Special Treatment for Stems and Closed Syllables: Tone in Arapaho

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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  tenéiʔeihi-noʔ  ‘we are strong’
niiʔóuubéíhi-noo  niiʔóuubeihí-ʔi  ‘they feel well’
bétéee-noo       betééé-ʔiʔ           ‘they are dancing’
Questions

- What is the origin of the second tone in some forms?
  
  (3)  
  \[
  \begin{array}{c|c|c}
  & \text{Sg} & \text{Pl} \\
  \hline
  \text{heniisétee}-? & \text{heniiséetéi}-?i & \text{‘they are ripe’}
  \end{array}
  \]

- What about stems without a tone on the penultimate syllable?
  
  (4)  
  \[
  \begin{array}{c|c|c}
  & \text{Sg} & \text{Pl} \\
  \hline
  \text{bíískooti} & \text{bíískootí}-?i & \text{‘they are blooming’}
  \end{array}
  \]

- Why is the shift absent in some forms?
  
  (5)  
  \[
  \begin{array}{c|c|c}
  & \text{Sg} & \text{Pl} \\
  \hline
  \text{tenéiʔéíhi-níθ} & \text{tenéiʔéíhi-níθ}-i & \text{‘they (obv) are strong’}
  \end{array}
  \]
Pattern II: Stem Asymmetries

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

(6)

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<tbody>
<tr>
<td>1sg</td>
<td>cííhʔoh-úθe-n</td>
<td>cííhʔoh-uθé-nee</td>
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<td>nonóóhob-éθe-n</td>
<td>nonóóhob-eθé-nee</td>
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<tr>
<td>1pe</td>
<td>cííhʔóh-ee-n</td>
<td>cííhʔóh-ee-nee</td>
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<td></td>
<td>nonoohób-ee-n</td>
<td>nonoohób-ee-nee</td>
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</table>

+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

**High pitch** | **Normal pitch** | **Falling pitch**
---|---|---
\( H \) | \( (\sigma \mu) \) | \( (\sigma \mu \mu) \)
\( \) | \( (\sigma \mu) \) | \( (\sigma \mu \mu) \)

- 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 diphtongs can have a ‘contour tone’
Main Assumptions

- Morphological Colours
- Containment
  - Containment for Elements (segments, features, ...)
  - Containment for Association Lines
1. Morphological Colours  (van Oostendorp 2006)

- every morpheme ≈ one specific ‘colour’ that is present on all phonological elements that are affiliated with this morpheme
- epenthetic elements ≈ colourless
- this e.g. allows an easy implementation of a constraint deriving Derived Environment Effects


\[
\text{Alternation} (\text{=Alt})
\]

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
Ilb. 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

\[(10)\quad \textit{Marking conventions for different types of association lines}\]

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<thead>
<tr>
<th>Morphological association relations</th>
<th>Epenthetic association relations</th>
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<td>phonetically visible:</td>
<td>phonetically visible:</td>
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<td>phonetically invisible:</td>
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realization of elements is in containment a consequence of proper integration ensured by e.g. (11) and (12)

(11) $H \downarrow \mu$
Assign a violation mark for every H that is not phonetically associated to a TBU.

(12) $H \downarrow \zeta \downarrow \mu$
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: /tenéi?éíhi+no?/ → tenéi?eihíno?

(16) underlying
\[
\begin{array}{c}
H_1 \\
\cap \\
| \\
t_1 e_1 n_1 e_1 i_1 \ ?_1 e_1 i_1 h_1 i_1 + n_2 o_2 ?_2
\end{array}
\]

surface
\[
\begin{array}{c}
H_1 \\
\cap \\
| \\
t_1 e_1 n_1 e_1 i_1 \ ?_1 e_1 i_1 h_1 i_1 n_2 o_2 ?_2
\end{array}
\]
OT-Analysis: the three main ingredients

- the floating tone must associate due to $H$ \( \hat{z} \mu \)

- 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-Analyses: /tenéiʔéíhi+no?/ → tenéiʔeihíno?

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<tr>
<th></th>
<th>Hs</th>
<th>H1</th>
<th>OCP</th>
<th>$(\mu)H\mu$</th>
<th>H</th>
<th>ALT</th>
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(17)
And the ‘dissociated’ stem-tone?

- cannot associate in a phonetically visible way due to the OCP
  
  (18) *tenéíʔeihíno?

- 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/ → heniíísetééʔi

- and this finally explains the appearance of an ‘additional’ tone in some plural forms
### OT-Analysis: /heniisétee+i/ → heníísetééʔi

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<th>Hs</th>
<th>H₁</th>
<th>*RISE</th>
<th>OCP</th>
<th>H₂</th>
<th>Alt</th>
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<tr>
<td>(μₛ)(μₛ μₛ)(μₛ)(μₛ μₛ) (μ₁)</td>
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</table>

(a)  

\[ H_s \quad H_1 \]

(μₛ)(μₛ μₛ)(μₛ)(μₛ μₛ) (μ₁)  

*!

(b)  

\[ H_s \quad H_1 \]

(μₛ)(μₛ μₛ)(μₛ)(μₛ μₛ) (μ₁)  

*!

(c)  

\[ H_s \quad H_1 \]

(μₛ)(μₛ μₛ)(μₛ)(μₛ μₛ) (μ₁)  

*

(d)  

\[ H_s \quad H_1 \]

(μₛ)(μₛ μₛ)(μₛ)(μₛ μₛ) (μ₁)  

*
Stem Asymmetries

A floating tone marks 1pe-2 contexts. (∼ tonal morpheme)
### Stem Asymmetries

(22) underlying surface

\[
\begin{align*}
&H_s & H_1 \\
\wedge & c_s \ i_s \ i_s \ h_s \ ?_s \ o_s \ h_s \ +_s \\
\wedge & n_s \ o_s \ n_s \ o_s \ o_s \ h_s \ o_s \ b_s \ +_s
\end{align*}
\]

\[
\begin{align*}
&H_s & H_1 \\
\wedge & c_s \ i_s \ i_s \ h_s \ ?_s \ o_s \ h_s \\
\wedge & n_s \ o_s \ n_s \ o_s \ o_s \ h_s \ o_s \ b_s
\end{align*}
\]
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

<table>
<thead>
<tr>
<th></th>
<th>OCP</th>
<th>$\H предикс$</th>
<th>$\H последики$</th>
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</table>

a. $H_s \rightarrow H_1$

\[
\H s \ \ \H 1
\]

$\text{c}_s \text{i}_s \text{i}_s \text{h}_s \ ?_s \text{o}_s \text{h}_s$

b. $H_s \rightarrow H_1$

\[
\H s \ \ \H 1
\]

$\text{c}_s \text{i}_s \text{i}_s \text{h}_s \ ?_s \text{o}_s \text{h}_s$

\[
*! \quad *
\]

(23)

<table>
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<tr>
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<th>$\H последики$</th>
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</table>

a. $H_s \rightarrow H_1$

\[
\H s \ \ \H 1
\]

$\text{n}_s \text{o}_s \text{n}_s \text{o}_s \text{o}_s \text{h}_s \text{o}_s \text{b}_s$

\[
*!
\]

b. $H_s \rightarrow H_1$

\[
\H s \ \ \H 1
\]

$\text{n}_s \text{o}_s \text{n}_s \text{o}_s \text{o}_s \text{h}_s \text{o}_s \text{b}_s$

\[
* \quad *
\]

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

#### A.

<table>
<thead>
<tr>
<th>$\mu_1$</th>
<th>+</th>
<th>$\mu_2$</th>
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Association of floating $H$

#### B.

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<tr>
<th>$H_1$</th>
<th>$H_2$</th>
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<tbody>
<tr>
<td>$\mu_1$</td>
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Floating $H$ overwrites without a surface effect

#### C.

<table>
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<tr>
<th>$H_1$</th>
<th>$H_2$</th>
<th>$H_3$</th>
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<tr>
<td>$\mu_1$</td>
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A floating $H$ and the OCP
This derives...

**stem cíh?oh (AO)**

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**AI stem bééee (AO)**

**stem nóóhow (AO)**

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**T1 stem noohóót (AO)**

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* – 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


Cowell, Andrew and Alonzo Moss (2008), *The Arapaho language*, University of Colorado Press.


