Vowel Harmony is local over multi-tiered ARs

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Introduction

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

Why should we care?

ARs make vowel harmony patterns Strictly Local (SL)

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- Patterns that are complex with one representation are made simpler with another
- ARs provide explanatory power
  - simpler subregular class than with strings (McMullin & Hansson, 2014; Aksënova, 2017; Aksënova & Deshmukh, 2018)

Locality

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

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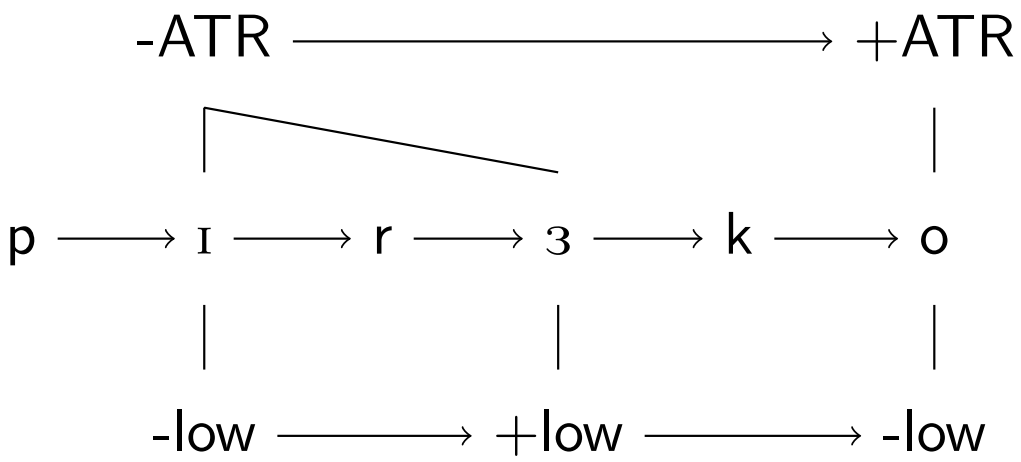
- Attested vowel harmony patterns captured by static surface well-formedness constraints: forbidden substructure constraints (FSCs) (Jardine 2016, 2017)
- FSCs over autosegmental representations (ARs) use two relations: association (|) and successor (→)

Akan: [pɪrɜko] 'pig'



Autosegmental Representations (ARs)

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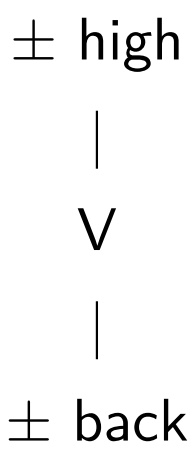
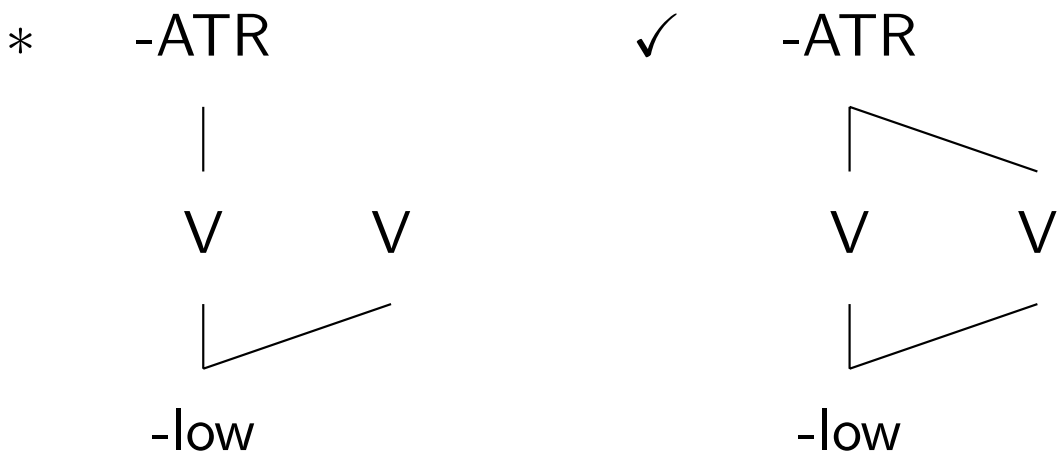
- Vowel harmony can be represented with multiple featural tiers



Representational Assumptions

Full Specification (FS):

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



Representational Assumptions

Full Specification (FS):

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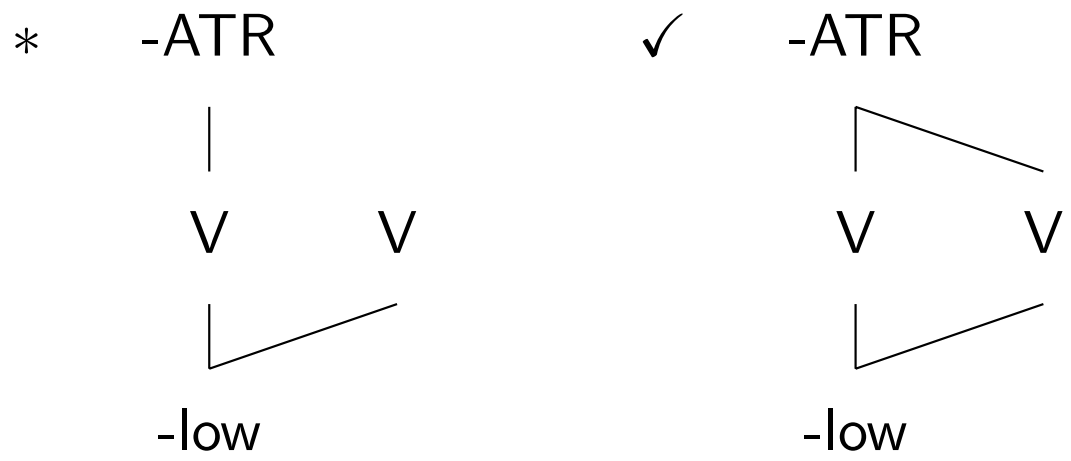
- each vowel must be associated to at least one element on each feature tier



Representational Assumptions

Full Specification (FS):

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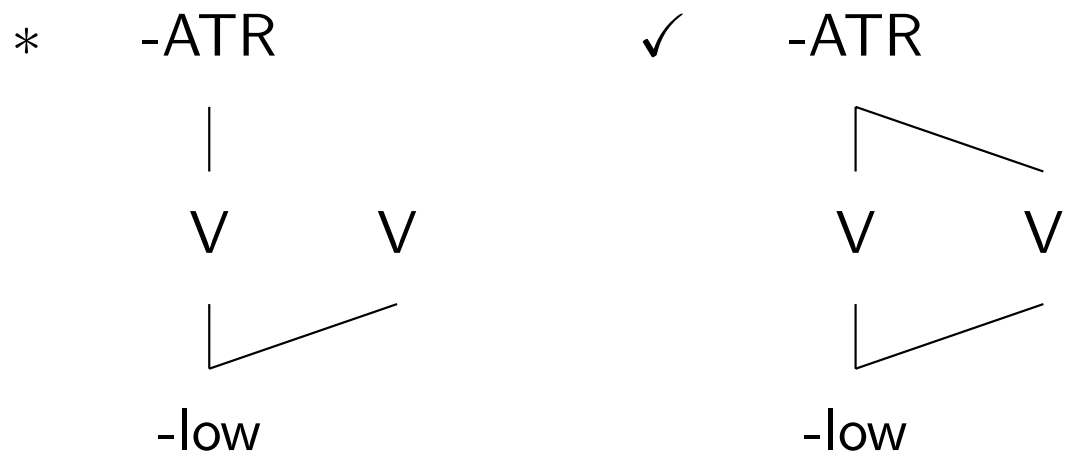
- each vowel must be associated to at least one element on each feature tier
- consonants are not associated to vowel features



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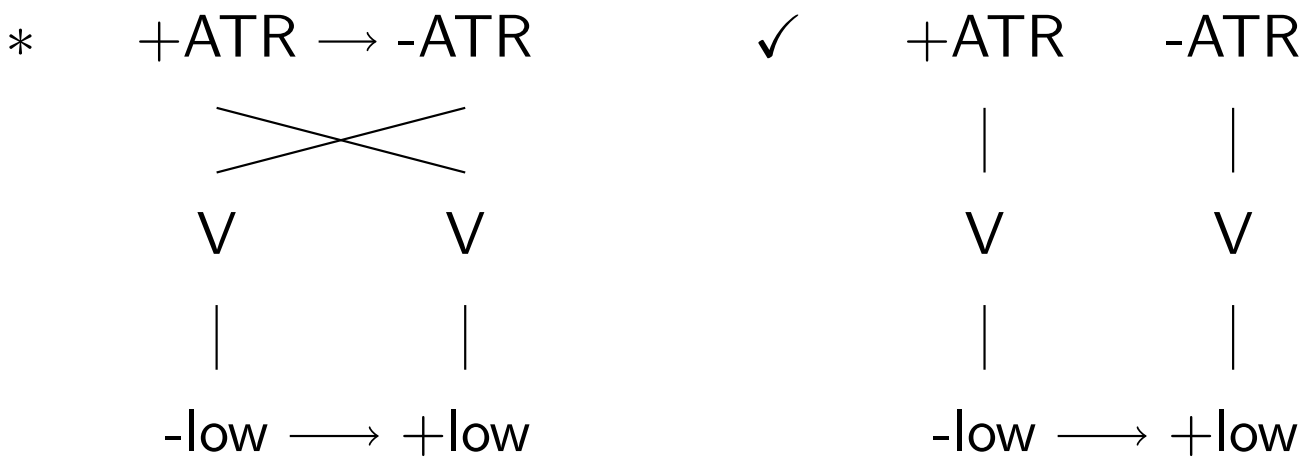
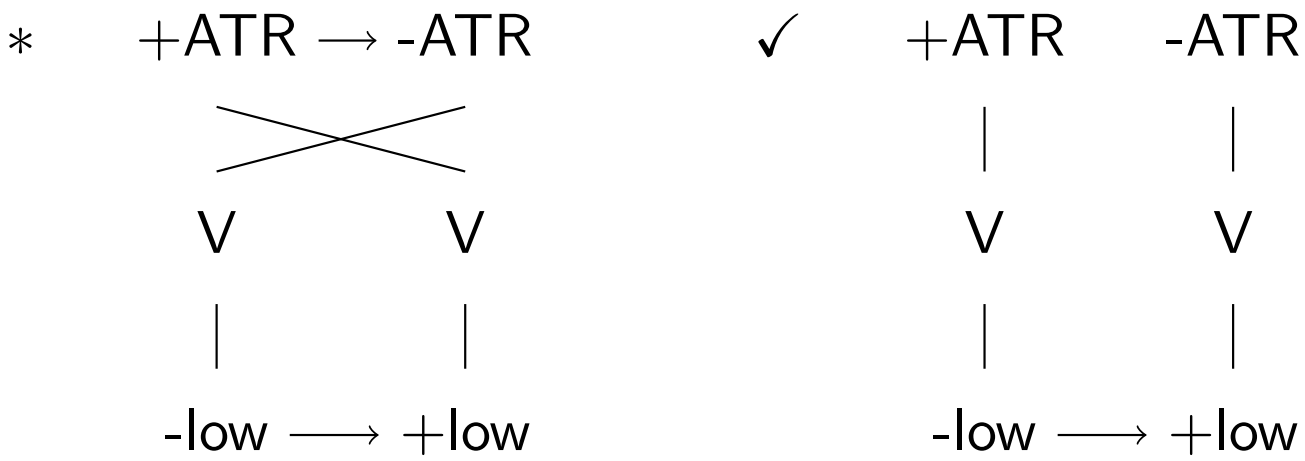


Representational Assumptions

No Crossing Constraint (NCC):

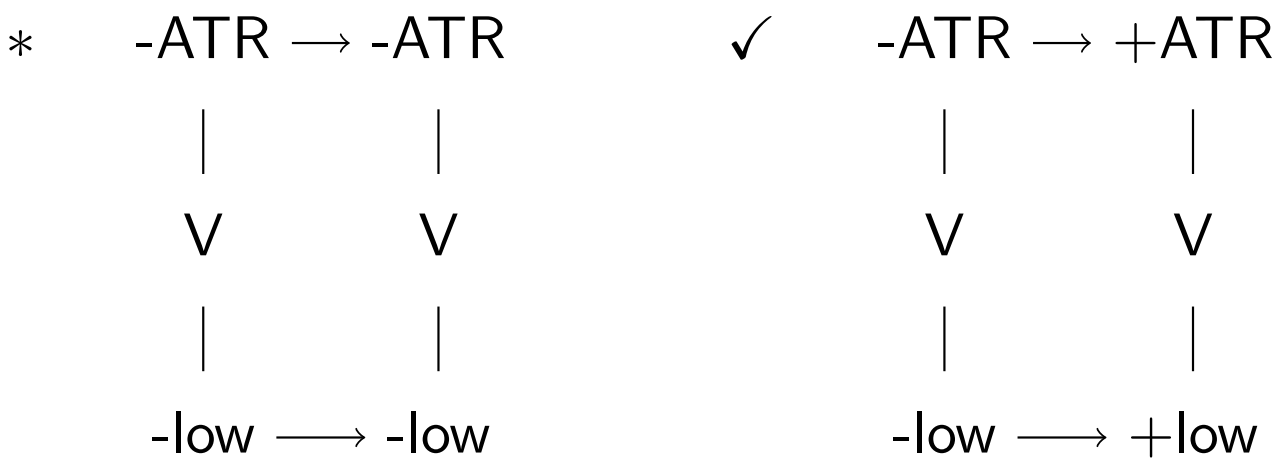
- association lines between the segmental tier and a feature tier never cross
- FS and NCC prevent gapped structures (Archangeli & Pulleyblank, 1994; Ringen & Vago, 1998)



Representational Assumptions

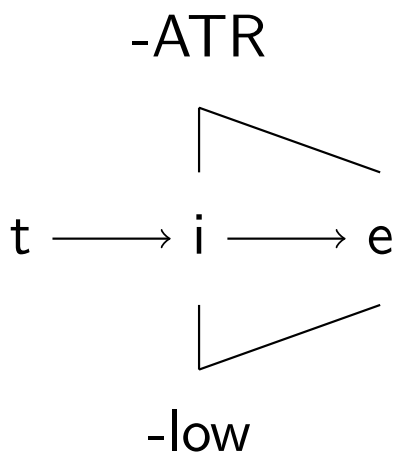
Obligatory Contour Principle (OCP):

- adjacent featural elements must be distinct



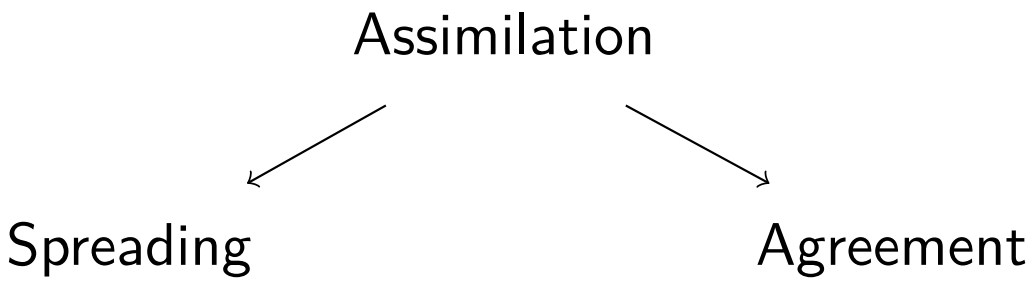
Representational Assumptions

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



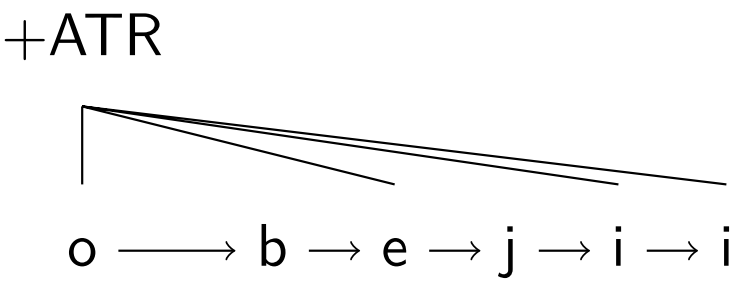
Terminology

- Assimilation: vowels have the same feature



Terminology

Spreading: multiple association



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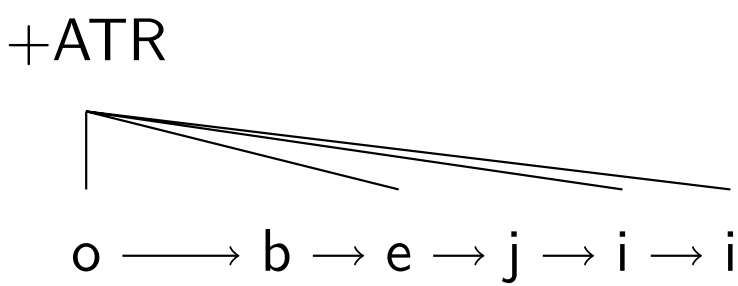
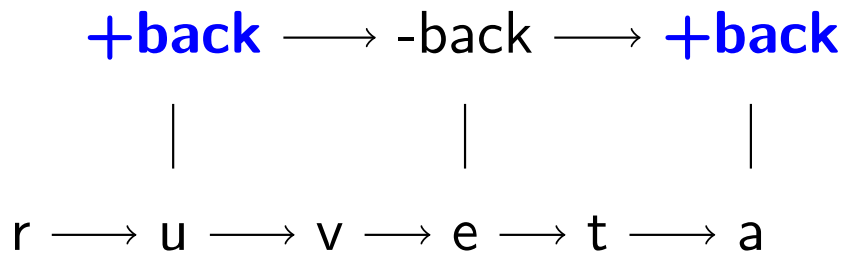


Agreement: different vowels associated to different iterations of the same feature



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 is a conjunction of negative literals
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  - describes a set of well-formed structures by ruling out ill formed substructures

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

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

- FSCs define locality because they refer to elements in a structure connected by successor or association

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'

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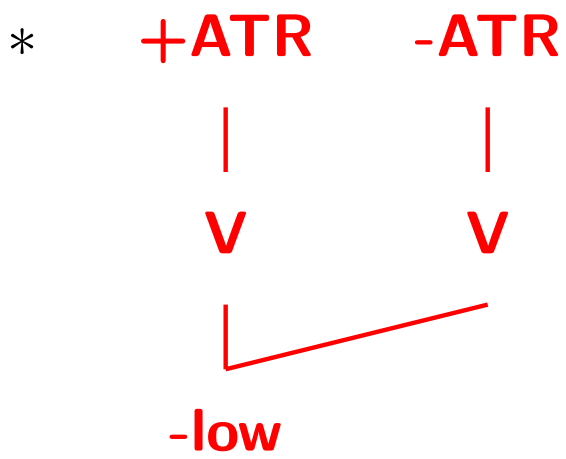
- -low vowels on either side of a +low vowel can be associated to different ATR features: [pɪrɜko] 'pig'

Blocking Vowels: Akan

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

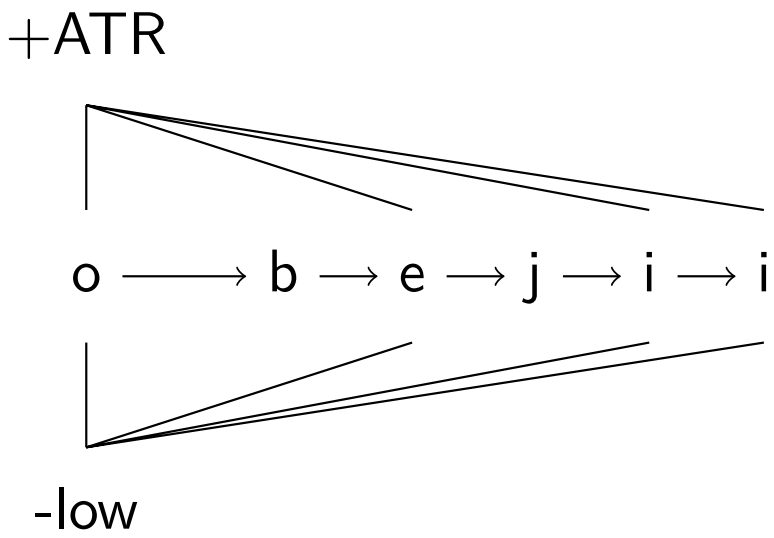
(1)



Blocking Vowels: Akan

- Akan FSC in (1) allows grammatical spreading AR

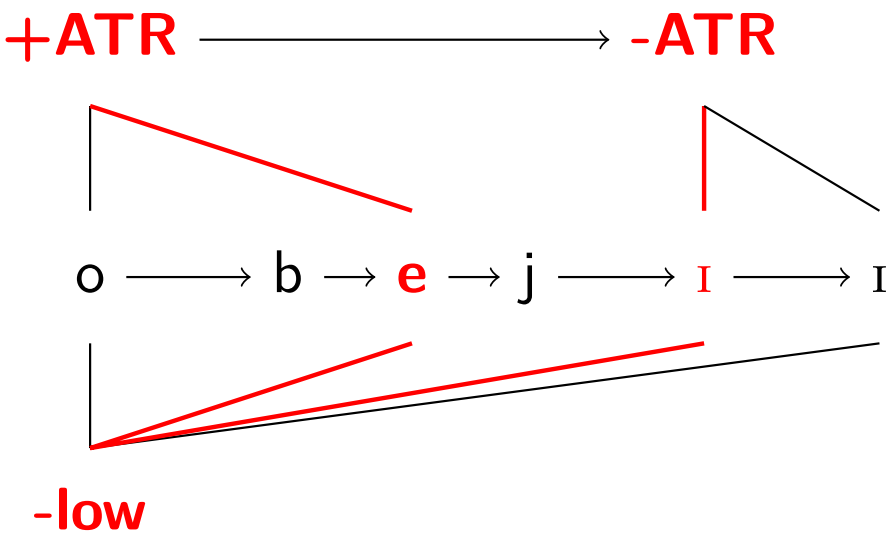
  [obejii] 'he came and removed it'



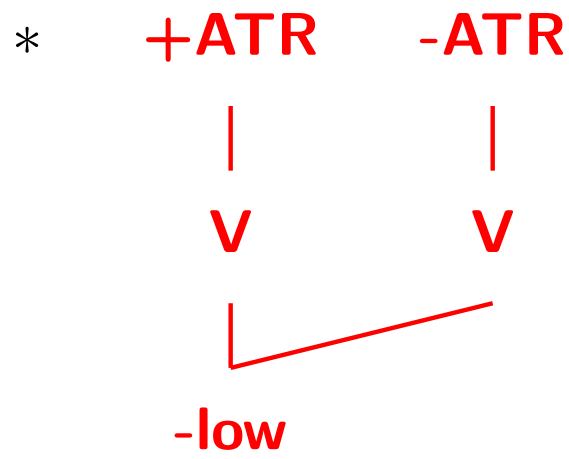
Blocking Vowels: Akan

- and (1) rules out an ungrammatical disharmonic AR because it contains the forbidden substructure

Ungrammatical Akan AR



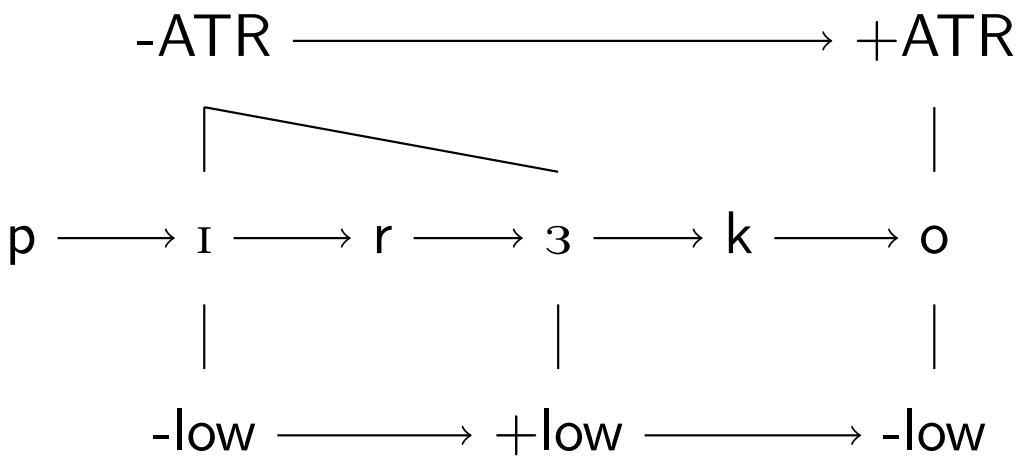
Akan FSC



Blocking Vowels: Akan

- The same FSC in (1) also allows a grammatical disharmonic AR with a +low vowel

[pɪrɜko] 'pig'



Spreading is local

Spreading ARs consist of. . .

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- 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.

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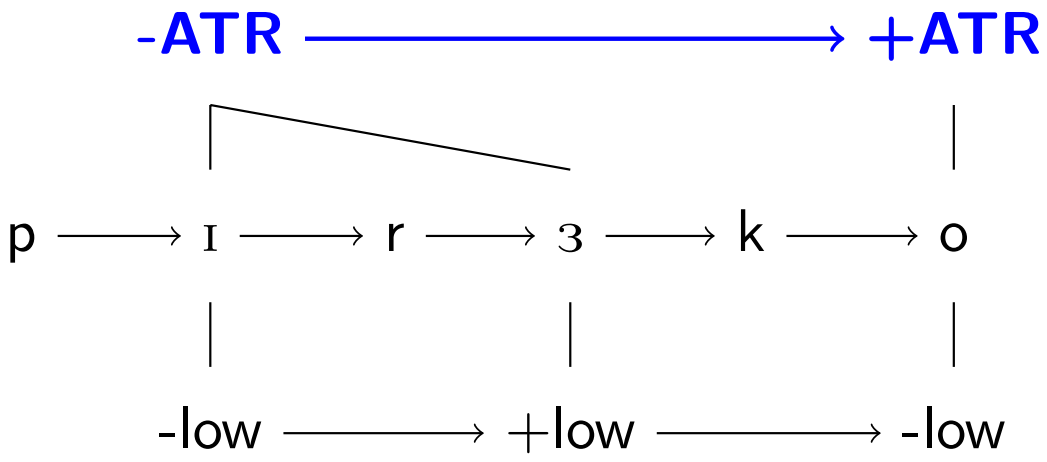

Transparent Vowels: Finnish

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- Back 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	

- Two harmonizing vowels in sequence are associated to a single back feature: [poutɑ] 'fine weather'

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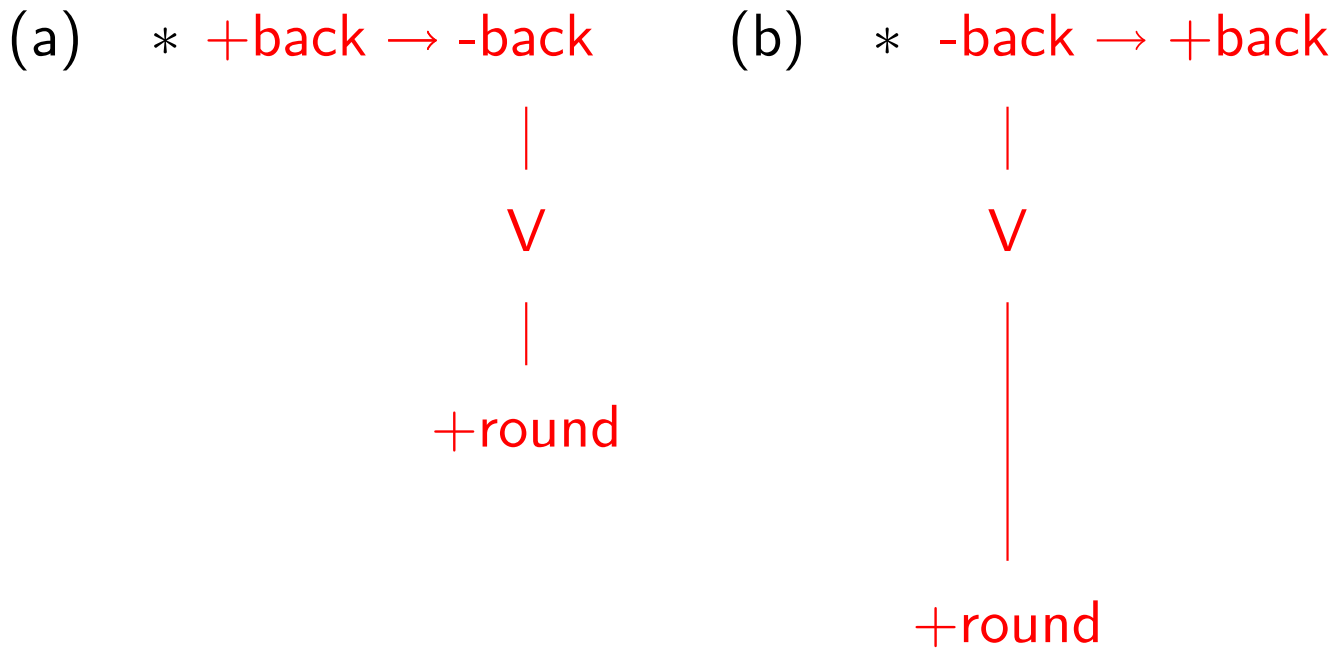
- The transparent vowel is associated to a different back feature **on the same tier**

Transparent Vowels: Finnish

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

(2) Finnish FSCs



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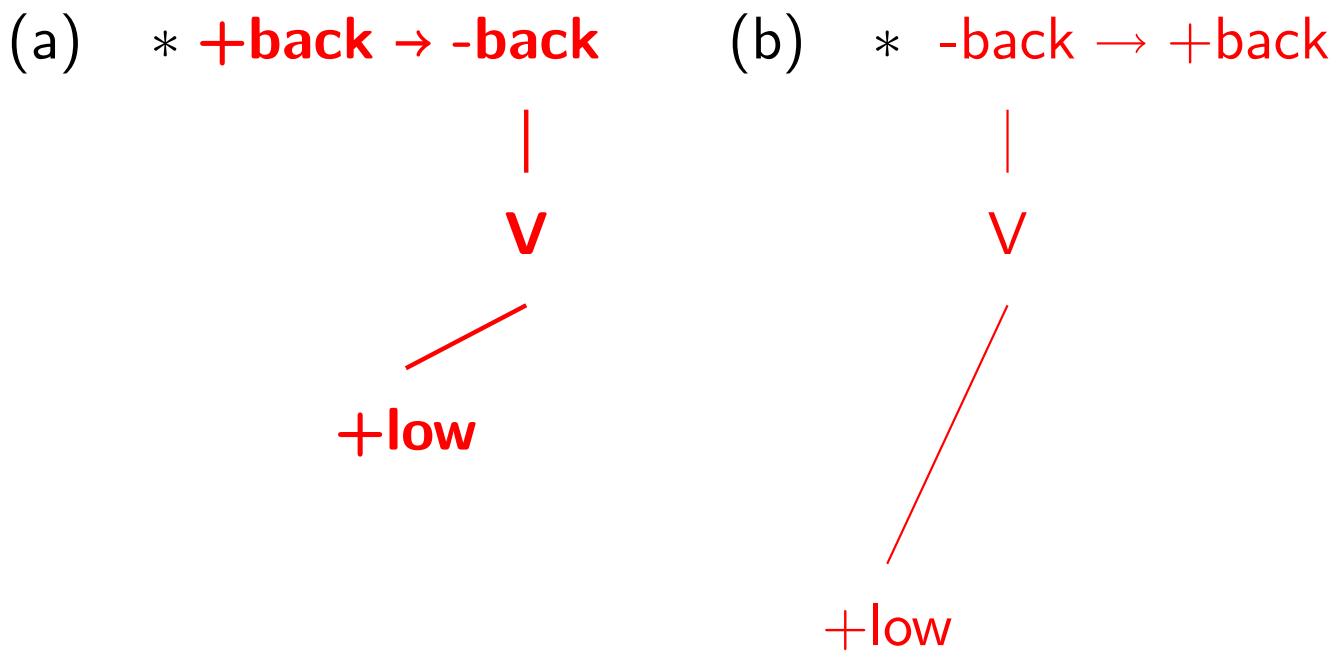
- and forbid +low vowels from being associated to a -back feature that precedes a +back feature

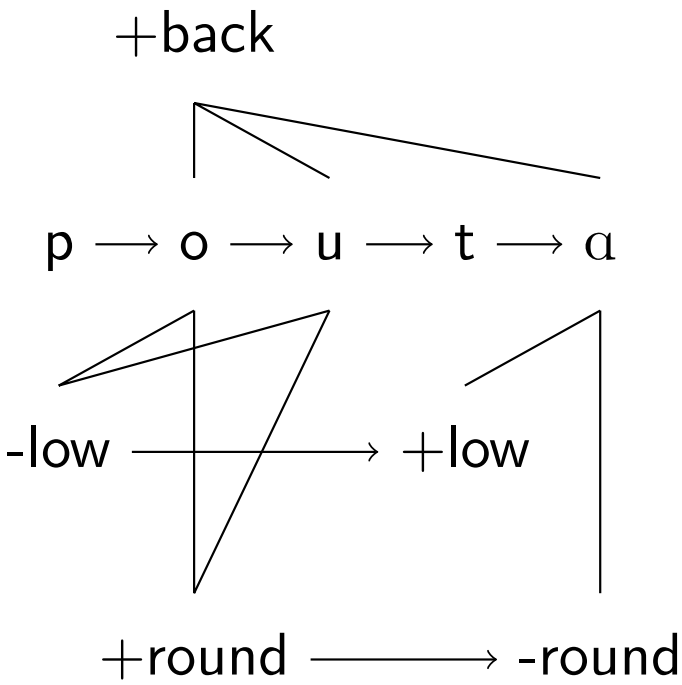
(3) Finnish FSCs



Transparent Vowels: Finnish

- A fully harmonic word does not violate any Finnish FSCs

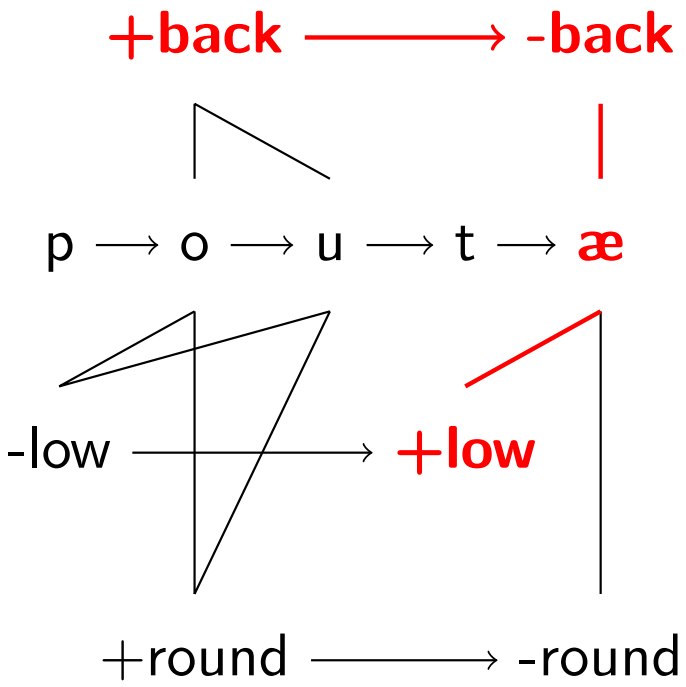
  [pouta] 'fine weather'



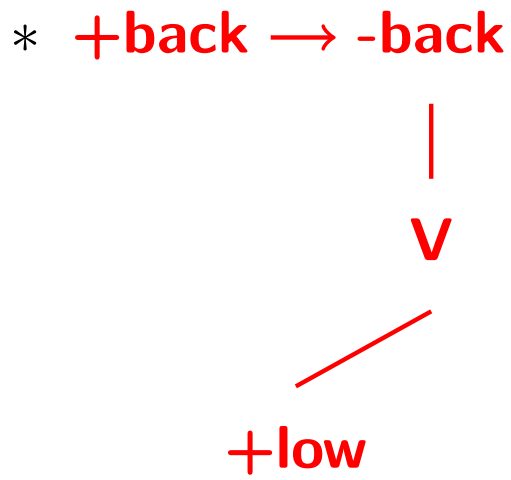
Transparent Vowels: Finnish

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

Ungrammatical disharmonic word



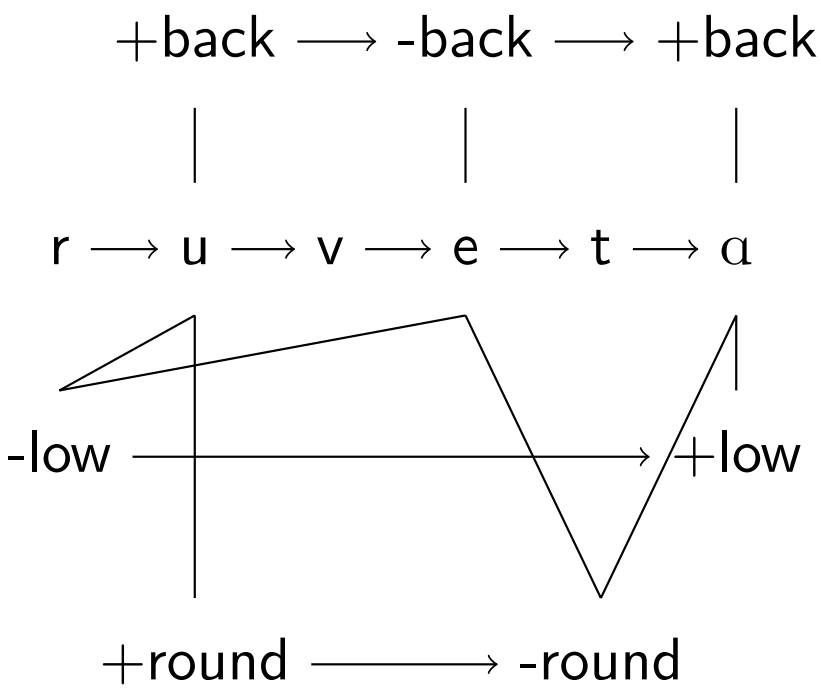
Finnish FSC



Transparent Vowels: Finnish

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

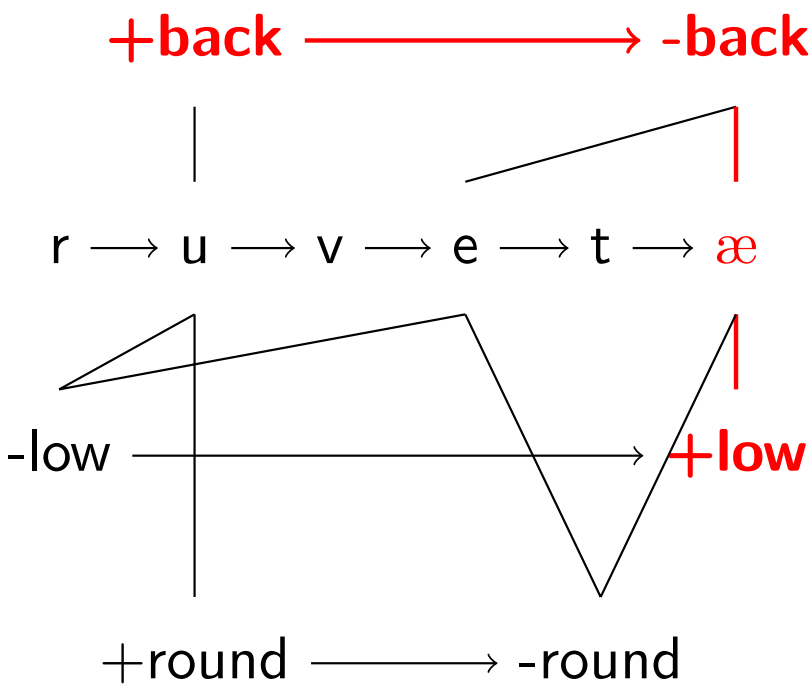
[ruvetɑ] 'start'



Transparent Vowels: Finnish

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

Ungrammatical disharmonic word



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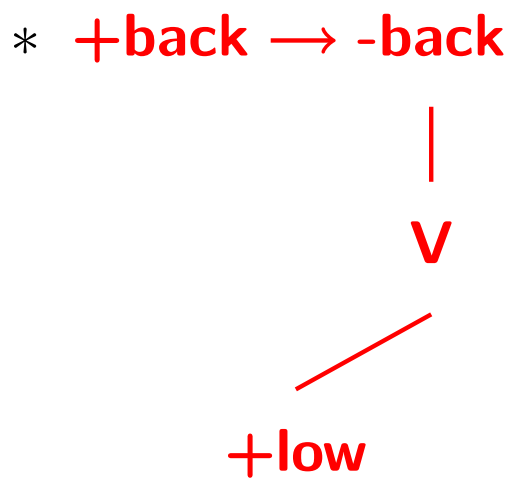


Agreement is local

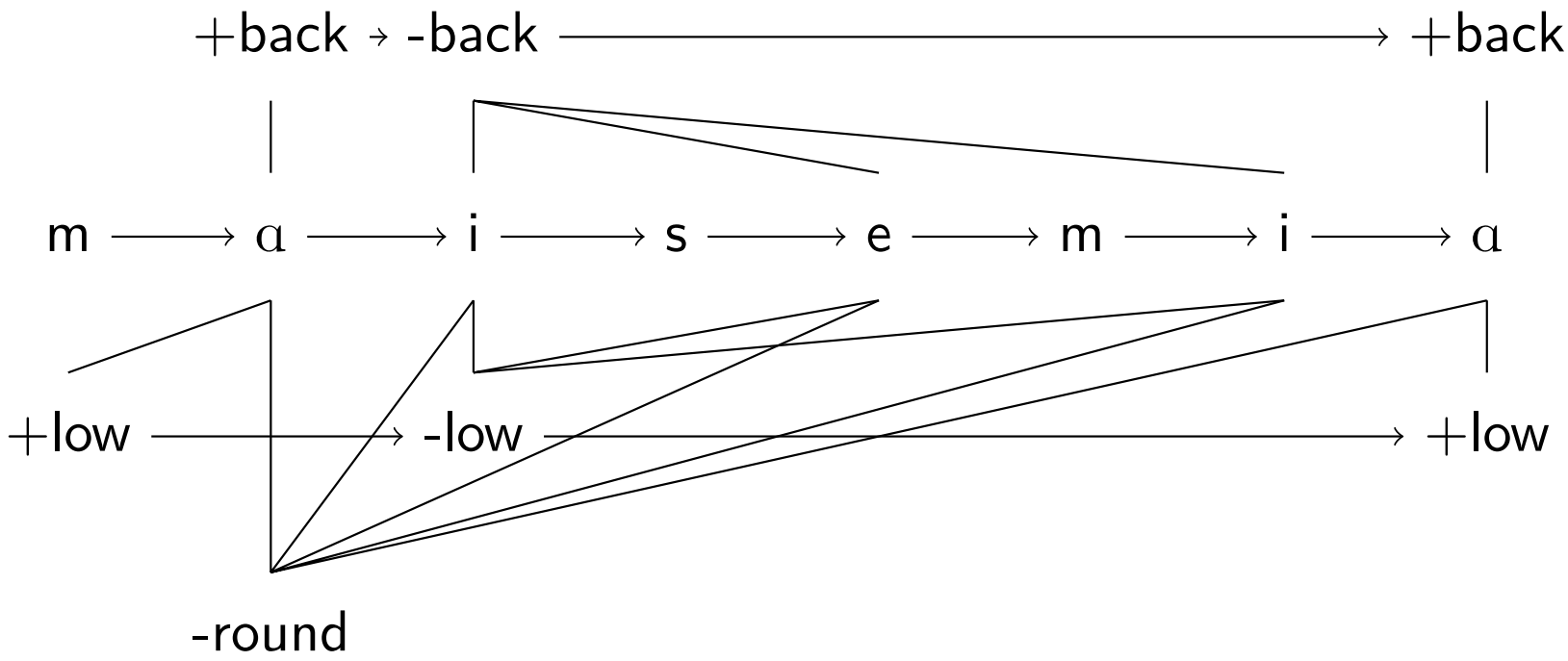
Agreement ARs consist of. . .

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

Agreement is local

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

[maisemia] 'scenery.plural.partitive'



Agreement is local

- Transparent vowels associated to a feature *on each feature tier*
- ARs make patterns local because of successor relation between features on each tier

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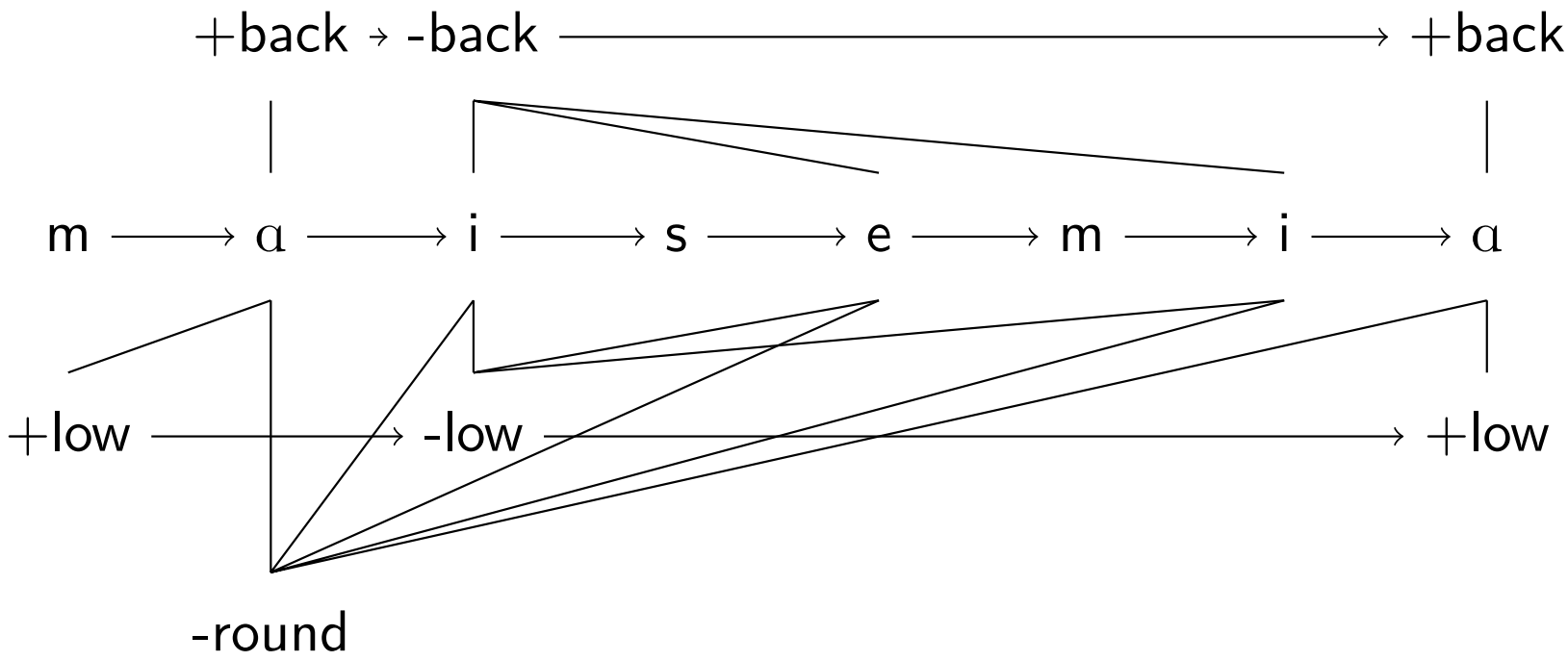

Discussion

Well-formed surface ARs of vowel harmony are local

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Well-formed surface ARs of vowel harmony are 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

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ARs can also represent boundaries

- FSCs can capture morphologically-conditioned harmony: morpheme boundaries on feature tiers in Turkish

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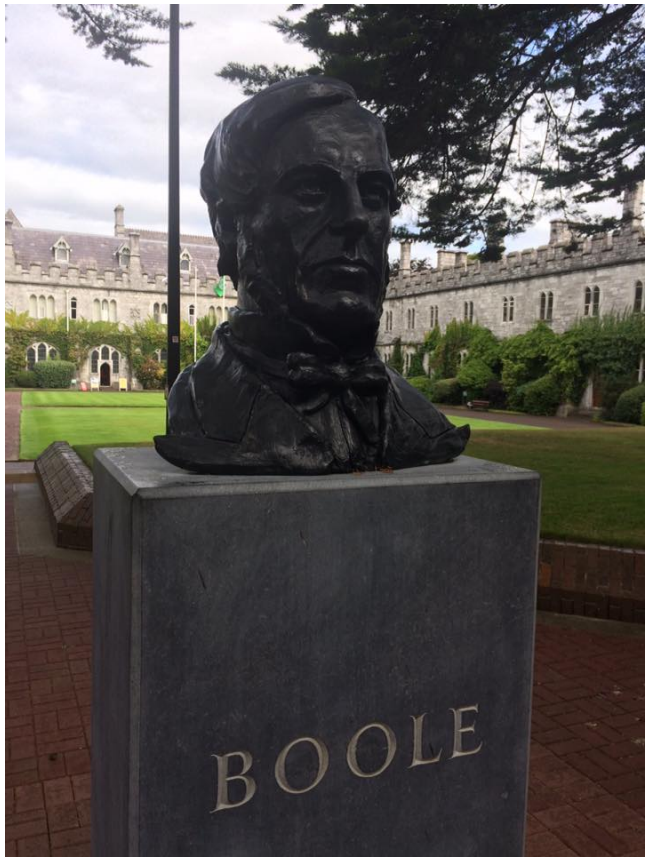
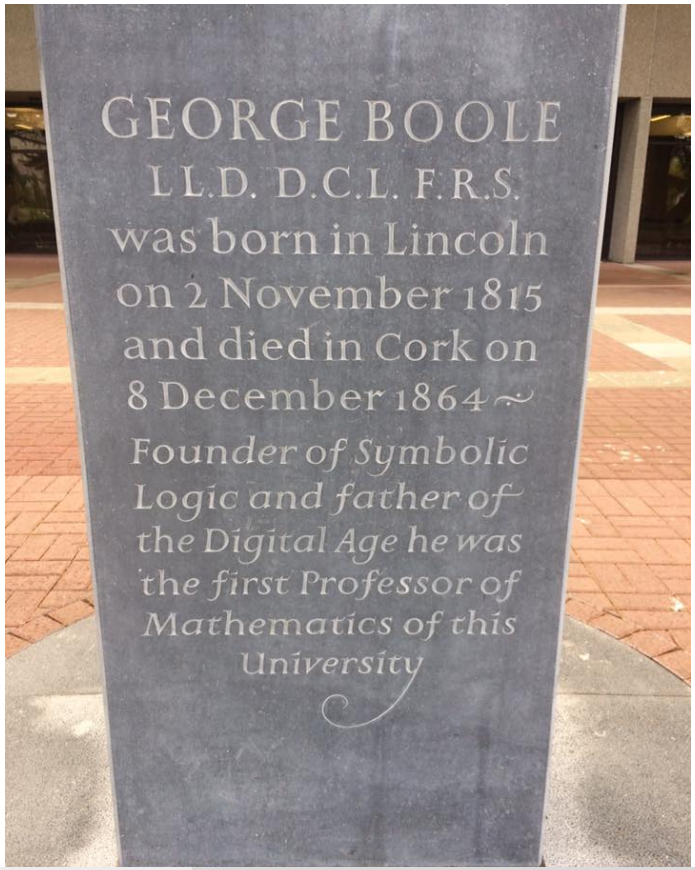
- Can multi-tiered ARs be restricted further to exclude unattested patterns?

Thank You

- QP committee: chair- Adam Jardine, Bruce Tesar, Simon Charlow
- Attendees of PhonX reading group and the 2nd Rutgers Computational Phonology Workshop

email: eileen.blum@rutgers.edu





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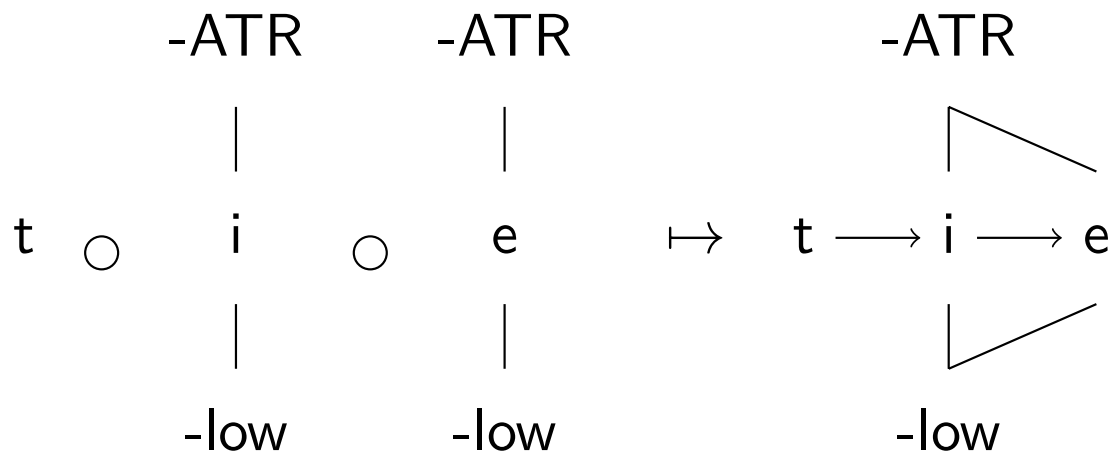
Appendix

Concatenation

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

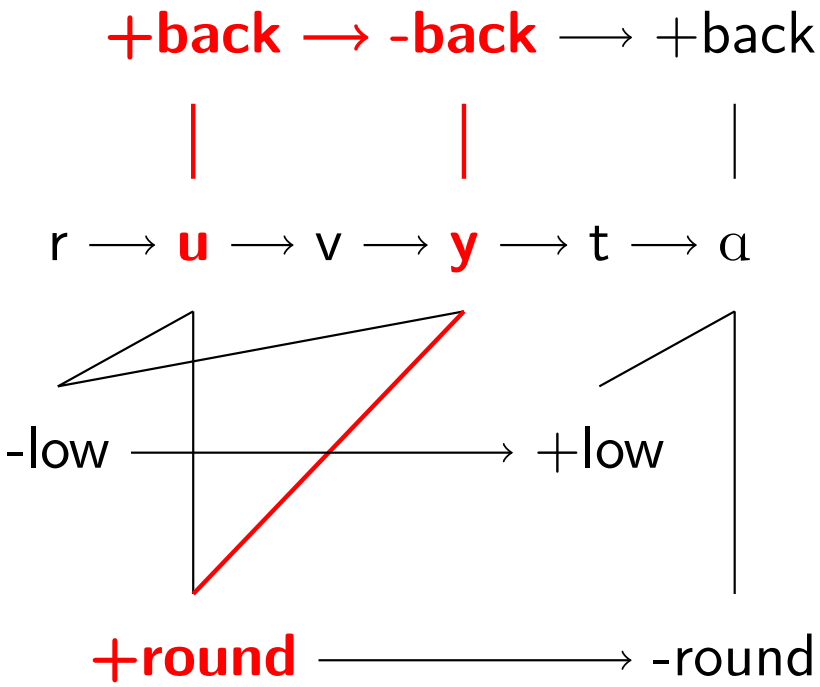
(4) Concatenation of adjacent autosegmental graph primitives



Transparent Vowels: Finnish

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

Ungrammatical disharmonic word



Finnish FSC

* +back → -back

V

+round