

“ATR” Harmony in Kàlòŋ and Nez Perce without /±ATR/: Abstraction, Economy and Primitives

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Introduction

Harmony poses many challenges to phonological theory:

- Only vocalic features seem to participate
- There are often partial class effects
- There are often vowels which are sometimes transparent and sometimes triggers
- It often displays what look like dependency relationships among features - some of which are not related in any obvious way

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Introduction

In the pre-OT literature, harmony has played an important role in determining:

- The universal set of primitive phonological features/elements
- Their allowable combinations and relations
- Their relationship to articulatory gestures/perceptual cues

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Introduction

In the OT literature, harmony has been relegated a minor role in phonological theory, with analyses using:

- Convenient, (usually) fully-specified, SPE-like bundles of binary features

The validity of those features is not questioned:

- Universally
- Within the language under investigation

The question of why only vocalic features seem to participate is left a mystery

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Goals

1. Conceptual

- Reintroduce (economical) autosegmental representations into OT phonology
- Explain C-V harmony asymmetries the old fashioned way - representationally
- Unify “ATR” with other phonological features
- Simplify the analysis of 2 cases of “ATR” harmony by suggesting that Kàlòŋ “+ATR” harmony and Nez Perce “-ATR” harmony are phonetic variants of the same phonological phenomenon (thus suggesting that the phonetics-phonology interface is more abstract and language-particular than is usually thought)

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Goals

2. Implementational

- Provide a representational and part of an OT analysis of the Kàlòŋ vowel inventory and harmony
- Suggest a representational analysis of Nez Perce vowel inventory and harmony

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Remainder of talk

- Introduce the vowel system of Kàlòŋ, including 3 types of harmony and one neutralization
- Introduce the Parallel Structures Model of feature geometry (Morén 2003, 2004)
- Apply the PSM to Kàlòŋ
- Implement PART of the Kàlòŋ representational analysis within OT
- Introduce the vowel system of Nez Perce and suggest a representational analysis

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Kàlòŋ

- Bantu language - Southern Cameroon
- All data come from Hyman (2002, 2005)
- 7 or 8 surface vowels depending on the context and dialect/idiolect
- Concentrate on one of the 8-vowel dialects

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Kàlòn̄ Surface Vowels

8 Surface Vowels

[i]		[u]
[e]	[ə]	[o]
[ɛ]		[ɔ]
	[a]	

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Kàlòn̄ Surface Vowels

7 of the vowels show a surface contrast in some contexts, e.g. verb roots

-tím		-fùk
-fén		-pós
-sél		-kòk
	-jàn	

Schwa appears only as the result of harmony
Note: I will ignore tone

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Kàlòn̄ Phonological Vowels

As Paulian (1986) and Hyman (2002) point out, the behaviour of the vowels suggests that there are two additional phonological vowels that do not phonetically differ significantly from the two high vowels

i	i* I		u* u
e		ə	o
ɛ			ɔ
		a	

I will provide evidence of a fifth high vowel

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Kàlòn̄ Phonological Vowels

Because phonetic realization does not match 1:1 with phonological representation, I will make use of the following transcription conventions:

//UR//	-	phonological
/SR/	-	phonological
[PF]	-	phonetic

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Kàlòŋ Vowel Processes

There are 3 vowel harmony processes and one vowel lowering process:

1. “ATR” harmony - **all** vowels are “+ATR” in a word containing an underlying “+ATR” vowel
2. “Front” harmony - the **low** vowel fronts when syllable-adjacent to **mid** “front” vowels
3. “Round” harmony - the **low** vowel rounds when syllable-adjacent to **mid** “round” vowels
4. “High” vowel lowering - **some** high vowels become mid “-ATR” in final syllables

Note: “front” and “round” harmony can be non-adjacent across a Paulian vowel (i*, u*) - not discussed here

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Kàlòŋ “+ATR” Harmony

All vowels are “+ATR” in a word with underlying “+ATR” vowel - E.g. //i// causative

Unaffixed	Affixed	
[ku-ɲim]	[ku-ɲim-i]	to lose
[ku-enep]	[ku-enep-i]	to blacken something
[ku-suk]	[ku-suk-i]	to make fail
[ku-wok]	[ku-wok-i]	to make cold
[ku-ɛj]	[ku-ɛj-i]	to change someone
[ku-sɔt]	[ku-sɔt-i]	to save someone
[ku-sak]	[ku-sɛk-i]	to dry/empty something

Note: 1) The infinitive [ku-] prefix does not condition harmony!
2) The causative [-i] conditions //a// --> [e], not [ə]!

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Kàlòŋ “+ATR” Harmony

All vowels are “+ATR” in a word with underlying “+ATR” vowel - E.g. //i// causative

//UR//	/SR/	[SR]
//ku*-ɲim-i// -->	/k <u>u</u> -ɲim-i/	[kupimi]
//ku*-enep-i// -->	/k <u>u</u> -enep-i/	[kuenepi]
//ku*-suk-i// -->	/k <u>u</u> -suk-i/	[kusuki]
//ku*-wok-i// -->	/k <u>u</u> -wok-i/	[kuwoki]
//ku*-ɛj-i// -->	/k <u>u</u> -ɛj-i/	[kueji]
//ku*-sɔt-i// -->	/k <u>u</u> -sɔt-i/	[kusɔti]
//ku*-sak-i// -->	/k <u>u</u> -sɛk-i/	[kuseki]

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Kàlòŋ Low Vowel Processes

E.g. //a// aspectual suffix (and //ma-//)

Harmony	Unaffixed	Affixed	
None	[ku-jan]	[ku-jan-a]	to play
“ATR”	[ku-fuk]	[ku-fuk-ɔ]	to close
	[ku-tim]	[ku-tim-ɔ]	to dig
“Front”	[ku-sɛl]	[ku-sɛl-ɛ]	to pluck
“Front” and “ATR”	[ku-fen]	[ku-fen-ɛ]	to disdain
“Round”	[ku-kɔk]	[ku-kɔk-ɔ]	to pull
“Round” and “ATR”	[ku-pos]	[ku-pos-ɔ]	to bark

Note: 1) [tim] conditions //a// --> [ə], not [e] - unlike causative [i]!
2) [fen] conditions //a// --> [e], not [ə] - like causative [i]!

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Kàlòŋ Low Vowel Processes

E.g. //a// aspectual suffix (and //ma-//)

Harmony	//UR//	/SR/	[SR]
None	//ku*-jan-a// -->	/ku*-jan-a/	[kujana]
“ATR”	//ku*-fuk-a// -->	/k <u>u</u> -fuk- <u>ə</u> /	[kufuk <u>ə</u>]
	//ku*-tɪm-a// -->	/k <u>u</u> -tɪm- <u>ə</u> /	[kutim <u>ə</u>]
“Front”	//ku*-sɛl-a// -->	/ku*-sɛl- <u>ɛ</u> /	[kuseɪ <u>ɛ</u>]
“Front” and “ATR”	//ku*-fɛn-a// -->	/k <u>u</u> -fɛn- <u>ɛ</u> /	[kufɛn <u>ɛ</u>]
“Round”	//ku*-kɔk-a// -->	/ku*-kɔk- <u>ɔ</u> /	[kukɔk <u>ɔ</u>]
“Round” and “ATR”	//ku*-pos-a// -->	/k <u>u</u> -pos- <u>ɔ</u> /	[kupos <u>ɔ</u>]
Causative vowel	//i//	conditions //a// -->	[e]
Paulian vowel	//i*//	conditions //a// -->	[a]
“tim” vowel	//ɪ//	conditions //a// -->	[ə]

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Kàlòŋ “High” Vowel Lowering

Some high vowels become mid “-ATR” in final syllables

Unsuffix	Suffix	
[ku-tim]	[ku-tim- <u>ə</u>]	to dig
[ku-fuk]	[ku-fuk- <u>ə</u>]	to close
[ku-lɛk]	[ku-lɛk- <u>ɛ</u>]	to lick
[ku-lɔk]	[ku-lɔk- <u>ɔ</u>]	to damage
[ku-lɛk]	[ku-lik-a]	to desire
[ku-lɔk]	[ku-luk-a]	to name

The last two show: 1) lowering when in final syllable
2) no harmony when suffixed

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Kàlòŋ “High” Vowel Lowering

Some high vowels become mid “-ATR” in final syllables

	//UR//	/SR/	[SR]
	//ku*-tɪm// -->	/k <u>u</u> -tɪm/	[kutim]
	//ku*-tɪm-a// -->	/k <u>u</u> -tɪm- <u>ə</u> /	[kutim <u>ə</u>]
	//ku*-lɛk// -->	/ku*-lɛk/	[kulɛk]
	//ku*-lɛk-a// -->	/ku*-lɛk- <u>ɛ</u> /	[kulɛk <u>ɛ</u>]
Lowering	//ku*-li*k// -->	/ku*-li <u>ɛ</u> k/	[kul <u>ɛ</u> k]
	//ku*-li*k-a// -->	/ku*-li*k-a/	[kulika]

The last two have underlying Paulian vowels, which lower in final syllables and do not condition harmony

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Kàlòŋ Vowel Description Summary

8 surface phonetic vowels

[i, u, e, o, ɛ, ɔ, a, ə]

11 surface phonological vowels

/i, i*, I, u, u*, e, o, ɛ, ɔ, a, ə /

10 contrastive phonological vowels

//i, i*, I, u, u*, e, o, ɛ, ɔ, a//

“+ATR” always harmonizes throughout the word

“Round” harmonizes only to the low vowel from a mid vowel

“Front” harmonizes only to the low vowel from a mid vowel

//i*// and //u*// undergo lowering in final syllables

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Hyman (2002)

Hyman (2002) does a convincing job of showing that a traditional “top down application of theoretical aprioris” (in particular traditional feature theory and assumptions) simply does not work for the Kàlòŋ vowel system.

He concludes that “the harmony processes in the Kàlòŋ language unambiguously lead to a unique representation of the vowel system and its ‘abstract’ properties” and that it is better to let the data of a language “guide us as to the exact vowel features that *need* to be posited” based on a “bottom-up analysis”.

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Hyman (2002)

Hyman’s analysis results in a system that is “similar in spirit to the ‘elements’ proposed in particle-, dependency-, government-, and (some) autosegmental phonology” and that is featurally economical in the way that Contrast-driven phonology would like (Dresher, *et al* 2004).

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Hyman (2002)

He uses four “features” to express his 10 vowels:
A, F, R and O

	//i//	//u//	//i*//	//u*//	//e//	//o//	//ɛ//	//ɔ//	//a//	/ə/
A	x	x			x	x				x
F	x		x		x		x			
R		x		x		x		x		
O					x	x	x	x	x	x

- Why do only vocalic features harmonize?
- What about //I//?
- Is this system maximally economical? - Where is the segment composed of only A?

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The Parallel Structures Model (Morén 2003, 2004)

This is a synthesis of aspect of:

- Sound Patterns of English (Chomsky and Halle 1968)
- Clements’ Feature Geometry (1985)
- Clements’ Place Model (1991a)
- Clements’ Height Model (1991b)
- Steriade’s Aperture Model (1993a, b, c, 1994)
- Particle Phonology (Schane 1984)
- Element Theory (Harris and Lindsey 1995)
- Dependency Phonology (Anderson and Ewen 1987)

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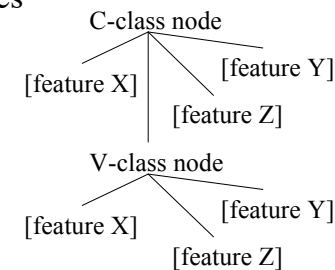
The Parallel Structures Model

- Makes use of structural and featural economy to the greatest extent possible
- Eliminates a large number of features from the grammar
- Provides a unified analysis for
 - Consonants and vowels
 - Place and manner (and laryngeal) features
 - Spoken and signed segments
- Captures
 - Consonant-vowel interactions
 - Consonant-vowel alternations
 - Consonant-vowel harmony asymmetries

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The Parallel Structures Model

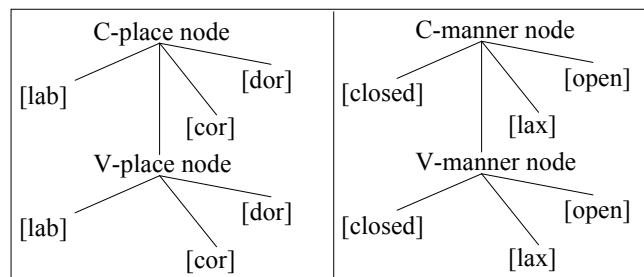
Phonological segments are composed of a limited set of identical structures and a limited set of privative (articulator-based?) features



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The Parallel Structures Model

Minimally, there are place and manner features (simplified)



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The Parallel Structures Model

Assumes an economical view of the grammar

- More complex structures are necessarily built from less complex primitives/structures

Assumes that the dichotomy between consonant and vowel features is false:

- Consonants and vowels use the same features, but sometimes associated with different (but related) class nodes
- Consonants can use V-node features
- Vowels can use C-node features
- BUT, consonants tend to have C-node features and vowels tend to have V-node features, if available

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PSM Applied to Kàlòŋ Vowels

“Rounding” harmony involves a feature associated with a lip gesture

“Fronting” harmony involves a feature associated with a tongue front/blade gesture

“ATR” harmony involves a feature associated with a tongue back/dorsum gesture

We know that these are V-node features because they spread over intervening consonants

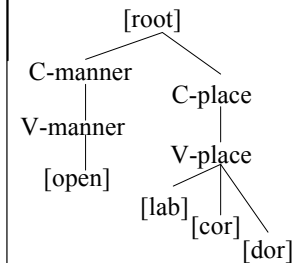
//a// is most susceptible to place harmony because it does not have a place of its own

Labial and Coronal harmony are restricted because these features cannot co-occur in this language

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PSM Applied to Kàlòŋ Vowels

Kàlòŋ vowel geometry and specifications



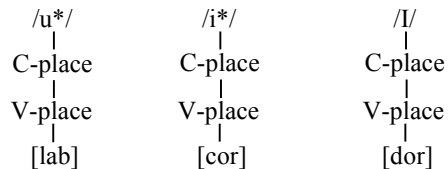
	V-manner	V-place		
	[open]	[lab]	[cor]	[dor]
/u*/		✓		
/i*/			✓	
/ɪ/				✓
/u/		✓		✓
/i/			✓	✓
/a/	✓			
/ɔ/	✓	✓		
/ɛ/	✓		✓	
/ə/	✓			✓
/o/	✓	✓		✓
/e/	✓		✓	✓

Shading = single feature segment

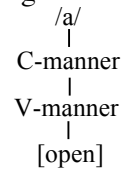
30

PSM Applied to Kàlòŋ Vowels

Simple place segments



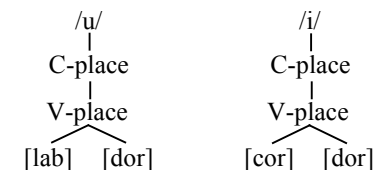
Simple manner segment



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PSM Applied to Kàlòŋ Vowels

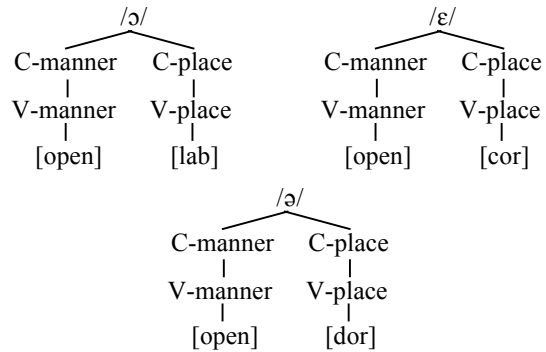
Complex place segments



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PSM Applied to Kàlòŋ Vowels

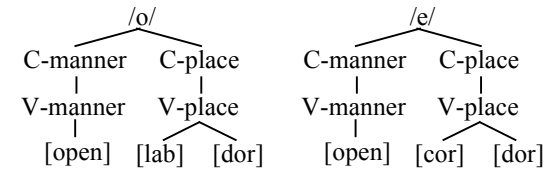
Simple place and simple manner segments



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PSM Applied to Kàlòŋ Vowels

Complex place and simple manner segments

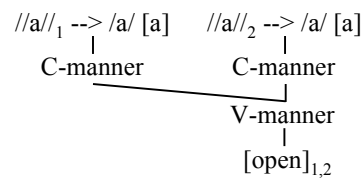


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PSM Applied to Kàlòŋ Feature Coalescence

There is evidence from the harmony system that this language makes use of a general “coalescence” of common features within a word (when auto-segmentally possible).

E.g. low vowels within the same word:



Note: I do not show intervening consonants!

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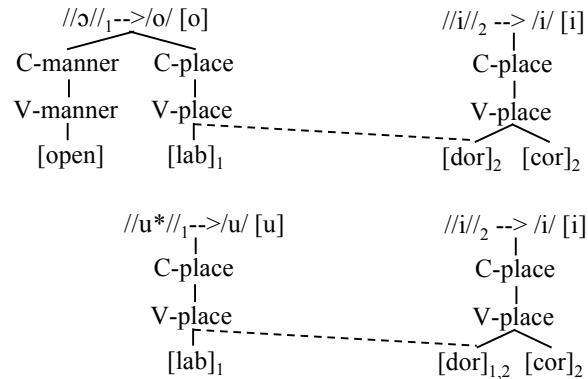
PSM Applied to Kàlòŋ Harmony

“ATR” or Dorsal Harmony
(the causative suffix)

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PSM Applied to Kàlòŋ Harmony

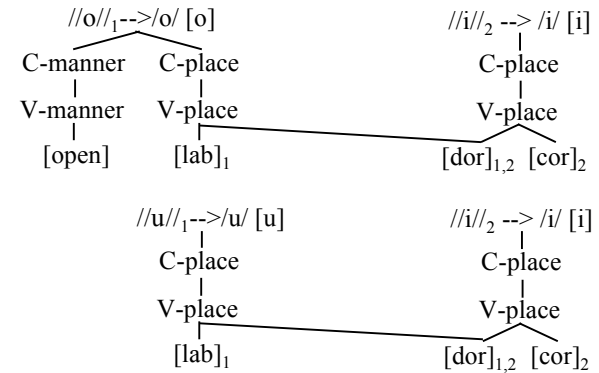
Dorsal Harmony



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PSM Applied to Kàlòŋ Harmony

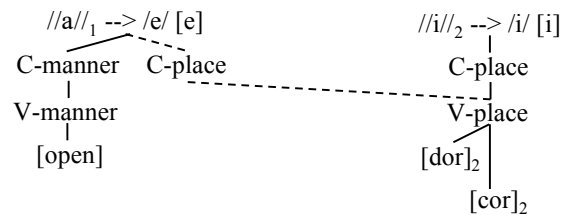
Dorsal Coalescence/Harmony



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PSM Applied to Kàlòŋ Harmony

Dorsal and Coronal Harmony

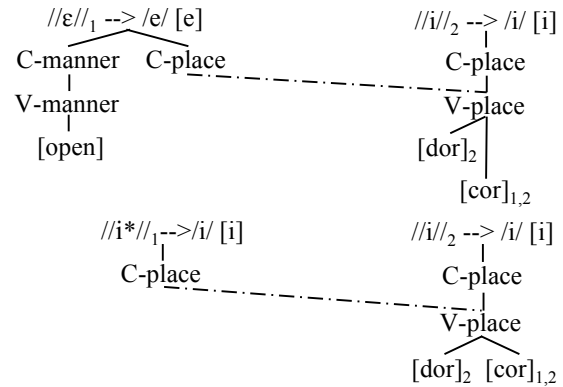


Note: Epenthetic C-place node

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PSM Applied to Kàlòŋ Harmony

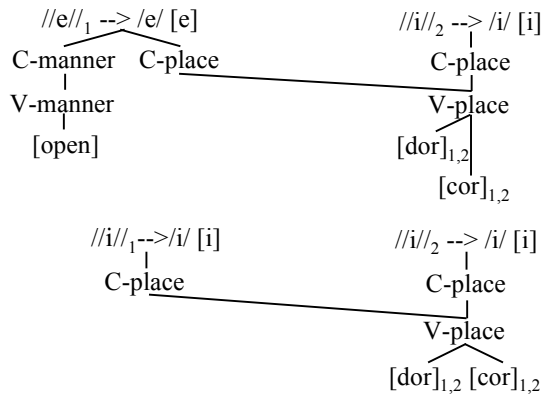
Dorsal Harmony and Coronal Coalescence/Harmony



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PSM Applied to Kàlòŋ Harmony

Dorsal and Coronal Coalescence/Harmony



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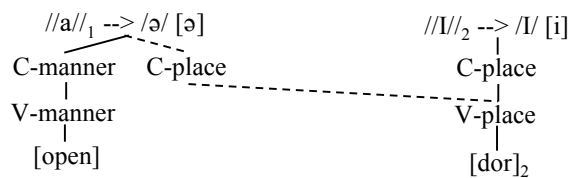
PSM Applied to Kàlòŋ Harmony

Low vowel harmony
(the $//ma-//$ prefix)

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PSM Applied to Kàlòŋ Harmony

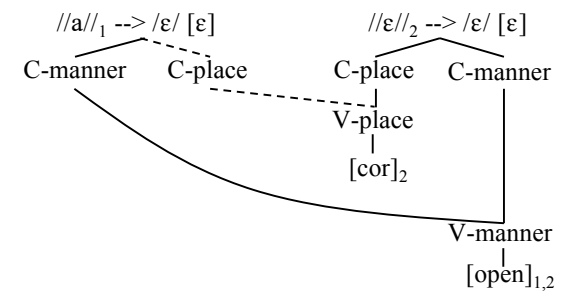
Dorsal Harmony



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PSM Applied to Kàlòŋ Harmony

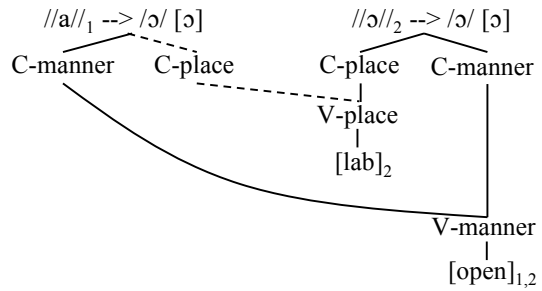
Coronal Harmony and Open Coalescence



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PSM Applied to Kàlòŋ Harmony

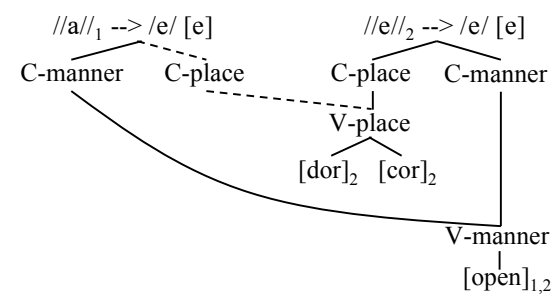
Labial Harmony and Open Coalescence



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PSM Applied to Kàlòŋ Harmony

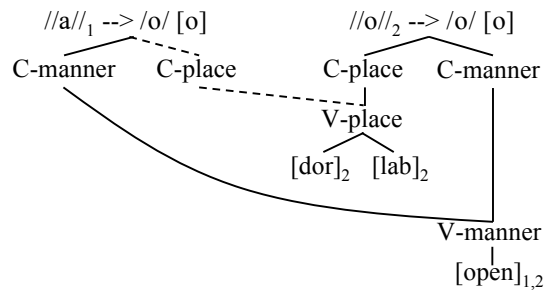
Dorsal and Coronal Harmony and Open Coalescence



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PSM Applied to Kàlòŋ Harmony

Dorsal and Labial Harmony and Open Coalescence



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PSM Applied to Kàlòŋ Lowering

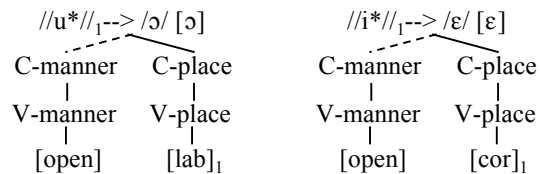
Paulian Vowel
Final Syllable Lowering

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PSM Applied to Kàlòŋ Lowering

Recall that Paulian vowels lower in final syllables

- I suggest that this is a requirement that final syllables have V-manner[open] if possible



- Does not apply to V-place[dor] segments

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PSM and OT in Kàlòŋ Harmony

“Dependency” between
height and place

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PSM and OT in Kàlòŋ Harmony

Recall that the low vowel does not harmonize in non-dorsal place with non-low vowels

This has led some to posit a representational dependency relationship between aperture (height) and place

However, this can be explained by allowing representations to play a role in constraint-based grammars

- We get a “free ride” phenomenon via the Emergence of the Unmarked (TETU)

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PSM and OT in Kàlòŋ Harmony

E.g. within OT:

MAX-F - shorthand for a variety of constraints against deleting underlying features

***V-manner[open]&*V-place[lab]** - violated every time these features are associated with one another on the surface

HARM-F - shorthand for the constraints motivating harmony

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PSM and OT in Kàlòŋ Harmony

	//aCu*//	MAX V-open	MAX V-lab	*V-open& *V-lab	HARM V-lab
--> a.	/aCu*/ O L				*
b.	/ɔCu*/ O L			*!	
c.	/u*Cu*/ O L	*!			
d.	/aCa/ O L		*!		

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PSM and OT in Kàlòŋ Harmony

	//aCɔ//	MAX V-open	MAX V-lab	*V-open& *V-lab	HARM V-lab
a.	/aCɔ/ O L			*	*!
--> b.	/ɔCɔ/ O L			*	
c.	/u*Cu*/ O L	*!			
d.	/aCa/ O L		*!		

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PSM and Kàlòŋ Summary

Kàlòŋ has a complicated vowel system:

- 3 phonetically “covert” vowels /i*, u*, I/
- Harmony involving:
 - Lips, front of tongue and back of tongue
- Lowering of two “covert” vowels in final syllables
 - Functionally - mark constituent boundary & robustly differentiate them from /i, I, u/
- A place-height dependency in non-dorsal harmony

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PSM and Kàlòŋ Summary

Analyzed the system using the PSM:

- 1 height feature
 - V-manner[open]
- 3 place features
 - V-place[lab]
 - V-place[cor]
 - V-place[dor] = “+ATR”

Provided a representational reason for the C-V harmony asymmetry

Suggested that the height-place dependency was due to representation+constraint-interaction

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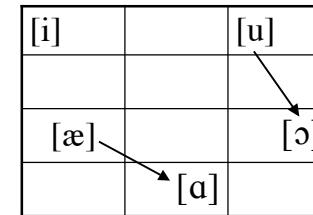
Nez Perce (Nimi'ipuu)

- Plateau Penutian language - Idaho, USA
- All data come from Aoki (1966)

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Nez Perce Surface Vowels

5 Surface Vowels



Triggers: [ɔ, a], sometimes [i]

Non-triggers: [u, æ], sometimes [i]

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Nez Perce Harmony Data

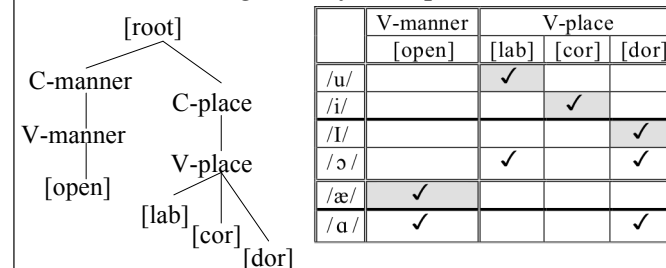
//næʔ-mæq//	-->	[næʔ-mæχ]	my paternal uncle
//mæq-æʔ//	-->	[mæq-æʔ]	uncle-voc
//næʔ-tɔt//	-->	[n <u>ɑ</u> ʔ-tɔt]	my father
//tɔ:t-æʔ//	-->	[tɔ:t- <u>ɑ</u> ʔ]	father-voc
//tæwæ:-pu://	-->	[tæwæ:-pu:]	the Orofino people
//sɔ:ja:-pu://	-->	[sɔ:ja:-p <u>ɔ</u> :]	the white people
//næʔ-ci:c//	-->	[n <u>ɑ</u> ʔ-ci:c]	my paternal aunt
//ci:c-æʔ//	-->	[ci:c- <u>ɑ</u> ʔ]	paternal aunt-voc
//næʔ-ʔi:c//	-->	[næ-ʔi:c]	my mother
//ʔi:c-æʔ//	-->	[ʔi:c-æʔ]	mother-voc

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PSM Applied to Nez Perce Vowels

6 phonological vowels with 5 phonetic realizations*

Nez Perce vowel geometry and specifications

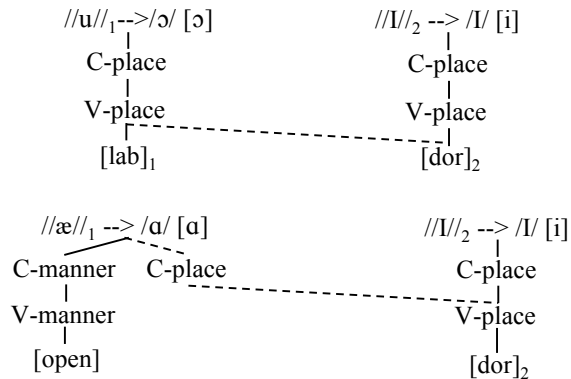


*Mackenzie and Dresher (2005) come to the same conclusion

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PSM Applied to Nez Perce Harmony

Dorsal Harmony



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PSM and Nez Perce Summary

Like Kàlòŋ, Nez Perce “ATR” harmony involves a tongue dorsum gesture

Unlike Kàlòŋ, Nez Perce has been described as having “-ATR” harmony

I suggest they both use the same phonological feature: V-place[dor]

I suggest that non-doral features in these languages do not harmonize because of feature co-occurrence restrictions

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Goals/General Conclusions

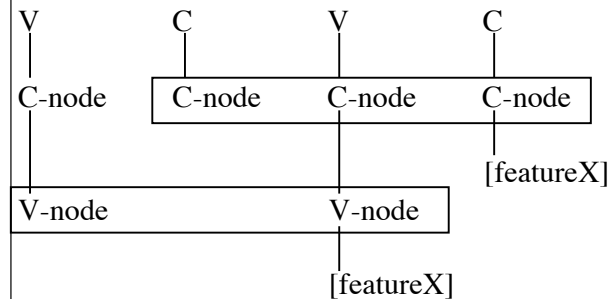
Reintroduce (economical) autosegmental representations into OT phonology

- They provide part of a *Theory of Representation* currently missing from mainstream OT
- Used the PSM in (part of) a constraint-based evaluation
- Showed that they can actually do some work for us - e.g. explain the place-height dependency in Kàlòŋ, and...

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Goals/General Conclusions

...Explain harmony asymmetries the old fashioned way, e.g.



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Goals/General Conclusions

Unify “ATR” with other phonological features

- May be analyzed as V-place[dor] - unifying it with other place features and harmony systems

Simplify the analysis of 2 cases of “ATR” harmony by suggesting that Kàlòŋ “+ATR” harmony and Nez Perce “-ATR” harmony are phonetic variants of the same phonological phenomenon

Phonetics ≠ phonology!

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Future research

- Lots!!!

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“ATR” Harmony in Kàlòŋ and Nez Perce without /±ATR/: Abstraction, Economy and Primitives

Thank you!

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Announcement: 2 Ph.D. Positions in Phonology

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