Sonority-based stress in Harmonic Grammar: Nontransitive Conflation in Phonological Hierarchies

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CLS 52
University of Chicago
April 22, 2016

Markedness Hierarchies

- Cross-linguistically we see patterns where certain structures are always more or equally marked than others, but never less marked, creating markedness hierarchies (de Lacy, 2004).
  - *Stressed Vowel Hierarchy*
    ˈə ≼ ˈi·ˈu ≼ ˈe·ˈo ≼ ˈɑ
  - *Place of Articulation Hierarchy*
    dorsal ≼ labial ≼ coronal ≼ glottal

Sonority Based Stress: Kobon

- In Kobon (Papua New Guinea, Davies 1981; Kenstowicz 1996) the leftmost most sonorous vowel gets main stress.

(1) *Stress in Kobon*

(a)	['dubu]	'to make noise by footsteps'
(b)	[kidol'man]	'arrow type'
(c)	[si.'og]	'bird species'
(d)	[nəŋ.'bin]	'I saw'

- *Stressed Vowel Hierarchy*
  'ə ≼ 'i·'u ≼ 'e·'o ≼ 'ɑ

Markedness Hierarchies: Sonority Based Stress

- Some languages (i.e. Nganasan (Uralic)) show a similar stress shift, but with conflation between some of the tiers.

(2) *Stress in Nganasan (de Lacy, 2004)*

a. *Default stress on penult*

(a)	[ab'aʔa]	'older sister, aunt'
(b)	[im'iɟi]	'grandmother'
(c)	[əmk'ətə]	'from here'

b. *Optional sonority-based stress shift*

(d)	[ɟ'embiʔʃi]	'dressing'
(e)	[s'olətu]	'glass'
(f)	['aniʔə]	'large'

- *Stressed Vowel Hierarchy*
  ˈə ≼ ˈiˑˈu ≼ ˈeˑˈo ≼ ˈɑ

Markedness Hierarchies: Conflation

- Some languages show conflation between two tiers of markedness.

(3) *Conflation in Nganasan*

a. *Central and High vowels*

(a) [cint'əɬi] 'stoke'

(b) [cuh'ənu] 'during'

b. *Mid and Low vowels*

(c) [bac'ebsa] 'breathing'

(d) [lʷam'obtuʔ] 'spill, splash'

- Nganasan pays no attention to the markedness difference between 'a and 'e·'o or 'i·'u and 'ə.
- *Stressed Vowel Hierarchy*

'ə ⪯ 'i·'u ≺ 'e·'o ⪯ 'ɑ

Markedness Hierarchies: Typology of conflation

- de Lacy (2002) shows that two tiers on the markedness hierarchy can be conflated, but they are never reversed.
- We will never see a language where stress shifts to the less sonorous syllable (with sonority being the only factor in play).
- As a corollary, conflation is contiguous: If [a] and [i u] are treated the same way, then [e o] must be treated the same way. (or else a reversal would occur.)

Conflation Patterns (Adapted from de Lacy (2004))

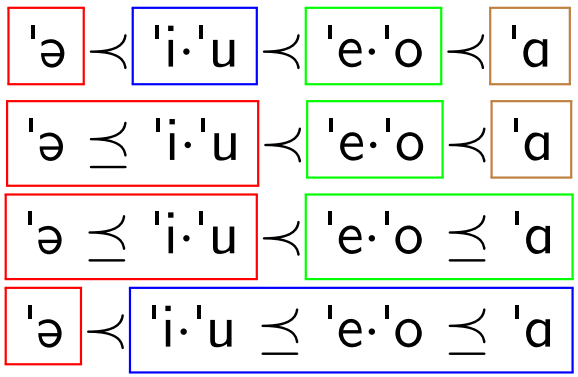
Categories				Attested
ə	i·u	e·o	ɑ	✓Kobon (Davies, 1981)
ə	i·u	e·o	ɑ	✓Gujarati (de Lacy, 2002, ch. 3)
ə	i·u	e·o	ɑ	✓Asheninca Payne (1990)
ə	i·u	e·o	ɑ	✓Yil (Martens & Tuominen, 1977)
ə	i·u	e·o	ɑ	?
ə	i·u	e·o	ɑ	✓Nganasan (de Lacy, 2004)
ə	i·u	e·o	ɑ	✓Kara (Schlie & Schlie, 1993; de Lacy, 1997)
ə	i·u	e·o	ɑ	✓Many (No sonority based stress)

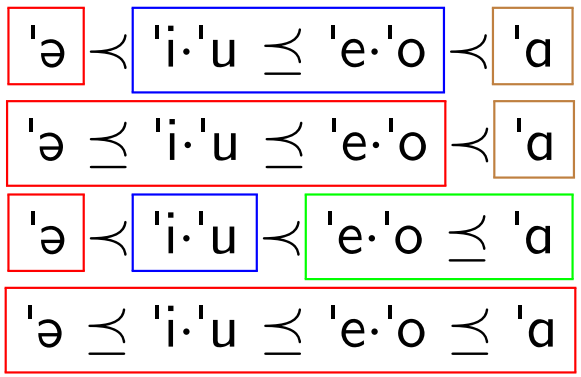
Conflation Patterns: Transitivity

- All of de Lacy's conflation patterns are *transitive*.
  - A conflation pattern is transitive *iff*:
    If ['a] is conflated with ['e 'o] and ['e 'o] is conflated with ['i 'u];
    ['a] **must** be conflated with ['i 'u].
- However, nontransitive conflation patterns are logically possible.
  - For example, ['e 'o] is conflated with ['a] and ['i 'u], but ['a] and ['i 'u] are not conflated.
  - [CaC'eCV] [CeC'iCV]
  - [C'aCiCV]

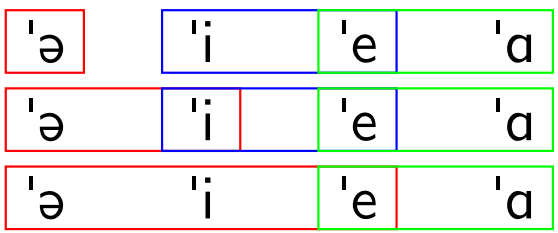
Conflation Patterns

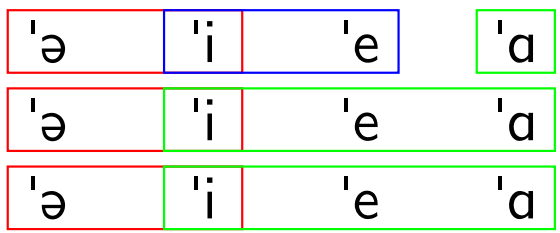
- Transitive Patterns:





- Nontransitive Patterns:





Goals of this Presentation

CLAIM

Harmonic Grammar (HG:(Legendre *et al.* , 1990, 2006; Pater, 2016) see also Goldsmith (1993)) differs from OT by predicting nontransitive conflation along with transitive conflation.

- At this point, no nontransitive conflation patterns have been identified, but they seem languagelike.

Corollary

Sets of stringently related constraints are equivalent to sets of constraints with fixed weightings in HG.

Sonority Based Stress Constraints

- In order to capture sonority based stress in Nganasan, we need the following constraints:
  - ALIGN-R- Assign a violation mark if the right most syllable of a word if it is unfooted.
  - Also assume the necessary constraints for trochaic feet and rightmost main stress are suitably high ranked.
- Crucially ALIGN-R here enforces that penultimate syllables are stressed; more generally, we need to have a constraint that enforces the default stress position.

Sonority Based Stress Constraints: Stringency

- de Lacy (2002) shows that the markedness hierarchy must be represented using stringently related constraints (Prince, 1999) in order to capture the possibility of conflation.
  - One constraint *A* is *more stringent* than another constraint *B* if the violations of *A* are a superset of the violations of *B* across all inputs/outputs.

(4) $^{*}\text{HD}_{ft}/\trianglelefteq x$- Assign a violation mark for each vowel that is the head of a foot and is less or equally sonorous to *x*.

(5) *Violations of the stringently related constraints*

	$^{*}\text{HD}_{ft}/\trianglelefteq$ə	$^{*}\text{HD}_{ft}/\trianglelefteq$i·u	$^{*}\text{HD}_{ft}/\trianglelefteq$e·o	$^{*}\text{HD}_{ft}/\trianglelefteq$a
a. 'ɑ				*
b. 'e			*	*
c. 'i		*	*	*
d. 'ə	*	*	*	*

Stringently Related Constraints capture transitive conflation in OT

- If the default stress constraint ALIGN-R is ranked above all the stringently related constraints, default stress always wins.
- In this language all vowels are conflated.
  ˈə ≼ ˈi·ˈu ≼ ˈe·ˈo ≼ ˈɑ

		AL-R	*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	iˈəV-ˈiəV	W	L		
b	eˈiV-ˈeiV	W		L	
c	ɑˈeV-ˈɑeV	W			L
d	ɑˈiV-ˈɑiV	W		L	L
e	eˈəV-ˈeəV	W	L	L	
f.	ɑˈəV-ˈɑəV	W	L	L	L

OT conflation patterns

ˈə ≍ ˈi ≍ ˈe ≍ ˈɑ

		AL-R	*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	iˈəV-ˈiəV	W	L		
b	eˈiV-ˈeiV	W		L	
c	ɑˈeV-ˈɑeV	W			L
d	ɑˈiV-ˈɑiV	W		L	L
e	eˈəV-ˈeəV	W	L	L	
f.	ɑˈəV-ˈɑəV	W	L	L	L

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		AL-R	*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	iˈəV-ˈiəV	W	L		
b	eˈiV-ˈeiV	W		L	
c	ɑˈeV-ˈɑeV	W			L
d	ɑˈiV-ˈɑiV	W		L	L
e	eˈəV-ˈeəV	W	L	L	
f.	ɑˈəV-ˈɑəV	W	L	L	L

OT conflation patterns

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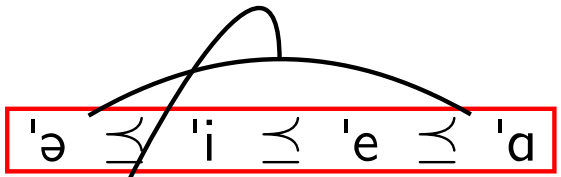
		AL-R	*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	iˈəV-ˈiəV	W	L		
b	eˈiV-ˈeiV	W		L	
c	ɑˈeV-ˈɑeV	W			L
d	ɑˈiV-ˈɑiV	W		L	L
e	eˈəV-ˈeəV	W	L	L	
f.	ɑˈəV-ˈɑəV	W	L	L	L

OT conflation patterns

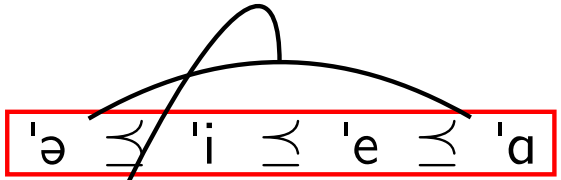
		AL-R	*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	iˈəV-ˈiəV	W	L		
b	eˈiV-ˈeiV	W		L	
c	ɑˈeV-ˈɑeV	W			L
d	ɑˈiV-ˈɑiV	W		L	L
e	eˈəV-ˈeəV	W	L	L	
f.	ɑˈəV-ˈɑəV	W	L	L	L

OT conflation patterns



		AL-R	*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	i'əV-'iəV	W	L		
b	e'iV-'eiV	W		L	
c	ɑ'eV-'ɑeV	W			L
d	ɑ'iV-'ɑiV	W		L	L
e	e'əV-'eəV	W	L	L	
f.	ɑ'əV-'ɑəV	W	L	L	L

OT conflation patterns



		AL-R	*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	i'əV-'iəV	W	L		
b	e'iV-'eiV	W		L	
c	ɑ'eV-'ɑeV	W			L
d	ɑ'iV-'ɑiV	W		L	L
e	e'əV-'eəV	W	L	L	
f.	ɑ'əV-'ɑəV	W	L	L	L

Stringently Related Constraints capture transitive conflation in OT

- If the default stress constraint ALIGN-R is ranked below all the stringently related constraints, stress always shifts.
- This is the language where no vowels are conflated.
  ˈə ≺ ˈi·ˈu ≺ ˈe·ˈo ≺ ˈɑ

		*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o	AL-R
a	ˈiəV-iˈəV	W			L
b	ˈeiV-eˈiV		W		L
c	ˈɑeV-ɑˈeV			W	L
d	ˈɑiV-ɑˈiV		W	W	L
e	ˈeəV-eˈəV	W	W		L
f.	ˈɑəV-ɑˈəV	W	W	W	L

Stringently Related Constraints capture transitive conflation in OT

- In OT, including the two previously seen, there are 2^3=8 possible weightings/conflation patterns.
- If a constraint that maximally marks x is ranked below $\textsc{Al-R}$, the distinction between x and the next tier less marked than it is conflated.

ˈə ≍ ˈi·ˈu ≺ ˈe·ˈo ≺ ˈɑ

		*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o	AL-R	*HD$_{ft}$/◁ə
a	iˈəV-ˈiəV			W	L
b	ˈeiV-eˈiV	W		L	
c	ˈɑeV-ɑˈeV		W	L	
d	ˈɑiV-ɑˈiV	W	W	L	
e	ˈeəV-eˈəV	W		L	W
f.	ˈɑəV-ɑˈəV	W	W	L	W

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ˈə ≺ ˈi·ˈu⪯ ˈe·ˈo ≺ ˈɑ

		*HD$_{ft}$/◁ə	*HD$_{ft}$/⪯e·o	AL-R	*HD$_{ft}$/⪯i·u
a	ˈiəV-iˈəV	W		L	
b	eˈiV-ˈeiV			W	L
c	ˈɑeV-ɑˈeV		W	L	
d	ˈɑiV-ɑˈiV		W	L	W
e	ˈeəV-eˈəV	W		L	W
f.	ˈɑəV-ɑˈəV	W	W	L	W

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- In OT, including the two previously seen, there are 2^3=8 possible weightings/conflation patterns.
- If a constraint that maximally marks x is ranked below $\textsc{Al-R}$, the distinction between x and the next tier less marked than it is conflated.

ˈə ≺ ˈi·ˈu ≺ ˈe·ˈo ≼ ˈɑ

		$*\textsc{Hd}_{ft}/\trianglelefteq$ə	$*\textsc{Hd}_{ft}/\trianglelefteq$i·u	$\textsc{Al-R}$	$*\textsc{Hd}_{ft}/\trianglelefteq$e·o
a	ˈiəV-iˈəV	W		L	
b	ˈeiV-eˈiV		W	L	
c	ɑˈeV-ˈɑeV			W	L
d	ˈɑiV-ɑˈiV		W	L	W
e	ˈeəV-eˈəV	W	W	L	
f.	ˈɑəV-ɑˈəV	W	W	L	W

Stringently Related Constraints capture transitive conflation in OT

- If two constraints both are ranked below AL-R, both distinctions become conflated.
- This only creates transitive conflation patterns, where conflated tiers do not overlap.

ˈə ≺ ˈi·ˈu ≺ ˈe·ˈo ⪯ ˈɑ

- This is Nganasan.

		*HD$_{ft}$/◁i·u	AL-R	*HD$_{ft}$/◁e·o	*HD$_{ft}$/◁ə
a	iˈəV-ˈiəV		W		L
b	ˈeiV-eˈiV	W	L		
c	ɑˈeV-ˈɑeV		W	L	
d	ˈɑiV-ɑˈiV	W	L	W	
e	ˈeəV-eˈəV	W	L		W
f.	ˈɑəV-ɑˈəV	W	L	W	W

Stringently Related Constraints capture transitive conflation in OT

- If two constraints both are ranked below AL-R, both distinctions become conflated.
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ˈə ≍ ˈi·ˈu ≍ ˈe·ˈo ≺ ˈɑ

		*HD$_{ft}$/◁e·o	AL-R	*HD$_{ft}$/◁ə	*HD$_{ft}$/◁i·u
a	iˈəV-ˈiəV		W	L	
b	eˈiV-ˈeiV		W		L
c	ˈɑeV-ɑˈeV	W	L		
d	ˈɑiV-ɑˈiV	W	L		W
e	ˈeəV-eˈəV		W	L	L
f.	ˈɑəV-ɑˈəV	W	L	W	W

Stringently Related Constraints capture transitive conflation in OT

- If two constraints both are ranked below AL-R, both distinctions become conflated.
- This only creates transitive conflation patterns, where conflated tiers do not overlap.

ˈə ≺ ˈi·ˈu ≼ ˈe·ˈo ≺ ˈɑ

		*HD$_{ft}$/◁ə	AL-R	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	ˈiəV-iˈəV	W	L		
b	eˈiV-ˈeiV		W	L	
c	ɑˈeV-ˈɑeV		W		L
d	ɑˈiV-ˈɑiV		W	L	L
e	ˈeəV-eˈəV	W	L	W	
f.	ˈɑəV-ɑˈəV	W	L	W	W

No Nontransitive Conflation in OT

- Nontransitive conflation leads to a ranking paradox in OT.

ˈə ˈi ˈe ˈɑ

		*HD$_{ft}$/◁ə	AL-R	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o
a	ˈiəV-iˈəV	W	L		
b	eˈiV-ˈeiV		W	L	
c	ɑˈeV-ˈɑeV		W		L
✗ d	ˈɑiV-ɑˈiV		!L!	W	W
e	ˈeəV-eˈəV	W	L	W	
f.	ˈɑəV-ɑˈəV	W	L	W	W

Intro

- Harmonic Grammar (HG: Legendre *et al.* 1990, 2006; Pater 2009b; Potts *et al.* 2010) is a modification of Optimality Theory (Prince & Smolensky, 1993/2004; McCarthy & Prince, 1995).
- OT uses constraints with a strict ranking.
- HG uses weighted constraints.

Intro

- Harmonic Grammar (HG: Legendre *et al.* 1990, 2006; Pater 2009b; Potts *et al.* 2010) is a modification of Optimality Theory (Prince & Smolensky, 1993/2004; McCarthy & Prince, 1995).
- OT uses constraints with a strict ranking.
- HG uses weighted constraints.

Benefits of weighted constraints

- Allow for language processes to be modeled using fewer and simpler constraints. (Pater 2009a; Potts *et al.* 2010; Pater 2009b, 2016; Jesney 2011, 2016; Bane & Riggle 2009, a.o.)
- Are easily adaptable to handle gradient phenomena. (MaxEnt (Goldwater & Johnson, 2003; Wilson, 2006; Jäger & Rosenbach, 2006) or Noisy HG(Goldrick & Daland, 2009; Boersma & Pater, 2016))
- Offer advantages in language learning (Jesney & Tessier, 2011; O'Hara, 2015)
- Despite the infinite possible weightings, Bane *et al.* (2010) show that the complexity of HG is bounded based on the number of constraints at the same bound as OT.

Conflation in HG

- In HG, because two lower weighted constraints can overcome a higher weighted constraint, non-transitive conflation is possible.
- ['i] is conflated with ['e] which is conflated with ['a], but ['i] is still mored marked than ['a].

['ə] ['i] ['e] ['ɑ]

		*HD$_{ft}$/◁ə	AL-R	*HD$_{ft}$/◁i·u	*HD$_{ft}$/◁e·o	H
		$w = 4$	$w = 3$	$w = 2$	$w = 2$	
a	'iəV-i'əV	+1	-1			+1
b	e'iV-'eiV		+1	-1		+1
c	ɑ'eV-'ɑeV		+1		-1	+1
d	'ɑiV-ɑ'iV		-1	+1	+1	+1
e	'eəV-e'əV	+1	-1	+1		+3
f.	'ɑəV-ɑ'əV	+1	-1	+1	+1	+5

Closer Look: Conflation in HG

- If ['e] and ['i] are conflated, AL-R>*HD$_{ft}$/◁i·u

eiV	AL-R	*HD$_{ft}$/◁i·u	H
	$w = 3$	$w = 2$	
a. 'eiV	-1		-3
☞ b. e'iV		-1	-2

- If ['e] and ['ɑ] are conflated, AL-R>*HD$_{ft}$/◁e·o

/ɑeV/	AL-R	*HD$_{ft}$/◁e·o	H
	$w = 3$	$w = 2$	
a. 'ɑeV	-1		-3
☞ b. ɑ'eV		-1	-2

Closer Look: Conflation in HG

- If ['e] and ['i] are conflated, AL-R>*HD$_{ft}$/◁i·u

eiV	AL-R	*HD$_{ft}$/◁i·u	H
	$w = 3$	$w = 2$	
a. 'eiV	-1		-3
☞ b. e'iV		-1	-2

- If ['e] and ['ɑ] are conflated, AL-R>*HD$_{ft}$/◁e·o

/ɑeV/	AL-R	*HD$_{ft}$/◁e·o	H
	$w = 3$	$w = 2$	
a. 'ɑeV	-1		-3
☞ b. ɑ'eV		-1	-2

Closer Look: Conflation in HG

- In OT, these results imply that ['ɑ]-['i] are conflated.

/ɑiV/	AL-R	*HD$_{ft}$/◁e·o	*HD$_{ft}$/◁i·u
a. 'ɑiV	-1		
☞ b. ɑ'iV		-1	-1

- Not so in HG.

/ɑiV/	AL-R	*HD$_{ft}$/◁e·o	*HD$_{ft}$/◁i·u	H
	$w = 3$	$w = 2$	$w = 2$	
☞ a. 'ɑiV	-1			-3
b. ɑ'iV		-1	-1	-4

Closer Look: Conflation in HG

- In OT, these results imply that ['ɑ]-['i] are conflated.

/ɑiV/	AL-R	*HD$_{ft}$/◁e·o	*HD$_{ft}$/◁i·u
a. 'ɑiV	-1		
☞ b. ɑ'iV		-1	-1

- Not so in HG.

/ɑiV/	AL-R	*HD$_{ft}$/◁e·o	*HD$_{ft}$/◁i·u	H
	$w = 3$	$w = 2$	$w = 2$	
☞ a. 'ɑiV	-1			-3
b. ɑ'iV		-1	-1	-4

Nontransitive Conflation in HG

- In this way, HG with stringent constraints predicts the 6 nontransitive conflation patterns mentioned earlier.

What about fixed weightings?

- Fixed Rankings (Prince & Smolensky, 1993/2004) are built of specific disjoint constraints that are in a universal ordering, so are not rerankable across languages, creating a markedness hierarchy.
- In OT, fixed rankings fail to predict all conflation patterns (de Lacy, 2002), particularly those that make multiple partitions, or where a conflated tier does not include the least marked member.
  Here, * ˈə ⪯ ˈi·ˈu ≺ ˈe·ˈo

eiV	AL-R	*HD$_{ft}$/ə	*HD$_{ft}$/i·u	*HD$_{ft}$/e·o
a. eˈiV	L		*W	L
☜ b. ˈeiV	*			*
iəV	AL-R	*HD$_{ft}$/ə	*HD$_{ft}$/i·u	*HD$_{ft}$/e·o
☞ c. iˈəV		*		
d. ˈiəV	*W	L	*W	

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eiV	*HD$_{ft}$/ə	*HD$_{ft}$/i·u	AL-R	*HD$_{ft}$/e·o
a. eˈiV		*W	L	L
☞ b. ˈeiV			*	*
iəV	*HD$_{ft}$/ə	*HD$_{ft}$/i·u	AL-R	*HD$_{ft}$/e·o
☜ c. iˈəV	*			
d. ˈiəV	L	*W	*W	

What about fixed weightings?

- In HG, all the observed patterns of conflation are possible with fixed weightings.

'ə $\preceq$ 'i·'u $\prec$ 'e·'o

eiV	*HD$_{ft}$/ə	*HD$_{ft}$/i·u	AL-R	*HD$_{ft}$/e·o	H
	$w = 5$	$w = 4$	$w = 2$	$w = 1$	
a. e'iV		-1W	L	L	-4
☞ b. 'eiV			-1	-1	-3
iəV	*HD$_{ft}$/ə	*HD$_{ft}$/i·u	AL-R	*HD$_{ft}$/e·o	H
	$w = 5$	$w = 4$	$w = 2$	$w = 1$	
☞ c. i'əV	-1				-5
d. 'iəV	L	-1W	-1W		-6

Fixed weightings = Stringency

- In fact, any harmonic grammar described by a set of fixed weighted constraints can be expressed using a stringent set of constraints and vice versa.

Fixed Weightings = Stringency

- Assume a markedness hierarchy A>B>C.
  - In a fixed weighting we have *A_{fw}>*B>*C.
  - Stringent constraints would be, *A_{strng}, *{A,B}, *{A,B,C}
- [C] only violates *C in the fixed weighting, and *{A,B,C} in the stringent set.
  - So let *C=*{A,B,C}.
- [B] violates *B in fixed weighting, and *{A,B} and *{A,B,C} in the stringent set.
  - Let *B=*{A,B,C}+*{A,B}
  - *B=*C+*{A,B}
  - *B-*C=*{A,B}
- [A] violates *A_{fw} in fixed weightings, or *{A,B,C}, *{A,B}, and *A_{strng} in the stringent set.
  - Let *A_{fw}=*{A,B,C}+*{A,B}+*A_{strng}
  - *A_{fw}=*B+*A_{strng}

Fixed Weightings = Stringency

- We now have two sets of equations, one to find the weights of the stringent constraints given the fixed weighting, and one to do the opposite.

- $*A_{strng}=*A_{fw}-*B$
- $*\{A,B\}=*B-*C$
- $*\{A,B,C\}=*C$

- $*A_{fw}=*\{A,B,C\}+*\{A,B\}+*A_{strng}$
- $*B=*\{A,B,C\}+*\{A,B\}$
- $*C=*\{A,B,C\}$

- The crucial rules are that all constraints are postively weighted, and that the fixed weights maintain their ordering.
- These rules enforce each other, fixed weights ensure that the derived stringent constraint weights are positive; and the fact that they must be positive ensures that each derived fixed weight constraint must weigh more than the last.

Nontransitive conflation with Fixed Weightings

- Fixed weightings also predict nontransitive conflation.
- If ['e] and ['i] are conflated, AL-R+*HD$_{ft}$/e·o>*HD$_{ft}$/i·u

eiV	AL-R	*HD$_{ft}$/i·u	*HD$_{ft}$/e·o	H
	$w = 3$	$w = 8$	$w = 6$	
a. 'eiV	-1		-1	-9
☞ b. e'iV		-1		-6

- If ['e] and ['ɑ] are conflated, AL-R+*HD$_{ft}$/ɑ>*HD$_{ft}$/e·o

/ɑeV/	AL-R	*HD$_{ft}$/e·o	*HD$_{ft}$/ɑ	H
	$w = 3$	$w = 6$	$w = 4$	
a. 'ɑeV	-1		-1	-7
☞ b. ɑ'eV		-1		-6

- But ['i] and ['ɑ] are not conflated, AL-R+*HD$_{ft}$/ɑ<*HD$_{ft}$/i·u

/ɑeV/	AL-R	*HD$_{ft}$/i·u	*HD$_{ft}$/ɑ	H
	$w = 3$	$w = 8$	$w = 4$	
☞ a. 'ɑiV	-1		-1	-7
b. ɑ'iV		-1		

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/ɑeV/	AL-R	*HD$_{ft}$/i·u	*HD$_{ft}$/ɑ	H
	$w = 3$	$w = 8$	$w = 4$	
☞ a. 'ɑiV	-1		-1	-7
b. ɑ'iV		-1		-6

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/ɑeV/	AL-R	*HD$_{ft}$/e·o	*HD$_{ft}$/ɑ	H
	$w = 3$	$w = 6$	$w = 4$	
a. 'ɑeV	-1		-1	-7
☞ b. ɑ'eV		-1		-6

- But ['i] and ['ɑ] are not conflated, AL-R+*HD$_{ft}$/ɑ<*HD$_{ft}$/i·u

/ɑeV/	AL-R	*HD$_{ft}$/i·u	*HD$_{ft}$/ɑ	H
	$w = 3$	$w = 8$	$w = 4$	
☞ a. 'ɑiV	-1		-1	-7
b. ɑ'iV		-1		

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/ɑeV/	AL-R	*HD$_{ft}$/e·o	*HD$_{ft}$/ɑ	H
	$w = 3$	$w = 6$	$w = 4$	
a. 'ɑeV	-1		-1	-7
☞ b. ɑ'eV		-1		-6

- But ['i] and ['ɑ] are not conflated, AL-R+*HD$_{ft}$/ɑ<*HD$_{ft}$/i·u

/ɑeV/	AL-R	*HD$_{ft}$/i·u	*HD$_{ft}$/ɑ	H
	$w = 3$	$w = 8$	$w = 4$	
☞ a. 'ɑiV	-1		-1	-7
b. ɑ'iV		-1		-8

Nontransitive conflation with Fixed Weightings

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- If ['e] and ['i] are conflated, AL-R+*HD$_{ft}$/e·o>*HD$_{ft}$/i·u

eiV	AL-R	*HD$_{ft}$/i·u	*HD$_{ft}$/e·o	H
	$w = 3$	$w = 8$	$w = 6$	
a. 'eiV	-1		-1	-9
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- But ['i] and ['ɑ] are not conflated, AL-R+*HD$_{ft}$/ɑ<*HD$_{ft}$/i·u

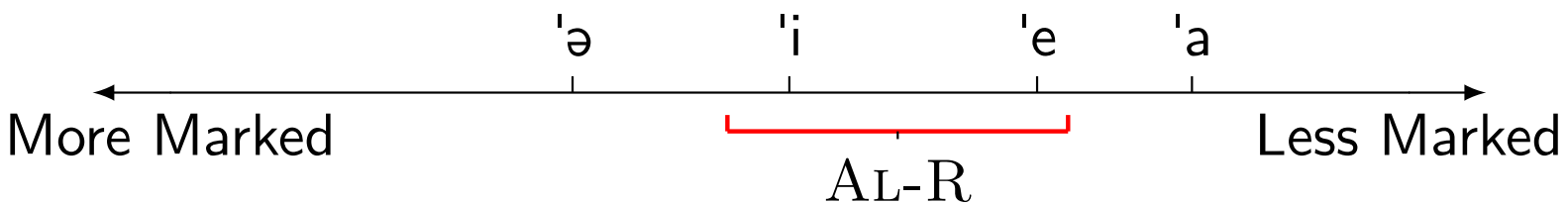
/ɑeV/	AL-R	*HD$_{ft}$/i·u	*HD$_{ft}$/ɑ	H
	$w = 3$	$w = 8$	$w = 4$	
☞ a. 'ɑiV	-1		-1	-7
b. ɑ'iV		-1		-8

What is conflation?

- Conflation occurs when the harmonic difference between two tiers is smaller than the effect of some other constraint.
- In HG, we can find the harmonic difference as the difference in harmony scores between two candidates on a set of constraints.
- If $^*\textsc{Hd}_{ft}/$ə$-^*\textsc{Hd}_{ft}/$i·u (or with stringent constraints $^*\textsc{Hd}_{ft}/\trianglelefteq$ə) is less than $\textsc{Al-R}$, we get conflation between those tiers.

Interim Summary

- In HG, markedness hierarchies are modeled by a more marked thing always receiving a worse harmony score than something less marked.
- Conflation is caused by some other constraint outweighing the difference in harmony of two candidates.
- Non-transitive conflation is unseparable from transitive conflation.



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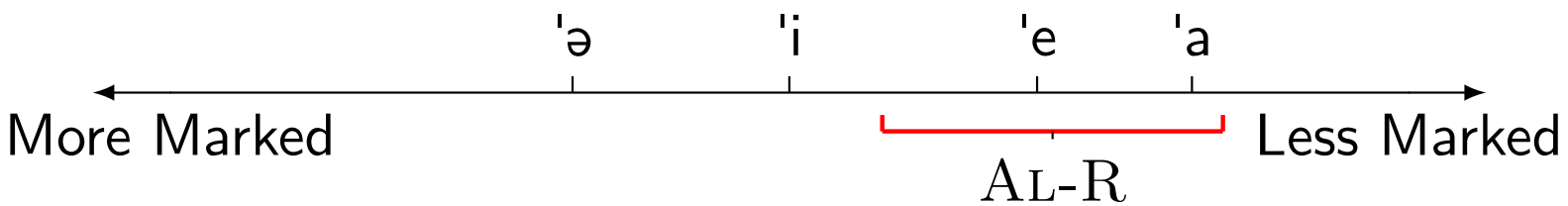
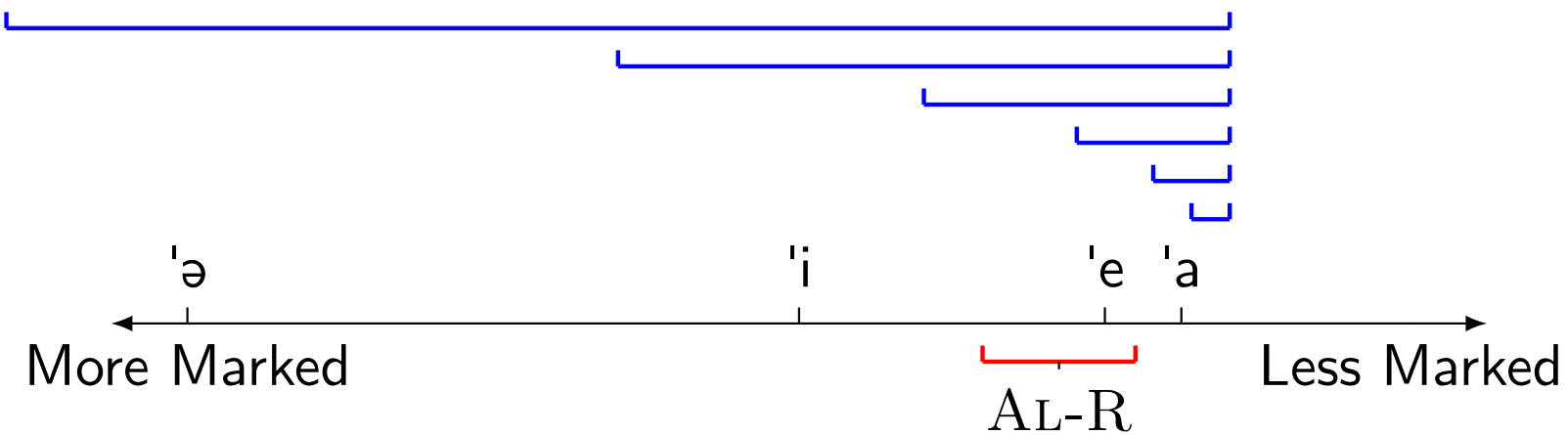


Interim Summary

- In OT, each constraint must be *way* bigger than the last, which we can model by restricting the possible sets of distances referencable, (Tesar, 2007).
- Each distance can only be used once, so the sum of all distances smaller than some distance, must be also smaller than that distance (Zeno's Paradox).



Does non-transitive conflation exist?

- I don't know.
- Pater (2016) notes that the sonority-driven stress data is a difficult place to look.
  - Sonority driven stress is relatively rare, as are conflation patterns on top of that.
  - Stress data can be fickle, calling into question some of the data for transitive conflation, (de Lacy, 2015a,b; Shih, to appear).

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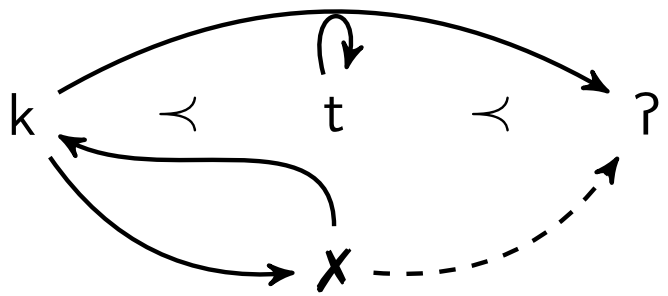
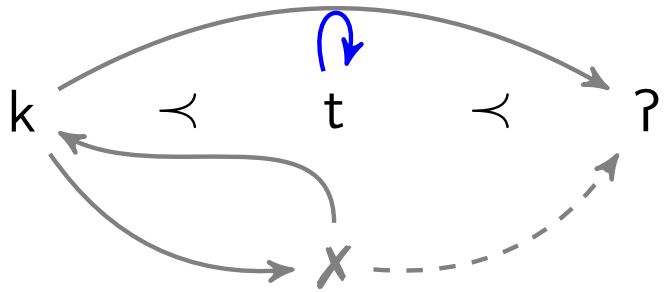
What would non-transitive conflation look like?

- de Lacy (2006) notes the place of articulation hierarchy dorsal>labial>coronal>glottal.
- Imagine a language where /k/ debuccalize to [ʔ] in codas, but /t/ does not.



- However, when phonotactics block glottals, dorsals remain faithful.
- This language is like a mix of Malay and Kashaya (de Lacy, 2006)
- If a dorsal is underlyingly marked for a laryngeal feature, /k^h/ or /$k^ʔ$/, it remains faithful.

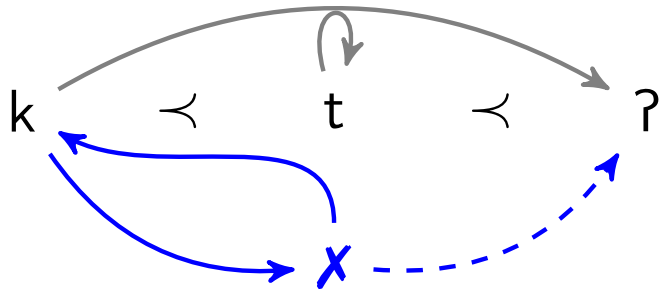
NonTransitive Language



- Since /t/ does not debuccalize, glottal and coronal are conflated.

/pat/	*ʔʰ/ʔ	Id(Place)	*dors	*dors,cor	H
	$w = 10$	$w = 3$	$w = 2$	$w = 2$	
☞ a. pat				-1	-2
b. paʔ		-1			-3

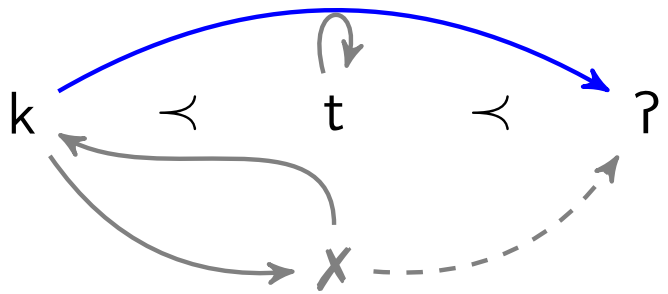
NonTransitive Language



- Since /k^h/ does not reduce in markedness to [t^h], dorsal and coronal are conflated.

/pak^h/	*$ʔ^{h/ʔ}$	Id(Place)	*Dors	*Dors,Cor	H
	$w = 10$	$w = 3$	$w = 2$	$w = 2$	
☞ a. pak^h			-1	-1	-4
b. pat^h		-1		-1	-5
c. $paʔ^h$	-1	-1			-13

NonTransitive Language



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/pak/	*ʔʰ/ʔ	Id(Place)	*dors	*dors,cor	H
	$w = 10$	$w = 3$	$w = 2$	$w = 2$	
a. pak			-1	-1	-4
b. pat		-1		-1	-5
☞ c. paʔ		-1			-3

Conclusion

- Non-transitive conflation languages seem language-like
- If we can find them, or show convincing artificial language learning data that they are learnable, this shows a typological area where weighted constraints outperform ranked constraints.
- Given that we want to represent markedness hierarchies, the existence (or not) of nontransitive conflation is a strong argument for (or against) weighted constraints over ranked constraints.

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