Domain Generalization: Cheyenne vowel devoicing

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Outline

● Introduction
  ○ Cross-linguistic overview of vowel devoicing
  ○ Domain Generalization
● Cheyenne background
● Vowel devoicing 1: phrase-final devoicing (phonetically grounded)
● Vowel devoicing 2: “penultimate” devoicing (no phonetic motivation)
● Proposal
● Conclusion
Vowel devoicing cross-linguistically

- Vowel devoicing is a common areal feature in the Plains region of North America where Cheyenne is spoken (Ladefoged and Maddieson 1996; Oberly and Kharlamov 2015)
- Also attested across a wide range of language families and regions of the world
  - e.g., East Asia, South Asia, Oceania, Europe, Africa, the Middle East, and elsewhere in North and South America (Greenberg 1969; Gordon 1998)
Vowel devoicing cross-linguistically

- Vowel devoicing typically fits into one of two categories in terms of the environments in which it occurs (Greenberg 1969; Gordon 1998):
  - Adjacent to voiceless consonants
  - Adjacent to the right edge of a prosodic domain
Common accounts of vowel devoicing

- Phonological analyses typically attribute voicelessness to some laryngeal feature ([-voice] or [spread glottis] e.g., Lipski 1990; Cho 1993; Tsuchida 1997; 2001)
  - Spreads from adjacent voiceless consonant (i.e. assimilation)
  - Or is inserted

- Phonetic accounts attribute voicelessness to
  - Gestural overlap: glottal adduction for vowel and abduction for voiceless consonant
  - Decreased subglottal air pressure at ends of long streams of speech
  - Opening of glottis in anticipation of a pause
    (e.g., Dauer 1980; Jun and Beckman 1993; Gordon 1998; Smith 2003)
Domain Generalization

- Historical phenomenon in which utterance-edge phonetic effect becomes phonologized and then extended to smaller prosodic domains
- Proposed to account for synchronic phonological word-edge processes that are not themselves phonetically grounded but would be at utterance boundaries
  - e.g., word-final obstruent devoicing, avoidance of high tones word-finally
    (Myers and Padgett 2014; Padgett 2015)
Cheyenne

- Plains Algonquian, spoken in Montana and Oklahoma
- Data in talk from pre-existing materials:
  - grammar, Leman 2011
  - online dictionary with audio, Fisher et al. 2017
  - papers, e.g., Leman and Rhodes 1978
  - archival recordings of narrative texts, Olson 1965; Leman 1980

* I would like to acknowledge the Cheyenne language and speakers and everyone who has done work to document the language.
Cheyenne

<table>
<thead>
<tr>
<th>Consonants</th>
<th>bilabial</th>
<th>dental</th>
<th>post-alveolar</th>
<th>velar</th>
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<th>Vowels</th>
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Voiceless vowels written with IPA diacritic: ַ

(Inventory from Leman 2011)
Cheyenne

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Vowels:

- e
- o
- a

Voiceless vowels written with IPA diacritic: q

All voiceless consonants are **obstruents**

(Inventory from Leman 2011)
Cheyenne

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Voiceless vowels written with IPA diacritic: ą

All voiceless consonants are **obstruents**
Two contrastive tones: high (‘), low

(Inventory from Leman 2011)
Word-internal sequences of multiple consonants permitted

[mahtaoʔkeme] ‘coffee bean’

[heʔékaʔɛfjóne] ‘girl’

(Fisher et al. 2017)
Morphological evidence for underlying word-final consonants

[póeson-o] ‘cats’ /póésón/ ‘cat’

[féʔenovot-o] ‘snakes’ /féʔenovot/ ‘snake’

[hóhkóx-ɛstse] ‘axes’ /hóhkóʃ/ ‘axe’

(Fisher et al. 2017)
But on the surface, word-final codas are avoided

- Final sonorants are deleted
  / póésón / \[ póéso ] ‘cat’

- Final obstruents are followed by epenthetic <e>
  / hóhkóʃ / \[ hohkʊxɛ ] ‘axe’

(Leman 2011; Fisher et al. 2017)
Extensive vowel devoicing

- Two processes focused on here restricted to one syllable toward end of word or phrase
- Additional word-internal process targeting low tone vowels followed by voiceless fricatives

Red vowels (ə) = devoiced by the process I am discussing at the moment
Blue vowels (a) = voiced when we’d otherwise expect them to devoice
Vowel devoicing 1: phrase-final devoicing

[návóómo mé[e] ‘I see the woodtick’ (Leman & Rhodes 1978)

- Typical of domain-final vowel devoicing patterns cross-linguistically (cf. typologies in Greenberg 1969; Gordon 1998)

- Phonetically grounded (e.g., Gordon 1998)
Vowel devoicing 1: phrase-final devoicing

návóomá
he saw me
Can occur without adjacent voiceless consonant

\[ \text{návóomã} \] ‘he saw me’ (Fisher et al. 2017)

- So feature spreading would not work
- Instead, feature inserted (or floating) at phrase boundary
Vowel devoicing 2: “penultimate” devoicing

- Surface penultimate vowels devoice in *some words* before voiceless consonants in words ending with an [e]

[heʔotse] ‘neck’ (Leman 2011)

[námeʔtatónə́vémə̱se] ‘what in the world should I do?’ (Olson 1965; Leman 1980)

[oeʃkəse] ‘dog’ (Leman 2011)
Only occurs before voiceless consonants

- Can be understood as assimilatory process, accounted for with leftward spreading of a laryngeal feature from a voiceless consonant to preceding vowel

heʔotse ‘neck’

[F]
Only occurs before voiceless consonants

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heʔ otse ‘neck’

- But why in only one specific syllable in the word?
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  heʔotse ‘neck’

  [F]

- But why in only one specific syllable in the word?

- Assimilatory vowel devoicing typically occurs across an entire prosodic domain
  
  - e.g., Cheyenne vowel devoicing before voiceless fricatives
Only occurs before voiceless consonants

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heʔ otse ‘neck’

- But why in only one specific syllable in the word?

- Assimilatory vowel devoicing typically occurs across an entire prosodic domain
  - e.g., Cheyenne vowel devoicing before voiceless fricatives
  - e.g., Japanese, Comanche, Acoma (Tsuchida 2001; Cho 1993)
Cannot be predicted only from surface environment

[vóhpomaʔohtse] ‘salt’ vs. [nenɛheʔohtse] ‘(you) go there’ (Leman 2011)

- Only in underlying word-final syllables followed by epenthetic <e> on the surface (Leman and Rhodes 1978)

[seoʔohtse] ‘ghost’

[séot-o] ‘ghosts’ (Leman 2011)

[nótaxe] ‘warrior’

[nótɔxe-oʔo] ‘warriors’ (Fisher et al. 2017)

- Makes reference to form prior to <e> epenthesis
If this process occurs before e epenthesis, it is domain-final

/heʔot/ → heʔot → [heʔotse] ‘neck’

• Thus, we are left with a phonetically ungrounded word-final process but that would be phonetically grounded utterance-finally

• As well as a phonetically well-motivated phrase-final process

  [néméhotətsɛ] ‘I love you’ (Fisher et al. 2017)
## Two domain-final vowel devoicing processes

<table>
<thead>
<tr>
<th></th>
<th>Word-final</th>
<th>Phrase-final</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Order relative to (&lt;e&gt;) epenthesis</strong></td>
<td>Before (&lt;e&gt;) epenthesis</td>
<td>With (&lt;e&gt;) epenthesis</td>
</tr>
<tr>
<td><strong>Segmental environment</strong></td>
<td>Only before voiceless consonants</td>
<td>Any</td>
</tr>
<tr>
<td><strong>Source of ([-voice])</strong></td>
<td>Spreading</td>
<td>Insertion</td>
</tr>
</tbody>
</table>
Proposal

- Both processes due to same preference for [-voice] at domain edges
- Family of constraints:
  - \( \*V_{[\text{+voice}]}C_0\text{PhPh} \) - no voiced vowels at the end of a phrase
  - \( \*V_{[\text{+voice}]}C_0\text{wd} \) - no voiced vowels at the end of a word
Different sources of [-voice] from different constraint rankings

\[ \ast V_{[+\text{voice}]} C_0 \]_{PhPh} >> DEP[Lar] >> \ast V_{[+\text{voice}]} C_0 \]_{wd} \\

- \ast V_{[+\text{voice}]} C_0 \]_{PhPh} >> DEP[Lar]: insertion of [-voice]

- DEP[Lar] >> \ast V_{[+\text{voice}]} C_0 \]_{wd}: devoicing only if [-voice] can spread
Different orderings accomplished within Stratal OT
(Bermúdez-Otero 2018; Kiparsky 2000)

- Three strata: stem, word, phrase
  (roughly = cyclic, post-cyclic, post-lexical in lexical phonology)
- Output of one stratum $\rightarrow$ input to next stratum
- Limited reranking possible: constraint promotion to undominated position from one stratum to the next
- Word-final devoicing at word-stratum
- $<$e$>$ epenthesis and phrase-final devoicing at phrase-stratum
## Word-final devoicing at word-stratum

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<thead>
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<tbody>
<tr>
<td>a.</td>
<td>heʔot</td>
<td></td>
<td>*!</td>
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<tr>
<td>→ b. heʔ̓ot</td>
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<td>*</td>
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/heʔot/ → heʔ̓ot ‘neck’
## Word-final devoicing at word-stratum

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<tbody>
<tr>
<td>a. he?ot</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
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<tr>
<td>➔ b. he?qot</td>
<td></td>
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<td>*</td>
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</table>

/he?ot/ → he?qot ‘neck’

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<tbody>
<tr>
<td>➔ a. póésono</td>
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<td>*</td>
<td></td>
<td></td>
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<tr>
<td>b. póésonq</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
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</tbody>
</table>

/póésono/ → póésono ‘cats’
No <e> epenthesis at word-stratum

- DEP, MAX(obs), MAX >> *CODA]_{wd}

<table>
<thead>
<tr>
<th>heʔot</th>
<th>DEP</th>
<th>MAX(obs)</th>
<th>*CODA]_{wd}</th>
<th>DEP[Lar]</th>
<th>*V[+voice]C_{0} wd</th>
<th>ID[voice]</th>
<th>*V[-voice]</th>
</tr>
</thead>
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<tr>
<td>a. heʔot</td>
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<td>*</td>
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<tr>
<td>→ b. heʔət</td>
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<td>*</td>
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<td>*</td>
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<tr>
<td>c. heʔotse</td>
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<td>*</td>
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<td>d. heʔo</td>
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</tbody>
</table>

/heʔot/ → heʔət ‘neck’
Promotion of \( \ast \text{CODA}]_{wd} \) and MAX(obs) at phrase-stratum

- \( \ast \text{CODA}]_{wd}, \) MAX(obs) >> DEP

<table>
<thead>
<tr>
<th></th>
<th>( \ast \text{CODA}]_{wd} )</th>
<th>MAX(obs)</th>
<th>DEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>heʔot</td>
<td>( \ast! )</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>heʔota</td>
<td></td>
<td>( \ast! )</td>
</tr>
<tr>
<td>c.</td>
<td>heʔotse</td>
<td></td>
<td>( \ast )</td>
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</table>

heʔot → [heʔotse] ‘neck’ (in phrase-medial position)
Two domain-final processes on consecutive syllables at phrase-stratum

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<td>a. heʔot</td>
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<td>b. heʔo</td>
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<tr>
<td>d. heʔotseɣ</td>
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<td>e. heʔotseɣ</td>
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heʔot $\rightarrow$ [heʔotseɣ] ‘neck’ (in phrase-final position)
Conclusion

- Two different domain-final vowel devoicing processes in Cheyenne.
- Due to post-lexical <e> epenthesis, domain-final environment of one process is obscured on surface.
- Both processes can attributed to same type of markedness constraint that must be satisfied at multiple prosodic domains.
- In this way, the word-level process is neither as typologically unexpected nor phonologically unmotivated as it first appears.
Conclusion

- Word-final devoicing does not have phonetic motivation on its own, may be a case of Domain Generalization (Myers and Padgett 2014)
  - In fact, word-final vowel devoicing could be understood this way cross-linguistically
- Post-lexical <e> epenthesis allows us to identify two separate processes
- What has been generalized here is a preferred surface configuration (markedness constraint) rather than a specific phonological process
- Due to different constraint rankings, surface preference for voiceless vowels is achieved by different processes at different domains
References


References


THANK YOU!

Though all data in this paper comes from pre-existing materials, I would like to acknowledge the Cheyenne speakers and the Cheyenne language, as well as those who have done work to document it.

I would also like to thank members of the Cornell Linguistics Department for their feedback on various stages of this project.
Vowel devoicing 2: “penultimate” devoicing

- Surface penultimate vowels devoice in some words before voiceless consonants in words ending with an [e]

[heʔotse] ‘neck’ (Leman 2011)

[námeʔtatóŋeʃévémaʃe] ‘what in the world should I do?’ (Olson 1965; Leman 1980)
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[námɛʔtatóŋɛʃévéməse] ‘what in the world should I do?’ (Olson 1965; Leman 1980)
Word-final devoicing at word-stratum

- *RightSpreading >> *$V_{[+\text{voice}]}C_0$$_{wd}$
  - /nótaxe/ $\rightarrow$ [nótaxe] ‘soldier’ (not [nótaxe])