Ditidaht Vowel Alternations and Prosody

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1. Introduction

Ditidaht exhibits patterns of short vowel epenthesis and deletion that are unusually complex among the Southern Wakashan languages. Elaborating on existing descriptions of these alternations (Swadesh and Swadesh 1933:201–202; Thomas and Hess 1981:80–81), I show that the presence or absence of short vowels in surface forms is determined not by their presence or absence in underlying forms, but by how consonants and vowels are parsed into prosodic constituents: syllables, feet, and prosodic words. To this end, I develop an analysis of Ditidaht vowel alternations and prosody in the Optimality Theory framework (Prince and Smolensky 1993).

In addition to the prosodic analysis, it proves necessary to account for phonotactic restrictions on voiced and glottalized consonants, in order to distinguish their effects from those purely prosodic. An additional finding emerging from this study is that all consonants whose articulation involves adducting the vocal folds are subject to a formal condition that they be postvocalic, mirroring what Jacobsen (1971) finds for Makah.

This article is organized as follows. In the rest of section 1, I introduce the alternations of vowel presence and absence that are the subject of this study, previewing the overall analysis. Section 2 is devoted to a discussion of general...
phonotactics, including the alternation that I call Final Absence. Section 3 is concerned with the phonotactics of adducted consonants, whose pervasive effects throughout the phonology include motivating Pre-adducted Presence.

Subsequent sections show how prosodic structures motivate vowel presence and absence. In section 4, I show that the alternations Pre-VV Presence and Medial Absence are based on foot construction. Similarly, section 5 connects Augmentative Presence to a disyllabicity condition on prosodic words. Section 6 summarizes and concludes.

1.1. Preliminary analysis

Based on data from my Ditidaht fieldwork, I identify six patterns in which short vowels alternate with zero, exemplified here (alternating vowels of interest are underlined):¹

(1) Ditidaht vowel-zero alternations:

<table>
<thead>
<tr>
<th>Surface</th>
<th>Underlying</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Augmentative Presence</td>
<td>hitqi</td>
<td>/hit-qs/ ‘be in canoe’</td>
</tr>
<tr>
<td>Pre-adducted Presence</td>
<td>wikbtu</td>
<td>/wik=bt=w/ ‘didn’t (QUOT)’</td>
</tr>
<tr>
<td>Pre-VV Presence</td>
<td>hidiksee?i</td>
<td>/hid-ii-ksee?i/ ‘going to take along’</td>
</tr>
<tr>
<td>Pre-CC Presence</td>
<td>?uk”aqi?</td>
<td>/?uk-k”aqi?/ ‘my name is’</td>
</tr>
<tr>
<td>b. Medial Absence</td>
<td>xiidqabs</td>
<td>/xii-dqab-s/ ‘smoke’</td>
</tr>
<tr>
<td>Final Absence</td>
<td>pisatuk</td>
<td>/pisat-uk=/ ‘Run!’</td>
</tr>
</tbody>
</table>

Of the six alternations in (1), I discuss five in this article, excluding Pre-CC Presence.² These patterns are interrelated to an extent that makes it difficult to talk about one without referring to others. Therefore, I discuss first those processes that have more general effects, and leave until later those whose analyses depend

¹To my knowledge, only three of these alternations are attested in other Southern Wakashan languages: Pre-adducted Presence in Makah (see section 3.3), Medial Absence in Kyuquot, and Final Absence in Makah and Kyuquot (Jacobsen 1971; Rose 1981:24–26; Davidson 2002:83–86).

The following abbreviations are used:

<table>
<thead>
<tr>
<th>ART</th>
<th>PINV</th>
<th>CAUS</th>
<th>Q</th>
<th>COND</th>
<th>QUOT</th>
<th>IMP</th>
<th>RED</th>
<th>IND</th>
<th>SOFT</th>
<th>IRR</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>article</td>
<td>passive-inverse</td>
<td>causative</td>
<td>interrogative</td>
<td>conditional</td>
<td>quotative</td>
<td>imperative</td>
<td>reduplicant</td>
<td>indicative</td>
<td>subject</td>
<td>irrealis</td>
<td>lengthen the first or second syllable</td>
</tr>
</tbody>
</table>

²In Pre-CC Presence, a vowel is retained or epenthesized before the last consonant of a stem-final cluster, in a stem containing no clitics that also occurs as an independent word, when it is followed by a consonant-initial suffix or clitic:
a great deal on what comes before. I devote the remainder of this section to some preliminary discussion of the concepts of presence and absence, as an introduction to the overall analysis.

One point I would like to make is that these patterns of short vowel presence and absence reveal a fundamental orientation in Ditidaht phonology toward targets, as opposed to processes. The terms presence and absence (as opposed to epenthesis and deletion) emphasize that vowel alternations converge on certain consonant-vowel sequences without regard to whether surface vowels reflect underlying vowels. In other words, some constraints force the presence of a vowel, whether this involves retaining an underlying vowel or epenthesizing a new one. Other constraints call for vowel absence, whether this requires deleting an underlying vowel, or failing to epenthesize.

Orientation to targets yields well to analysis in Optimality Theory (OT), under which grammars compare and evaluate surface and underlying forms according to various constraints, rather than stating rules that produce surface forms. In OT, cases where surface forms differ from their underlying forms result from the prioritization of markedness constraints, which restrict surface structure markedness, over faithfulness constraints, which command faithfulness to underlying forms.

The subordination of faithfulness can be an obstacle to analysis, in that it is often difficult to determine whether surface vowels are underlying or epenthetic. Still, we may cite at least the following diagnostics. Underlying vowels have unpredictable quality, can fuse with adjacent segments (see section 2.2), and are likely to be attested in cognates from related languages. Epenthetic vowels, by contrast, have quality that is partially predictable from their environment, do not fuse, and are less likely to be comparatively attested (Matthew Davidson, Thom Hess, William Jacobsen, Terry Klokeid, p.c.).

Take for example the vowel of /-tätx/ 'live at'. It must be underlying because, though frequently lost by Medial Absence (see section 4.3), it can concomitantly fuse with a preceding stem vowel, yielding whatever quality is expected from regular fusion of /a/ with that vowel (see section 2.2):

(2) a. waayaa?tätx /waayaa-tätx/ ‘person from Whyac’
    b. čąayidee?tätx /čąayidei-tätx/ ‘person from China’
    c. ?ıhoo?tätx /?ıhuu-tätx/ ‘person from Ilclo’

(ı) čawaaβt /čawaaβt/ ‘do once’
   kafaįks /kafaįks/ ‘need to drink coffee’
   keyćck /keyćck/ ‘purple (COND.3SG)’
   qałaakt /qałaakt/ ‘He’s my younger brother.’

Although the pattern of Pre-CC Presence appears to be related to syllable structure, the issues raised by this alternation are too complex to deal with in this article.
In addition, this vowel is attested in cognates from neighbouring dialects. Compare Ditidaht cíšaaʔtx (sic), Makah cíšaʔatx̣, and Tseshaht cíšaaʔatth ‘(person from) Tseshaht’.

By contrast, the suffix /-yak/ ‘tool for’ is often preceded by a vowel that is epenthetic (see section 3.2). After vowel-final stems, no vowel is epenthesized (3a), but after consonant-final stems we find vowels varying between /i/ (3b) and /e/ (3c):

(3) a. babúyk /babú-yak/ ‘work’
    baqáyk /baqá-yak/ ‘for what’

b. čišt̓ y̱k /čišt̓-y̱k/ ‘saw’ (tool)
    qic̓ y̱k /qic̓-y̱k/ ‘pen, pencil’

c. ʔake̱yk /ʔake̱-y̱k/ ‘claw’
    q̓awmv̓ y̱k /q̓awmv̓-y̱k/ ‘toy, game’
    daq̓ y̱k /daq̓-y̱k/ ‘mirror’
    kace̱yk /kace̱-y̱k/ ‘measure stick’

One reason for thinking that these vowels are epenthetic is that the forms with epenthetic /i/ appear to get this vowel because their stems contain an /i/ vowel followed by a coronal consonant. Further evidence is that the stem-final /a/ of baqáyk does not become [e], as we would expect if it were fusing with a following underlying /i/.

Many other cases are less clear. For the present, I depend on an etymological criterion, generally assuming that vowels that alternate with zero are underlying if they reflect vowels in cognates from Makah and Tseshaht. It may therefore prove necessary to revise some of the underlying forms posited here in future work.

As this suggests, this article includes examples from Ditidaht, Makah, and the Tseshaht dialect of Nuu-chah-nulth. These are taken from Sapir and Swadesh (1939), Powell (1991), Davidson (2002), an unpublished but extensive Ditidaht wordlist prepared by Thom Hess, and my own fieldwork on Makah (2002) and Ditidaht (2002–present).

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Also in the interest of simplifying the present study, I say as little as possible about some alternations that interact with, but are not crucial to, patterns of vowel presence and absence. These include vowel spreading and metathesis across the non-oral stops /ʔ s/ (e.g., ʔayiiq ∼ ʔayeeʔa ‘there are many’; ʔxaxadaʔ?t ∼ ʔxaxadʔats ‘I’m very’), variable-length vowels (see section 5), and some subtle effects of adducted consonants on word shapes (see note 15).

2. General Phonotactics

This section analyzes some general aspects of Ditidaht phonotactics, laying the groundwork for a fuller account of vowel alternations and prosody in later sections. I show that syllable onsets are simple and obligatory, and that final short vowels are generally banned, in a pattern that I call Final Absence. In addition,
the analysis begun here formalizes a main theme of the article: that faithfulness to short vowels is subordinated to phonotactic considerations, which freely force short vowel epenthesis, deletion, metathesis, and fusion.

2.1. Consonants and vowels

Let us begin by looking at consonants, vowels, and the sequences in which they occur. Ditidaht makes use of the following consonant inventory:\(^3\)

(4) *Ditidaht consonant inventory:*

<table>
<thead>
<tr>
<th>plain obstruents</th>
<th>ñ s š x x\textsuperscript{w} ŵ ŕ x\textsuperscript{w} h</th>
</tr>
</thead>
<tbody>
<tr>
<td>plain stops</td>
<td>p t ś č ř k k\textsuperscript{w} q q\textsuperscript{w}</td>
</tr>
<tr>
<td>adducted consonants</td>
<td>p ř ś č ř k k\textsuperscript{w} q q\textsuperscript{w} ?</td>
</tr>
<tr>
<td>plain voiced stops</td>
<td>b d</td>
</tr>
<tr>
<td>voiced glottalized stops</td>
<td>b d</td>
</tr>
<tr>
<td>plain sonorants</td>
<td>m n l y w</td>
</tr>
<tr>
<td>glottalized sonorants</td>
<td>ř ř ř y w</td>
</tr>
</tbody>
</table>

Just as Jacobsen (1971) finds for Makah, it proves necessary when generalizing over Ditidaht phonotactics to distinguish two general categories among the consonants: plain obstruents and adducted consonants. The adducted consonants (Jacobsen’s “glottalic consonants”) involve adducting the vocal folds, whether to create glottalization or voicing, and are more restricted in their distribution than the plain obstruents.

Glottalization is realized differently on voiced and voiceless consonants. Voiceless glottalized consonants have an ejective release, while glottalized sonorants and voiced stops are consistently preglottalized, even when word-final. This difference becomes relevant in the discussion of adducted consonant phonotactics (see section 3.3).

\(^3\)The following non-IPA consonant symbols are used in this article:


The non-continuant portion of the affricate /ň/ sounds sometimes more apical, and sometimes more palatal. The sound /ň/ is almost or completely non-continuant when prevocalic, but is approximant when non-prevocalic, and involves some epiglottal or pharyngeal gesture, giving it a sound similar to English r. Though it is phonetically voiced, phonotactically it patterns with the voiceless glottalized stops (see section 3.1).

Transcriptions in this article follow the orthographies used by Ditidaht Community School (Nitinat, BC) for Ditidaht, by Ha-Ho-Payuk School (Port Alberni, BC) for Tseshawa, and by the Makah Language Program (Neah Bay, WA) for Makah. The Makah orthography differs from the others only in its use of the symbol /ň/ for the uvular fricative, and the symbols /a e i o u/ for the long vowels.
Ditidaht distinguishes ten vowels:4

(5) **Ditidaht vowel inventory:**

<table>
<thead>
<tr>
<th>Short vowels</th>
<th>Long vowels</th>
</tr>
</thead>
<tbody>
<tr>
<td>i e a o u</td>
<td>ii ee aa oo uu</td>
</tr>
</tbody>
</table>

The data in (6) illustrate the general phonotactics of Ditidaht consonant-vowel sequences, including medial (6a) and final (6b) clusters of interest, and motivating several relevant generalizations. As in most Wakashan languages, words begin with exactly one consonant, and there is no hiatus: vowels are not adjacent to other vowels. As in Makah and Kyuquot, words typically end in consonants or long vowels: final short vowels are banned (with some principled exceptions; see section 2.4). Last, although clusters of up to four consonants occur both medially and finally, these follow the generalization that all adducted consonants are adjacent to some vowel.

(6) **Some consonant-vowel sequences:**

a. baqхаqь ‘be babysat’
dačšawii ‘look through’
picksiʔ ‘grave’
ʔatčьii ‘vomit’ (noun)

b. babуjьk ‘work’
dixпš ‘grapes’
beʔиqь ‘boy’
ciyaаппь ‘hat’

The rest of section 2 addresses the phonotactic restrictions on onsets, hiatus, and final short vowels. I leave an account of adducted consonant phonotactics to section 3.

### 2.2. Syllable onsets

All words begin with exactly one consonant; the simplest analysis of this is that onsets are obligatory and simple: every syllable has an onset, and every onset consists of exactly one consonant (Sapir and Swadesh 1939:13; Stonham 1990:124, 1994:76, 1999:47; Davidson 2002:350, note 7). This also explains why there is no hiatus: if every vowel is a syllable nucleus, and every syllable has an onset, then

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4The Ditidaht vowels are pronounced as follows:

(i) i [i] ~ [i] e [ɛ] ~ [æ] a [a] ~ [a] o [o] u [u] ~ [u]

As in Makah, the short and long vowels contrast primarily in duration (rather than quality). The short vowels tend to be pronounced lax (close to the centre of the vowel space), but are tenser (more peripheral) preceding glides /y w/, voiced glottalized consonants /b d m n ŋ ŋ/ and the non-oral stops /p t s/.
any two vowels will be separated by at least one consonant. Although it is not obvious that non-initial syllables also have simple onsets, I will assume henceforth that all syllables obey the same restrictions on onsets.

In OT analyses of syllable structure, the cross-linguistic preference for syllables to have onsets is expressed by the constraint ONSET:

(7) **ONSET**: Syllables have onsets. (Prince and Smolensky 1993:17)

ONSET belongs to the class of markedness constraints, which express preferences for certain structures in surface forms. These often conflict with faithfulness constraints, which prefer that surface forms resemble underlying forms. Three general faithfulness constraints that will be of concern in this study are the constraint that ensures that an input segment has at least one corresponding output segment (MAX), the constraint that ensures that an output segment depends on at least one corresponding input segment (DEP), and the constraint that ensures that an output segment corresponds to only one input segment (UNIFORMITY). The effects of these constraints are such that MAX, DEP, and UNIFORMITY forbid deletion, epenthesis, and fusion, respectively. I make use of versions of MAX and DEP that specifically forbid deletion and epenthesis of vowels:

(8) a. **MAX/V**: A vowel in the input has a correspondent in the output.
    b. **DEP/V**: A vowel in the output has a correspondent in the input.
    c. **UNIFORMITY**: An output segment has only one input correspondent.

These constraints are defined over correspondences between input and output structures, according to the Correspondence Theory of faithfulness (McCarthy and Prince 1995).

The principles expressed by the constraints ONSET, MAX/V, and UNIFORMITY interact in processes of vowel fusion, by which adjacent /a i/ fuse to become [e], and /a u/ fuse to become [o], in order to prevent hiatus: 5

(9) **Vowel fusion:**

<table>
<thead>
<tr>
<th>Input</th>
<th>Surface</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>/hiyu=/ʔąʔ/</td>
<td>hiyooʔą</td>
<td>‘finished now’</td>
</tr>
<tr>
<td>/hqʔ/c-ą/</td>
<td>hqʔ/caʔʔ</td>
<td>‘go back’</td>
</tr>
<tr>
<td>/pipʔ=ʔak=iiʔ/</td>
<td>pipʔ/ceʔ/kik</td>
<td>‘your ears’</td>
</tr>
<tr>
<td>/RED-saantii-ąats/</td>
<td>saasanteetx</td>
<td>‘Saturday’</td>
</tr>
</tbody>
</table>

The fact that these surface vowels differ from the underlying vowels that contribute to them shows that this is fusion, rather than deletion. The significance of fusion for our analysis is that it shows that the directives of the markedness constraint ONSET (which requires that a syllable have an onset) and the faithfulness

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5The metathesized, fused, and deleted vowels of pipʔ/ceʔ/kik, hoʔ/caʔʔ, and hiyooʔą are lost by regular processes associated with Hardening (section 2.4) and Medial Absence (section 4.3). As these examples illustrate, most cases of vowel fusion in Ditidaht involve vowel metathesis across the non-oral stops /ʔ/.
constraint Max/V (which requires that a vowel in the input have a corresponding vowel in the output) are fulfilled at the expense of the faithfulness constraint Uniformity (which requires that an output segment have only one corresponding input segment).

In the OT framework, conflicts between constraints are resolved by constraint ranking: the relative ranking of two constraints in the grammar of a particular language determines which is satisfied and which is violated in cases where they conflict. The fact that Ditidaht resorts to vowel fusion in order to prevent hiatus, as seen above, shows that Onset and Max/V outrank Uniformity. The fused output (10a), which violates Uniformity, is preferred to candidates involving deletion (10b) or hiatus (10c).

(10)

<table>
<thead>
<tr>
<th>/RED-saantii-aatx/ ‘Saturday’</th>
<th>Onset: Max/V</th>
<th>Uniformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. .saa.saan.teetx.</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. .saa.saan.taatx.</td>
<td>!</td>
<td></td>
</tr>
<tr>
<td>c. .saa.saan.tii.aatx.</td>
<td>!</td>
<td></td>
</tr>
</tbody>
</table>

In fact, Onset is never violated in Ditidaht. However, the nature of codas is more elusive. It is not obvious whether all consonants not parsed as onsets are parsed as codas, or whether large medial and final consonant clusters are appended to higher prosodic constituents, such as feet and words. I leave this question open for future work, and assume in this article that all consonants not parsed as onsets are parsed into potentially complex codas (e.g., .Paptś.Aid. ‘we hid’, .ci.yaapx"s. ‘hat’).6

On the subject of faithfulness, we must consider faithfulness not only to short vowels, but also to consonants and long vowels. Consonants and long vowels are never deleted or epenthesized, despite the fact that such deletion and epenthesis might improve some surface forms. For example, another strategy to avoid hiatus in /RED-saantii-aatx/ (10) would be to epenthize a consonant between the two offending vowels. The preference for fusion over consonant epenthesis shows that the faithfulness constraint Uniformity is outranked not only by the markedness constraint Onset, but also by some constraint against consonant epenthesis.

I assume that constraints against epenthesis and deletion of consonants and long vowels, and against non-morphological vowel lengthening and shortening, are not crucially dominated in Ditidaht; that is, they are not outranked by any constraints that conflict with them, and therefore are never violated. Unfortunately, space limits further discussion concerning the definitions and rankings

6I know of no reason to think that consonants are ever syllabic in Ditidaht, as has been suggested for Bella Coola (Salish; Hoard 1978:68–71, cf. Bagemihl 1991) and Oowekyala (Northern Wakashan; Howe 2000:9–17). Ditidaht has no vowelless words, consonants never bear stress, nor even contribute to syllable weight (section 4.1), and consonants always reduplicate along with some adjacent vowel, never alone.
of these constraints. Therefore, I will continue to propose rankings involving
the constraints on faithfulness to short vowels (MAX/V and DEP/V), but leave
consideration of faithfulness to consonants and long vowels at this (regard-
ing differentiation of MAX/C and MAX/V, see McCarthy and Prince 1995).

2.3. Final Absence

Recall the third phonotactic generalization from section 2.1, that short vowels are
(generally) banned at the ends of words. In fact, although non-alternating forms
support this observation, few alternating forms show the existence of underlying
short vowels that surface in some forms, but are lost in others (in contrast to

Two alternations that do give evidence for underlying final short vowels,
however, involve imperatives and variable-length vowels. The short vowel of the
imperative clitic /=?i/ surfaces after fricative-final stems, where it is protected by
metathesis of the clitic’s glottal stop (11a). But after stems ending in plain obstru-
ents, this vowel is deleted under the general pattern of Final Absence (11b).

(11) Final Absence in imperatives:
   a. kwiiy/=Pi/ 'Be quiet!'
      kwiiya/=Pi/ 'Keep still!'
   b. Xici/=Pi/ 'Shoot (gun)!'
      pisatu/=Pi/ 'Run!'

Another alternation illustrating Final Absence is Variable-length Vowel Short-
ening. Variable-length vowels are pronounced long in a first or second syllable
(12a), but are shortened in third and later syllables (see section 5). When this
shortening would otherwise yield a final short vowel, it is deleted by Final Ab-
sence (12b).

(12) Final Absence of variable-length vowels:
   a. /ii-ck=i/; 'footprints (of a human)'
      /ii-cak=i/; 'footprints (of an animal)'
   b. /iidit-cck=vi/; 'remains of snot'
      /i-pac-cck=vi/; 'remains of a canoe'

I surmise that Final Absence satisfies the markedness constraint FiNA-L-C:

(13) FiNA-L-C: Prosodic words end in consonants. (McCarthy 1993:176)

   By prosodic word, I mean a phonological constituent that, in Ditidaht, is left-
aligned with a root or a reduplicative prefix, is right-aligned with the last suffix
or enclitic, begins with exactly one consonant, and is the domain of word stress
(see section 4.1) and variable-length vowel length determination (see section 5).
Although it generally corresponds to the orthographic word, some orthographic

7The imperative clitic also happens to be a hardening ending; see section 2.4.
words aren’t pronounced as prosodic words, including deictic elements like *tu ‘this’, *ya ‘that’, *xa? ‘that (far away)’, and reduced *yuwa? ‘then’.

Since FINAL-C is satisfied in Ditidaht by deleting word-final short vowels, in violation of MAX/V, I conclude that FINAL-C outranks MAX/V:

(14) **FINAL-C is satisfied by short vowel deletion:**

<table>
<thead>
<tr>
<th>/ʔį-čiƛʔ=ʔi/ ‘Shoot (gun)!’</th>
<th>FINAL-C</th>
<th>MAX/V</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ’čiƛƛ’</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. ’čiƛƛƛ’</td>
<td></td>
<td>!</td>
</tr>
</tbody>
</table>

To summarize the analysis so far, ONSET motivates vowel fusion, while FINAL-C motivates Final Absence. We will see as the analysis develops that these are just two cases among many where the low rankings of MAX/V, DEP/V, and UNIFORMITY make short vowel deletion, epenthesis, and fusion generally available as strategies for improving surface markedness.

### 2.4. Strong short vowels and Hardening

Before closing this discussion of Ditidaht phonotactics, I address two other phenomena that are not a focus of this article, but whose effects must be understood in order to consider the vowel-zero alternations that are the focus. These are strong short vowels and the Hardening mutation.

While most underlying short vowels freely undergo deletion, as well as metathesis with the non-oral stops /ʔ ʔ/, a few morphemes contain short vowels that are never deleted or metathesized (Swadesh and Swadesh 1933:201). Such vowels share no other apparent property, except perhaps that they are usually /a/, and are more frequent in enclitics than in roots or suffixes. While this article does not involve an analysis of these morphemes, at least one case warrants mention, as it occurs frequently in my examples. This is the vowel of the indicative clitic /=ʔa/:

(15) **Some morphemes containing strong short vowels:**

<table>
<thead>
<tr>
<th>Morpheme</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. čačaƛƛ ‟correct, okay”</td>
<td>čačaƛƛ ‟correct, okay”</td>
</tr>
<tr>
<td>b. /=ʔqsp/ ’woman (from)’</td>
<td>bablaʔqsp ’white woman’</td>
</tr>
<tr>
<td>c. /=ʔiik/ ’Q.2SG’</td>
<td>baʔiiksi ’What are you eating?’</td>
</tr>
<tr>
<td>d. /=ʔa/ ’IND.3SG’</td>
<td>daʔaʔaʔa ’3SG hears, understands’</td>
</tr>
<tr>
<td>e. /=ka/ ’SOFT’</td>
<td>wikika ’Don’t!’</td>
</tr>
</tbody>
</table>

8To my knowledge, the free pronouns siʔa ‘1SG’, suʔa ‘2SG’, the clitics /=ʔa/ ‘IND.3SG’, /=ʔaʔ/ ‘SOFT’, and the interjections siʔ ‘okay, goodbye, next’ and ku ‘here you go’ are the only morphemes in Ditidaht that resist Final Absence. Morphemes that resist Medial Absence are less rare, but occur, I estimate, in fewer than ten percent of Ditidaht morphemes.
We must therefore include strong short vowels with consonants and long vowels in the class of undeletable segments. In this study, I assume that strong short vowels differ underlyingly in some way from normal vowels, and are protected by constraints specific to them. As with the problem of distinguishing underlying and epenthetic vowels (section 1.2), progress on the problem of strong short vowels must await a fuller analysis of regular vowel alternations.

Another phenomenon that bears on many examples in this article is Hardening. As across the Wakashan languages, one finds suffixes and clitics in Ditidaht that mutate preceding consonants, most commonly by glottalization, or “Hardening” (Swadesh and Swadesh 1933:199–200; Thomas and Hess 1981:18–19; Jacobsen 1996; Kim 2001:180–183). These are some common Ditidaht hardening suffixes (16a) and clitics (16b):9

(16) a. Hardening suffixes:
-ʔeeʔis ‘going to’
-ʔatx ‘live at’
-ʔiʔks ‘consume’

b. Hardening clitics:
=ʔa ‘IND.3SG’ =ʔaʔ ‘now’
=ʔaq ‘ART’ =ʔap ‘CAUS’
=ʔi ‘IMP’ =ʔit ‘PINV’

The effects of Hardening depend on the nature of the preceding sound, as summarized in (17) (some peculiarities of Hardening are ignored here).

(17) The Hardening mutation:

<table>
<thead>
<tr>
<th>Stem</th>
<th>Plus ending</th>
<th>Underlying</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ʔiiʔci</td>
<td>ʔiiʔci</td>
<td>ʔiiʔcʔaʔa ‘then walked’</td>
</tr>
<tr>
<td>ʔuuʔap</td>
<td>ʔuuʔapʔaʔa</td>
<td>ŋuʔapʔaʔa ‘foreigner, people to east’</td>
</tr>
<tr>
<td>duub</td>
<td>duubʔiʔ</td>
<td>/duubʔiʔ ‘eat everything’</td>
</tr>
<tr>
<td>kiikii</td>
<td>kiikiiʔa</td>
<td>/kiikiiʔa ‘3SG is fast’</td>
</tr>
<tr>
<td>b. bucibux</td>
<td>bucibuxʔa</td>
<td>/bucibuxʔa ‘bear (ART)’</td>
</tr>
<tr>
<td>ʔiniʔq</td>
<td>ʔiniʔqʔa</td>
<td>/ʔiniʔqʔa ‘there are few’</td>
</tr>
<tr>
<td>c. yubul</td>
<td>yubulʔa</td>
<td>/yubulʔa ‘can’t now’</td>
</tr>
<tr>
<td>saʔaas</td>
<td>saʔaasʔaʔa</td>
<td>/saʔaasʔaʔa ‘crawling one (ART)’</td>
</tr>
<tr>
<td>d. diitiidʔa</td>
<td>diitiidʔaʔaʔa</td>
<td>/diitiidʔaʔaʔa ‘Ditidaht (person)’</td>
</tr>
<tr>
<td>qaliʔ</td>
<td>qaliʔʔa</td>
<td>/qaliʔʔa ‘it is an eye’</td>
</tr>
<tr>
<td>e. tii</td>
<td>tiiʔiʔks</td>
<td>/tiiʔiʔks ‘drink tea’</td>
</tr>
<tr>
<td>qakaʔ</td>
<td>qakaʔʔa</td>
<td>/qakaʔʔa ‘there are three’</td>
</tr>
<tr>
<td>bablaʔ</td>
<td>bablaʔʔa</td>
<td>/bablaʔʔa ‘white person (ART)’</td>
</tr>
<tr>
<td>tayeʔ</td>
<td>tayeʔʔa</td>
<td>/tayeʔʔa ‘he is an older brother’</td>
</tr>
</tbody>
</table>

9Although there are reasons in other dialects to suppose that Hardening is caused by a segment or feature distinct from /ʔ/ (Jacobsen 1996; Davidson 2002:56–57), in Ditidaht the simplest analysis appears to be that it results from an underlying /ʔ/. I therefore assume /ʔ/-initial underlying forms for these endings.
These examples show that Hardening glottalizes underlyingly non-glottalized stops and sonorants (17a), except for /q/, which glottalizes after consonants, but becomes /Ɂ/ after vowels (17b). After fricatives, /Ɂ/ metathesizes with normal short vowels, but vanishes before strong short vowels (17c). After /Ɂ/-final stems, both stem and ending undergo vowel-Ɂ metathesis, yielding a long vowel flanked by two Ɂs (17d). Lastly, after vowels and glottalized oral consonants, hardening is realized as [ʔ] (17e).

This concludes the discussion of general phonotactics. The next section gives an overview of adducted consonant phonotactics, and their effects on vowel alternations.

3. Adducted Consonant Phonotactics

Adducted consonants — consonants whose laryngeal articulation involves adducting the glottis, whether for voicing or for glottalization — are subject to phonotactic constraints on their co-occurrence with vowels. The relevance of these constraints for the present study is that they motivate the vowel alternation that I call Pre-adducted Presence.

3.1. Adducted consonant sequencing restrictions

Ditidaht consonant phonotactics are determined by consonants’ laryngeal articulations (plain, voiced, glottalized), rather than by supralaryngeal manner (stop, fricative, sonorant) or place (labial, coronal, dorsal). While plain obstruents freely form clusters in any order, clusters containing adducted consonants are highly restricted. We may distinguish three groups within the adducted consonants, differing by the severity of the requirements on their co-occurrence with vowels: voiceless glottalized /p t ŋ c ĺ k w q w ʔ/, plain voiced /b d m n l y w/, and voiced glottalized /b d m n l y w/.

To gain an understanding of Ditidaht consonant sequencing restrictions, it is easiest to begin with the relatively unrestricted plain obstruents. These include the plain stops /p t ŋ c ĺ k w q w ʔ/ and the fricatives /s š x x w/ and are found in four significantly different phonotactic environments: initial, postvocalic, postconsonantal, and non-vowel-adjacent. I exemplify these in (18) with the plain obstruent /t/.

(18) Possible phonotactic environments for plain obstruents:

vowel-adjacent environments
a. initial ṭaala ‘money’
b. postvocalic
   intervocalic čitiy ‘saw’ (tool)
   postvocalic and preconsonantal qaaltąg ‘younger brother’
   final postvocalic qaataqat ‘head’
c. postconsonantal (and prevocalic) ṭaptə ‘hiding’
d. non-vowel-adjacent environments
   interconsonantal         hitakqaa ‘underneath’
   final postconsonantal    qaqapt ‘alder tree’

Henceforth, I will refer only to the four significantly different environments.

Adducted consonants must always be next to a vowel; in the terminology of (18), they are never non-vowel-adjacent. Of the three remaining environments, all adducted consonants can be postvocalic, and all but the voiced glottalized consonants are found initially, but only the voiceless glottalized consonants can be postconsonantal.

Table 1 summarizes these generalizations. Columns list phonotactic environments from the least marked to the most marked, and rows list the four consonant classes distinguished by their laryngeal features, also from the least to the most marked, as follows: plain obstruents (T), voiceless glottalized (T’), plain voiced (R), and voiced glottalized consonants (R’). Cells give an example of each combination of environment and consonant type (for glosses, see preceding and following data sets in this section).

<table>
<thead>
<tr>
<th></th>
<th>Post vocalic</th>
<th>initial</th>
<th>post consonantal</th>
<th>non-vowel-adjacent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain obstruents (T)</td>
<td>qałaʔk</td>
<td>ʔaala</td>
<td>ʔapʔaa</td>
<td>qaqapt</td>
</tr>
<tr>
<td>Voiceless glottalized (T’)</td>
<td>waʔiʔks</td>
<td>ʔaba</td>
<td>ʔaqʔplá</td>
<td>*</td>
</tr>
<tr>
<td>Plain voiced (R)</td>
<td>balaʔaʔk</td>
<td>ʔisīʔk</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Voiced glottalized (R’)</td>
<td>hitaʔdá</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

It is worth emphasizing here that, in Ditidaht, the voiced stops have the same distribution as the other voiced sounds (i.e., the sonorants), rather than that of the other stops. This is what I mean by generalizing that Ditidaht consonant phonotactics depend on consonants’ laryngeal — rather than supralaryngeal — articulations.

The following data sets exemplify these generalizations. As depicted in Table 1, we find that the voiceless glottalized, plain voiced, and voiced glottalized consonants occur in gradually more restricted contexts as we look at them in turn.

The least restricted of these, the voiceless glottalized consonants, are almost as free as plain obstruents, but must be vowel-adjacent. They are found postvocalically (19a), initially (19b), and postconsonantally (19c).

Some borrowed words exceptionally contain postconsonantal voiced consonants, such as saplił ‘bread’ and muusmus ‘cow’ from Chinook Jargon (Sapir and Swadesh 1939), and liplaaš ‘board’ from French by way of Chinook Jargon. The word wadaxč ‘cougar’ exceptionally contains a non-vowel-adjacent voiceless glottalized consonant; I do not know the source of this word.

10Some borrowed words exceptionally contain postconsonantal voiced consonants, such as saplił ‘bread’ and muusmus ‘cow’ from Chinook Jargon (Sapir and Swadesh 1939), and liplaaš ‘board’ from French by way of Chinook Jargon. The word wadaxč ‘cougar’ exceptionally contains a non-vowel-adjacent voiceless glottalized consonant; I do not know the source of this word.
(19) a. Postvocalic voiceless glottalized consonants:

\[
\begin{align*}
\text{ha}a\text{aad} & \quad \text{‘bathe’} \\
\text{wa}x\text{iik} & \quad \text{‘eat kelp’} \\
\text{kaapi} & \quad \text{‘barbecue’} \\
\text{či}č\text{či} & \quad \text{‘toothache’}
\end{align*}
\]

b. Initial voiceless glottalized consonants:

\[
\begin{align*}
\text{tabaa} & \quad \text{‘break song’} \\
\text{pji} & \quad \text{‘ears’} \\
\text{kaapi} & \quad \text{‘harbour seal’}
\end{align*}
\]

c. Postconsonantal voiceless glottalized consonants:

\[
\begin{align*}
\text{qaw} & \quad \text{‘salmonberry’} \\
\text{qa} & \quad \text{‘burden basket’}
\end{align*}
\]

Although voiceless glottalized consonants can be postconsonantal, as in (19c), such cases are almost all derived by the Hardening mutation plus Medial Absence (sections 2.4 and 4.3). That is, such sequences are rare in underlying forms.

Plain voiced consonants are only postvocalic (20a) or initial (20b).

(20) a. Postvocalic plain voiced consonants:

\[
\begin{align*}
\text{hiidub} & \quad \text{‘be born’} \\
\text{ba} & \quad \text{‘Malachan’ (place)} \\
\text{tii} & \quad \text{‘bell’} \\
\text{hu}la\text{ati} & \quad \text{‘have a snack’} \\
\text{qa} & \quad \text{‘burden basket’}
\end{align*}
\]

b. Initial plain voiced consonants:

\[
\begin{align*}
\text{b}uulaa & \quad \text{‘motor’} \\
\text{ba} & \quad \text{‘land’} \\
\text{la} & \quad \text{‘lick’} \\
\text{g}a & \quad \text{‘grizzly bear’} \\
\text{wa} & \quad \text{‘have as relative’}
\end{align*}
\]

Finally, the voiced glottalized consonants are found only after vowels:

(21) \[
\begin{align*}
\text{babu} & \quad \text{‘work’} \\
\text{na} & \quad \text{‘I, me’} \\
\text{si} & \quad \text{‘father’} \\
\text{tayee} & \quad \text{‘older brother’} \\
\text{babu} & \quad \text{‘get closer’}
\end{align*}
\]

While the vowel-adjacency requirement on adducted consonants holds generally across the Southern Wakashan languages (with the exception of Kyuquot; see Rose 1981), only in Ditidaht are voiced sounds avoided after consonants (section 3.3).

3.2. Pre-adducted Presence

The preceding phonotactic generalizations hold robustly, to the extent that they productively motivate Pre-adducted Presence, an alternation where vowels are retained or epenthesized before adducted consonants (Jacobsen 1971:7). A frequent source of this alternation is underlying forms in which a suffix beginning with an
adducted consonant follows a consonant-final stem, as in the following examples (examples with vowel-final stems are also included for comparison):

(22) Pre-adducted Presence before suffixes:

a. qačičq /qač-čq/ ‘three o’clock’
cawaačq /cawaa-čq/ ‘one o’clock’
b. hiwičąs /hiwič-bis/ ‘cloud’
ʔučąbs /ʔučq-bis/ ‘fog’
c. qakačądk /qakač-daʔk/ ‘have three’
ʔudaak /ʔu-daʔk/ ‘have’
d. kacęykü /kac-yak/ ‘measure stick’
ʔuʔak /ʔu-ʔak/ ‘use for’

That these presuffixal vowels are epenthetic is clear from their variable quality across forms, and from the lack of vowel fusion after vowel-final stems (e.g., cawaačq, ʔudaak, not *caweečq, *ʔodaak; section 2.2).

Pre-adducted Presence is also observed before enclitics, as in (23). Like the suffixes in (22), the voiced consonant-initial clitics in (23a–b) are necessarily preceded by a vowel. The hardening clitics in (23c–d) produce a different pattern: since they glottalize the last consonant of their stem (section 2.4), they force vowel retention or epenthesis inside the stem, before the newly glottalized consonant.

(23) Pre-adducted Presence before enclitics:

<table>
<thead>
<tr>
<th>Stem</th>
<th>Cliticized</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. qaxšįx</td>
<td>qaxšįxʷuw /qaxšįxʷ=ʷ/ ‘died (QUOT)’</td>
</tr>
<tr>
<td>waa</td>
<td>waa/w /waa=ʷ/ ‘said (QUOT)’</td>
</tr>
<tr>
<td>b. ʔoʔatąx</td>
<td>ʔoʔatąxʷis /ʔoʔatxʷis/ ‘live at (IRR)’</td>
</tr>
<tr>
<td>qʷiššaʔa</td>
<td>qʷiššaʔwaʔs /qʷiššaʔwaʔs/ ‘need to smoke (IRR)’</td>
</tr>
<tr>
<td>c. diidiitdiq</td>
<td>diidiitdiqʷ /RED-1.1.-diiti-da_qʷʔʔ/ ‘Speak Ditidaht!’</td>
</tr>
<tr>
<td>ʔaʔaʔaʔa</td>
<td>ʔaʔaʔaʔaʔa /ʔaʔaʔaʔaʔaʔa/ ‘Stand up!’</td>
</tr>
<tr>
<td>d. hułačšįx</td>
<td>hułačšįxʷ /hułačšįxʷʔʔ/ ‘then started dancing’</td>
</tr>
<tr>
<td>babuyk</td>
<td>babuykʷaʔ /babuykʷaʔʔ/ ‘then worked’</td>
</tr>
</tbody>
</table>

I propose to account for Pre-adducted Presence using the following markedness constraints:

(24) a. V-Adj: An adducted consonant is adjacent to some vowel (in its prosodic word).
b. VC’: A glottalized consonant is postvocalic (in its prosodic word).
c. VR: A voiced consonant is postvocalic (in its prosodic word).
d. VR’: A voiced glottalized consonant is postvocalic (in its prosodic word).

The following analysis will show that, while some of these constraints are crucially outranked, and therefore sometimes violated, all are active in the grammar. Further, the directional markedness constraints (VC’, VR, VR’), as defined here,
account both for Pre-adducted Presence, and for the neutralization of glottalization on initial voiced consonants.

Take the neutralization of glottalization on initial voiced consonants. Since this reflects a historical deglottalization, alternations showing synchronic deglottalization are hard to find. However, baabiiks ‘older sibling’ may be such a case, since its Tseshaht cognate niiaatiiiqsu indicates an underlying initial /bl/.

I motivate the neutralization to initial /b/ by ranking VR’ (the markedness constraint that requires that a voiced glottalized consonant be postvocalic) over IDENT(cgl), a member of the IDENT constraint family (McCarthy and Prince 1995) that enforces faithfulness to underlying glottalization. Voiceless consonants, on the other hand, do contrast for glottalization initially, indicating that IDENT(cgl), in turn, outranks VC’ (the markedness constraint that requires that a glottalized consonant be postvocalic) (25).

(25) *Glottalization is neutralized initially only on voiced consonants:*

<table>
<thead>
<tr>
<th>/baabiiks/ ‘older sibling’</th>
<th>VR’</th>
<th>IDENT(cgl)</th>
<th>VC’</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. baabiiks</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. baabiiks</td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Another strategy to satisfy VR’ here would be to epenthesize a vowel before the offending consonant, as in candidate (26b). Since deglottalization is preferred to word-initial epenthesis, I conclude that the markedness constraint ONSET also outranks faithfulness to underlying glottalization (IDENT(cgl)).

(26) *Initial vowel epenthesis is ruled out by ONSET:*

<table>
<thead>
<tr>
<th>/baabiiks/ ‘older sibling’</th>
<th>ONSET</th>
<th>IDENT(cgl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. baabiiks</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. aaabiiks</td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>

Medially, on the other hand, vowel epenthesis is the preferred strategy for satisfying constraints on adduced consonant sequences, since medial vowel epenthesis does not risk violating ONSET. Since voiced consonants (whether plain or glottalized) are never postconsonantal, I conclude that VR outranks DEP/V, forcing epenthesis if necessary to satisfy VR, and yielding the pattern of Pre-adducted Presence (27).

11 Epenthesizing a consonant to support an epenthetic vowel (e.g., *?abaabiiks*) is also impossible by the general restriction on consonant epenthesis (section 2.2).
(27) Non-initial voiced consonants force Pre-adducted Presence:

<table>
<thead>
<tr>
<th>/red-t̠-baʔs/ ‘houses’</th>
<th>VR</th>
<th>DEP/V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. baat̠baʔs</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. baat̠baʔs</td>
<td>**!</td>
<td></td>
</tr>
</tbody>
</table>

The relevant part of this example is the second /b/, which is repaired by epenthesis. The fact that the first /b/ also violates VR, yet is not repaired by epenthesis or devoicing, shows that ONSET and IDENT(voice) also outrank VR (tableau not shown).

In contrast to non-initial voiced consonants, which always motivate Pre-adducted Presence, vowel epenthesis in the vicinity of voiceless glottalized consonants is more complex. First, since voiceless glottalized consonants are not necessarily postvocalic, I conclude that VC’ is ranked lower than DEP/V, and therefore cannot force epenthesis (28).

(28) Voiceless glottalized consonants do not force Pre-adducted Presence:

<table>
<thead>
<tr>
<th>/čičkawaʔs/ ‘chum salmon’</th>
<th>DEP/V</th>
<th>VC’</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. čičkawaʔs</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. čičkákwaʔs</td>
<td></td>
<td>*!</td>
</tr>
</tbody>
</table>

However, while voiceless glottalized consonants need not be postvocalic, they must still be vowel adjacent, which sometimes requires epenthizing a vowel. I capture this by ranking the general constraint V-ADJ above DEP/V. Importantly, such cases also show that the low-ranked VC’, while unable to force epenthesis, determines that the locus of epenthesis in these cases precedes, rather than follows the triggering consonant (29).

(29) Voiceless glottalized consonants sometimes trigger Pre-adducted Presence:

<table>
<thead>
<tr>
<th>/qaž-čq/ ‘three o’clock’</th>
<th>V-ADJ</th>
<th>DEP/V</th>
<th>VC’</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. qažčq</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. qažčq</td>
<td></td>
<td>*</td>
<td>*!</td>
</tr>
<tr>
<td>c. qažčq</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
</tbody>
</table>

The preceding examples show that, while voiceless glottalized consonants require the presence of an adjacent vowel, whether this vowel precedes or follows is subject to a number of factors. To see this, compare the cases in (30). These illustrate that we find voiceless glottalized consonants with following vowels when the consonant is word-initial (30a), when the following vowel is required to support

\[12\] While this accounts for the data seen so far on the distribution of voiceless glottalized consonants, I will find reason to reconsider the ranking of DEP/V and VC’ in section 4.3.
a voiced consonant (30b), or when the following vowel is undeletable because it is an strong short vowel (30c) (section 2.4). Voiceless glottalized consonants are preceded by vowels only when a following vowel is prohibited by Final Absence (30d) (section 2.3), or when none of these factors intervenes, and V-ADJ and VC’ work together to force Pre-adducted Presence (30e).

(30) Vowel presence next to voiceless glottalized consonants:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>/laaq/</td>
<td>‘real, true, straight’</td>
</tr>
<tr>
<td>b.</td>
<td>/čičkawaʔs/</td>
<td>‘chum salmon’</td>
</tr>
<tr>
<td>c.</td>
<td>/qaqap=ʔa/</td>
<td>‘it is an alder tree’</td>
</tr>
<tr>
<td>d.</td>
<td>/R E D-su-duk-ʔiʔi/</td>
<td>‘Take (someone’s) hand!’</td>
</tr>
<tr>
<td>e.</td>
<td>/qaq-čq/</td>
<td>‘three o’clock’</td>
</tr>
</tbody>
</table>

Of these five cases, VC’ is active only in the last.

To summarize this analysis of adducted consonant phonotactics, the constraints that I have proposed account both for Pre-adducted Presence and for the neutralization of glottalization on initial voiced consonants. While VR’ drives neutralization, VR drives vowel presence before voiced consonants. The general constraint V-ADJ forces presence in the vicinity of voiceless glottalized consonants — since the more specific VC’ is too low-ranked for this purpose — yet VC’ makes itself felt by preferring preceding over following vowel presence when other priorities do not take precedence.

3.3. Phonetic and formal constraint grounding

In this final section on adducted consonant phonotactics, I address some issues raised by the constraint set \( \langle V-ADJ, VC’, VR, VR’ \rangle \) used in the preceding analysis of Pre-adducted Presence. Of these constraints, V-ADJ and VC’ have only minor effects in the analysis, and stand apart from VR and VR’ in lacking a clear phonetic motivation. In what follows, I evaluate the phonetic and formal motivations for these constraints.

The constraints \( \langle VC’, VR, VR’ \rangle \) collectively require that adducted consonants be postvocalic. In the case of voiced glottalized consonants, this may be connected directly to these sounds’ perceptibility. Voiced glottalized consonants are preglottalized, usually involving mere glottal constriction rather than full closure, and are perceptible best by their tensing and lengthening of preceding vowels (see note 4). Their postvocalicity therefore enhances their perceptibility. As for plain voiced sounds, one might argue that they are preferentially postvocalic in order to make apparent their lack of glottalization, to distinguish them from their glottalized counterparts.

As for voiceless glottalized consonants, their glottalization is perceptible only in their ejective release, which is therefore more perceptible on a following vowel. The postvocalicity requirement expressed by VC’ therefore does not help to distinguish them from the plain stops. The same objection may be brought against
V-ADJ, which does not even specify on which side an adducted consonant should be vowel adjacent.

However, despite the lack of direct phonetic motivation for VC’ alone, the constraint set (VR’, VR, VC’), ranked as it is in Ditidaht, respects an implication that is phonetically grounded: the consonants that depend most on preceding vowels for their perceptibility (i.e., voiced glottalized) must be postvocalic, while those that are the least dependent on preceding vowels (voiceless glottalized) merely tend toward postvocalicity.

Further support that VC’ is a constraint comes from Pre-adducted Presence in Makah (Jacobsen 1971:1–10). The following data illustrate how Makah realizes this alternation differently from Ditidaht. As in Ditidaht, Pre-adducted Presence in Makah requires vowels before adducted consonants. In Makah, however, this vowel is always long, is a copy of the root vowel, and is inserted only after an initial syllable that contains a short vowel. Last, in Makah, voiceless glottalized consonants trigger this alternation just like other adducted consonants. The examples in (31b) show that adducted consonants later in the word do not trigger epenthesis in Makah.

(31) Pre-adducted Presence in Ditidaht and Makah:

<table>
<thead>
<tr>
<th>Ditidaht</th>
<th>Makah</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. lakevik</td>
<td>lakayak 'tongue'</td>
</tr>
<tr>
<td>kuxsqwii</td>
<td>kuxsqwi 'hole through'</td>
</tr>
<tr>
<td>bixsnaa</td>
<td>bixsnaa 'rain off and on'</td>
</tr>
<tr>
<td>luçiidaak</td>
<td>luçiidaak 'married (male SUBJ)'</td>
</tr>
<tr>
<td>taak.taak</td>
<td>taak.taak 'whittle repeatedly'</td>
</tr>
<tr>
<td>b. ?i?iiçxii?i</td>
<td>?i?iiçxii?i 'have big feet'</td>
</tr>
<tr>
<td>pipickk'</td>
<td>pipickuk 'orange'</td>
</tr>
<tr>
<td>ąeeąawąbis</td>
<td>ąawąbis 'blood'</td>
</tr>
</tbody>
</table>

The relevance of Makah Pre-adducted Presence for VC’ is that voiceless glottalized consonants trigger epenthesis as regularly as voiced consonants, supporting the existence of a cross-linguistically active constraint that calls for vowels before all glottalized consonants. (See Werle 2002 for further analysis of epenthesis in Makah.)

Next, the following examples from Ditidaht, Makah, and Tseshalt illustrate that, despite their varying phonotactic patterns, all three languages consistently satisfy V-ADJ, requiring that adducted consonants be vowel-adjacent (32). Ditidaht, as we have seen, requires that non-initial voiced consonants be postvocalic, but allows voiceless glottalized consonants after consonants as long as they are vowel-adjacent (32a). In Tseshalt, by contrast, all glottalized consonants must be prevocalic (or, equivalently, must be onsets), but plain voiced consonants can be codas as long as they are vowel adjacent (32b) (Stonham 1990:124, 1994:76;
Howe and Pulleyblank 2001:65–68):\(^{13}\)

(32) **Adducted consonant sequencing restrictions in Ditidaht, Tseshaht, and Makah**:

<table>
<thead>
<tr>
<th>Tseshaht</th>
<th>Ditidaht</th>
<th>Makah</th>
</tr>
</thead>
<tbody>
<tr>
<td>maatmaas</td>
<td>baataʰas</td>
<td>bathʰas</td>
</tr>
<tr>
<td>tiiʔisɪʔak</td>
<td>Ṝeʔiɪkseɪk</td>
<td>Ṝeʔiksyak</td>
</tr>
<tr>
<td>tutupas</td>
<td>tutupas</td>
<td>tutupas</td>
</tr>
</tbody>
</table>

b. ?aʔa | ?a | ?a | ‘thick’

mamah₁ | babah₁ | babah₁ | ‘white person’
kakawin | kakawad | kawad | ‘killer whale’

These data offer additional support for V-Adj, which is active and consistently satisfied in all three languages. More fundamentally, this establishes the existence of three phonotactic systems that single out (subsets of) the adducted consonants in more or less arbitrary ways. I suggested above that glottalization on voiced consonants is most perceptible on preceding vowels, while on voiceless consonants it is most perceptible on following vowels. While vowel presence in Ditidaht generally supports the perceptibility of glottalization on voiced consonants, but not on voiceless ones, Tseshaht does the opposite. In yet a third pattern, Makah patterns with Ditidaht, even though glottalization is not contrastive on voiced consonants in Makah (see (31), note 13).

I take the different restrictions on adducted consonants across the Southern Wakashan languages to support Howe and Pulleyblank’s (2001) finding concerning the distribution of glottalized segments: that some phonological constraints are grounded in phonetic ease of perception, but contrary to a strong interpretation of Steriade’s Licensing by Cue (1999a, 1999b), this grounding is often generalized to arbitrary phonological constraints. I conclude that VC’ and V-Adj represent purely formal requirements, in the sense that they are only indirectly grounded in phonetic considerations.

### 4. Vowel Alternations and Feet

In section 2.3, I proposed that Final Absence is motivated by Final-C, a constraint on the structure of prosodic words. This section presents two more cases where prosody motivates vowel alternations, connecting the alternations Pre-VV Presence and Medial Absence to the structure of feet. I argue that Pre-VV Presence improves the shapes of feet, while Medial Absence eliminates unfooted

\(^{13}\) Ditidaht, Makah, and Nuu-chah-nulth differ in their inventories of voiced glottalized segments. Ditidaht’s are /b, d, t, n, l, y, w/, and Tseshaht’s are /t, n, y, w/. Voiced segments in Makah are never glottalized.

Howe and Pulleyblank (2001:65–68) discuss the facts of glottal gesture timing and glottalized consonant distribution in the Ahousaht dialect of Nuu-chah-nulth, where the relevant facts are identical to those of Tseshaht. As in Ditidaht, voiced glottalized consonants in Nuu-chah-nulth are preglottalized.
syllables. Independent evidence for foot structure comes from stress, which shows that Ditidaht favours iambic feet, and often leaves syllables unfooted when footing them would require stressing light syllables.

4.1. Footing and stress

I do not attempt here to execute an exhaustive analysis of Ditidaht stress. Rather, my purpose in this section is to motivate an analysis of Ditidaht footing that supports the following points, for which stress provides the most direct evidence. First, the ideal foot is an iamb of the shape LH (the abbreviations L and H represent light and heavy syllables, respectively; the acute accent represents stress). A heavy syllable in Ditidaht is one that contains a long vowel (coda consonants do not affect syllable weight). Second, after the initial foot, syllables are unfooted unless they can be incorporated into LH or H feet.

The data in (33) exemplify Ditidaht’s entirely regular stress pattern. Anticipating my analysis, I mark these words for primary and secondary stress (with acute and grave accents, respectively), for feet (with parentheses), and for syllables (see section 2.2).

(33) Some stressed and footed words:

<table>
<thead>
<tr>
<th>#L...</th>
<th>#H...</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (ňáb)</td>
<td>‘post’</td>
</tr>
<tr>
<td>b. (ba.bú?i)</td>
<td>‘basketwork’</td>
</tr>
<tr>
<td>(ka.lá)(ka.lii)</td>
<td>‘ankle’</td>
</tr>
<tr>
<td>(ńútýk.čáy)</td>
<td>‘rotten log’</td>
</tr>
<tr>
<td>c. (ti.łúup)</td>
<td>‘octopus’</td>
</tr>
<tr>
<td>(ya.yáad)qiy</td>
<td>‘children’</td>
</tr>
<tr>
<td>(ʔi.ʔii)či.baʔk.ła.qad</td>
<td>‘our late elders’</td>
</tr>
<tr>
<td>d. (wíid)</td>
<td>‘go to war’</td>
</tr>
<tr>
<td>e. (ńúu)ba’it</td>
<td>‘sunny’</td>
</tr>
<tr>
<td>(háa)wičqš</td>
<td>‘tell stories’</td>
</tr>
<tr>
<td>(bíi)(bi.díak)</td>
<td>‘scary’</td>
</tr>
<tr>
<td>f. (ńúu)ba’it</td>
<td>‘sunny’</td>
</tr>
<tr>
<td>(ńúu)ba’it</td>
<td>‘sunny’</td>
</tr>
<tr>
<td>(ńúu)ba’it</td>
<td>‘sunny’</td>
</tr>
<tr>
<td>(ńúu)ba’it</td>
<td>‘sunny’</td>
</tr>
<tr>
<td>(ńúu)ba’it</td>
<td>‘sunny’</td>
</tr>
</tbody>
</table>

Stress placement obeys the following generalizations. First, syllables with long vowels are always stressed. Second, syllables with short vowels are stressed only in monosyllables (33a), and in second syllables following an initial syllable that also contains a short vowel (33b). Third, the first stress is the primary (strongest) one.

I conclude, first, that only long vowels contribute to syllable weight, since only syllables containing long vowels attract stress, regardless of their position in the word.

Further, I reason that the lack of stress on later sequences of light syllables supports an analysis under which feet in Ditidaht are iambic (i.e., right-headed), as follows. I interpret the lack of stress on some sequences of light syllables to indicate that failing to parse these syllables into feet is preferred to building non-initial LL feet. Then this supports an iambic analysis, because LL is cross-linguistically disfavoured as an iamb, whereas LH makes a fine trochee, iamb...
showing a stronger preference than trochees for stressed syllables to be heavy, and favouring the canonical shape LH (Hayes 1995).

From this, I conclude that the simplest footing analysis is as follows:

(34) a. Feet are iambic, built left-to-right, main stress left.
    b. Long vowels contribute to syllable weight, but coda consonants do not.
    c. Initial feet can be of any of the shapes LH, H, LL, or L.
    d. After the initial foot, syllables are unfooted unless they can form LH or H feet.

The relevance of footing for the rest of the analysis rests in two points. First, this analysis suggests an explanation for the pattern of Pre-VV Presence, which appears to prefer LH feet to H feet (section 4.2). Second, I argue that the failure to foot many later light syllables accounts for the alternation that I call Medial Absence (section 4.3).

4.2. Pre-VV Presence

The alternation that I call Pre-VV Presence is less understood than the other alternations discussed in the study. Nevertheless, I include it for its contribution to the overall point that vowel-zero alternations improve prosodic structures. In this section, I describe its general pattern and some problematic exceptions, and propose an account that relates it to footing.

In Pre-VV Presence, a vowel is retained or epenthesized in a stem-final consonant cluster, before an ending whose first vowel is long. Most examples that I have observed involve the suffixes /-pee/ 'going to,' /-(k)ii-/ 'make,' and /-šiid-/ 'off and on':

(35) Stem Plus VV ending
    a. (hidíiks) (hidíi)(kísèc?s) ‘going to take along’
      (?u?úuks) (?u?úu)(kújíc?s) ‘going to consume’
    b. (siqó)(dáakšx) (siqó)(dáak)(šíkæc?s) ‘going to cook’
      (čapác) (čáa)(pæiil) ‘make canoes’
        (cf. čap’a ‘3SG is a canoe’)
    c. /hadi/- (háa)(díšiid) ‘shoot (bow) off and on’
      (tu?ílq) (tu?í)(líšíiil) ‘make/pick strawberries’
      (dačó?) (daá)(?úšiid) ‘see from time to time’
      (pisá)tidk (píisáti(dušíid) ‘run at each other repeatedly’

Unfortunately, available space prevents executing an analysis of Ditidaht footing in terms of constraints. However, of the constraints used in this study, only PARSE-σ would be directly involved in such an analysis (in order to account for what forces its violation in forms with unfooted syllables). Therefore, I think that we may safely assume that we are missing no ranking paradoxes by skipping an OT analysis.
I propose that Pre-VV Presence is motivated in order to improve footing. While adding another vowel near a long vowel might seem counterintuitive, it makes sense under the footing analysis of section 4.1: creating a light syllable just before a heavy syllable turns an H iamb into an ideal LH iamb — for example, *(hidíi)kisèe?i* versus *(hidíik)sèe?i*.

A problem with this explanation is that some stems in (35) already contain a short vowel that could be incorporated into an LH foot without the presence of another vowel — for example, unattested *(lúu)lučqìi*). I suggest that Pre-VV Presence occurs in such cases because, besides creating rhythmically well-formed feet, it improves syllables by parsing consonants as onsets instead of as codas — such as the /x/ in *(lúu)luč(xa)qìi*.

Another problem for this account of Pre-VV Presence is that it fails to occur with some endings whose first vowel is long:

(36) a. *(?uʔúuks) (ʔuʔúuk)(siìi)* ‘will consume’
   */ʔaads-*, *(ʔaad)siìi)* ‘will only’
   *(ʔuʔùu)(kùišiìi)* ‘become a pukuhs’
   *(čučúu)(wašx̂iìi)* ‘become a wolf’

Nor do we observe Pre-VV Presence in words of the shape CV:CCV: whose foot and syllable structures could conceivably be improved:

(37) *(wíiq)(siìi)* ‘windy’ *(qáat)(qáat)* ‘head’
   *(xùuk)(šiìid)* ‘raven’ *(tiš)(èkšìi)* ‘urine’
   *(čiix)(pàa)* ‘six’ *(sáa)(nitài)* ‘Sunday’

Apparently, Pre-VV Presence happens only with some endings, and not otherwise. Evidence for conditioning by ending rather than by stem comes from minimal pairs like *(ʔuʔúuksii)* ‘going to consume’ (35a) ∼ *(ʔuʔùuksii)* ‘will consume’ (36a).

If an OT analysis of Ditidaht vowel alternations is to be successful, we must identify the constraints responsible for Pre-VV Presence. An account in terms of syllable and foot structure, as outlined above, seems promising; the chief problem lies in explaining why only certain endings trigger the alternation. One possibility is that it is driven by constraints indexed to a particular class of morphemes (Ito and Mester 1999; Pater 2000). Another possibility is that the endings that trigger the alternation share some morphological or prosodic domain (Czaykowska-Higgins 1998; Shaw 2002).

However, like the problem of strong short vowels (section 2.4), I think that a satisfactory account of Pre-VV Presence requires a better understanding of its pattern, based on more data, and I leave this question open for future research. Despite these drawbacks, I take this discussion to support my contention that Pre-VV Presence improves feet and syllables.
4.3. Medial Absence

Another alternation that I connect with footing is Medial Absence, a pattern under which words surface with only as many short vowels as required by markedness (as opposed to faithfulness) considerations. I distinguish it from Final Absence because these two alternations achieve different ends: while Final Absence eliminates final short vowels, I argue that the purpose of Medial Absence is to eliminate unfooted syllables.

To grasp the effects of Medial Absence, it is instructive to compare Ditidaht and Makah cognates. In the data in (38), vowels found in only one language or the other are underlined. Where a Makah vowel corresponds to zero in Ditidaht, Makah is generally conservative, whereas a vowel has been lost in Ditidaht by Medial Absence (conversely, we sometimes find Ditidaht vowels resulting from Pre-adducted Presence corresponding to zero in Makah).

(38) Ditidaht Makah

<table>
<thead>
<tr>
<th>Stem</th>
<th>Stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>ċiclib</td>
<td>ċiclib</td>
</tr>
<tr>
<td>tidiččkʷ</td>
<td>tidiččk</td>
</tr>
<tr>
<td>hiidubl</td>
<td>hiidubl</td>
</tr>
<tr>
<td>haawičqš</td>
<td>haawičqš</td>
</tr>
<tr>
<td>katawačk</td>
<td>katawačk</td>
</tr>
<tr>
<td>diidiitidq</td>
<td>diidiitidq</td>
</tr>
<tr>
<td>qʷiśqʷiidiččq</td>
<td>qʷiśqʷiidiččq</td>
</tr>
<tr>
<td>baabaablaq</td>
<td>baabaablaq</td>
</tr>
<tr>
<td>kʷisuqaktx</td>
<td>kʷisuqaktx</td>
</tr>
<tr>
<td>qaqaqwaškkʷ</td>
<td>qaqaqwaškkʷ</td>
</tr>
</tbody>
</table>

However, Medial Absence is not merely a historical artifact, but also a source of synchronic alternations. The examples in (39), involving the indicative clitic /=ʔa/, illustrate the interaction between Medial Absence and Pre-adducted Presence.

(39) Stem IND.3SG Stem IND.3SG

a. ċabas ċabsa ‘tasty’ ċapal ċapla ‘taste watery’
   šuuswa šuuswa ‘shoe’ ?oʔtax ?oʔtxa ‘live at’

b. ċustuk ċustkʷa ‘new’ ċibpat ċibplə ‘sedge grass’
   haadaq haadxq ‘goose’ xičičlə xičičlə ‘then walked’
   čakup čakʷa ‘man’ pipickačkoś pipickačkoš ‘orange’

c. haʔub haʔuθa ‘fish, food’ wiʔib wiʔiθa ‘angry (female SUBJ)’
   teekin teekina ‘sock’ saasin saasiniθa ‘hummingbird’

The forms in (39a) represent the simplest case: following fricative-final stems (which are not mutated by Hardening; section 2.4), the additional vowel introduced by the indicative clitic (which is not deletable; section 2.4) results in Medial
Absence of a preceding vowel. The data sets in (39b) and (39c), on the other hand, show the effects of /=ʔa/ after stems ending in hardenable sounds. After stems ending in voiceless stops (39b), Medial Absence occurs as long as all glottalized consonants remain vowel-adjacent, but fails otherwise (e.g., liičǎx’a, pipick’k’a). After stems ending in voiced consonants (39c), absence is consistently blocked by the requirement that voiced consonants be postvocalic.

I propose that Medial Absence is driven by the constraint **PARSE-σ**:  

(40) **PARSE-σ**: Syllables are parsed into feet. (McCarthy and Prince 1993:160)

**PARSE-σ** favours Medial Absence because it reduces the number of unfooted syllables:

(41)

<table>
<thead>
<tr>
<th>/ďabas=ʔa/ ‘3SG is tasty’</th>
<th><strong>PARSE-σ</strong></th>
<th><strong>MAX/V</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (ďabsá)</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. (ďabá)sá</td>
<td></td>
<td>!</td>
</tr>
</tbody>
</table>

Another conceivable output, (ďabás), though it also satisfies **PARSE-σ**, cannot win here because the vowel of /=ʔa/ is undeletable (tableau not shown; section 2.4).

This example also illustrates that Medial Absence deletes vowels (or prevents them from surfacing) not necessarily because they would otherwise be unfooted themselves, but in order to reduce the total number of unfooted syllables.

We saw in (39) that Medial Absence interacts with — indeed, is overruled by — Pre-adducted Presence. In accordance with the generalizations on adducted consonant sequences (section 3.1), Medial Absence is blocked when it would otherwise make a voiced consonant postconsonantal, indicating that **VR** (the constraint requiring that a voiced consonant be postvocalic) is ranked higher than **PARSE-σ** (the constraint requiring that a syllable be parsed by a foot).

(42)

<table>
<thead>
<tr>
<th>/ťasab=ʔa/ ‘3SG is a dear child’</th>
<th><strong>VR</strong></th>
<th><strong>PARSE-σ</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (ťasá)ba</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. (ťasá)á</td>
<td>!</td>
<td></td>
</tr>
</tbody>
</table>

The more specific **VR’** (requiring that a voiced glottalized consonant be postvocalic) would also do for this particular example. However, the fact that Pre-adducted Presence obtains consistently before plain voiced consonants as well (section 3.2) shows that **VR** (requiring that a voiced consonant be postvocalic) is the relevant constraint here.

Medial Absence also obeys the same restrictions on the distribution of voiceless glottalized consonants as were identified in section 3.1. Voiceless glottalized consonants become postconsonantal by Medial Absence only as long as they are still vowel-adjacent, as in (43a). Otherwise, Pre-adducted Presence prevents Medial Absence, as in (43c). I capture this by prioritizing the vowel-adjacency of adducted consonants (V-ADJ) above the elimination of unfooted syllables (**PARSE-σ**).
This recalls a ranking that I proposed as part of the analysis of Pre-adducted Presence in section 3.2, whereby the markedness constraint requiring an adducted consonant to be adjacent to some vowel (V-ADJ) is more highly ranked than the faithfulness constraint that requires an output vowel to depend on an input vowel (DEP/V); this in turn is more highly ranked than the markedness constraint requiring a glottalized consonant to be postvocalic (VC'). This yields an overall ranking of V-ADJ >> DEP/V >> VC'. Given the ranking under consideration here, namely V-ADJ >> PARSE-σ >> VC', it would seem that PARSE-σ and DEP/V do the same work: they prevent vowel presence before voiceless glottalized consonants, and this in spite of VC' (because they are more highly ranked than VC'), but not if prevented by V-ADJ (because they are ranked lower than V-ADJ).

I conclude that it is the elimination of unfooted syllables (PARSE-σ), and not faithfulness to output-input correspondence (DEP/V), that takes priority over the necessity of glottalized consonant to be postvocalic (VC'). This is because the markedness constraint PARSE-σ is needed to actively motivate absence — whether by deletion or by failure to epenthesize — whereas the faithfulness constraint on output-input correspondence (DEP/V) only forbids epenthesis. Having revised the analysis of Pre-adducted Presence in this way, we may retain the assumption that faithfulness constraints on input-output and output-input correspondence relations (respectively MAX/V and DEP/V) are uniformly low-ranked, and do not crucially outrank any markedness constraints. Consistent with this general claim, in order to drive epenthesis to achieve Pre-adducted Presence, the arguments from section 3.2 still hold: the markedness constraints VR (requiring a voiced consonant to be postvocalic) and V-ADJ (requiring an adducted consonant to be adjacent to a vowel) outrank the faithfulness constraint DEP/V (which forbids epenthesis).

In another case where two constraints do similar work, one might object that I have motivated Final Absence by FINAL-C (the constraint requiring that prosodic words end in consonants), but Medial Absence by PARSE-σ. Here, though, both constraints are needed. The key difference between them is that PARSE-σ only disfavours vowels in unfooted syllables, while FINAL-C disfavours word-final vowels regardless of their footing. We need FINAL-C in order to eliminate final
vowels that would otherwise be parsed into feet, as in, for example, /wik=ʔi/ → wik ‘Don’t!’.
Moreover, Makah exhibits Final Absence (Jacobsen 1971), but not Medial Absence, suggesting that the two processes are motivated by different constraints.

5. **Augmentative Presence**

The last alternation that I discuss is Augmentative Presence, whereby short words are augmented to two syllables. I argue that augmentation, too, improves prosody, and is motivated by a disyllabic condition on prosodic words found in a particular configuration, which I provisionally call inner prosodic words.

The following data illustrate one of several interesting gaps in Ditidaht’s inventory of word shapes. While one finds monosyllabic words, polysyllabic words, and words that end in consonant clusters, there are no monosyllabic words that end in consonant clusters (44b).

(44) Monosyllables Disyllables Trisyllables
a. ḥab ‘post’ c. wałuk ‘weak’ e. ćawaasib ‘nine’
b. — d. ćiyeyk ‘knife’ f. ciciqidk ‘pray’

This gap results from Augmentative Presence, which augments potential cluster-final monosyllables to disyllables by retaining or epenthesizing a vowel inside their final consonant cluster. Only CVC monosyllables are not augmented, lacking a phonotactically sound locus for the presence of a second vowel. A question that arises is what prevents CVCV. As discussed in section 2.3, Final Absence prevents CVCV. The impossibility of augmenting CVC to either VCVC or CVCV is analyzed later in section 5 (see the tableau in (51)).

The examples in (45) show the effects of Augmentative Presence with a variety of suffixes. For each suffix, suffix vowels are absent after a disyllabic or longer stem, but after a monosyllabic stem, presence augments the resulting word to two syllables.

---

15The word haaps ‘hops’, presumably borrowed from English, is an exceptional cluster-final monosyllable.

16I assume the underlying forms /ʔuʔ-atx/, /ći-(b)apt/ for ʔoʔatx, ćibpat, based on comparison with related forms, although this complicates these words’ derivations. I hypothesize that ʔoʔ atx, ćibpat are preferred to more faithful *ʔoʔ atx, *ćib bapt, in order to fill a coda position after a CV root, a pattern that is also observed in the morphology of repetitive aspect, where reduplicated CV roots get default coda consonants:

<table>
<thead>
<tr>
<th>(i)</th>
<th>Root</th>
<th>Perfective</th>
<th>Repetitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>/ti-/</td>
<td>tićix</td>
<td>tićixiix</td>
</tr>
<tr>
<td></td>
<td>/qa-/</td>
<td>qaćiix</td>
<td>qaćiixquăy</td>
</tr>
<tr>
<td>b.</td>
<td>/ćit-/</td>
<td>čitșiix</td>
<td>čitćiit</td>
</tr>
<tr>
<td></td>
<td>/ćiq-/</td>
<td>cićișiix</td>
<td>cićiściq</td>
</tr>
</tbody>
</table>
I propose that Augmentative Presence satisfies a requirement that a prosodic word contain at least two syllables. But can this be stated more primitives? A natural source of such a requirement might seem to be a condition that feet be minimally disyllabic. Then since a prosodic word contains at least one foot, it also contains at least two syllables.

However, under the footing analysis presented in section 4.1, feet need not be disyllabic: a single heavy syllable can be a foot. Then if the minimal word requirement results from a minimal foot condition, we expect no augmentation in words whose first syllable is heavy. Yet such words are well attested in Ditidaht (46).

These words are stressed on their initial, heavy syllable, while their second, light syllable is unstressed, and therefore unfooted. Yet they are not truncated to monosyllables by Medial Absence, though the clusters that would result are licit. It seems, therefore, that the minimal word condition specifies disyllabicity; merely to be a foot is insufficient.

A clue to the source of this condition comes from Variable-length Vowel Shortening, where disyllabicity also plays a role (Swadesh and Swadesh 1933). While some underlyingly long vowels are consistently pronounced long, the length of variable-length vowels (transcribed underlyingly as /V^l/) depends on their position in a word. Following a pattern found throughout Southern Wakashan, variable-length vowels are long when they occur in a first or second syllable, but short in

(45) a. ʔadaa-pəl /ʔadaa-ปาล/ ‘have a strong smell’
b. ʔápu-təq /ʔápu-ตəq/ ‘seven o’clock’
c. dik-iiks /dik-iiks/ ‘carry in one’s claws’
d. ξəuu-uuwsa-təx /ξəuu-uuwsا-ตəx/ ‘person from Clooos’
e. taalaaksc /taalaak-sac/ ‘wallet’
f. dix-apx.apt /dix-apix.-(b)apt/ ‘grapevine’

(46) (túu)puk ‘happy’ (háa)daq ‘goose’
(ʃi)uk ‘move (residence)’ (qi)wax ‘steelhead trout’
(qi)kix ‘long time’ (ée)di ‘totem pole’
(xi)kix ‘walk’ (kũ-yi)ya’il ‘quiet’
(páa)wic ‘nest, hive’ (qir)fas, (qúo)fas ‘(First Nations) person’
(qáa)wic ‘potato’ (šúu)wis ‘shoe’
third and later syllables (in Ditidaht, shortened variable-length vowels are often subsequently deleted by Medial or Final Absence):\(^{17}\)

\[\begin{align*}
\text{(47) } &\text{a. } \text{diitida} &/\text{diit}da-/ &\text{‘Jordan River’} \\
&\text{diitiq} &/\text{RED}-\text{L}-\text{liit}da-q/ &\text{‘speak Ditidaht’} \\
&\text{b. } \text{?inuux}i\text{i\c{s\c{c}}} &/\text{?in-}u\text{x}=?i\text{\c{c}\c{c}}/ &\text{‘small’} \\
&\text{?i\c{c}mx}i\text{i\c{s\c{c}}} &/\text{RED}-\text{?in-}u\text{x}=?i\text{\c{c}\c{c}}/ &\text{‘small (PL)’} \\
&\text{c. } \text{wa\c{c}k}ii &/\text{wa}\text{-ck}ii/ &\text{‘kicked out by significant other’} \\
&\text{\c{s\c{c}}u\text{\c{c}}as} &/\text{\c{s\c{c}}u\text{\c{c}}as-ck}ii/ &\text{‘stump’} \\
&\text{d. } \text{\c{c}e\text{\c{c}}ixks} &/\text{\c{c}a-\c{c}i}ks/ &\text{‘drink water’} \\
&\text{ka\text{\c{c}}iks} &/\text{ka\text{\c{c}}a-\text{\c{c}}i}ks/ &\text{‘drink coffee’} \\
&\text{e. } \text{saktuup} &/\text{sa-(k})tu\text{p}/ &\text{‘animal’} \\
&\text{qu\text{\c{c}}actp} &/\text{qu\text{\c{c}}ac-(k})tu\text{p}/ &\text{‘First Nations person’}
\end{align*}\]

Some scholars have suggested that the variable-length vowel alternation results from a condition that licenses long variable-length vowels only in the first foot (Wilson 1986; Stonham 1990:145, 1994:132). However, this cannot be the case, at least in Ditidaht, for the same reason that the disyllabic word minimal-ity condition cannot be based on the foot: variable-length vowel length is licensed in the second syllable even when the first foot is built only over an initial heavy syllable, as in (dii)(ii)da? (Werle 2002:392 offers a similar argument for Makah).

Instead, I propose to explain both augmentation and shortening by reference to a constituent larger than a foot, but (sometimes) smaller than the morphological word: an inner prosodic word. Following Kager’s (1996) analysis of a similar shortening process in third and later syllables in Guugu Yimidhirr, I propose that Ditidaht always builds a prosodic word over the first one or two syllables of the word. In words of more than two syllables, this inner prosodic word is nested recursively inside an outer prosodic word.

This proposal enables concise descriptions of Augmentative Presence and Variable-length Vowel Shortening by reference to the inner word. The former

\(^{17}\)It is not clear why a suffix vowel is lost in /\text{\c{s\c{c}}u\text{\c{c}}as-ck}ii/ /\text{\c{s\c{c}}u\text{\c{c}}asck}ii/, /\text{qu\text{\c{c}}ac-(k})tu\text{p}/ qu\text{\c{c}}actp, instead of a stem vowel: *\text{\c{s\c{c}}u\text{\c{c}}asck}ii, *\text{qu\text{\c{c}}ac-(k})tu\text{p}/. A possibility is that this happens in order that the adducted consonants /\text{\c{c}c}/ may be parsed as onsets. A similar pattern is found in triconsonantal roots bearing durative aspect. Durative forms of CCC roots with a plain second consonant may have the shapes CVCCV or CVCC (a), but to my knowledge, those whose second consonant is adducted occur only in the shape CVCCV, parsing this consonant as an onset (b):

<table>
<thead>
<tr>
<th>(i)</th>
<th>Root</th>
<th>Durative</th>
<th>Root</th>
<th>Durative</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>/pisat-/</td>
<td>pisatk\c{c}</td>
<td>‘run’</td>
<td>b.</td>
</tr>
<tr>
<td></td>
<td>/\c{c}u\text{\c{c}}jak</td>
<td>‘know how’</td>
<td></td>
<td>/\text{\c{c}}ebaq-\text{\c{c}}ak</td>
</tr>
<tr>
<td>/\c{c}ust-\text{\c{c}}ak</td>
<td>‘new’</td>
<td>/\text{\c{c}}eyic-\text{\c{c}}ak</td>
<td>‘bruise, purple’</td>
<td></td>
</tr>
<tr>
<td>/\text{\c{c}}ixc\text{\c{c}}ak</td>
<td>‘faded’</td>
<td></td>
<td>/\text{\c{c}}i\text{\c{c}}waq-\text{\c{c}}ak</td>
<td>‘cloudy’</td>
</tr>
</tbody>
</table>
alternation ensures that the inner word is disyllabic, as in (48a), while the latter is driven by a condition that licenses long variable-length vowels only in inner words (48b).

(48) a. [(búu)]_{PWd} /bū-ʔq/ ‘four o’clock’
   b. [(dií)]_{PWd} /RED-L-L-dií-da-ʔ/ ‘speak Ditidaht’

Augmentative Presence and Variable-length Vowel Shortening make apparent the bounds on the size of the inner word: augmentation shows that the inner word is minimally disyllabic, while shortening shows that it is maximally disyllabic. I propose to express this in terms of a constraint on the size of the inner prosodic word, defined as follows:

(49) IWd = σσ: A prosodic word that directly dominates a main stressed foot (i.e., an inner prosodic word) contains exactly two syllables.

While I cannot state this any less stipulatively, I take it to be well motivated by the fact that it connects the seemingly independent phenomena of augmentation and shortening.\(^{18}\)

In order to force augmentation, the size restriction on inner prosodic words (IWd = σσ) must outrank the markedness constraint that syllables be footed (PARSE-σ), and the faithfulness constraint on output-input correspondence (DEP/V). This is because augmentation sometimes violates PARSE-σ by forcing the presence of unfooted syllables, and sometimes violates DEP/V by forcing vowel epenthesis:

(50)

<table>
<thead>
<tr>
<th>/ʔu-iks/ ‘take along’</th>
<th>IWd = σσ</th>
<th>PARSE-σ; DEP/V</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. [((ʔu)k^u^i)s]_{PWd}</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. [(ʔuiks)]_{PWd}</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

However, in CVC words, the markedness constraints requiring syllables to have onsets (ONSET) and prosodic words to end in consonants (FINAL-C) make augmentation impossible. This is because these constraints forbid the initial and final short vowels that would otherwise help to satisfy the size restriction on inner prosodic words (IWd = σσ) (51).\(^{19}\)

\(^{18}\)Kager derives inner word disyllabicity in Guugu Yimidhirr using a constraint DISYLL. (McCarthy and Prince 1993:82). I use the more stipulative IWd = σσ, as the additional analysis required to implement this condition with DISYLL raises too many ancillary issues to address here (see Kager 1996).

\(^{19}\)Epenthetic vowels cannot be protected by epenthizing a consonant (section 2.2, note 10).
As a result, only underlyingly /CVCC/ and /CVCCC/ words are augmented, because epenthesis anywhere except into clusters yields onsetsless syllables or final short vowels.

An alternative to this account of prosodic word parsing is that third and later syllables are parsed not into a larger, recursive prosodic word, but into an adjacent prosodic word, as in the ungrammatical forms in (52). However, assuming that all prosodic words are subject to the same conditions on footing and stress, this alternative incorrectly predicts, first, that short third syllables should be stressed (52a), and second, that the first post-second syllable stress should be a primary stress (52a–b).

Furthermore, if the third syllable of ʔiʔinlexical were a prosodic word, then it ought to undergo Augmentative Presence, to something like *ʔiʔinlexical.

I therefore maintain the inner prosodic word account of Augmentative Presence.

### 6. Conclusion

This study has been concerned with several patterns of short vowel presence and absence in Ditidaht. I showed that vowel presence and absence are determined by considerations of surface markedness, without regard to whether or not vowels are underlying. Four of the five patterns discussed here (Final Absence, Medial Absence, Pre-VV Presence, and Augmentative Presence) improve the markedness of prosodic structures like syllables, feet, and prosodic words, while the fifth (Pre-adducted Presence) positions adducted consonants optimally with respect to vowels.

In a more formal vein, I showed that an analysis in the Optimality Theory framework makes it possible to state these observations with desirable generality. First, the uniform disregard for vowels’ underlyingness—an apparent conspiracy across processes—is modelled by the uniformly low ranking of two faithfulness constraints. Patterns of vowel presence result from various markedness constraints outranking the faithfulness constraint that requires an output vowel to have a
corresponding input vowel (DEP/V) (53a), while absence results from various markedness constraints outranking the faithfulness constraint that requires an input vowel to have a corresponding output vowel (MAX/V) (53b).

(53) Markedness and faithfulness interactions:
   a. Presence: VR, V-ADJ, IWd = σσ > > DEP/V
   b. Absence: FINAL-C, PARSE-σ > > MAX/V

Various epentheses and deletions are not independent rules with no eye to their result, but examples of the same two strategies used to satisfy a variety of surface constraints.

Second, interactions among alternations reflect the relative prioritizations of the markedness constraints that motivate them, requiring no additional machinery beyond constraint ranking. Pre-adducted and Augmentative Presence block Medial Absence because their motivating constraints outrank PARSE-σ (54a), whereas Final Absence blocks Augmentative Presence because FINAL-C outranks IWd = σσ (54b).

(54) Markedness interactions:
   a. Presence blocks Absence: VR, V-ADJ, IWd = σσ > > PARSE-σ
   b. Absence blocks Presence: FINAL-C > > IWd = σσ

Figure 1 summarizes the constraint rankings argued for in this article.

\[
\begin{align*}
&\text{VR} & \text{IDENT(voice)} & \text{ONSET} & \text{FINAL-C} \\
&\text{IDENT(cgl)} & \text{VR} & \text{V-ADJ} & \text{IWd = σσ} \\
&\text{PARSE-σ} & \text{DEP/V} \\
&\text{VC} & \text{MAX/V} \\
\end{align*}
\]

**Figure 1:** Constraint ranking summary

I also described, and identified as objects for future research, two patterns that defied such neat analysis. These were Pre-VV Presence and strong short vowels.

Last, an interesting finding of the study of adducted consonant phonotactics was that all adducted consonants are subject to constraints on their adjacency to vowels. In cases where these constraints enforce vowel presence that does not plausibly enhance the perception of laryngeal features, I concluded that they are purely formal requirements.
References

Jacobsen, William H., Jr. 1996. ‘Hardening’ and ‘softening’ in Makah. Paper read at the 31st International Conference on Salish and Neighbouring Languages, Vancouver, BC.