Locality in Vowel Harmony

Eileen Blum

Rutgers University

SCAMP CSULB 4/27/19

Introduction

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  - neutral vowels: blocking in Akan, transparent vowels in Finnish
- Transparent vowels don't rely on underspecification

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  - neutral vowels: blocking in Akan, transparent vowels in Finnish
- Transparent vowels don't rely on underspecification
- Eastern Meadow Mari? (Vaysman, 2009; Walker, 2011)

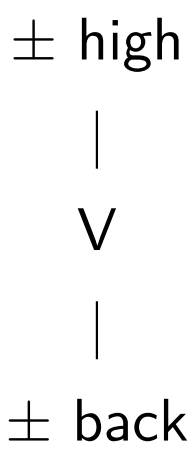
Why do we care?

Autosegmental representations (ARs) make vowel harmony strictly local

- Patterns that are complex with one representation can be simpler with a different representation
- ARs provide explanatory power
  - allow for strictly local descriptions with single representation as opposed to multiple distinct representations (Heinz, 2010; Heinz et al, 2011; Aksënova & Deshmukh, 2018)

Autosegmental Representations (ARs)

- Tone patterns have been represented with two autosegmental tiers (Goldsmith, 1976; Jardine, 2016, 2017, etc.)
- Vowel harmony can be represented with multiple featural tiers



Locality

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

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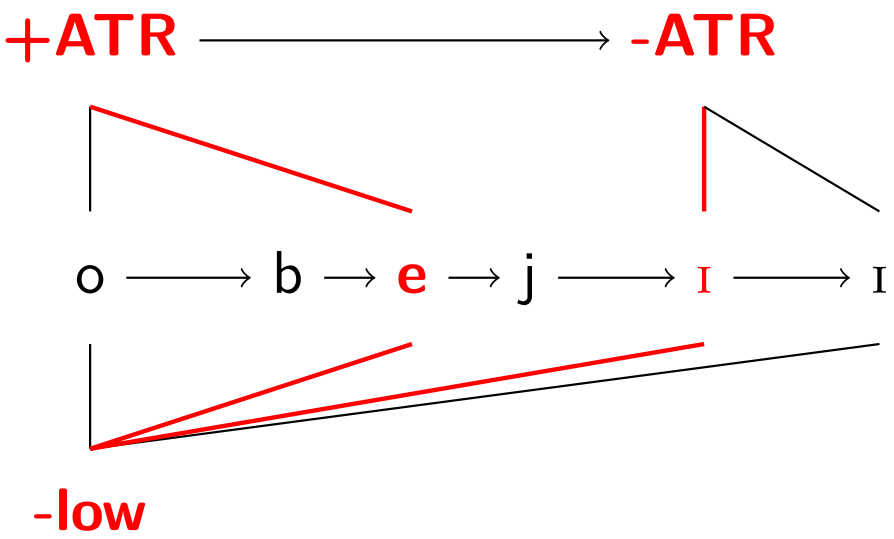
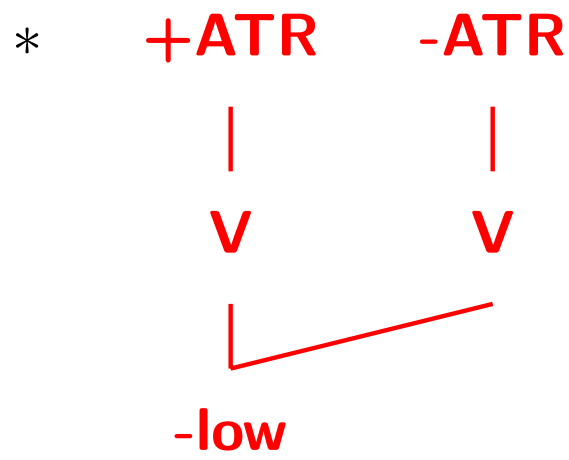
- FSCs over ARs use two relations: association (|) and successor ($\rightarrow$)

Ungrammatical Akan AR



Akan FSC



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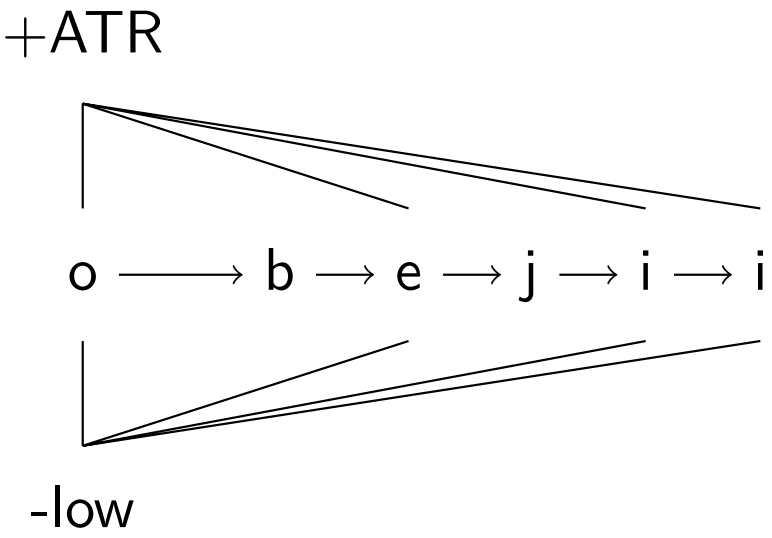
[obejii] 'he came and removed it'



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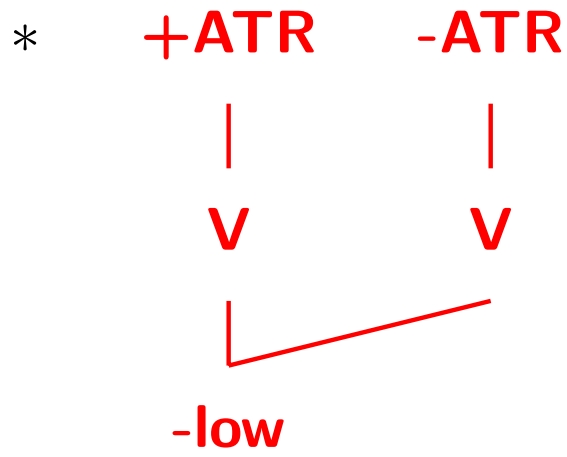
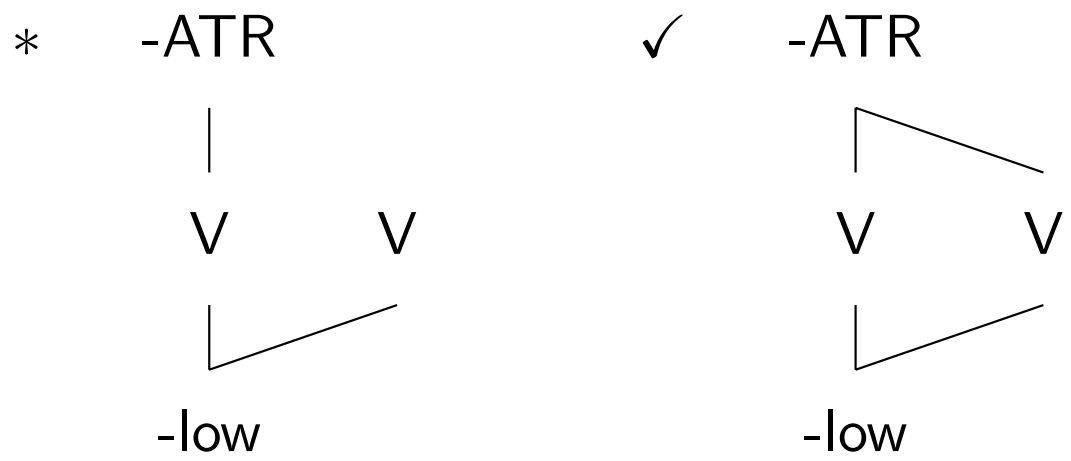


Representational Assumptions

Full Specification (FS):

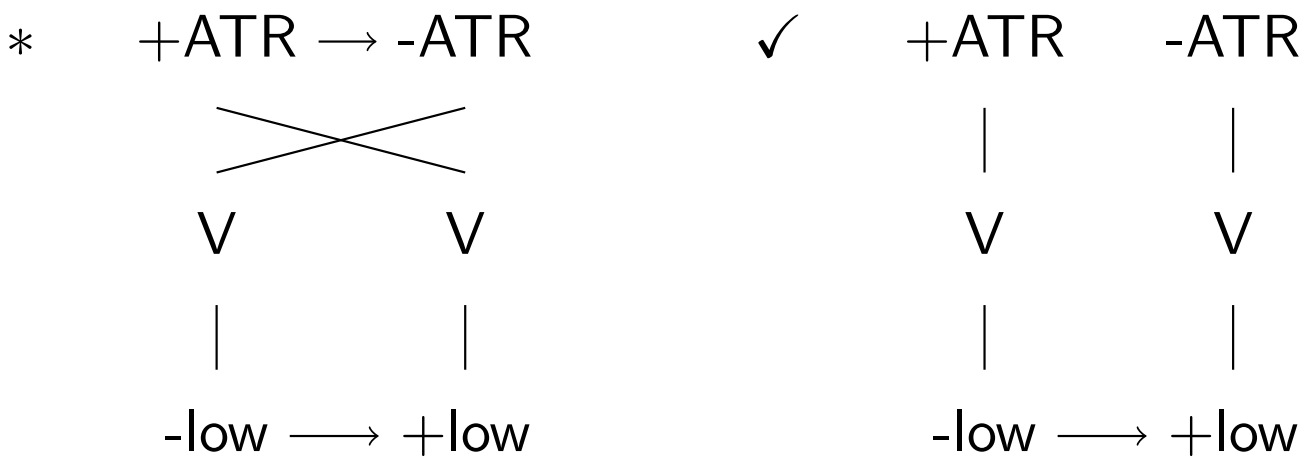
- each featural element must be associated to at least one vowel
- each vowel must be associated to at least one element on each feature tier
- consonants are not associated to vowel features



Representational Assumptions

No Crossing Constraint (NCC):

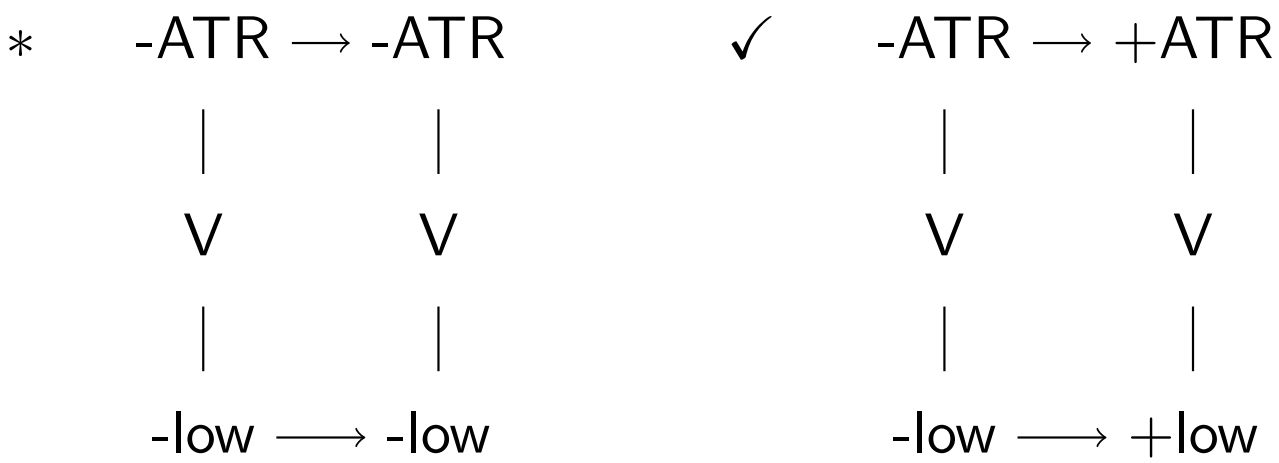
- association lines between the segmental tier and a feature tier never cross
- FS and NCC prevent gapped structures (Archangeli & Pulleyblank, 1994; Ringen & Vago, 1998)



Representational Assumptions

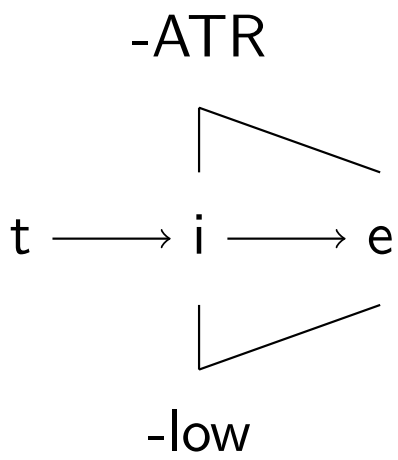
Obligatory Contour Principle (OCP):

- adjacent featural elements must be distinct



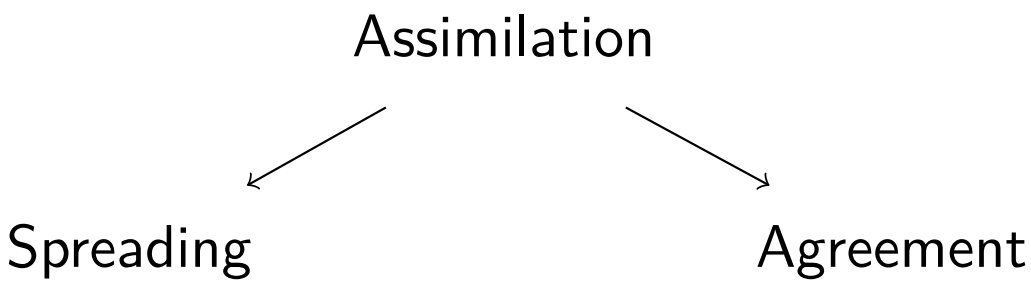
Representational Assumptions

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



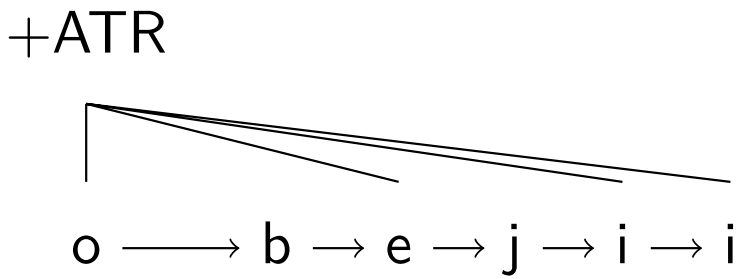
Terminology

- Assimilation: vowels have the same feature (Walker, 2011)

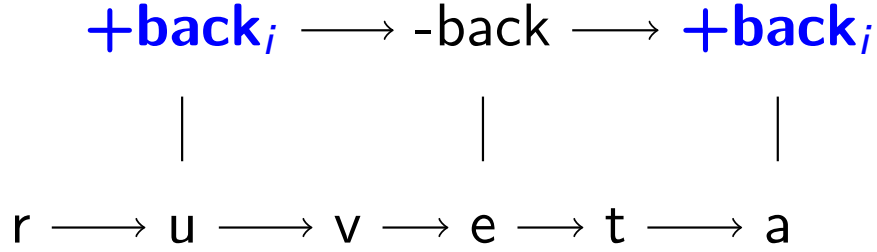


Walker (2011): Licensing

Indirect licensing: multiple association

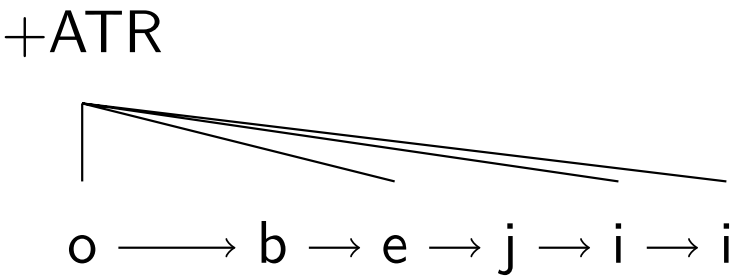


Identity licensing: different vowels associated to different iterations of the same feature in correspondence

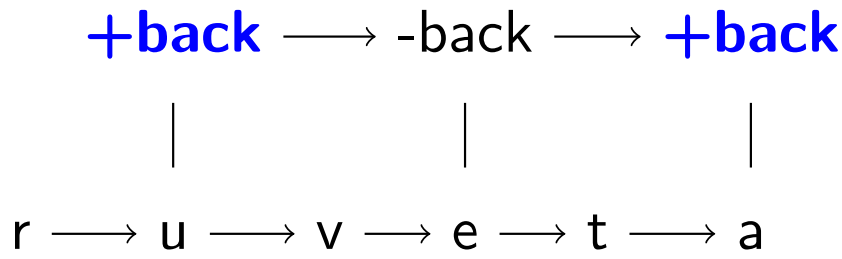


Terminology

Spreading: multiple association



Agreement: different vowels associated to different iterations of the same feature



- I propose surface vowel feature agreement does not require correspondence

Forbidden Substructure Grammar

- Previous work applied logical descriptions of formal languages to phonological well formedness constraints (Heinz et al., 2011; Rogers et al., 2013)
- Forbidden substructure grammar is a conjunction of negative literals
  - literals = substructures
  - describes a set of well-formed structures by ruling out ill formed substructures, r_1 through r_n

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

- FSCs define locality because they refer to elements in a structure connected by a bounded number of successor or association relations
  - pick out substructures of size k

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)
- The vowels on either side of a +low vowel can be associated to different ATR features

Blocking Vowels: Akan

Table 1: Akan Vowels

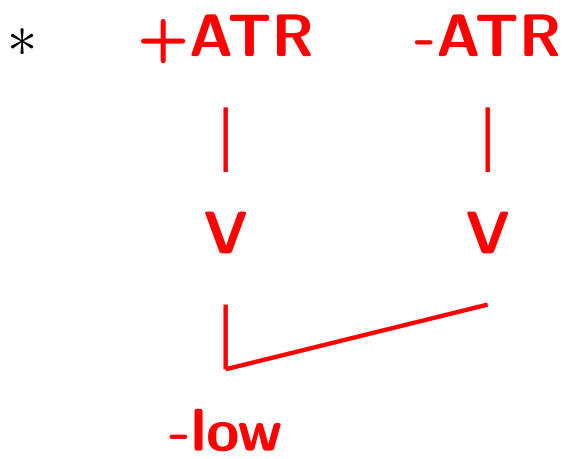
	+ATR	-ATR
-low	i	ɪ
	u	ʊ
	e	ɛ
	o	ɔ
+low	ɜ	a

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

Blocking Vowels: Akan

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

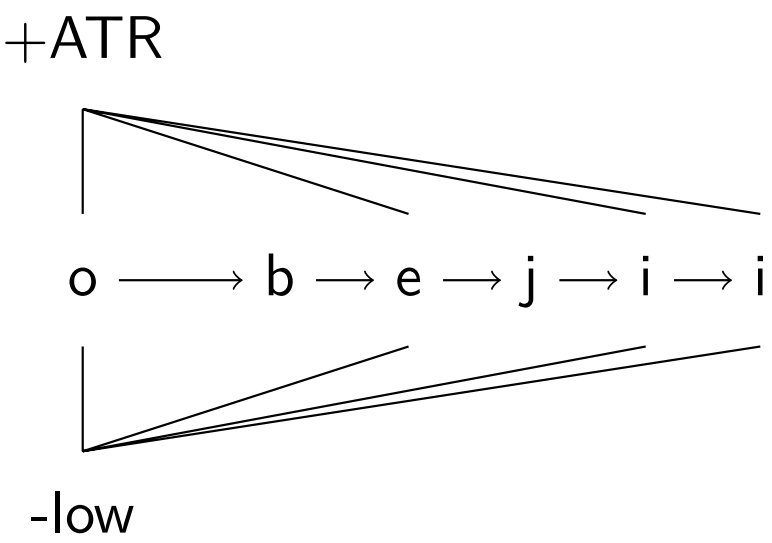
(1)



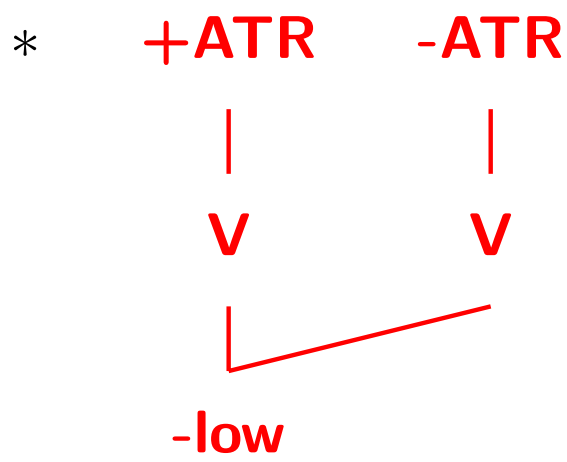
Blocking Vowels: Akan

- Akan FSC allows grammatical spreading AR

[obejii] 'he came and removed it'



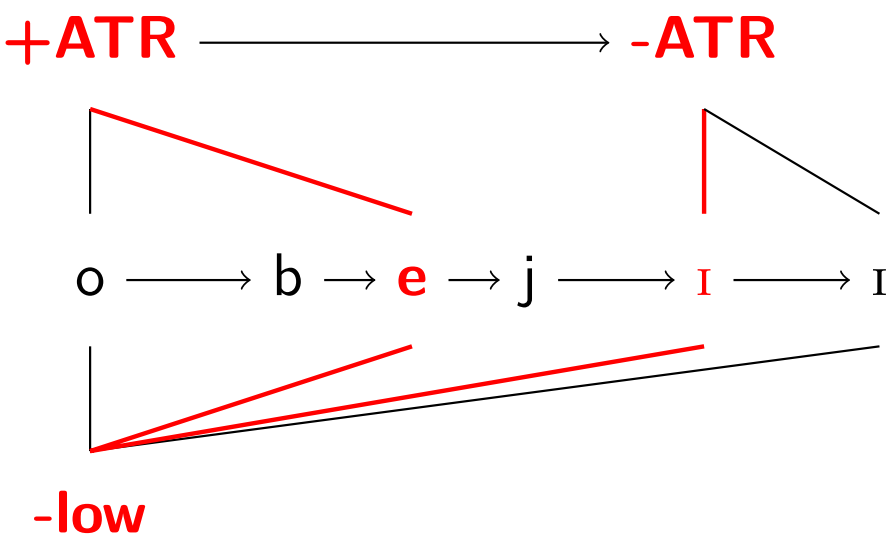
Akan FSC



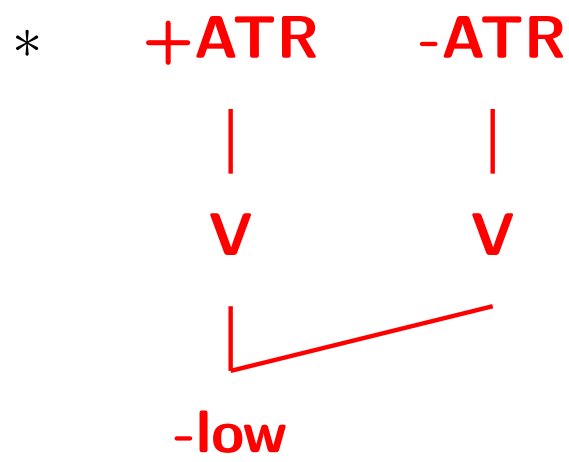
Blocking Vowels: Akan

- and rules out an ungrammatical disharmonic AR because it contains the forbidden substructure

Ungrammatical Akan AR



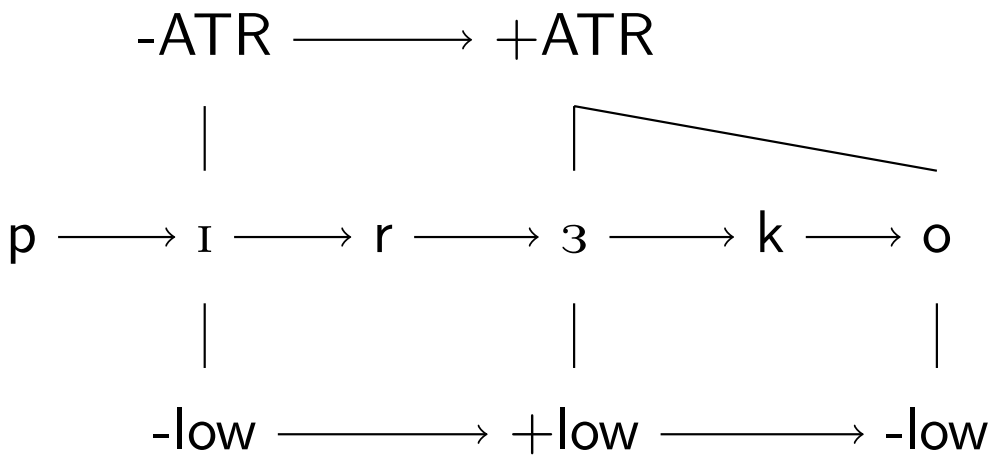
Akan FSC



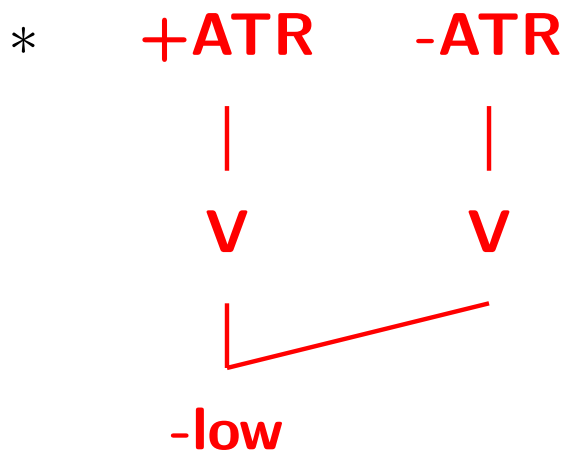
Blocking Vowels: Akan

- The same FSC also allows a grammatical disharmonic AR with a +low vowel

[pɪrɜko] 'pig'



Akan FSC



Spreading is local

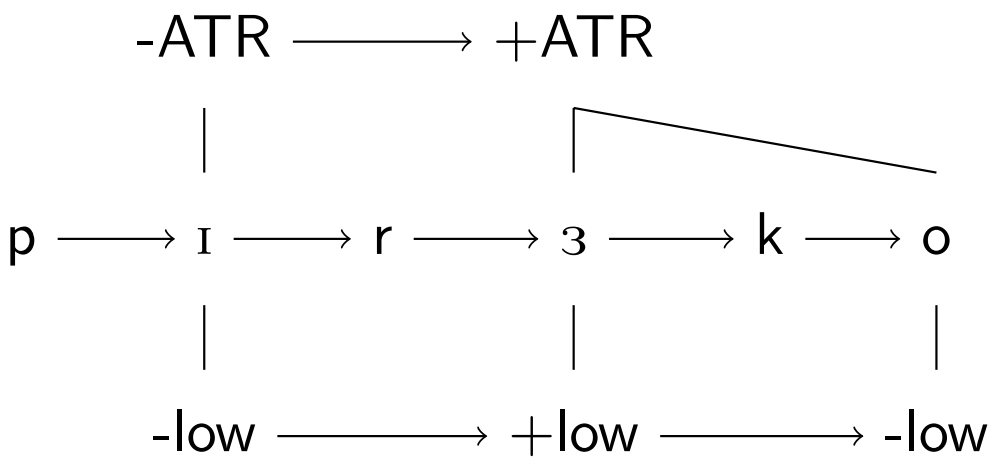
Spreading ARs consist of. . .

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

Spreading is local

- Spreading patterns are local over multi-tiered ARs
  - multiple association
  - distinct successor relations on each tier

[pɪrɜko] ‘pig’



Transparent Vowels: Finnish

Finnish Back harmony:

- Harmonizing vowels are associated to a single back feature
- Back harmony appears to skip over [-back, -round, -low] vowels (Nevins, 2010; Ringen & Heinamaki, 1999; van der Hulst, 2017; Välimaa-Blum, 1986)

Transparent Vowels: Finnish

Table 2: Finnish Vowels

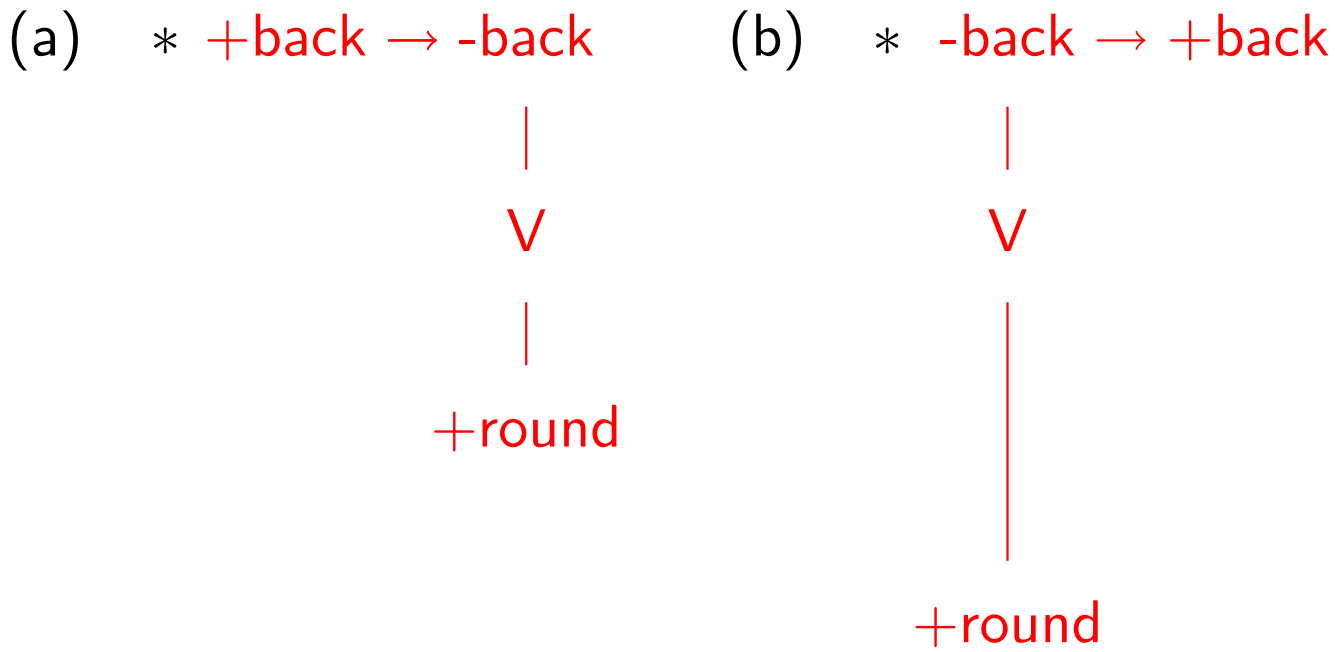
	-round	+round		
-low	i, iː	y, yː	u, uː	
	e, eː	ø, øː	o, oː	
+low		æ, æː	ɑ, ɑː	-round
	-back		+back	

- Two harmonizing vowels in sequence are associated to a single back feature: [poutɑ] 'fine weather'
- 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 vowels from being associated to a -back feature in a successor relation with a +back feature

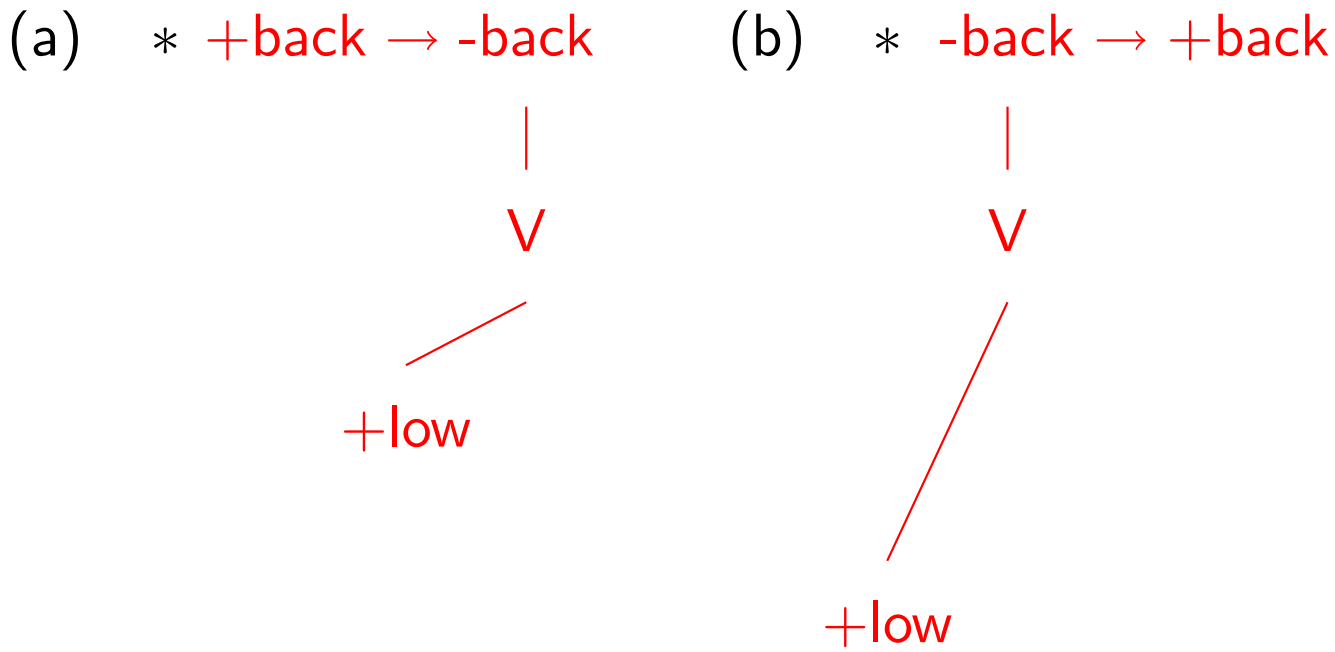
(2) Finnish FSCs



Transparent Vowels: Finnish

- and forbid +low vowels from being associated to a -back feature in a successor relations with a +back feature

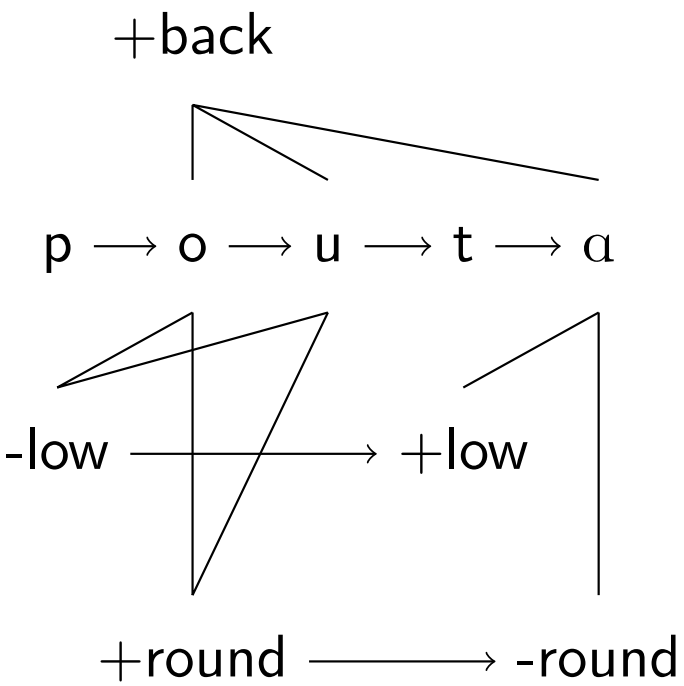
(3) Finnish FSCs



Transparent Vowels: Finnish

- A fully harmonic word does not violate any Finnish FSCs

[pouta] 'fine weather'



Finnish FSC

* **+back → -back**

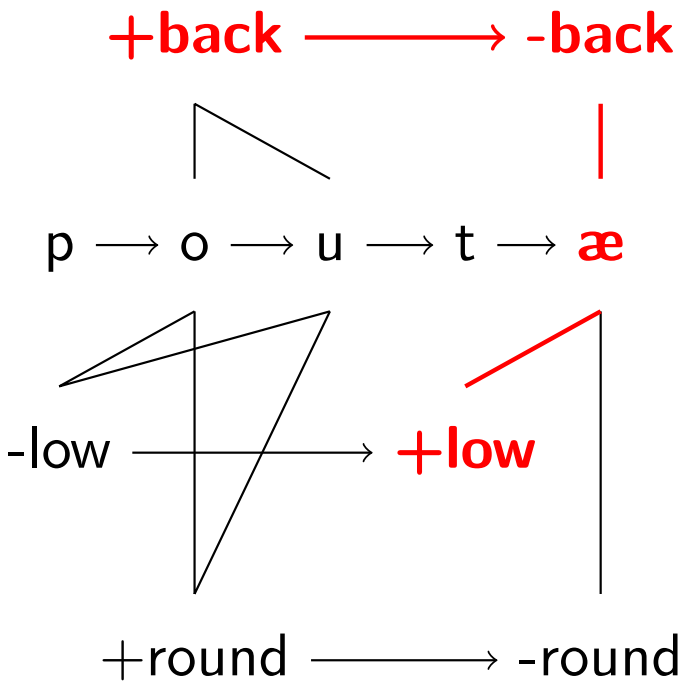
V

+low

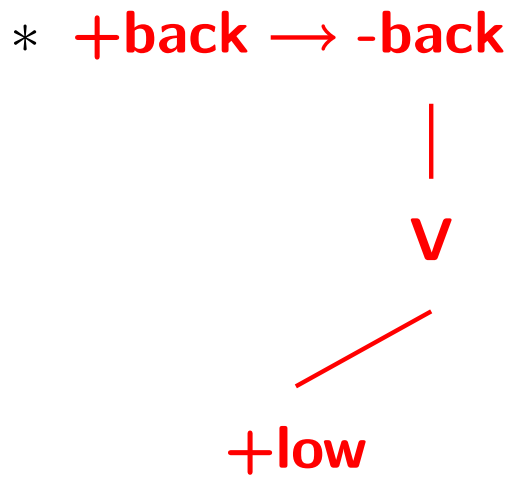
Transparent Vowels: Finnish

- A disharmonic word is ungrammatical because it contains the forbidden substructure of (3a)

Ungrammatical disharmonic word



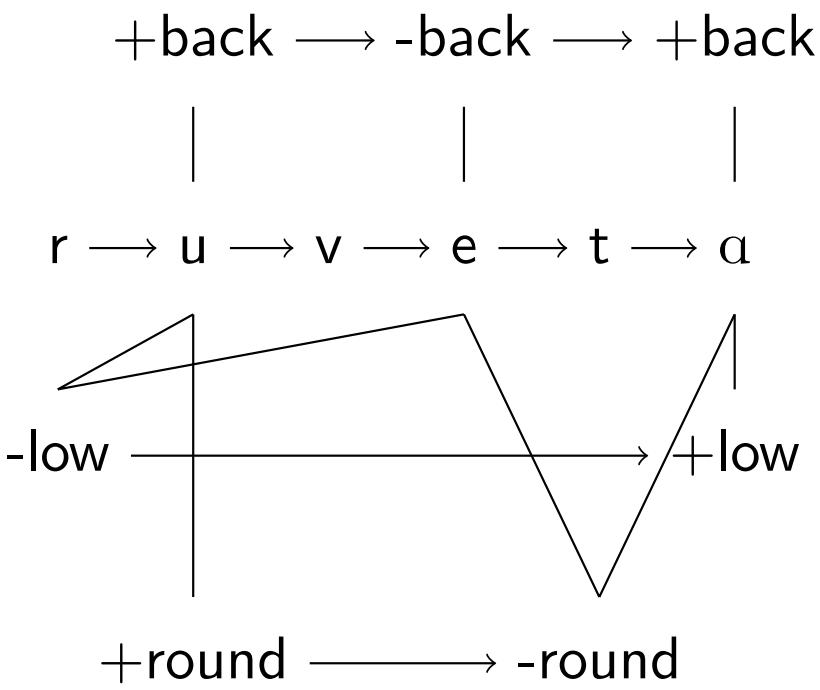
Finnish FSC



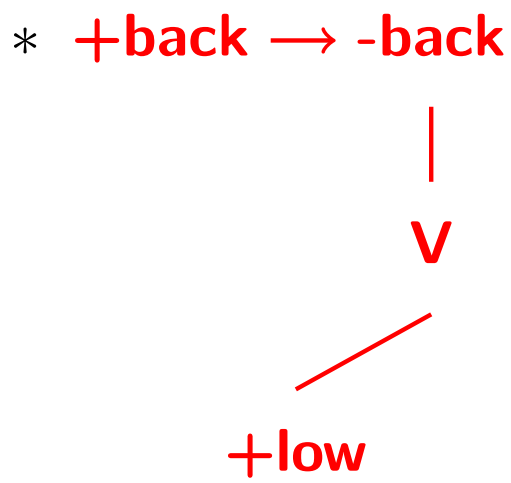
Transparent Vowels: Finnish

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

[ruvetɑ] 'start'



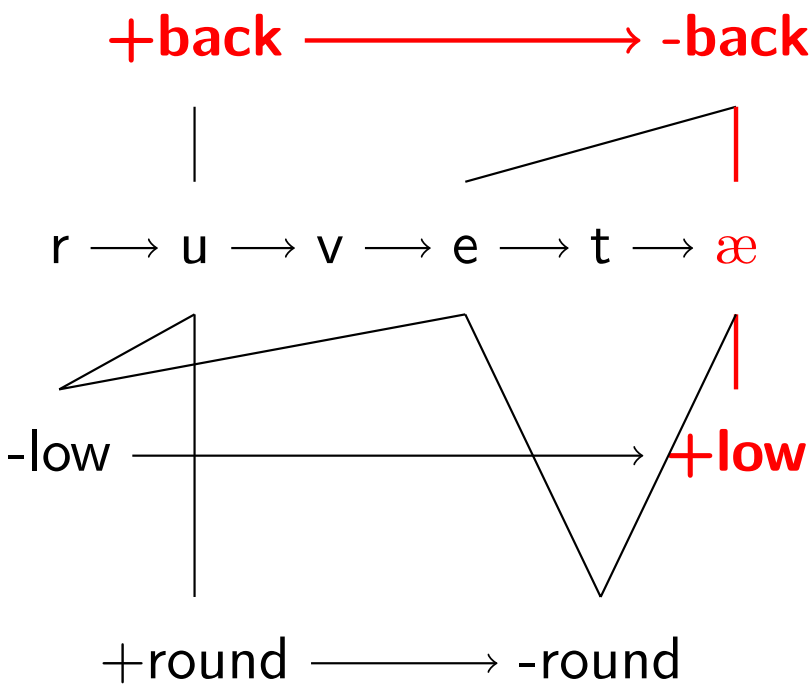
Finnish FSC



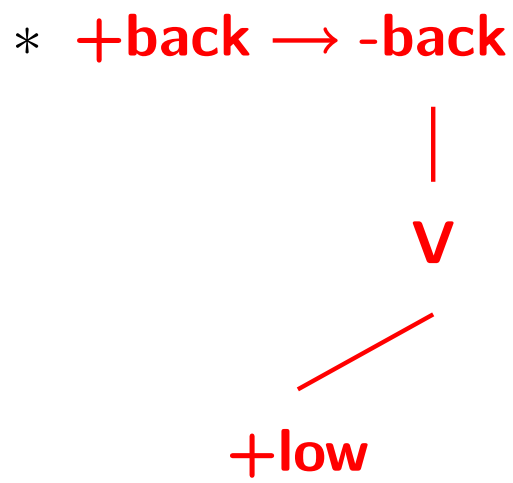
Transparent Vowels: Finnish

- A disharmonic word with a transparent vowel is ungrammatical because it contains the forbidden substructure of (3a)

Ungrammatical disharmonic word



Finnish FSC



Agreement is local

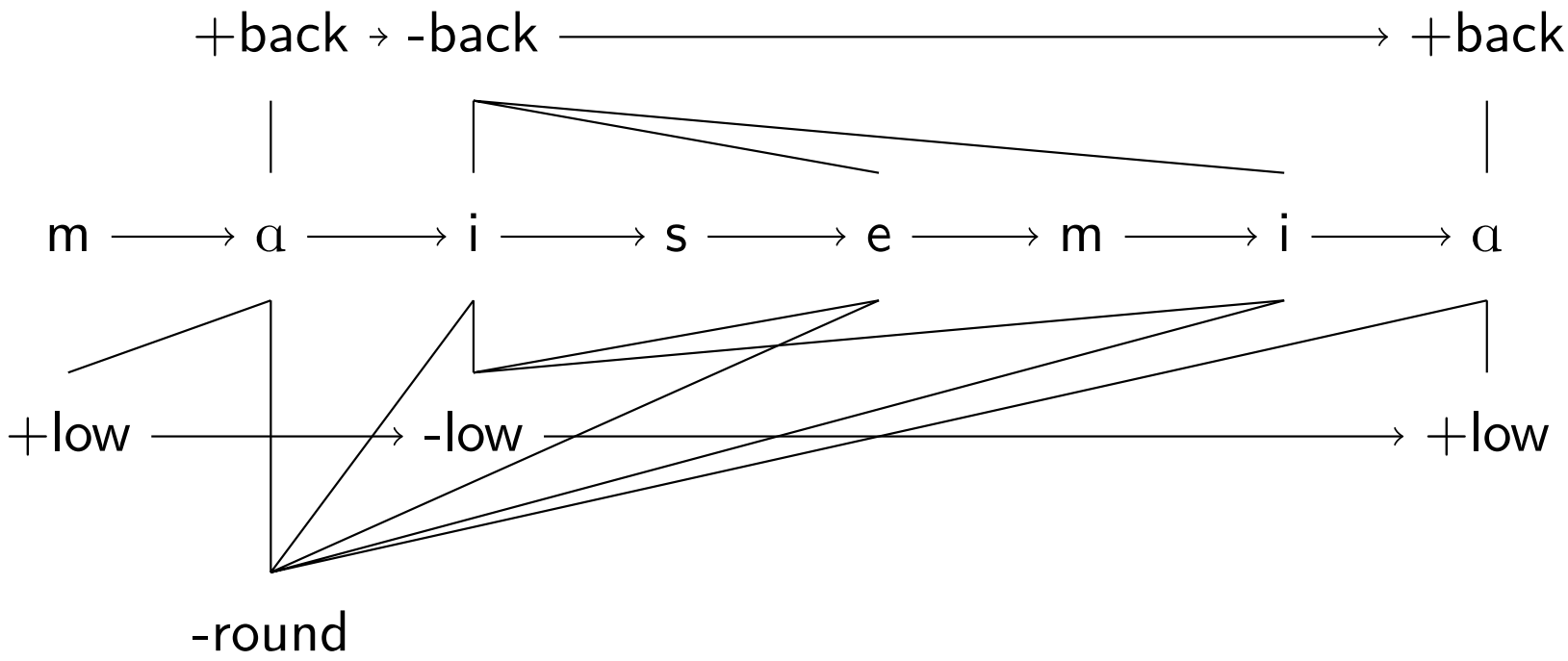
Agreement ARs consist of. . .

- Multiple iterations of the same feature, with a different intervening feature **on the same tier**
- Transparent vowels associated to a feature **on each feature tier**

Agreement is local

- Multi-tiered ARs make agreement patterns local
  - multiple association
  - successor relations on distinct tiers

[maisemia] 'scenery.plural.partitive'



Discussion

Well-formed multi-tiered surface ARs make vowel harmony strictly local

- ARs of vowel harmony utilize successor and association relations
- FSCs capture attested vowel harmony patterns that use neutral vowels: Akan, Finnish
- Transparent vowels do not require underspecification on the surface

First-last harmony

Eastern Meadow Mari

- 3 suffixes alternate in backness depending upon the back feature of the initial vowel:
  - nom.sg 1.pl.poss [næ/na]
  - nom.sg. 2.pl.poss [tæ, dæ/ta]
  - dative [læn/lan]

Eastern Meadow Mari

- 3 suffixes alternate in backness depending upon the back feature of the initial vowel:
  - nom.sg 1.pl.poss [næ/na]
  - nom.sg. 2.pl.poss [tæ, dæ/ta]
  - dative [læn/lan]
- Initial and suffix vowels associated to same back feature:
  - [ij-næ] 'our year', [ʃot-na] 'our sense'
  - [em-dæ] 'your(pl) medecine', [kutko-ta] 'your(pl) ant'
  - [pel-læn] 'half (dative)', [lum-lan] 'snow (dative)'

Eastern Meadow Mari

Table 3: Eastern Meadow Mari Vowels

	-back		+back	
+high	i	y		u
-high	e	ø	ə	o
	æ		a	
	-round	+round	-round	+round

- Harmony appears to skip over three vowels when they have a different back feature: [ə], [a], and [e]
  - [yremə-næ] 'our street'
  - [uβer-ta] 'your(pl) news'
  - [meraŋ-læn 'hare (dative)'
- but [æ] always has same back feature as the initial vowel
  - tʃødræ-tæ 'your (pl) forest'
  - tynæ-næ 'our world'

Eastern Meadow Mari

Table 4: Eastern Meadow Mari Vowels

	-back		+back	
+high	i	y		u
-high	e	ø	ə	o
	æ		a	
	-round	+round	-round	+round

- Suffix vowels alternate when [ə], [a], and [e] are initial:
  - [pərəs-na] 'our cat'
  - [aβam-ta] 'your(pl) mother'
  - [kenez-læn] 'summer (dative)'

Eastern Meadow Mari

- [ə], [a], and [e] do not make up a natural class
- Is there a set of FSCs that can capture the Eastern Meadow Mari pattern?

Computational Consequences

- Eastern Meadow Mari could be viewed as first-last harmony
- Locally Testable (LT) over strings (Heinz, 2018)
- Theory of phonotactics as only SL, SP, or TSL predicts to be unattested
  - first-last harmony is harder to learn (Lai, 2015)
- SL over multi-tiered ARs if captured by FSC(s)

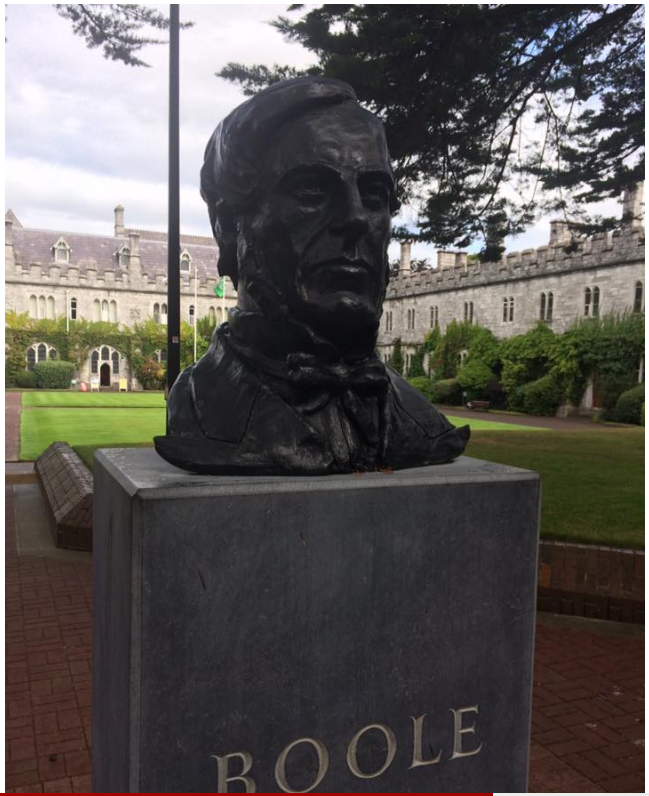
Dissertation Proposal

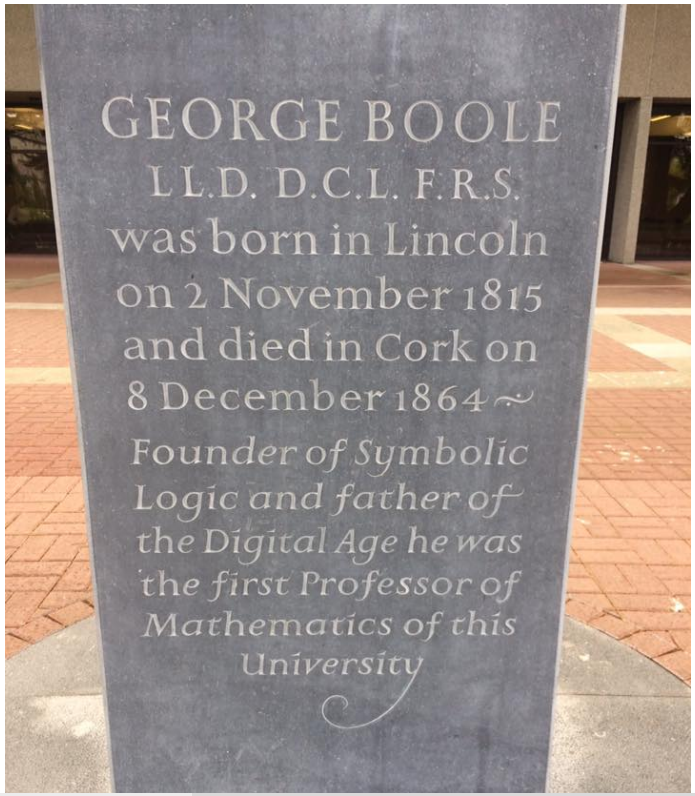
- Reanalyze variety of vowel harmony patterns using FSCs over multi-tiered ARs
  - those in Walker (2011)
  - unbounded spreading/blocking
  - agreement
  - bounded (non-iterative) harmony
- Investigate locality in transformational accounts of vowel harmony using Quantifier-Free Least Fixed Point logic (QFLFP)

Thank You

- Dissertation committee: chair- Adam Jardine, Bruce Tesar, Akinbiyi Akinlabi
- Attendees of PhonX reading group and the 2nd & 3rd Computational Phonology Workshops

email: eileen.blum@rutgers.edu





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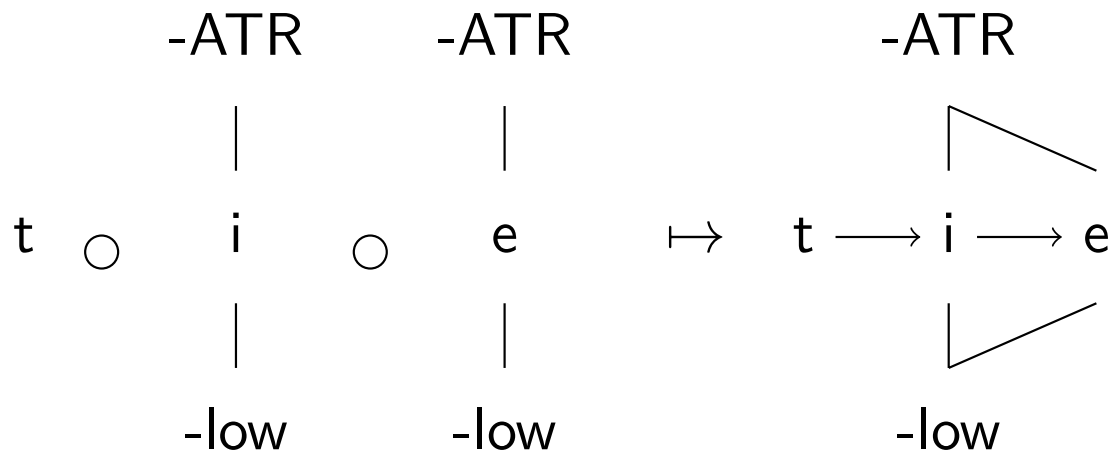
Appendix

Concatenation

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

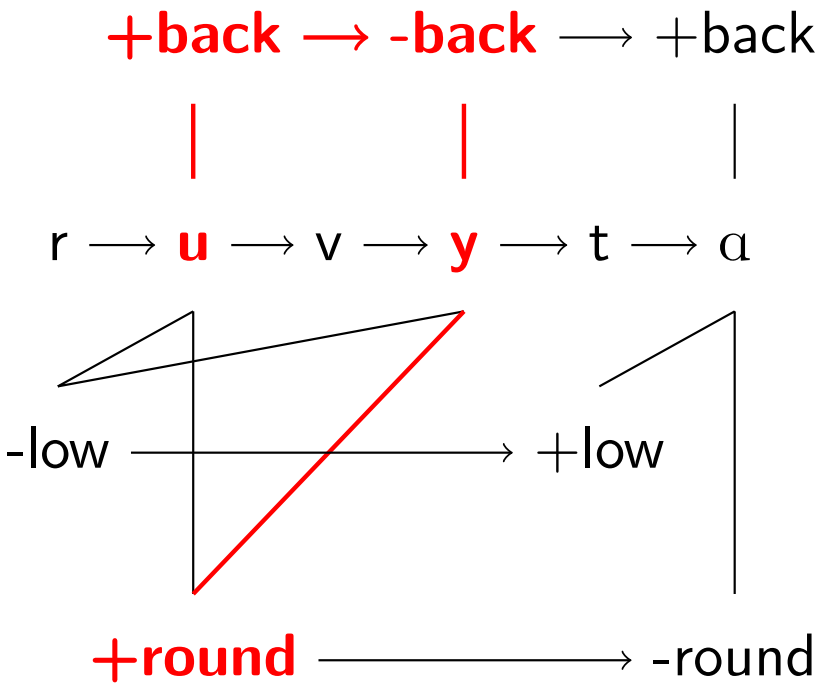
(4) Concatenation of adjacent autosegmental graph primitives



Transparent Vowels: Finnish

- This disharmonic word is ungrammatical because it contains the forbidden structure of (2a)

Ungrammatical disharmonic word



Finnish FSC

* +back → -back

V

+round

Morphologically-conditioned harmony: Turkish

Turkish back harmony:

- Suffix vowels are associated to the same back feature as the root-final vowel
- Multiple suffix vowels are associated to the same back feature
- Disharmonic roots

Morphologically-conditioned harmony: Turkish

Table 5: Turkish Vowels

	-back		+back	
+high	i	ü	ɨ	u
-high	e	ö	a	o
	-round	+round	-round	+round

- Suffix vowels are associated to the same back feature as the root-final vowel: [ip+ler] 'rope (Nom.pl)'
- All suffix vowels are associated to the same back feature: [kɨz+lar+ɨn] 'girls (gen.)'
- Disharmonic roots are also grammatical: [tatil] 'vacation'

Morphologically-conditioned harmony: Turkish

- Turkish FSCs forbid two back features in a successor relation with a morpheme boundary from having different values

(5)

(a) $*$ +back $\longrightarrow$ + $\longrightarrow$ -back

(b) $*$ **-back** $\rightarrow$ **+** $\rightarrow$ **+back**

Morphologically-conditioned harmony: Turkish

- FSC in (5b) allows a grammatical Turkish word

[ip+ler] 'rope (Nom.pl)

Turkish FSC

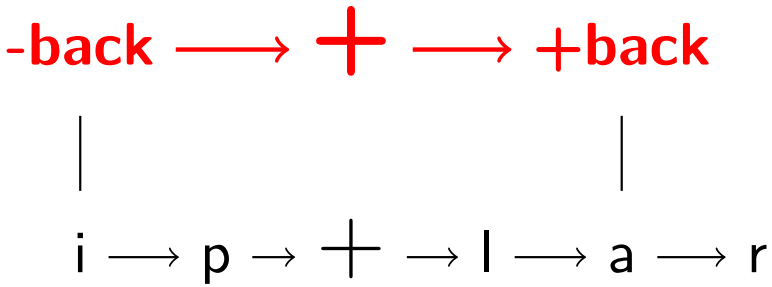
(a) -back ⟶ + ⟶ -back * **-back → + → +back**

i ⟶ p → + → l ⟶ e ⟶ r

Morphologically-conditioned harmony: Turkish

- and (5b) rules out an ungrammatical word that contains the forbidden substructure

Ungrammatical Turkish word



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Turkish FSC