

Ditidaht boundary epenthesis*

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1 Boundary epenthesis

Ditidaht (diidiitidq) exhibits several interesting vowel-zero alternations. I'll be interested here in a pattern that I call *boundary epenthesis*, in which a vowel is inserted into a stem-final consonant cluster when an ending is added to the stem (first described by Swadesh & Swadesh 1933).¹

Curiously, boundary epenthesis is triggered both by suffixes or clitics that consist only of consonants, and those whose first vowel is long (hyphens indicate suffix boundaries, equals signs indicate clitic boundaries).^{2,3}

(1) Pre-C boundary epenthesis

- | | | |
|----|----------------|------------------------|
| a. | yaadaq-k | 'youngster' |
| b. | Ziidaq-sc | 'container for smoke' |
| c. | Japac-ckv | 'remains of a canoe' |
| d. | XuXtak-Sz | 'learn how' |
| e. | hadl iYak-sc | 'container for arrows' |
| f. | qviS/iikis-j z | 'smoke a cigarette' |
| g. | taafaadaak=s | 'I have money' |
| h. | JuJuwaXsil=s | 'I'm a wolf' |

(2) Pre-VV boundary epenthesis

- | | | |
|----|------------------|---------------------------|
| a. | ?iidit-iil | 'make snot' |
| b. | Jaapac-iil | 'make canoes' |
| c. | fuufuj Xaq-iil | 'pick flowers' |
| d. | TuuTudxaKukv-iil | 'pick three-corner grass' |
| e. | haadil -Siidl | 'shoot bow off and on' |
| f. | waal eeyik-Siidl | 'go off and on' |
| g. | /u/uukvis-ee/s | 'going to eat' |
| h. | siqidaakSiZ-ee/s | 'going to cook' |

Curiously, no such epenthesis is observed before endings beginning with a vowel, or with a single consonant followed by a short vowel.

(3) No epenthesis before V-initial and CV-initial endings

- | | | |
|----|--------------------|-----------------|
| a. | ?idt-ibs | 'snot' |
| b. | taafaadk=id | 'we have money' |
| c. | fuufuj XQ=aq | 'a/the flower' |
| d. | JaJaaqab?aqsI -sib | 'tears' |

Second, while a single consonant-only clitic triggers pre-C boundary epenthesis (see above), subsequent clitics don't.

(4) No boundary epenthesis to already cliticized stems

- | | | | |
|----|--------------|-------------------------|--------------------|
| a. | /ayiiq=kv=s | */ayiiq= <u>a</u> kv=s | 'I have a lot' |
| b. | babuYik=z=s | *babuYik= <u>a</u> z=s | 'then I worked' |
| c. | SaXSiZ=t=s | *SaXSiZ= <u>i</u> t=s | 'ran away from me' |
| d. | yaa/aK=p=s | *yaa/aK= <u>a</u> p=s | 'I like' |
| e. | daj Sz=ibt=s | *daj Sz=ib <u>i</u> t=s | 'I saw' |
| f. | /aabay=ibt=s | */aabay=ib <u>i</u> t=s | 'yesterday I' |

I'm interested in several aspects of boundary epenthesis.

- ◆ Why do C and VV endings pattern together?
- ◆ Why do suffixes and clitics trigger epenthesis differently?
- ◆ Why is the locus of epenthesis prefinal in the stem, rather than, say, between morphemes?

The formal analysis is couched in the Optimality Theory (OT) framework (Prince & Smolensky 1993).

I'll proceed by first developing an analysis of pre-C boundary epenthesis, then consider what additional measures are needed for pre-VV epenthesis.

2 Pre-C boundary epenthesis**2.1 Pre-C boundary epenthesis improves alignment**

Recall that pre-C boundary epenthesis inserts a vowel before the last consonant of a stem-final cluster, when followed by a consonant-only suffix (a) or clitic (b), but never into a stem that already contains clitics (c).

(5) *Pre-C boundary epenthesis*

- | | | | |
|----|-----------------------|---------------|------------------------|
| a. | hadl iY <u>a</u> k-sc | /hadl iYk-sc/ | ‘container for arrows’ |
| b. | taafaad <u>a</u> k=s | /taafaadk=s/ | ‘I have money’ |
| c. | /ayiiq=kv=s | //ayiiq=kv=s/ | ‘I have a lot’ |

Our analysis of pre-C epenthesis must account for several facts.

- ◆ *Motivation*: what motivates pre-C epenthesis?
- ◆ *Locus*: why is the locus of epenthesis *prefinal* in the stem?
- ◆ *Suffix/clitic difference*: why don’t subsequent clitics trigger epenthesis?

To take the suffix/clitic difference first, we might rephrase this as follows.

- ◆ There’s epenthesis into the *morphological stem* (i.e. root plus suffixes), but not into the *extended word* (i.e. word plus clitics).
- ◆ *Idea*: perhaps the morphological stem is the domain over which the condition that motivates epenthesis is stated, but clitics are nevertheless able to affect it somehow (although they lie outside it).
- ◆ I’ll conclude that clitics are syllabified with the stem, thereby affecting its syllable structure, but only the syllabic well-formedness of the stem itself is important in motivating epenthesis.

Now concerning the locus of epenthesis, we’ve surmised that the edge of the morphological stem is an important morphological constituent.

- ◆ *Idea*: perhaps epenthesis serves to align the stem with some *prosodic* constituent, such as the syllable.
- ◆ Assume that (i) Ditidaht syllables are maximally CVC, and (ii) consonants not parsed as onsets or codas are appendices of some kind.
- ◆ Then epenthesis serves to align the right edge of the morphological stem with a CVC syllable.

(6) *Epenthesis aligns the stem with a CVC syllable*

- | | | |
|----|---|---------------------------------|
| a. | [.had.l i.Y <u>a</u> k.] _{St-SC} | *[.had.l iY.k] _{St-SC} |
| b. | [.taa.faa.d <u>a</u> k.] _{St=S} | *[.taa.faad.k] _{St=S} |

(periods indicate syllable boundaries, italics indicate appended consonants, and square brackets delineate the morphological stem)

- ◆ *Deduction*: the constraint motivating epenthesis forbids candidates in which *the stem isn’t right-aligned with a syllable*.

However, right-alignment with CVC syllables isn’t sufficient to motivate epenthesis. We don’t get epenthesis into a *word-final* cluster, even though this is a stem too, and epenthesis could align it with a CVC syllable.

(7) *Alignment alone doesn’t motivate epenthesis*

- | | | |
|----|---|---|
| a. | [.taa.faad.k] _{St} | *[.taa.faa.d <u>a</u> k.] _{St} |
| b. | [.Ju.Ju.waX.s] _{St} | *[.Ju.Ju.waX.s] _{St} |
| c. | [.Ja.pac.] _{St} ckv] _{St} | *[.Ja.pac.] _{St} -cu]kv] _{St} |
| d. | [.had.l i.Yak.] _{St} sc] _{St} | *[.had.l i.Yak.] _{St} -sac.] _{St} |

- ◆ *Deduction*: epenthesis is motivated only when the alternative is a structure that violates both alignment *and* some other constraint.
- ◆ *Idea*: epenthesis happens only when a stem is misaligned in the *vicinity of an unsyllabified ending*: the consonant-only endings that trigger boundary epenthesis aren’t syllabified, but are entirely appendical.
- ◆ Epenthesis then responds by fixing one of these problems: alignment.

Before implementing a formal version of this proposal, let’s first evaluate the proposal that Ditidaht syllables are maximally CVC.

2.2 **Ditidaht syllable structure**

First, some descriptive observations about consonant-vowel sequences.

- ◆ As in all the Wakashan languages, all Ditidaht words begin with exactly one consonant, and there’s no word-internal hiatus.
- ◆ These two observations follow if all syllable onsets are obligatory and simplex—i.e. every syllable contains a single consonant onset.

(8) *Onsets are obligatory and simplex*

- | | | | |
|----|---------------------------------------|----|---|
| a. | . <u>S</u> uJ. ‘five’ | e. | . <u>d</u> ii. <u>d</u> ii.tidq. ‘speak Ditidaht’ |
| b. | . <u>p</u> iiS. <u>p</u> iS. ‘cat’ | f. | . <u>b</u> i. <u>z</u> ibzS. ‘raining off and on’ |
| c. | . <u>k</u> iiw. <u>t</u> eef. ‘horse’ | g. | . <u>p</u> uun. ‘spoon’ |
| d. | . <u>f</u> ak. <u>j</u> aa. ‘light’ | h. | <i>Cott’n</i> ’Speden ‘Scott & Peden’ |

- ◆ Medial consonant clusters contain up to four consonants, and final clusters up to three consonants.

(9) *Medial clusters*

- a. Jibpat ‘razor grass’
- b. ?idtibs ‘snot’
- c. ?iditXtid ‘Snot Boy’
- d. qaXSZaq ‘the dead one’
- e. picksi/ ‘graveyard’
- f. Xuuxtkak ‘do you know?’
- g. /aptSZid ‘we hid’
- h. ZutXvkjay ‘rotten log’

(10) *Final clusters*

- a. waaxaaCl ‘bee’
- b. bafaaCadt ‘Malachan’
- c. pipickaKkv ‘orange (color)’
- d. be/izqc ‘little boy’
- e. fuufujXq ‘flower’
- f. XaXapXt ‘teaching’
- g. JuJuwaXsl ‘wolf’
- h. haawiCqs ‘tell fairy tales’

We’ve seen that the pattern of pre-C boundary epenthesis suggests that only the first consonant following a vowel is parsed as a coda, and any consonant not parsed as an onset or coda is appended. While the data above are compatible with this idea, they don’t seem to provide evidence one way or the other for the parsing of postvocalic consonants.

Nevertheless, I’ll pursue this idea.⁴ A formal analysis follows.

(11) *Constraints*

- a. NOCODA: no coda consonants.
- b. *COMPLEX-CODA: no coda clusters—*Abbreviation*: *CC.
- c. *APPENDIX: consonants aren’t licensed directly by a prosodic word — i.e. no word appendices—*Abbreviation*: *APP.

Under the following ranking, only simplex codas are allowed. The winning parse of *XaXapXt* ‘teaching’ therefore parses the last two consonants as appendices to the prosodic word.⁵

(12) *Only simplex codas are allowed*

	/XaXapXt/	*CC	*APP	NOCODA
a.	.Xa.Xa.p <u>Xt</u>		***!	
b. →	.Xa.Xap. <u>Xt</u>		**	*
c.	.Xa.XapXt.	*!		*

- ◆ *Observation*: under this analysis, any word with a medial cluster of three or more consonants contains a word-medial appendix (b-d).

(13) *Medial clusters*

- a. .Jib.pat. ‘razor grass’
- b. .pic.k.si/. ‘graveyard’
- c. ./ap.tS.zid. ‘we hid’
- d. .Zut.Xvk.jay. ‘rotten log’

- ◆ We also require also a restriction against word-initial appendices in order to rule out word-initial consonant clusters.

2.3 **An OT analysis of pre-C boundary epenthesis**

So far, I’ve proposed that pre-C boundary epenthesis serves to repair structures where a stem is *misaligned* in the vicinity of an *unsyllabified* ending. Key to this proposal is that Ditidaht syllables are maximally CVC. Here I present an Optimality-Theoretic implementation of this proposal.

I draw the first two constraints below from Walker 2002 to implement the alignment and syllabification requirements, respectively.⁶

(14) *Constraints*

- a. ALIGN(Stem, R, s, R): align the right edge of every morphological stem with the right edge of some syllable—*Abbreviation*: R(St|s).
- b. MAX-s/Morpheme: every morpheme contains some segment that is parsed as a syllable nucleus—*Abbreviation*: MAX/M.

The next constraint, [R&M], is the *local conjunction* of these constraints in the domain of the prosodic word (Smolensky 1993). DEP-V is a faithfulness constraint of the Correspondence family (McCarthy & Prince 1995).

(15) *Constraints*

- a. [R(St|s) & MAX/M]_?: the constraints R(St|s) and MAX/M aren’t both violated within a prosodic word—*Abbreviation*: [R&M].
- b. DEP-V: don’t epenthesize vowels.

The following tableau shows that it’s the locally conjoined constraint [R&M] that crucially outranks DEP-V, motivating boundary epenthesis.

(16) Epenthesis is motivated by [R&M]

	/hadl iYk-sc/	[R&M]	DEP-V	R(St s)	MAX/M
a.	→ .had.l i.Yak.sc		*		*
b.	.had.l i.Y.ksc	*!		*	*

	/taafaadk=s/	[R&M]	DEP-V	R(St s)	MAX/M
c.	→ .taa.faa.dak.s		*		*
d.	.taa.faad.ks	*!		*	**

(The constraints R(St|s) and MAX/M, while not involved in this tableau, are shown here for comparison with their conjunction [R&M], but set to the side and grayed out to show that they don't affect the outcome here.)

Next, the fact that we don't get epenthesis in Ditidaht just to satisfy R(St|s), MAX/M, or *APP alone indicates that DEP-V outranks all of these.

(17) No epenthesis just for R(St|s), MAX/M, or *APP

	/fuufuj Xq/	DEP-V	R(St s)	*APP	MAX/M
a.	→ .fuu.fuj.Xq		*	**	
b.	.fuu.fuj.Xaq	*!			

	/hadl iYk-sc/	DEP-V	MAX/M	*APP	R(St s)
c.	→ .had.l i.Yak.sc	*	*	**	
d.	.had.l i.Yak.sac	**!			

The ranking so far correctly predicts no epenthesis into already cliticized stems, because R(St|s), and hence [R&M], isn't violated here.

(18) No epenthesis into already cliticized stems

	//ayiiq=kv=s/	[R&M]	DEP-V	R(St s)	MAX/M	*APP
a.	→ .a.yiiq.kvs				**	**
b.	.a.yiiq.kvis		*!		*	
c.	.a.yii.qkv.s	*!	*	*	*	*

Finally, epenthesis into stems ending in CCC clusters like *JuJuwaXsl* shows that low-ranking R(St|s) must nevertheless outrank MAX/M, in order to ensure that epenthesis is prefinal in the stem.

(19) Epenthesis is prefinal

	/JuJuwaXsl =s/	[R&M]	DEP-V	R(St s)	MAX/M
a.	→ .Ju.Ju.waX.sil.s		*		*
b.	.Ju.Ju.waX.s.l.s		*	*!	
c.	.Ju.Ju.wa.Xil.s	*!	*	*	*

2.4 Other approaches

Since this account of pre-C boundary epenthesis involves a somewhat unusual conjoined constraint, it may be worth considering whether another, simpler account might work better.

First, boundary epenthesis doesn't seem to have anything to do with consonant cluster size. Epenthesis breaks up dimorphemic CC-C# clusters (a-c), but not monomorphemic CCC# (d).

(20) Boundary epenthesis is not concerned with cluster size

a.	taafaada ^a k=s	'I have money'
b.	/ukvaqa ^a l=s	'my name is'
c.	diidiitida ^a q=s	'I'm speaking Ditidaht'
d.	fuufuj Xq	'flower'

Another possible account, suggested by the different triggering behavior of suffixes and clitics, is that the suffixes and clitics lie in different prosodic domains, and are therefore subject to different phonotactic conditions.

For example, Shaw 2002 finds reasons to posit an important boundary between the Morphological Root (MRt) and Morphological Word (MWd) in Musqueam (h\$NQi\$miN\$M). Similarly to Ditidaht, schwa epenthesis breaks up obstruent clusters in the MRt, but not in MWd.

(21) Musqueam: CCC clusters only outside the Morphological Root

a.	cpxviqv	[c-[pxv=iqv	'blond haired'
b.	Sxvswe/	[s-xv-s-[we/	'master, owner'
c.	txvs/\$t\$N	[txv-s-]/\$t\$N	'to buy food'
d.	C!xv\$fm\$Xv	[C!-xv\$fm\$Xv	'fellow First Nations people'

(Shaw 2002:130)

Crucially different from Ditidaht, however, is that consonants in the MWd domain in Musqueam don't affect epenthesis and syncope in the MRT.

However, explanations for Ditidaht boundary epenthesis that depend on a phonological boundary between suffixes and clitics fail, because this prevents clitics from triggering epenthesis inside the morphological stem.

(22) *Ditidaht: clitics trigger epenthesis inside their stem*

- | | | | |
|----|--------------------------------------|--|--------------|
| a. | [/ukvaql] _{st} | | 'be called' |
| b. | [/ukvaq <u>al</u>] _{st} =s | | 'my name is' |

Another appealing account concerns Lakota. While roots in this language never contain codas, function words, including clitics, can (Albright 2004). This is reminiscent of the larger heteromorphemic consonant clusters possible in Ditidaht clitic sequences.

(23) *Lakota: codas found only in function words*

- | | | | |
|----|----------------|----------------|------------------|
| a. | .tu.'kte.ktel. | | 'here and there' |
| b. | .ja.tkām. | /jatkã-pi/ | 'drink-PL' |
| c. | .ju.'hak. | /ju'ha-ki/ | 'have-DEF' |
| d. | .ni.jekʃ. | /ni'je=kʃ(to)/ | 'it's up to you' |

(Albright 2004:3-4)

Albright accounts for this with a root-specific markedness constraint: *CODA_{Root}. However, while a domain-specific markedness approach might account for why larger heteromorphemic consonant sequences are allowed in the Ditidaht clitic domain, such an approach again says nothing about how an element in this domain can trigger epenthesis inside the stem.

2.5 Summary

I concluded this section with the following hypothesis.

- ◆ Ditidaht syllables are maximally CVC.
- ◆ Postvocalic consonants not parsed as codas are word appendices.
- ◆ A conjoined constraint against misaligned stems and unsyllabified morphemes motivates epenthesis—epenthesis satisfies this constraint by aligning the stem with a syllable.

(24) *Combined rankings for pre-C boundary epenthesis*

- a. *COMPLEX-CODA >> *APPENDIX >> NOCODA
- b. [R&M] >> DEP-V >> R(St|s), MAX/M, *APPENDIX
- c. R(St|s) >> MAX/M

The next section extends this analysis to pre-VV boundary epenthesis.

3 Pre-VV boundary epenthesis

3.1 Pre-VV boundary epenthesis yields better footing

What additional measures are required to account for *pre-VV* boundary epenthesis? Recall that this process inserts a vowel before the last consonant of a stem when it's followed by an ending whose first vowel is long.

(25) *Pre-VV boundary epenthesis*

- | | | | |
|----|-------------------------|--|------------------------|
| a. | Jaap <u>a</u> c-iil | | 'make canoes' |
| b. | haad <u>i</u> l -Siidl | | 'shoot bow off and on' |
| c. | /u/uukv <u>i</u> s-ee/s | | 'going to eat' |

Unlike pre-C epenthesis, pre-VV epenthesis can't be motivated by [R&M]:

- ◆ First, pre-VV epenthesis doesn't always align the stem with a syllable.
- ◆ Second, the ending in pre-VV epenthesis contains a vowel, and therefore violates neither MAX/M, nor, by extension, [R&M].
- ◆ *Idea:* pre-VV epenthesis yields better footing: by creating a light syllable just before a heavy syllable, it enables the parsing of an ideal LH iamb (McCarthy & Prince 1986, Hayes 1987, 1995).

(26) *Pre-VV boundary epenthesis creates good iambs*

- | | | | |
|----|----------------------------------|--|-----------------------|
| a. | .(Jaa).(p <u>a</u> c.-iil). | | *.(Jaap).(c-iil). |
| b. | ./(u./uu).(kv <u>i</u> .s-ee/).s | | *./(u./uuk).(s-ee/).s |

Let's see why we might want to say that Ditidaht builds iambic feet.

3.2 Ditidaht stress patterns

Stress in Ditidaht exhibits the following pattern.

- ◆ Syllables with long vowels are heavy, all other syllables are light.
- ◆ The main stress falls on the first syllable if it's heavy, and otherwise on the second syllable.
- ◆ After the main stress, secondary stresses occur on every heavy syllable.

From these observations, I conclude that the simplest analysis of footing in Ditidaht is as follows.

- ◆ Feet are iambic, built left-to-right, main stress left.
- ◆ The initial foot can be L, LL, H, or LH.
- ◆ Non-initial feet are only H or LH.

In other words, L syllables are parsed only if they are in the initial foot, or are the first part of a LH iamb.

(27) *Footed words*

#LL ...	#LH ...
(babú/) 'basketwork'	(til úup) 'octopus'
(kafá)(kafii) 'ankle'	(yayáad)(ðii) 'children'
(ZutXvkj áy) 'rotten log'	(/u/uu)(kv _i see/).s 'going to eat'
#HL ...	#HH ...
(Zúu)ba?t 'sunny'	(táa)(fàa) 'money'
(haa)wiCq\$ 'tell fairy tales'	(JiiX)(pàa)l a 'there's six'
(fúu)fuj (Xaqiil) 'pick flowers'	(yáa)(yàa)(wàaX) 'sore all over'

Then pre-VV epenthesis improves footing by creating LH iambs where otherwise only H iambs could be built.

(28) *Pre-VV boundary epenthesis creates good iambs*

- | | |
|---|-----------------------------|
| a. .(?ii).(d _i t.-iil). | *.(?iid).(t-iil). |
| b. .(Jaa).(p _a c.-iil). | *.(Jaap).(c-iil). |
| c. .(/u/uu).(kv _i .s-ee/).s | *.(/u./uuk).(s-ee/).s |
| d. .(waa).(l ee).(y _i k.-Siid).l | *.(waa).(l eey).k.(-Siid).l |

3.3 An OT analysis of pre-VV epenthesis

For our formal analysis of pre-VV epenthesis, however, a pure constraint against non-LH iambs is too strong, since we observe pre-VV epenthesis only at morpheme boundaries, not in monomorphemic words (see below).

I therefore resort again to constraint conjunction.

(29) *Constraints*

- a. LH-IAMB: an iamb is built over a light syllable followed by a heavy syllable—*Abbreviation*: LH.
- b. [R(St|s) & LH]₂: the constraints R(St|s) and LH aren't both violated within a prosodic word—*Abbreviation*: [R&L].

Under the ranking [R&L] >> DEP-V, epenthesis is triggered only to repair the cooccurrence of a misaligned stem and bad footing in the same word.

(30) *[R&L] motivates pre-VV boundary epenthesis*

		[R&L]	DEP-V	R(St s)	LH
a.	→ (/u./uu).(kv _i .see/).s		*	**	
b.	./u./uuk).(see/).s	*!		**	*

Just as in pre-C epenthesis, low-ranking R(St|s) can emerge to determine the prefinal locus of epenthesis in clusters of three consonants.

(31) *Alignment determines prefinal locus of epenthesis*

	/hadl -Siid [L]/	[R&L]	DEP-V	R(St s)	LH
a.	→ .(haa).(di _i .Siid).l	*	*	*	*
b.	.(haad).(l _i .Siid).l	*	*	**!	*

It's important that DEP-V outrank LH itself, since otherwise we predict ubiquitous epenthesis into monomorphemic HH words with medial clusters, e.g. *qaatqaat* 'fishhead'.

(32) *No epenthesis into CVVCCVVC words*

	/qaatqaat/	DEP-V	LH
a.	→ .(qaat).(qaat).		**
b.	.(qaa).(ta _a .qaat).	*!	*

Such words are frequent enough in Ditidaht to show that such epenthesis doesn't occur.

(33) *Some CVVCCVVC words*

- a. wiiqsii 'wind'
- b. JiiXpaal 'six'
- c. tiiSckvii 'urine'
- d. ZuukSiid 'raven'
- e. Jiil siip 'night owl'
- f. jiiijiiJp 'toothache'

A possible problem with this analysis of footing and pre-VV epenthesis is that some words already have unfooted light syllables available to be built into LH iambs, and yet still exhibit pre-VV epenthesis.

(34) *Why not parse earlier light syllables instead of epenthesizing?*

- a. .(fuu).fuj.(Xa.qiil). *(fuu).(fuj.Xqiil).
- b. .(Tuu).Tud.xa.(Ku.kviil). *(Tuu).Tud.(xaK.kviil).

One approach to account for why these earlier light syllables aren't exploited for LH iambs is to call on Output/Output faithfulness to the prosodic structure of the unsuffixed stem.

(35) *Constraint*

ANCHOR-OO/SEGMENT: every segment in an affixed form is parsed into syllables and feet identically to the corresponding segment in the unaffixed form—*Abbreviation*: ANCHOR.

Epenthesizing, rather than footing an earlier syllable, prosodifies the suffixed word more similarly to the unsuffixed stem: .(Tu.Tud).xaK.kv

(36) *ANCHOR-OO/S prevents parsing earlier light syllables*

	/TuTudxaKkv-(kv)iil [L]/	[R&L]	ANCHOR	DEP-V
a. →	.(Tuu).Tud.xa.(K <u>u</u> .kviil).	*	TuuKkv	*
b.	.(Tuu).Tud.(xaK.kviil).	*	TuuxaKkv!	

3.4 Summary

In this section, I concluded that pre-VV boundary epenthesis is also motivated by a conjoined constraint: this time, one that is concerned with stem alignment and foot structure.

(37) *Combined rankings for pre-VV boundary epenthesis*

[R&L], ANCHOR >> DEP-V >> R(St|s), LH-IAMB

While pre-C and pre-VV epenthesis are motivated by different constraints, they have the same repair—epenthesis—for two reasons:

- ◆ In both cases, the constraint motivating epenthesis—either [R&M] or [R&L], outranks DEP-V, the faithfulness constraint that forbids it.
- ◆ In both cases, epenthesis can do something to satisfy the motivating constraint.

Furthermore, I needed the constraint R(St|s)—on the alignment of stems and syllables—in both cases, both to motivate epenthesis in the first place, and then to determine the stem-prefinal locus of epenthesis.

This raises the question of why Ditidaht doesn't resort to some other repair, such as consonant epenthesis, in order to satisfy [R&M] and [R&L]. In Section 4, I discuss the general availability of vowel epenthesis as a repair.

4 Ditidaht vowel alternations

In this section, I cull data from other areas of Ditidaht phonology to support the account of boundary epenthesis developed here.

4.1 Short vowel epenthesis and deletion

In Section 3, I pointed out that while pre-C and pre-VV epenthesis are motivated by different markedness constraints, they have in common that they're satisfied by the same repair: epenthesis. Under the OT analysis developed here, this is because both [R&M] and [R&L] outrank DEP-V.

In fact, we find that both epenthesis and deletion of short vowels are generally available as repairs in Ditidaht. Contexts where short vowels are epenthesized include the following:

- ◆ pre-C: /taafaadaak=s/ → taafaadaaks
- ◆ pre-VV: /haadl -Siidl / → haadil Siidl
- ◆ to augment monosyllables: /hitqs/ → hitqis
- ◆ before glottalic consonants: /zakiSSZ/ → zakiSSiZ ‘stand up!’⁷

Moreover, short vowels are deleted in the following contexts:

- ◆ wherever possible in unfooted syllables
- ◆ in the context VC+V → CV: //aptSiiz=id/ → /aptSzi

The extensive epenthesis and deletion of short vowels in Ditidaht is what renders many otherwise close cognates between Ditidaht and Makah difficult to recognize.

(38) *Ditidaht and Makah vowel alternations*

	Ditidaht	Makah	
a.	haawiCqS	haawiC <u>a</u> qS	‘tell stories’
b.	Ziidq <u>a</u> bs	Ziid <u>a</u> q <u>b</u> is	‘smoke’ / ‘fog’
c.	qaqaw <u>S</u> aKkv	qaqaw <u>a</u> SK <u>u</u> k	‘wild blackberry’ / ‘raspberry’
d.	kvisuuqaKtX	kvisuuqaK <u>a</u> tX	‘live in Canada / USA’

The indiscriminate deletion of unfooted short vowels in later syllables is echoed in Kyuquot, as well as in Makah casual speech vowel deletion.

(39) *Kyuquot: vowel deletion in later syllables*

a.	/u/uKvkv	//u-Kuk[R]/	‘he resembled him’
b.	miixtKvp	/mixt-Kvap[L]/	‘he likes old people’
c.	Hayujl	/Hayu-j i:l /	‘it went on for ten days’
d.	hisiikvsint	/his-i-kv-‘is-int/	‘he traveled along the beach’

(Rose 1981:24-26)⁸

(40) *Makah: vowel deletion in casual speech*

a.	QvaCaqk ~ QvaCa <u>a</u> qk	‘fresh fish’
b.	xad/awSj ~ xad/awi <u>i</u> Sj	‘girl’

- c. /atXiiy/uuqv ~ /atXiiu/uuuqv ‘(in) the night’
- d. waa/aZtduukv ~ waa/aZitduukv ‘she would tell us’

(Werle 2002:387)

The other well-reported Southern Wakashan dialects—Tseshaht (Sapir & Swadesh 1939, Stonham 1999, Davidson 2002) and Ahousaht (Nakayama 2001)—are relatively undeleting.

Consonants, on the other hand, are almost never epenthesisized or deleted in Ditidaht. This seems to reveal something about the organization of the grammar. Generally speaking, faithfulness to short vowels is ranked below a number of markedness constraints that motivate epenthesis and deletion, while faithfulness to consonants and long vowels (or moras) isn’t.

(41) *Consonant Faith, mora Faith, and vowel Faith*

C-FAITH, μ-FAITH >> MARKEDNESS >> V-FAITH

This appears to support the use of at least two of the constraints involved in this analysis: DEP-V and R(St(s):

- ◆ low-ranked DEP-V, because it accounts for the variety of conditions that are repaired by short vowel epenthesis,
- ◆ R(St(s) because of its effects in determining the locus of epenthesis.

5 Conclusion

I offered an analysis of Ditidaht boundary epenthesis involving reference to:

- ◆ syllable structure
- ◆ foot structure
- ◆ alignment of morphological and prosodic categories
- ◆ an Optimality Theoretic implementation

(42) *Combined rankings for Ditidaht*

- a. *COMPLEX-CODA >> *APPENDIX >> NOCODA
- b. [R&M], [R&L], ANCH >> DEP-V >> R(St(s), MAX/M, *APP, LH
- c. R(St(s) >> MAX/M

To respond to the questions raised in the introduction:

- ◆ C and VV endings pattern together in triggering epenthesis because (i) both C and VV endings disturb stem alignment, (ii) both can be repaired by short vowel epenthesis, and because of (iii) the general availability of short vowel epenthesis as a repair strategy in Ditidaht.
- ◆ Suffixes and clitics trigger epenthesis differently because the key constraint R(St|s) only cares about the alignment of the morphological stem, not of the clitics. However, clitics can still trigger epenthesis because they're syllabified into the prosodic word with the stem.
- ◆ Lastly, R(St|s) also proved to be important in determining the locus of epenthesis in both pre-C and pre-VV boundary epenthesis.

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¹ “When a stem-suffix ending in a consonant group comes to stand before another stem-suffix beginning in a consonant or a long vowel, a short vowel (the determination of whose quality is not known) is inserted between the last two consonants of the first suffix... Before the last consonant of the last stem-suffix in the word, a vowel is inserted a) when that consonant stands before a word-suffix [i.e. clitic —AW] beginning in a consonant ...” (Swadesh & Swadesh 1933:201).

² Suffixes and clitics with consonant-only allomorphs include -k/-kv ‘DURATIVE’, -SZ/-jz ‘PERF’, -ckv ‘remains of’, -(k)sc ‘container for’, -/ks ‘consume’, -/tX ‘reside’, -Kkv ‘resemble’, -bs ‘stuff’, -dk ‘have’, -(b)pt ‘plant species’, =s ‘1SG’, =d ‘1PL’, =kv ‘POSS’, =/z ‘now, then’, =/p ‘CAUS’, =/t ‘PASSIVE-INVERSE’.

³ Suffixes whose first vowel is long include -(kv)iil [L] ‘make’, -Siidl [L] ‘off and on’, and -/ee/s ‘going to’. Besides containing long vowels, these suffixes have the following additional properties. (i) The kv of -(kv)iil appears only after vowels. (ii) The suffixes -(kv)iil [L] and -Siidl [L] lengthen the first vowel of their stem, indicated here by [L]. (iii) The suffix -/ee/s induces a glottalizing mutation on the final consonant of its stem.

⁴ This contrasts with Stonham’s analysis of Tseshah Nuuchahnulth syllable structure: maximally CVCCC, with the additional restriction that glottalized segments are forbidden from the coda (Stonham 1990, 1994, 1999).

⁵ Why suppose that appended consonants are appended to the word, as opposed to the mora, syllable, or foot? First, as we’ll see, postvocalic consonants in Ditidaht don’t contribute to syllable weight. Under the proposal of Rosenthal & van der Hulst 1999, coda consonants are either “moraic”: associated with a mora, and hence contributing weight—or “appendices” associated directly to a syllable. If Ditidaht codas are nonmoraic, then under this proposal they must be associated directly to the syllable. Then *appendical* consonants can’t be associated with the syllable, but must be associated with the foot or word. Since appendices aren’t compatible with the normal well-formedness conditions on feet (e.g. binarity), I reason that appendical consonants in Ditidaht are associated directly to the *prosodic word*.

⁶ The constraints Align(Stem, R, s, R) and MAX-s/Morpheme are taken from Walker 2002. My MAX-s/Morpheme is just a renaming of Walker’s MAX-MP_{s-head}: “every morpheme must have a corresponding segment in a syllable head”.

⁷ A constraint that requires glottalic (i.e. voiced or glottalized) consonants to be word-initial or preceded by a vowel is also needed for Makah, in order to drive a process that inserts a long, second syllable copy vowel in order to satisfy this constraint, e.g.: *siqibis* ‘pus’ (Jacobsen 1971, Davidson 2002). Similarly, a significant difference between Heiltsuk and Oowekyala is that the former epenthesizes schwa after glottalized stops and affricates: e.g. *T\$Xt\$Kv\$S* (cf. Oowekyala *txTKvs*) ‘fish hawk’ (Lincoln & Rath 1980:31, Howe 2000:5).

⁸ “It appears that the rightmost vowel is deleted if it is in a third or later syllable, is not obligatorily long, and is not already flanked by any consonant clusters... If a vowel is blocked from deleting, then the rightmost vowel which is capable of deleting will do so.” (Rose 1981:25)