

# Special Treatment for Stems and Closed Syllables: Tone in Arapaho

Eva Zimmermann and Jochen Trommer  
(University of Leipzig)

WSCLA 16

February 11-13th, 2011

## Cowell & Moss (2008) on Arapaho

‘has resisted attempts at explanation up to the present’

Three interacting mechanisms seem necessary to *describe* the patterns:

- some morphemes require tone pattern on adjacent syllables
- word-level redistribution rules
- grammatical tone shifting rules

# My Aims

- present a formal analysis for the tone patterns using standard assumptions about autosegmental analysis of tone inside an optimality theoretic framework (Yip 2002, Prince & Smolensky 1993)
  - ① morphemes can have **(floating) tones** in their representation
  - ② **Obligatory Contour Principle**

## *Not my aims today*

- add any new data or theoretical machinery
- present a complete picture of the Arapaho tone pattern

# Arapaho

- a Plains Algonquian language spoken almost entirely by elders in Wyoming, and to a much lesser extent in Oklahoma (Salzmann 1963, Cowell & Moss 2008)
- remarkable inside the Algonquian family for being a tone language (Mithun 1999, Yip 2002)
- others: Blackfoot and Cheyenne

# Contrastive tone

(1) tecénoo ‘door’ vs. técenoo ‘roll it out’

- **high** or **normal** pitch on short vowels, **falling** pitch is possible on long vowels and diphthongs

## Pattern I: Shift in verbs with plural person suffixes

‘The majority of verbs show shift of pitch accent one syllable to the right when plural person suffixes are used’ (CM,30)

(2)	Sg	Pl	
	tenéiʔéíhi-noo	tenéiʔeihí-noʔ	‘we are strong’
	niiʔóuubéíhi-noo	niiʔóuubeihí-θi	‘they feel well’
	betéee-noo	beteéé-θiʔ	‘they are dancing’

## Questions

- What is the origin of the second tone in some forms?

(3) 

Sg	PI	
heniisétee-ʔ    heníísetéí-ʔ-i    ‘they are ripe’		

- What about stems without a tone on the penultimate syllable?

(4) 

Sg	PI	
bíískooti    bíískootí-ʔi    ‘they are blooming’		

- Why is the shift absent in some forms?

(5) 

Sg	PI	
tenéiʔéíhi-níθ    tenéiʔéíhi-níθ-i    ‘they (obv) are strong’		

## Pattern II: Stem Asymmetries

Some stems show departure from their underlying tone pattern in the very same morpho-syntactic context.

(6)

	2s	2p
1sg	cíihʔoh-úθe-n nonóóhob-éθe-n	cíihʔoh-uθé-nee nonóóhob-eθé-nee
1pe	cíihʔóh-ee-n nonoohób-ee-n	cíihʔóh-ee-nee nonoohób-ee-nee

*+high tone?*  
*Tone Shift?*

### Question

- Is this simply idiosyncratic behaviour of these stems or is there an independent explanation for these asymmetries?



# Theoretical Background: Tones as Autosegments in OT

(7)	High pitch <hr style="border: 0.5px solid black;"/> H   (σμ )	Normal pitch <hr style="border: 0.5px solid black;"/> (σμ )	Falling pitch <hr style="border: 0.5px solid black;"/> H   (σμ    μ )
-----	--	---	--

- Tones as autosegments on a tier of their own (Goldsmith 1976)
- associate to tone-bearing units (TBUs) on another tier and can associate to more than one
- the mora is assumed to be the TBU in Arapaho: only long vowels and diphthongs can have a ‘contour tone’

# Main Assumptions

- Morphological Colours
- Containment
  - Containment for Elements (segments, features,...)
  - Containment for Association Lines

# I. Morphological Colours (van Oostendorp 2006)

- every morpheme  $\approx$  one specific ‘colour’ that is present on all phonological elements that are affiliated with this morpheme
- epenthetic elements  $\approx$  colourless
- this e.g. allows an easy implementation of a constraint deriving Derived Environment Effects  
(Lubowicz 2002, Anttila 2005, van Oostendorp 2008)

- (8) ALTERNATION (=ALT) (van Oostendorp 2006)  
If an association line links two elements of colour  $\alpha$ ,  
the line should also have colour  $\alpha$ .

## Ila. Containment (Prince & Smolensky 1993)

### (9) *Containment*

Every element of the phonological input representation is contained in the output.

- all input elements must still be present in the output but can be marked as phonetically invisible
- elements that are invisible for the phonetics = elements that are not properly integrated into the prosodic structure, i.e. not dominated by the highest prosodic word node

## IIb. Containment for Association Lines

(Goldrick 2001, Revithiadou 2007)

- all association relations that were present underlyingly must be kept in the structure although they can be marked as phonetically invisible

(10) *Marking conventions for different types of association lines*

Morphological association relations		Epenthetic association relations
phonetically visible:	phonetically invisible:	phonetically visible:
X   Y	X ‡ Y	X ⋮ Y

# Realization of elements in containment $\approx$ Max-constraints

- realization of elements is in containment a consequence of proper integration ensured by e.g. (11) and (12)

(11)  $\begin{array}{c} \text{H} \\ \downarrow \\ \mu \end{array}$  Assign a violation mark for every H that is not phonetically associated to a TBU.

(12)  $\begin{array}{c} \text{H} \\ \sim \\ \sim \\ \mu \end{array}$  Assign a violation mark for every H that is not (phonetically or morphologically) associated to a TBU.

- the latter one is a less restrictive version demanding only *any* association (a phonetically invisible one as well)

## Relevant markedness constraints

- (13) OBLIGATORY CONTOUR PRINCIPLE (=OCP) (Odden 1986)  
 Assign a violation mark to every distinct pair of adjacent TBUs which are associated to different Hs.
- (14) \*RISE (Yip 2002)  
 Assign a violation mark for every rising tone ( $\sim$  sequence of a TBU without a tone and a TBU with H in one syllable).
- (15)  ${}_{(\mu)}H_{\mu}$   
 Assign a violation mark whenever a H is associated to two TBUs through different kinds of association lines, one phonetically visible and another one phonetically invisible.

# Analysis

- of the plural ‘shift’
- and the stem asymmetry



## The mysterious 'Plural Shift' in verbs

- What is the origin of the second tone in some forms?
- What about stems without a tone on the penultimate syllable?
- Why is the shift absent in some forms?
  - ➡ because some agreement marker lack the floating H
  - ➡ it will only provide the stem with a H if it is adjacent to it

**Some agreement marker have a floating H in their representation that associates to the preceding final stem syllable**

Example: /tenéiʔéíhi+noʔ/ → tenéiʔeihínoʔ

(16)

underlying

$$\begin{array}{ccc}
 H_1 & H_1 & H_2 \\
 | & \wedge & \\
 t_1 e_1 n_1 e_1 i_1 \text{ʔ}_1 e_1 i_1 h_1 i_1 & + & n_2 o_2 \text{ʔ}_2
 \end{array}$$

surface

$$\begin{array}{ccc}
 H_1 & H_1 & H_2 \\
 | & \cancel{\wedge} & / \\
 t_1 e_1 n_1 e_1 i_1 \text{ʔ}_1 e_1 i_1 h_1 i_1 n_2 o_2 \text{ʔ}_2
 \end{array}$$

## OT-Analysis: the three main ingredients

- the floating tone must associate due to

H  
ζ  
μ

- the tone cannot associate with a TBU that has the same morphemic affiliation due to ALTERNATE (Derived Environment Effect)
- no two adjacent TBUs with different Hs are possible and the second stem tone must therefore be marked as invisible

## OT-Analysis: /tenéiʔéíhi+noʔ/ → tenéiʔeihínoʔ

(17)

	$\begin{array}{c} H_s \quad H_1 \\ \wedge \\ (\mu_s \mu_s)(\mu_s) \quad (\mu_1) \end{array}$	OCP	$(\mu)H\mu$	$\begin{array}{c} H \\ \sim \\ \downarrow \\ \mu \end{array}$	ALT	$\begin{array}{c} H \\ \downarrow \\ \mu \end{array}$
a.	$\begin{array}{c} H_s \quad H_1 \\ \wedge \\ (\mu_s \mu_s)(\mu_s) \quad (\mu_1) \end{array}$			*!		*
b.	$\begin{array}{c} H_s \quad H_1 \\ \wedge \quad \text{---} \\ (\mu_s \mu_s)(\mu_s) \quad (\mu_1) \end{array}$	*!				
d.	$\begin{array}{c} H_s \quad H_1 \\ \wedge \quad \text{---} \\ (\mu_s \mu_s)(\mu_s) \quad (\mu_1) \end{array}$		*!			
c.	$\begin{array}{c} H_s \quad H_1 \\ \wedge \quad \text{---} \\ (\mu_s \mu_s)(\mu_s) \quad (\mu_1) \end{array}$				*!	
e.	$\begin{array}{c} H_s \quad H_1 \\ \wedge \quad \text{---} \\ (\mu_s \mu_s)(\mu_s) \quad (\mu_1) \end{array}$					*

## And the 'dissociated' stem-tone?

- cannot associate in a phonetically visible way due to the OCP

(18) \*tenéíʔeihínoʔ

- but if enough 'space' is left, it can indeed associate to a preceding stems syllable to receive a phonetically visible association

(19) heniisétee+ʔ+i/ → heníísetééʔi

- and this finally explains the appearance of an 'additional' tone in some plural forms

## OT-Analysis: /heniisétee+ʔ+i/ → heníisetééʔi

(20)

	$\begin{array}{c} H_s \quad H_1 \\   \\ (\mu_s)(\mu_s \mu_s)(\mu_s)(\mu_s \mu_s) (\mu_1) \end{array}$	*RISE	OCP	$\begin{array}{c} H \\ \downarrow \\ \mu \end{array}$	ALT	$\begin{array}{c} H \\ \downarrow \\ \mu \end{array}$
a.	$\begin{array}{c} H_s \quad H_1 \\   \quad \diagup \\ (\mu_s)(\mu_s \mu_s)(\mu_s)(\mu_s \mu_s) (\mu_1) \end{array}$	*!				
b.	$\begin{array}{c} H_s \quad H_1 \\   \quad \diagup \\ (\mu_s)(\mu_s \mu_s)(\mu_s)(\mu_s \mu_s) (\mu_1) \end{array}$		*!			
c.	$\begin{array}{c} H_s \quad H_1 \\ \ddagger \quad \diagup \\ (\mu_s)(\mu_s \mu_s)(\mu_s)(\mu_s \mu_s) (\mu_1) \end{array}$					*
d.	$\begin{array}{c} H_s \quad H_1 \\ \diagup \ddagger \diagup \\ (\mu_s)(\mu_s \mu_s)(\mu_s)(\mu_s \mu_s) (\mu_1) \end{array}$					

# Stem Asymmetries

(21)

	2s	2p
1pe	cíihʔóh-ee-n nonoohób-ee-n	cíihʔóh-ee-nee nonoohób-ee-nee

*+H?**Shift of H?*

**A floating tone marks 1pe-2 contexts. (~ tonal morpheme)**

# Stem Asymmetries

(22)

underlying	surface
$  \begin{array}{c}  H_s \qquad \qquad H_1 \\  \wedge \\  c_s \ i_s \ i_s \ h_s \ ?_s \ o_s \ h_s \ +_s  \end{array}  $	$  \begin{array}{c}  H_s \qquad \qquad H_1 \\  \wedge \qquad \qquad \text{---} \\  c_s \ i_s \ i_s \ h_s \ ?_s \ o_s \ h_s  \end{array}  $
$  \begin{array}{c}  H_s \qquad \qquad H_1 \\  \wedge \\  n_s \ o_s \ n_s \ o_s \ o_s \ h_s \ o_s \ b_s \ +_s  \end{array}  $	$  \begin{array}{c}  H_s \qquad \qquad H_1 \\  \text{A} \qquad \qquad \text{---} \\  n_s \ o_s \ n_s \ o_s \ o_s \ h_s \ o_s \ b_s  \end{array}  $

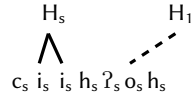
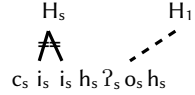
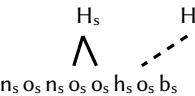
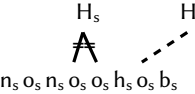


# Stem Asymmetries: Assumptions

- the TBU is the mora
- codas are moraic: an intervening coda consonant between two TBUs therefore ensures that no OCP-violation arises

# Stem Asymmetries: OT-Analysis

(23)

	OCP	H ~ μ	H ↓ μ
a. 			
b. 		*!	*
a. 	*!		
b. 		*	*

**Note:** it is impossible for a ‘dissociated’ stem tone to associate with the first syllable.

# Summary of patterns

A.	$\begin{array}{c} H_2 \\ \mu_1 + \quad \mu_2 \end{array}$	$\begin{array}{c} H_2 \\ \mu_1 \quad \mu_2 \end{array}$	<p>Association of floating H</p>
B.	$\begin{array}{c} H_1 \quad H_2 \\   \quad   \\ \mu_1 + \quad \mu_2 \end{array}$	$\begin{array}{c} H_1 \quad H_2 \\ \mu_1 \quad \mu_2 \end{array}$	<p>floating H overwrites without a surface effect</p>
C.	$\begin{array}{c} H_1 \quad H_2 \quad H_3 \\   \quad   \\ \mu_1 + \mu_2 \quad \mu_2 + \quad \mu_3 \end{array}$	$\begin{array}{c} H_1 \quad H_2 \quad H_3 \\   \quad \ddagger \\ \mu_1 + \mu_2 \quad \mu_2 + \quad \mu_3 \end{array}$	<p>a floating H and the OCP</p>

## This derives...

stem *cihʔoh* (AO)

	1s	1pe	1pi	2s	2p	3s	3p	4s	4p	5s	5p
1s											
1pe											
1pi											
2s											
2p											
3s		*									
3p											
4s						*					
4p						*					
5s											
5p											

stem *nóóhow* (AO)

	1s	1pe	1pi	2s	2p	3s	3p	4s	4p	5s	5p
1s											
1pe											
1pi											
2s											
2p											
3s	*	*	*	*	*						
3p	*	*	*	*	*						
4s						*	*				
4p						*	*				
5s								**	**		
5p								**	**		

Al stem *betéee* (AO)

1s	
1pi	
1pe	
2s	
2p	
3s	
3p	
4s	
4p	

Tl stem *noohóot* (AO)

1s	
1pi	
1pe	
2s	
2p	
3s	
3p	
4s	
4p	

\* – stem-specific exceptions in the tonal patterns of *suffixes*

# Conclusion

- the main patterns can be explained from assuming:
  - floating tones that constitute morphemes on their own
  - floating tones that are part of a morphemes and cannot associate with a TBU that belongs to the same morpheme
  - the OCP
  - that intervening coda consonants between Hs are able to prevent OCP-violations
- there are still (stem-specific) lexical exceptions for the distribution of tone

## Selected References

- Anttila, Arto (2005), 'Derived environment effects in Colloquial Helsinki Finnish', *The Nature of the Word: Essays in Honor of Paul Kiparsky*.
- Cowell, Andrew and Alonzo Moss (2008), *The Arapaho language*, University of Colorado Press.
- Goldrick, Matthew (2001), Turbid output representations and the unity of opacity, in 'Proceedings of NELS 30', Amherst, MA: GLSA, pp. 231-245.
- Goldsmith, John A. (1976), *Autosegmental Phonology*, PhD thesis, Massachusetts Institute of Technology.
- Lubowicz, Anna (2002), 'Derived Environment Effects in Optimality Theory', *Lingua* 112, 243-280.
- Mithun, Marianne (1999), *The Languages of Native North America*, Cambridge: Cambridge University Press.
- Odden, David (1986), 'On the Obligatory Contour Principle', *Language* 62, 353-383.
- Prince, Alan and Paul Smolensky (1993), *Optimality theory: Constraint interaction in generative grammar*, Technical reports of the Rutgers University Center of Cognitive Science.
- Revithiadou, Anthi (2007), Colored turbid accents and containment: A case study from lexical stress, in S.Blaho, P.Bye and M.Krämer, eds, 'Freedom of Analysis?', Berlin & New York: Mouton De Gruyter, pp. 149-174.
- Salzmann, Zdeněk (1963), *A Sketch of Arapaho Grammar*, PhD thesis, Indiana University.
- van Oostendorp, Marc (2006), *A theory of morphosyntactic colours*. Ms., Meertens Institute, Amsterdam. Available under: <http://egg.auf.net/06/docs/Hdt%20Oostendorp%20colours.pdf>.
- van Oostendorp, Marc (2008), Derived environment effects and consistency of exponence, in S.Blaho, P.Bye and M.Krämer, eds, 'Freedom of Analysis?', Berlin: Mouton de Gruyter, pp. 123-148.
- Yip, Moira (2002), *Tone*, Cambridge University Press.