

### Domain Generalization: the case of vowel devoicing in Cheyenne

Domain generalization has been proposed to account for phonological effects that are phonetically motivated in utterance-final position but appear in other domain-final contexts where they are less well-motivated.<sup>[1]</sup> In this paper, I examine two processes of vowel devoicing (VD) in Cheyenne (Algonquian, spoken in Montana and Oklahoma),<sup>[2]</sup> a phrase-level one that is clearly phonetically grounded, and a word-level one that at first glance appears to be somewhat idiosyncratic. Specifically, I show that while these processes appear on the surface to be quite distinct, they can in fact be unified in terms of domain generalization as the same type of well-motivated edge devoicing phenomenon applying at multiple domains. I further demonstrate that this result is directly predicted within a Stratal OT framework.

The phoneme inventory of Cheyenne is relatively small, with only voiceless obstruents and voiced sonorants. Vowels are underlyingly voiced; voiceless vowels appear only on the surface.<sup>[2]</sup> Codas are permitted word-internally but not word-finally, although evidence from morphology indicates that underlyingly, words can end with a consonant. On the surface, final obstruents are followed by an epenthic <e> (e.g., *féʔ/enovot-o* ‘snakes,’ but *féʔ/enovotse* ‘snake;’ /t/ affricates before [e]),<sup>[3]</sup> while final sonorants are deleted (e.g., *póeson-o* ‘cats,’ but *póéso* ‘cat’).<sup>[2]</sup>

The first process, **phrase-final devoicing** (PFD),<sup>[4]</sup> is illustrated in (1) and (2). Note that the last vowel of *névóoh táhe* devoices phrase-finally in (1) but not phrase-medially in (2). Meanwhile, the second word in (2) exhibits PFD as expected. (Devoicing marked with a diacritic: [e̥].)

- (1) *névóoh táheʔ* ‘Do you see it?’<sup>[4]</sup>    (2) *névóoh táhe mahpəʔ* ‘Do you see the water?’<sup>[4]</sup>

PFD is phonetically well-motivated and may serve as a form of edge-marking. A decrease in subglottal air pressure or anticipation of a glottal opening during a pause may weaken voicing at the end of larger phrases and utterances, thus making phonetic and phonologized phrase and utterance-final devoicing fairly common cross-linguistically.<sup>[5]</sup> VD is usually analyzed phonologically as the spreading or insertion of a laryngeal feature (e.g., Tsuchida 2001). Since PFD may occur without an adjacent voiceless segment (e.g., *é-vóomeʔ* ‘he is seen’<sup>[4]</sup>), the feature must be inserted. I thus posit a positional markedness constraint referring to a phrase edge ( $*V_{[+voice]}]_{PhPh}$ ) ranked above a constraint against feature insertion (DEP[F]), as shown in (3). Two additional constraints, both ranked below  $*V_{[+voice]}]_{PhPh}$ , are introduced for the next VD process.

(3) */é-vóome/* → *[é-vóome̥]* ‘do you see him’?

$é-vóome]_{PhPh}$	$*V_{[+voice]}]_{PhPh}$	DEP[F]	ID[voice]	$*V_{[-voice]}$
a. <i>évóome</i>	*!			
→ b. <i>é-vóome̥</i>		*	*	*

The second process, **penultimate devoicing** (PD),<sup>[3]</sup> devoices word-penultimate vowels that precede a voiceless obstruent, suggesting that it is an assimilatory process. It also only

applies in words with final epenthetic <e>. We therefore see it in (4), but not in (5), which has a similar surface environment, but with a final /e/ in the UR.

- (4) *hohkəxe* ‘axe’<sup>[3]</sup>    (5) *nótaxe* ‘soldier’<sup>[4]</sup>

While assimilatory VD processes are not uncommon cross-linguistically,<sup>[4]</sup> they typically occur across an entire prosodic domain (e.g., Japanese, Comanche, Acoma<sup>[6][7]</sup>), not in one (seemingly arbitrary) syllable of a word. However, if we assume that PD occurs before <e> epenthesis, it can in fact be seen as an edge-marking process, like PFD. This can be achieved straightforwardly in Stratal OT.<sup>[8][9]</sup> That is, PD can occur at the word stratum, while <e> epenthesis and PFD occur at the phrase stratum. A Stratal OT analysis also allows us to account for the difference between PD's more restricted segmental context (before voiceless consonants) compared to that of PFD. I propose that this difference due to assimilation vs. feature insertion, respectively, is attributed to different constraint rankings relative to DEP[F]. At the phrase level, the edge constraint outranks DEP[F], but at the word level, DEP[F] outranks the edge constraint. Thus, word-level edge-marking

is only allowed when feature spreading is possible. Given Cheyenne phonotactics, this is crucially only in forms that ultimately exhibit <e> epenthesis on the surface, as shown in (7). (8) shows that devoicing cannot arise if there is no source of spreading. Note that rightward spreading is prohibited by \*RightSpreading >> \*V<sub>[+voice]</sub>C<sub>0</sub>]<sub>wd</sub> (e.g., in /nótaxe/ ‘soldier.’).

(7) /hohkox/ → hohkox ‘axe’

hohkox	DEP[F]	*V <sub>[+voice]</sub> C <sub>0</sub> ] <sub>wd</sub>	ID[voice]
a. hohkox		*!	
→ b. hohkox			*

(8) /póésono/ → póésono ‘cats’

póésono	DEP[F]	*V <sub>[+voice]</sub> C <sub>0</sub> ] <sub>wd</sub>	ID[voice]
→ a. póésono		*	
b. póésono	*!		*

The winner, (7b) is the input to the phrase stratum, where it undergoes <e> epenthesis and PFD. <e> epenthesis is accounted for with a constraint \*CODA]<sub>wd</sub> ranked below faithfulness at the word stratum but promoted to an undominated position at the phrase stratum. That is, \*CODA]<sub>wd</sub>, MAX(obs) >> DEP results in epenthesis rather than deletion of obstruents, as in (9); DEP >> MAX results in deletion of sonorants. Note that the epenthesis causes the devoiced vowel from (7) to appear in the penultimate syllable, obscuring its original word-final position.

(9) hohkox → [hohkoxe] ‘axe’ phrase-medially

hohkox	*CODA] <sub>wd</sub>	MAX(obs)	DEP
a. hohkox		*!	
→ b. hohkoxe			*

Phrase-finally, words are subject to a second round of domain-final devoicing which affects epenthetic <e>. The vowel devoiced at the word stratum remains devoiced due to ID[voice] >> \*V<sub>[-voice]</sub> even

though it is no longer word-final. The full set of interactions is shown in (10).

(10) hohkox → [hohkoxe] ‘axe’ phrase-finally

hohkox] <sub>PhPh</sub>	*CODA] <sub>wd</sub>	MAX(obs)	DEP	*V <sub>[+voice]</sub> ] <sub>PhPh</sub>	DEP[F]	ID[voice]	*V <sub>[-voice]</sub>
a. hohkox	*!						*
b. hohkox		*!					*
c. hohkoxe			*	*!			*
→ d. hohkoxe			*		*	*	**
e. hohkoxe			*		*	**!	*

In conclusion, the proposed analysis demonstrates that two VD phenomena of Cheyenne that appear to be fundamentally different on the surface, are in fact attributable to the same type of edge constraint that must be satisfied at multiple domains. Stratal OT allows us to identify the domain-final environment of the lower domain process, which is otherwise obscured on the surface. Crucially, while word-final devoicing is not itself phonetically motivated, I show that it can be undersood as a case of domain generalization<sup>[1]</sup>: the phonetically grounded utterance-final effect becomes phonologized and then generalized to lower prosodic domains. Finally, it is interesting to note that what has been generalized in the present analysis is a preferred surface structure rather than a specific phonological process. Due to different constraint rankings, this surface preference for voiceless vowels is achieved by different processes at the different domains.

## References

- <sup>[1]</sup>Myers, S., and Padgett, J. (2014). Domain generalisation in artificial language learning. *Phonology*, 31(3), 399-433.  
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<sup>[6]</sup>Tsuchida, A. (2011). “Japanese vowel devoicing: Cases of consecutive devoicing environments.” *Journal of East Asian Linguistics*, 10(3), 225-245. <sup>[7]</sup>Cho, Y-M Y. (1993). “The phonology and phonetics of ‘voiceless’ vowels,” *BLS* 19, 64-75. <sup>[8]</sup>Bermúdez-Otero, R. (2018). Stratal Phonology. In S.J. Hannahs and A. R. K. Bosch (eds), *The Routledge Handbook of Phonological Theory*, 100-134. <sup>[9]</sup>Kiparsky, P. (2000). Opacity and cyclicity. *The Linguistic Review*, 17(2-4), 351-366.