

Vowel Raising and Positional Privilege in Klamath

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Introduction

- In previous work on Klamath (Barker, 1963, 1964), several opaque alternations are explained using abstract phonemes in the underlying forms.
- Specifically here, we'll look at the phoneme /i/. This phoneme only appears in final syllables in verb stems.
- According to Barker (1964), /i/ either deletes or surfaces as [i].
- If Klamath has the phoneme /i/ available to the lexicon,
 - Why doesn't it ever appear in non-verbs?
 - Why doesn't it appear in stem-initial syllables?

CLAIM

This alternation is caused by underlying /e/.

Outline

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 - Epenthesis
 - Glottalization
- 3 [i]~[∅] Alternation
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Background on Klamath

- Klamath was spoken in south-central Oregon.
- It has been argued both to be a Plateau Penutian language (DeLancey, 2000), and a linguistic isolate (Lewis *et al.* , 2013).
- There are no living native speakers of Klamath.

Phonemic Inventory of Klamath

Consonants of Klamath (Adapted from Blevins (1993))

Consonants	Bilabial	Alveolar	Palatal	Velar	Uvular	Glottal
<i>Stops</i>						
Unaspirated	p	t	tʃ	k	q	
Aspirated	p ^h	t ^h	tʃ ^h	k ^h	q ^h	
Ejective	p'	t'	tʃ'	k'	q'	ʔ
<i>Fricatives</i>						
		s				h
<i>Sonorants</i>						
Voiced	m	n l	j	w		
Voiceless	m̥	n̥ l̥	j̥	w̥		
Laryngealized	m'	n' l'	j'	w'		

Phonemic Inventory of Klamath II

Vowels of Klamath (Adapted from Blevins (1993))

Vowels	+front		+long	+front
+hi	i	u	+hi	i: u:
	e	a		e: a:

Sources

- My data comes from my digital transcription of Barker's Klamath Dictionary (1963).
- This searchable representation is available on my website.

Epenthesis

There's significant evidence that [a] is the default epenthetic vowel in Klamath.

/snak'l-a/	[snak'la]	'has spots on the face'	(Barker, 1963, p. 379)
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/snak'l-s/	[snak'als]	'pregnancy spots'	(Barker, 1963, p. 301)
/p ^h ip ^h i:k'-tk ^h /	[p ^h ip ^h i:k'atk ^h]	'wearing a bracelet'	

/p ^h ip ^h i:k'-s/	[p ^h ip ^h i:ks]	'bracelet'
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Glottalization Effects

- The glottal stop in Klamath tends to coalesce with the previous consonant when in a C?V context.
/p^heɬʃ-ʔa:k'/ [p^heɬʃ'a:k] 'little foot' (Barker, 1964, p. 54)
- The [constricted glottis] node usually deletes when not in syllable onset.
/n-t^hit'-tqi/ [nt^hittqi] 'defecates' (Barker, 1963, p. 408)

Setup

- For our purposes we will focus largely on two verb suffixes
 - /-a/: the indicative suffix
 - /-tk^h/: having been ...-ed
- With most consonant final morphemes, [a] epenthesis is triggered when combined with /-tk^h/

/taq'-a/ [taq'a] 'is sharp edged' (Barker, 1963, p. 109)
 /taq'-tk^h/ [taq'atk^h] 'sharp edged'

- With [i] final morphemes, the [a] of the indicative suffix is deleted.

/stupw̥i-a/ [stupw̥i] 'has first menstruation' (D-358)
 /stupw̥i-tk^h/ [stupw̥itk^h] 'woman'

[i]~[∅] Alternation

- Around 50 stems show [i] before the /-tk^h/ morpheme, but appear consonant final elsewhere.

- a) [ʔe:wa] 'is deep' (D-31)
 b) [ʔe:witk^h] 'deep'

- Many of these stems show glottalization on the final consonant where it would be licensed, unless the [i] surfaces.

- a) [nt^he:w'a] 'breaks with a round instrument' (D-403)
 b) [nt^he:witk^h] 'broken'
 c) [nt^hew|i] 'breaks into'

- The underlying form for these stems cannot be a surface exponent.
 - If the underlying form for 'be deep' was /ʔe:ɰ/, it should pattern like other consonant final stems
 - We would get [ʔe:ɰa] and *[ʔe:ɰak^h]
 - If the underlying form was /ʔe:ɰi/, it should pattern like i final stems.
 - We would get *[ʔe:ɰi] and [ʔe:ɰitk^h]

Analyses

- Barker (1964) marks these stems with an abstract phoneme seen nowhere else in the grammar, /i̯/.
- This phoneme is specifically defined only to capture this alternation.
 - /ʔe:w̥i̯-a/ → [ʔe:wa]
 - /nte:w̥i̯ʔ-tk^h/ → [nte:witk]
- However, this analysis adds complexity to the lexicon that may not be warranted.
 - Why doesn't it appear in other contexts?
 - /ʔi̯w-a/ → ???

[i] Epenthesis?

- In order to get [tʃima:ʔas], [a] epenthesis must bleed [cg] deletion.

U.R.	/tʃima:ʔ-s/	/nt ^h e:w'-tk ^h /
[a]-Epen	tʃima:ʔas	nt ^h e:w'atk ^h
[cg]-Del	—	—
S.R.	[tʃima:ʔas]	[nt ^h e:w'atk ^h]

- But in order to get [nt^he:witk^h], through [i]-epenthesis, [i]-epenthesis must counter-bleed [cg]-deletion.

U.R.	/tʃima:ʔ-s/	/nt ^h e:w'-tk ^h /
[cg]-Del	tʃima:s	nt ^h e:wtk ^h
[i]-Epen	—	nt ^h e:witk ^h
S.R.	[tʃima:s]	[nt ^h e:witk ^h]

[i] Epenthesis?

- However, if we assume this ordering, [a]-Epenthesis should bleed [i]-Epenthesis, since [i]-Epenthesis occurs in contexts where we expect to see [a]-Epenthesis.
- Without some sort of abstract feature preventing [a]-epenthesis, we cannot get [nt^he:w'itk^h]

U.R.	/tʃima:ʔ-s/	/nt ^h e:w'-tk ^h /	/nt ^h e:w'-tk ^h /No a-epen
[a]-Epen	tʃima:ʔas	nt ^h e:w'atk ^h	—
[cg]-Del	—	—	nt ^h e:wtk ^h
[i]-Epen	—	—	nt ^h e:witk ^h
S.R.	[tʃima:ʔas]	[nt ^h e:w'atk ^h]	[nt ^h e:witk ^h]

- Thus, this analysis is just as abstract as the /i/ analysis, since all the same stems must be marked.

CLAIM

CLAIM

This alternation is caused by underlying /e/.

- The 4-way vowel contrast in Klamath exists only in privileged positions.
- /e/ deletes when possible, else it raises to [i].

Distribution of e

- [e] is never found as the last segment in a multisyllabic verb stem in Barker (1963)
- This is not true for the other vowels.
 - /ʔampu/ 'is thirsty' (D-26)
 - /sq^heti/ 'be on the left' (D-390)
 - /swaqsna/ 'straighten out' (D-399)

Distribution of [e]

- Out of over 3100 verb surface forms in Barker's dictionary, only 71 show non-initial e.
- Of these, 56 are caused by reduplication of a stem-initial [e].
[p'etq̄p'etq̄'a] blinks (D-308)
- The remaining 15 forms get their [e]s from just four morphemes. The low frequency of these leads me to believe that these are lexical exceptions.
- Thus, I claim [e] is not found normally in verb non-initial position.

- If /e/ always surfaces faithfully, then it would need to be an accidental gap in Klamath's lexicon that /e/ never surfaces in non-initial positions in verbs.
 - /?e:wə-tk^h/ → ??? * [?e:wətk^h]
- Under the abstract phoneme analysis, /i/ only appears in the final syllable of multisyllabic verb stems, either as the last segment, or only followed by a glottal stop.
- /e/ and /i/ are in complementary distribution.
- Both can be represented by the same underlying phoneme, /e/, minimizing the abstractness of the Klamath lexicon.

Abstractness

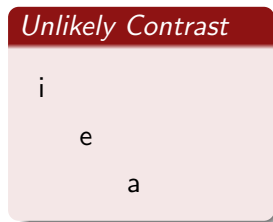
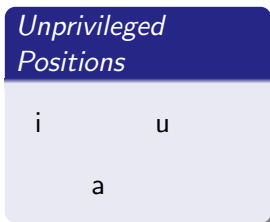
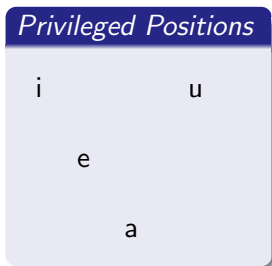
- Under the abstract phoneme analysis, there must be lexical rules
 - /e/ is not allowed in noninitial syllables of verb stems
 - /i/ is only allowed at the right edge of multisyllabic verb stems (or 50 verb stems are memorized exceptions)
- Under this /e/ analysis,
 - 4 verb stems with noninitial syllable /e/ are exceptional
- This analysis is far less lexically abstract.

Positional Privilege

- Phonological contrasts are more likely to be maintained in privileged positions. (Beckman, 1998)
- Privilege can come from phonetic or psycholinguistic grounds.
 - Verbs are less privileged than non-verbs. (Smith, 1998, 2011)
 - Initial syllables are privileged over non-initial syllables. (Steriade, 1995; Walker, 2011; Trubetzkoy, 1969)
 - Long vowels are privileged over short vowels. (Steriade, 1995)

- Klamath typically has a four-way vowel quality contrast, but in the least privileged position, non-initial syllables of verbs, only a three way contrast is preserved.
- Barnes (2002) shows that it is rather cross-linguistically common for a language to lose some height contrasts in unstressed syllables.
 - Many five vowel-systems shrink to three vowel systems.
 - This effect happens in unstressed syllables because they are less privileged than stressed syllables. (Walker, 2011; Crosswhite, 2004; Beckman, 1998)
 - So we should expect to see similar vowel inventory shrinking in other unprivileged positions.

- [e] is the most marked of the vowels in Klamath
- A three vowel inventory with [i a u] is much more likely than [i e a] or any other combination, because these ‘corner vowels’ are maximally acoustically distinct, (Crosswhite, 2004).



Repairs

- Since [e] is marked in this unprivileged position, there needs to be some repair.
 - If deletion is feasible, it deletes.
/ʔe:w̥e-a/ → [ʔe:w̥a]
 - If the phonotactics prevent deletion of the vowel, it raises.
/ʔe:w̥e-tk^h/ → [ʔe:w̥itk^h], *[ʔe:w̥tk^h]

Richness of the Base

- Under this analysis, verbs with /e/ in non-initial positions have either /e/ raising or /e/ deletion.
 - Typically, non-initial /e/ deletes.
 - If deletion would create a phonotactically illicit cluster, /e/ raises instead.
- [Ctk^h] is an illicit coda in Klamath.
- If the /e/ is morpheme final, we see the [i]~[∅] alternation, because /e/ must raise to avoid [Ctk^h].
 - /...Ce-a/ → [...Ca]
 - /...Ce-tk^h/ → [...Citk^h], * [...Ctk^h]

Richness of the Base II

- If a glottal stop intervenes between /e/ and the end of the stem, the glottal stop will delete in order to avoid the [ʔtk^h] coda, so /e/ will raise before /-tk^h/.
 - /...Ceʔ-a/ → [...C'a]
 - /...Ceʔ-tk^h/ → [...Citk^h], * [...Ctk^h]
- If any other consonant intervenes between /e/ and the end of the stem, this alternation will not appear, because epenthesis will break up the [Ctk^h] cluster.
 - /...CeC-a/ → [...CCa]
 - /...CeC-tk^h/ → [...CCatk^h]
- These stems will be lexicalized as having no /e/, since this /e/ deletes in all contexts.
- If an /e/ exists stem internally breaking up a large cluster, it should always raise, no matter what suffixes are applied.
 - /...CCeCC-a/ → [...CCiCCa], * [...CCCCa]
 - /...CCeCC-tk^h/ → [...CCiCCatk^h]
- These stems will always be lexicalized as containing /i/.

Richness of the Base III

- With this analysis, any gaps in the distribution of /e/ throughout the lexicon are caused by total neutralization with /i/ or /∅/.
- No abstract phonemes have highly specific distributions in the lexicon.

Optimality Theory

- This phenomenon can be modeled easily using Positional Faithfulness constraints. (Beckman, 1998).
- With the constraint ranking:
Positional Faithfulness \gg Markedness \gg General Faithfulness
this type of positional neutralization falls out.

Constraints

- DEP[HI]- Violated by epenthesis of a [hi] node. /e/→[i]
- MAX-V- Violated by deleting a vowel. /e/ →[∅]
- *MIDV- Violated by mid vowels in output. [e].
- PHTAC- Violated by illicit clusters. [Ctk^h]
- F/P- Violated by violations of a faithfulness constraint *F* in a position *P*.

- In order for noninitial /e/ to delete in most situations, *MIDV and DEP[HI] must dominate MAX-V.

/tʃ'u:jeʔ-a/	*MIDV	DEP[HI]	MAX-V
☞ a. tʃ'u:j'a			* _e
b. tʃ'u:jeʔa	* _e W		L
c. tʃ'u:jiʔa		* _i W	L
/sk ^h umeʔ-ta/	*MIDV	DEP[HI]	MAX-V
☞ d. sk ^h umta			* _e
e. sk ^h umeta	* _e W		L
f. sk ^h umita		* _i W	L

- In order for deletion to be prevented and raising to occur, PHTAC and *MIDV must dominate DEP[HI].

/tʃ'u:jeʔ-tk ^h /	PHTAC	*MIDV	DEP[HI]	MAX-V
☞ a. tʃ'u:jitk ^h			* _i	
b. tʃ'u:jtk ^h	* _{jtk^h} W		L	* _e W
c. tʃ'u:jetk ^h		* _e W	L	

- /e/ is protected in initial syllables, by having $\text{DEP}[\text{HI}]/\sigma_1$ and $\text{MAX-V}/\sigma_1$ dominate $^*\text{MIDV}$.

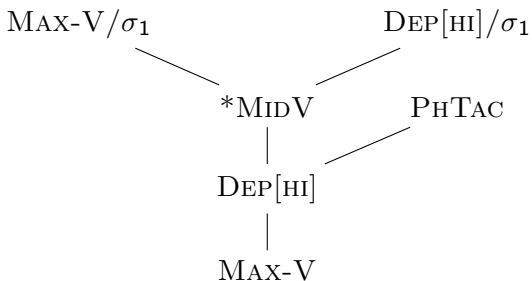
/teju:w-a/	$\text{DEP}[\text{HI}]/\sigma_1$	$\text{MAX-V}/\sigma_1$	$^*\text{MIDV}$
☞ a. te.ju:w.a			*_e
b. tju.wa	$^*_e W$		L
c. ti.ju.wa		$^*_i W$	L

- Non-initial /e/ is not protected by these constraints.

/wk ^h umeʔ-a/	MAX-V/ σ_1	*MIDV	MAX-V
☞ a. wk ^h u.m'a			* _e
b. wk ^h umeʔa		* _e W	L

Preliminary Hasse Diagram

- With this ranking, short /e/ exhibits the [i]~ [∅] alternation, in verbs as expected.



Short /e/ in noninitial syllables of nouns is protected

$\text{MAX-V}_{\text{NOUN}}, \text{DEP}[\text{HI}]_{\text{NOUN}} \gg *_{\text{MIDV}}$

/sq ^h u.l'e/_{\text{NOUN}}	$\text{MAX-V}_{\text{NOUN}}$	$\text{DEP}[\text{HI}]_{\text{NOUN}}$	*_{\text{MIDV}}
☞ a. sq ^h u.l'e			* _e
b. sq ^h ul'	* _e W		L
c. sq ^h u.l'i		* _i W	L

Conclusion

- Analyzing the [i]~[∅] alternation as a loss of vowel contrasts in unprivileged positions simplifies the grammar of Klamath.
- This analysis not only explains this phenomenon but explains gaps in the distribution of [e].¹
- While /e/ never surfaces in these verb stems, we should posit that a language learner would be able to discover it in these positions.

¹It also explains some interesting behavior with long e: 

Thanks

I would like to thank Karen Jesney, Rachel Walker and the USC PhonLunch for their insights on this project. None of this work would be possible without M.A.R. Barker's thorough work on the Klamath language. All errors are my own.

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- However, most of the verb stems in Barker (1963) with noninitial long /e/ have allomorphs where the /e:/ deletes.
- An investigation of this allomorphy shows that these /e:/-less forms surface in the same environments where short /e/ deletes.
 - /nt'use:ʔ-tk^h/ → [nt'use:tk^h], but
 - /nt'use:ʔ-a/ → [nt'usʔa]

Long /e/s in verbs are not totally protected

PH_{TAC}, DEP_[HI]/V: \gg *MIDV \gg MAX-V/V:

/nt'use:ʔ-tk ^h /	PH _{TAC}	DEP _[HI] /V:	*MIDV	MAX-V/V:
☞ a. nt'u.se:tk ^h			* _{e:}	
b. nt'u.si:tk ^h		* _{i:} W	L	
c. nt'ustk	* _{stk} W		L	* _{e:} W
/nt'use:ʔ-a/	PH _{TAC}	DEP _[HI] /V:	*MIDV	MAX-V/V:
☞ d. nt'usʔa				* _{e:}
e. nt'u.si:ʔa		* _{i:} W		L
f. nt'use:ʔa			* _{e:} W	L