ATR -ATR



-low

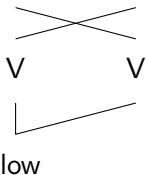
Representational Assumptions

No Crossing Constraint (NCC):

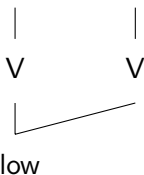
- ▶ association lines between the segmental tier and a feature tier never cross
- ▶ FS and NCC prevent gapped structures (Archangeli & Pulleyblank, 1994; Ringen & Vago, 1998)

(8) No Crossing Constraint

* +ATR → -ATR



✓ +ATR -ATR



Representational Assumptions

Obligatory Contour Principle (OCP):

- ▶ adjacent featural elements must be distinct

(9) Obligatory Contour Principle

* -ATR → -ATR

 | |

 V V

 | |

 -low → -low

✓ -ATR → +ATR

 | |

 V V

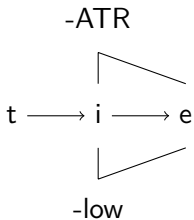
 | |

 -low → +low

Representational Assumptions

- ▶ A well-formed AR obeys FS, the NCC, and the OCP

(10)



Terminology

- ▶ Assimilation: vowels have the same feature

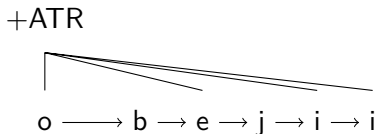
Terminology

- ▶ Assimilation: vowels have the same feature
- ▶ Spreading: multiple association

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(13) Spreading



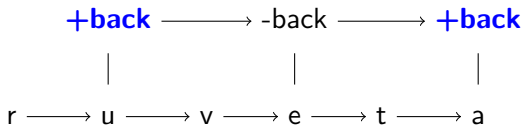
Terminology

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(15) Agreement



Forbidden Substructure Grammar

- ▶ Previous work applied logical descriptions of formal languages to phonological well formedness constraints (Heinz et al., 2011; Rogers et al., 2013)

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- ▶ Forbidden substructure grammar generates a set of well-formed structures and rules out ill formed substructures, r_1 through r_n

(18) Forbidden substructure grammar (Jardine, 2017)

$$\neg r_1 \wedge \neg r_2 \wedge \neg r_3 \wedge \dots \wedge \neg r_n$$

Forbidden Substructure Constraints (FSCs)

- ▶ Phonotactic restriction that combines the OT (Prince & Smolensky, 1993, 2004) representation of surface markedness (*) with forbidden substructures, like r_1

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- ▶ Phonotactic restriction that combines the OT (Prince & Smolensky, 1993, 2004) representation of surface markedness (*) with forbidden substructures, like r_1
- ▶ FSCs can define locality because they refer to elements in a structure connected by an ordering or association relation

Neutral Vowels

Blocking Vowels: Akan

Akan ATR harmony:

- ▶ If a word contains a sequence of -low vowels they will be associated to a single ATR feature (Clements, 1976)

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Blocking Vowels: Akan

Table 1: Akan Vowels

| | +ATR | -ATR |
|------|------|------|
| -low | i | ɪ |
| | u | ʊ |
| | e | ɛ |
| | o | ɔ |
| +low | ɜ | a |

- -low vowels in sequence are associated to a single ATR feature:
[obejii] 'he came and removed it'

Blocking Vowels: Akan

Table 1: Akan Vowels

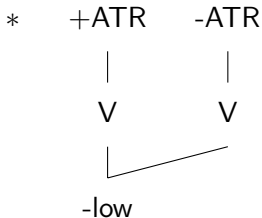
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- ▶ -low vowels in sequence are associated to a single ATR feature: [obejii] 'he came and removed it'
- ▶ -low vowels on either side of a +low vowel can be associated to different ATR features: [pɪɾɜko] 'pig'

Blocking Vowels: Akan

- ▶ Akan ATR harmony pattern captured by a single FSC
 - ▶ forbids two -low vowels from being associated to different ATR features

(19)

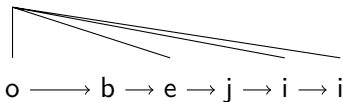


Blocking Vowels: Akan

- ▶ Akan FSC in (19) allows grammatical spreading AR

(20) [obejii] 'he came and removed it'

+ATR

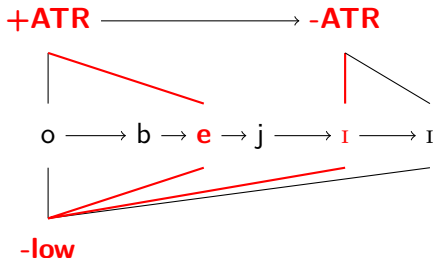


-low

Blocking Vowels: Akan

- ▶ and (19) rules out an ungrammatical disharmonic AR because it contains the forbidden substructure

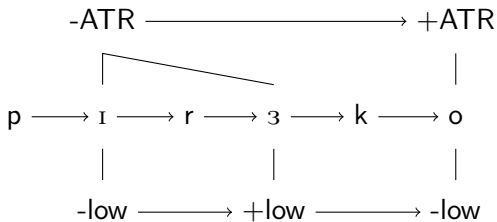
(21) Ungrammatical AR



Blocking Vowels: Akan

- ▶ The same FSC in (19) also allows a grammatical disharmonic AR with a +low vowel

(22) [pɪrɜko] 'pig'



Spreading is local

Spreading ARs. . .

- ▶ consist of an unbounded span of contiguous vowels associated to a single feature

Spreading is local

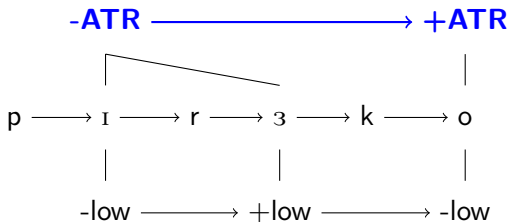
Spreading ARs. . .

- ▶ consist of an unbounded span of contiguous vowels associated to a single feature
- ▶ successor relation between two different features on the same tier

Spreading is local

- ▶ OCP makes ARs local because different features on a tier are in successor relation regardless of how many vowels are associated to each.

(23) [pɪrɜko] 'pig'



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Finnish Back harmony:

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- ▶ Harmonizing suffix vowels are associated to the same back feature as the harmonizing root-final vowel (Nevins, 2010; Ringen & Heinamaki, 1999; van der Hulst, 2017; Välimaa-Blum, 1986)

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- ▶ Harmony appears to skip over [-back, -round, -low] vowels

Transparent Vowels: Finnish

Table 2: Finnish Vowels

| | -round | +round | | |
|------|--------|--------|-------|--------|
| -low | i, iː | y, yː | u, uː | |
| | e, eː | ø, øː | o, oː | |
| +low | | æ, æː | ɑ, ɑː | -round |
| | -back | | +back | |

- Default -back suffix vowel: [tienæ] 'road'

Transparent Vowels: Finnish

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- ▶ Default -back suffix vowel: [tienæ] ‘road’
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- ▶ Harmonizing vowels on either side of a transparent vowel are associated to the same back feature: [ruvetɑ] ‘start’

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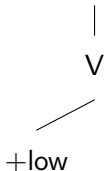
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- ▶ Harmonizing vowels on either side of a transparent vowel are associated to the same back feature: [ruvetɑ] ‘start’
- ▶ The transparent vowel is associated to a different back feature **on the same tier**

Transparent Vowels: Finnish

- Set of Finnish FSCs forbid +round or +low vowels from being associated to a -back feature that succeeds a +back feature

(24) Finnish FSCs

(a) * +back \rightarrow -back



(b) * +back \rightarrow -back

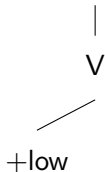


Transparent Vowels: Finnish

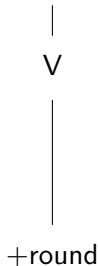
- ▶ and forbid +round or +low vowels from being associated to a -back feature that precedes a +back feature

(25) Finnish FSCs

(a) * -back \rightarrow +back



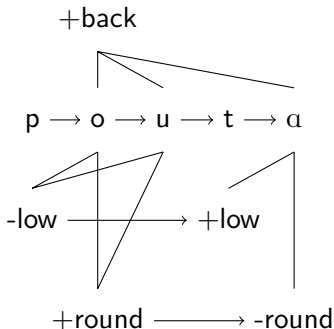
(b) * -back \rightarrow +back



Transparent Vowels: Finnish

- A fully harmonic word does not violate any Finnish FSCs

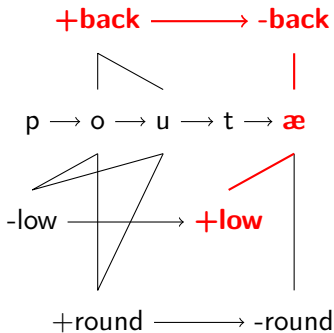
(26) [poutɑ] 'fine weather'



Transparent Vowels: Finnish

- ▶ A disharmonic word is ungrammatical because it contains the forbidden structure of (24a)

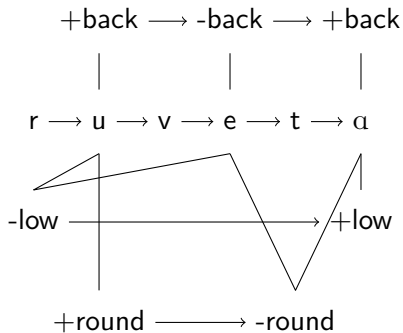
(27) Ungrammatical disharmonic word



Transparent Vowels: Finnish

- ▶ Transparent vowels [i, iː, e, eː] are associated to a feature *on each feature tier*

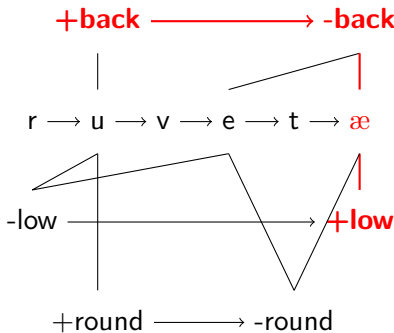
(28) [ruvetɑ] 'start'



Transparent Vowels: Finnish

- ▶ A disharmonic word with a transparent vowel is ungrammatical because it contains the forbidden structure of (24a)

(29) Ungrammatical word with transparent vowel



Agreement is local

Agreement ARs...

- ▶ consist of multiple iterations of the same feature, with a different intervening feature on the same tier

Agreement is local

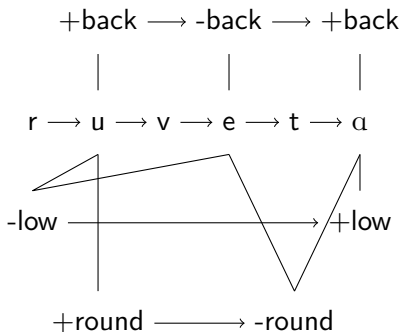
Agreement ARs...

- ▶ consist of multiple iterations of the same feature, with a different intervening feature on the same tier
- ▶ successor relation between assimilating and intervening features

Agreement is local

- ▶ Transparent vowels associated to a feature *on each feature tier*

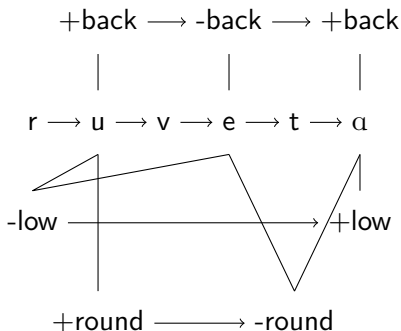
(30) [ruvetɑ] 'start'



Agreement is local

- ▶ Transparent vowels associated to a feature *on each feature tier*
- ▶ ARs are local because successor relation between features on each tier

(31) [ruveta] 'start'



Discussion

- ▶ Well-formed surface ARs of vowel harmony are local
- ▶ Autosegmental representations of vowel harmony utilize successor association relations
- ▶ FSCs capture attested vowel harmony patterns that use neutral vowels: Akan, Finnish
- ▶ Transparent vowels do not require underspecification on the surface

ARs can also represent boundaries

- ▶ FSCs can capture morphologically-conditioned harmony: morpheme boundaries on feature tiers in Turkish
- ▶ FSCs over multi-tiered ARs can also capture an unattested pattern: sour grapes

Future Work

- ▶ Are multi-tiered ARs too powerful?

Future Work

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- ▶ Can multi-tiered ARs be restricted further to exclude unattested patterns?

Thank you

- ▶ QP chair- Adam Jardine
- ▶ QP committee- Bruce Tesar, Simon Charlow

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Appendix

Concatenation

- ▶ NCC and OCP derived by concatenation operation (\circ) (Jardine & Heinz, 2015)
 - ▶ Concatenation merges autosegmental graph primitives, like (1)

(32) Concatenation of adjacent autosegmental graph primitives

