Characteristics of non-pre-vocalic ejectives in Yakima Sahaptin

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NoWPhon, UO, Eugene, 5-13-16
Organization

• Ejective background
• Sahaptin
• Word-final ejectives
• Pre-consonantal ejectives
• Conclusions and further research
Ejectives
Ejective types

• Plosives [t’]
• Affricates [ts’]
• Fricatives [s’]
Some properties of pre-vocalic ejectives

- f0 low or high at vowel onset
- Silent period
- Slow rise time

Tlingit /χ/ vs. /χ’/

- /χaːt/ ‘spruce roots’
- /χ’aːn’/ ‘fire’

Ejective distribution

• In most languages, ejectives only occur before vowels
  – Chipewyan, Witsuwit’en, etc.

• In some languages, ejectives also occur before consonants and/or word-finally
  – Tlingit, Gitksan, Coast Tsimshian, Montana Salish, Ahtna, etc.
  – Ejectives in these environments less well described
Tlingit word-final ejective stops

- “shorter and higher-amplitude noise than the pulmonic stops”

- /k’éːt/ ‘salmonberry bush; sprouts’ /kʰaːk’/ ‘forehead’

Tlingit ejective fricatives

- Pre-vocalic:
- post-glottalized

- Post-vocalic:
  - pre-glottalized

\[ \chi^{'a:n} \] ‘fire’

\[ k^{h}a:\chi^{'} \] ‘chicken, grouse’
Coast Tsimshian

• Post-vocalic ejective stops and affricates are pre-glottalized: <’k, ’k̕, ’p, ’t, ’ts>
  – hanaa’k̕ ‘woman’
  – ~ hana’a
Ahtna

• “In all dialects of Ahtna except Mentasta, ejectives occur finally in some form---usually, however, not as canonical ejectives with a glottal release.” (Tuttle 2015)

<table>
<thead>
<tr>
<th></th>
<th>Western</th>
<th>Central</th>
<th>Lower</th>
<th>Mentasta</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘liver’ /c’ezet’/</td>
<td>[c’ɛzɛt’]</td>
<td>[c’ɛzɛt]</td>
<td>[c’ɛzɛɬ]</td>
<td>[c’ɛzɛt]</td>
</tr>
<tr>
<td>‘mittens’ /cets’/</td>
<td>[cɛts’]</td>
<td>[cɛʂ], [cɛ̰s]</td>
<td>[cɛʂ]</td>
<td>[cɛts]</td>
</tr>
</tbody>
</table>

Central Ahtna word-final [ts’]

Ik’ey’nest’aats’ /ik’ejnest’a:ts’/ ‘he cut it apart by accident’
“Ejectives” are pre-glottalized stops

• Word-finally in Tlingit
• Word-finally in Ahtna
• Post-vocalically in Coast Tsimshian
Sahaptin ejectives
# Sahaptin consonants

<table>
<thead>
<tr>
<th></th>
<th>lab</th>
<th>alv</th>
<th>pal-alv</th>
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<td>k^w</td>
<td>q</td>
<td>q^w</td>
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<td>tʃ</td>
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<td>t'</td>
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<td>k'</td>
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<td>k'^w</td>
<td>q'</td>
<td>q'^w</td>
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<td>x</td>
<td>x^w</td>
<td>χ</td>
<td>χ^w</td>
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</tbody>
</table>

Previous instrumental study of Sahaptin ejectives

- /p p’, /t t’, /k k’, /q q’, /kʷ kʷ’, /qʷ qʷ’/
- Prevocally

<table>
<thead>
<tr>
<th></th>
<th>VOT</th>
<th>post-release silent dur</th>
<th>f0 at vowel onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>plosives</td>
<td>38 ms.</td>
<td>--</td>
<td>211 Hz</td>
</tr>
<tr>
<td>ejectives</td>
<td>103 ms.</td>
<td>43 ms.</td>
<td>224 Hz</td>
</tr>
</tbody>
</table>

Sahaptin
/k/ vs. /k’/

páku ‘have sex’

pák’u ‘council’
Sahaptin /ts/ vs. /ts'/

- *tsíχ [ˈtsíχ] ‘sting’*

- *ts’íχ [ˈts’íχ] ‘defecate’*
Sahaptin phonotactics

- Abundant consonant clusters
  - $p-shxú$ ['pʃχu] ‘sagebrush’
  - $shtxní$ ['ʃtχni] ‘horsefly’
  - $pstxɬá$ ['pstχɬa] ‘blacksmith’
  - $ílkwsh$ ['ilkwʃ] ‘fire’
  - $pákwchtk$ ['paqwʃtk] ‘plug in’

Distribution of Sahaptin ejective stops

• Pre-vocalic
  – \textit{k’úxl} ['q’uχɬ] ‘knee’

• Pre-consonantal
  – Before obstruent \textit{k’sháash} ['q’ʃáːʃ] ‘curly’
  – Before sonorant \textit{k’mîl} ['q’mîɬ] ‘rock’

• Word-final (rare)
  – \textit{huk’húk’} [huq’huq’] ‘pig’

• *C’C’; *C’/__ affr
Ejective stops before stops

<table>
<thead>
<tr>
<th></th>
<th>p</th>
<th>t</th>
<th>k</th>
<th>k’</th>
<th>q</th>
<th>q’</th>
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<tr>
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<td></td>
<td></td>
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</tr>
<tr>
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Note: The table represents possible combinations of ejective stops before stops, with specific symbols indicating ejective affricates and plain stops.
Ejective stops before fricatives

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<th>t’</th>
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<th>χ</th>
<th>χ^w</th>
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<td>p’ʃ</td>
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<td>t’x^w</td>
<td>t’χ</td>
<td>t’χ^w</td>
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<tr>
<td>k’</td>
<td>k’s</td>
<td>k’ʃ</td>
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<td>q’^wʃ</td>
<td></td>
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</tr>
</tbody>
</table>
Distribution of Sahaptin ejective affricates

• Pre-vocalic
  – ts’áa [ˈts’aː] ‘near’

• Pre-consonantal
  – Before obstruent: ts’xwíi [ˈts’xwíː] ‘conical’
  – Before sonorant: ts’míst [ˈts’míst] ‘9’

• Not word-final
# Ejective affricates

<table>
<thead>
<tr>
<th></th>
<th>p</th>
<th>k</th>
<th>kw</th>
<th>q</th>
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<tbody>
<tr>
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<td>ts’p</td>
<td>ts’k</td>
<td>ts’kw</td>
<td></td>
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<td>tɬ’</td>
<td>tɬ’p</td>
<td>tɬ’k</td>
<td></td>
<td>tɬ’q</td>
</tr>
<tr>
<td>tf’</td>
<td></td>
<td>tf’k</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>x\textsuperscript{w}</th>
<th>x</th>
<th>x\textsuperscript{w}</th>
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<tr>
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<td>tɬ’x\textsuperscript{w}</td>
</tr>
<tr>
<td>tf’</td>
<td></td>
<td>tf’x</td>
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</table>


Questions about Sahaptin ejectives

• As compared with (non-ejective) plosives and affricates, what are the phonetic properties of ejectives
  – before voiceless consonants?
  – word-finally?
Word-final ejectives
<table>
<thead>
<tr>
<th>C</th>
<th>C’</th>
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<tr>
<td>q</td>
<td>jiqˈjiq (creaky sound)</td>
</tr>
<tr>
<td></td>
<td>jiq’ˈjiq’ (especially creaky sound)</td>
</tr>
<tr>
<td></td>
<td>huq’ˈhuq’ ‘pig’</td>
</tr>
<tr>
<td></td>
<td>juq’ˈjuq’ ‘unstable, wobbly’</td>
</tr>
<tr>
<td></td>
<td>'χiːq’ ‘hoot’ (by owl)</td>
</tr>
<tr>
<td>t</td>
<td>'k’att ‘steep’</td>
</tr>
<tr>
<td></td>
<td>t’t’t’t’ (noise of rain)</td>
</tr>
</tbody>
</table>
Word-final [q] vs. [q’]

[jiq]jiq [‘creaky sound’]

[jiq’]jiq’ [‘especially creaky sound’]
Word-final [t] vs. [t’]

[ˈk’att] ‘steep’

[ˈt’t’t’t’] (sound of rain)
Word-final ejective characteristics

• High intensity stop burst and/or
• Preceded by creaky voice
Pre-consonantal ejectives
Observations

Ku kwlák k’xlípa ikushpaynk
Ku ‘kwlak ‘q’χlipa ‘ikušpajnk
and there on tule mat like this

iyáwitamaasha
i’jawitamasha.
‘it (lying) is floating’
‘Then here was something lying on top of on one of the floating tule mats.’
Stops before stops

\[ \text{[aʃnækt\textsuperscript{w}t]} \]
‘separated, divorced’

\[ \text{[taʃmæk\textsuperscript{w}'p]} \]
‘behead, knock top off’
Stops before fricatives

[ˈksɪk]  ‘stink’

[ˈkʼsit]  ‘cold’
Affricicates before stops

[ʰlatsq]-
‘daydream’

[ʰlats’q]-
‘snap, crack, spark’
Affricates before fricatives

\[ \text{[i'miʧχa]} \]  
‘(3sg) places’

\[ \text{[i'witʃ'χna]} \]  
‘(3sg) shredded (pl.)’
## Hypotheses

Relative to non-ejective:

<table>
<thead>
<tr>
<th></th>
<th>__stop</th>
<th>__fricative</th>
</tr>
</thead>
<tbody>
<tr>
<td>ejective stop</td>
<td>• high intensity burst</td>
<td>• high intensity burst</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• silent interval</td>
</tr>
<tr>
<td>ejective affricate</td>
<td>• high intensity fricative</td>
<td>• high intensity fricative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• silent interval</td>
</tr>
</tbody>
</table>
Intensity measure

- Stops: $\text{Intensity-max}_{\text{vowel}} - \text{Intensity-max}_{\text{release}}$

[tíːtkʷk] ‘advise’

[ɬíːt’k] ‘nasal mucus, snot’
Intensity of release burst in other languages

- C’ vs. C
  - Gitksan stops
  - Ingush stops
  - Georgian stops
  - Deg Xinag lateral affricates: did not distinguish


Intensity measure

- Affricates
  - Intensity-max\textsubscript{vowel} – Intensity-max\textsubscript{fricative}

Gordon, Matthew, and Ayla Applebaum. 2006. 'Phonetic structures of Turkish Kabardian.' *Journal of the International Phonetic Association* 36:159-186.
Materials

• Words and sentences
• 9,830 with published (2009) dictionary
• 12,972 currently

# Word lists

<table>
<thead>
<tr>
<th>pairs</th>
<th>release</th>
<th>pairs</th>
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</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>stop</td>
<td>p</td>
<td>'χapʃanajk- ‘pile up’</td>
<td>'χapʃnak- ‘collapse’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>t</td>
<td>i'atχa he goes out</td>
<td>i'lat'χa ‘it sparked’</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>k</td>
<td>'ksik ‘stink’</td>
<td>'k’sít ‘cold’</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>q</td>
<td>'tʃaqpt- ‘pull tight’</td>
<td>'tʃaq’p- ‘tie down’</td>
</tr>
<tr>
<td>14</td>
<td>labialized</td>
<td>k’w</td>
<td>wa'pakʷstik- ‘grab at and miss’</td>
<td>sa'pakʷstik- ‘wipe’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>stop</td>
<td>'ʃa'paqʷtk- join together</td>
<td>ti'naqʷtk- sprain</td>
</tr>
<tr>
<td>15</td>
<td>affricate</td>
<td>ts</td>
<td>'latsq- ‘daydream’</td>
<td>'lats’q- ‘crack, snap, spark’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tɬl</td>
<td>'qatɬχatk- ‘get used to’</td>
<td>iw'jaɬ’χwa ‘it ended’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tʃf</td>
<td>i'niitʃχa ‘he places it’</td>
<td>i'wifʃ’cha ‘he stripped, shredded it’</td>
</tr>
<tr>
<td>50</td>
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</tr>
</tbody>
</table>
Silent interval before fricative?

- 28 pairs
- Yes. Mean duration: .031 sec (s = .019)

[pináqʷʔtaj-] ‘win back’
Higher-intensity release?

- Non-labialized stops (31 pairs): yes

![Bar chart showing normalized intensity-max (dB) for ejective and non-ejective sounds. The non-ejective sound has a significantly higher normalized intensity-max (25 dB) compared to the ejective sound (10 dB). There is a star (*) indicating a significant difference.]
Higher-intensity release?

- Labialized stops (14 pairs): yes
Higher-intensity release?

- Affricates (15 pairs): no
Fate of hypotheses

Relative to non-ejective:

<table>
<thead>
<tr>
<th></th>
<th>__stop</th>
<th>__fricative</th>
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<td>✓high intensity burst</td>
<td>✓high intensity burst</td>
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<tr>
<td></td>
<td></td>
<td>✓silent interval</td>
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<tr>
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<td>X high intensity fricative</td>
<td>X high intensity fricative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓silent interval</td>
</tr>
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</table>
Ejective affricates

1. Most as predicted
Ejective affricates, cont.

2. In Turkish Kabardian, ejective fricatives had significantly less intensity relative to non-ejective fricatives
   •  < narrower supralaryngeal constriction (reduces airflow and noise)
   •  < narrower glottal constriction

Conclusions
Sahaptin C’

• Word-final
  – High intensity release
  – Pre-glottalized

• Before voiceless C
  – High intensity release
    • Stops—always
    • Fricatives—often but not always
  – Silent period discernible before fricative
Further research

• Compare pre-consonantal and pre-vocalic ejective properties

• Scrutinize previously transcribed geminate affricates
  – 'ts’ts’u:p ‘thaw, melt’
  – 'tɬ’tɬ’umχ ‘red-wing blackbird’
Funding acknowledgements

• Jacobs Research Funds

• Native Voices Endowment