Halkomelem. extensively with the exceptions of Demers and Horn's (1978) and Davis's (1984) analyses of Squamish, and one considers only the Bianco (1995) and Urbanczyk (1996) on Northern Lushootseed. In this paper I present an analysis of stress placement on roots in Halkomelem-Cowichan, the language of the Cowichan people of Vancouver Island, British Columbia, which is more accurately described as a sub-dialect of the Island dialect of Halkomelem. Cowichan was originally spoken in a collection of villages in the areas of Cowichan Bay and the Cowichan River including the site of the modern town of Duncan, B.C.1

This study focuses on the assignment of primary stress on unaffixed roots in the language. When one considers only the limited set of data in (1) it appears that stress is randomly assigned in Cowichan. That is, roots can be stressed on any vowel. In order to more clearly illustrate the patterns of stress placement, I employ templates which pick out the nuclear vowels in a root. For now I distinguish only between schwa [ə] in opposition to any full vowel [v].

(1) disyllabic roots tri- syllabic roots


The data which consist of disyllabic roots in (1) can be stressed on either the left or the right syllable regardless of the quality of the nuclear vowel. In roots which contain only schwa and no full vowels, as in a. and b., stress alternates between the left or right syllable respectively. In c. and d. which contain a sequence of the full vowels [i] and [e], the same alternation occurs. In e. and f. sequences of [a] followed by the full vowel [e] are also alternately stressed. Finally, in g. the sequence of a full vowel [a] followed by [a] is stressed on the leftmost syllable which contains the full vowel. No data exist which display a [v a] pattern in which stress falls on the rightmost syllable.

In the data which contain three syllables stress placement is likewise varied. In h., i., and j. stress falls on the first (leftmost) syllable regardless of vowel quality. In k. and l. stress "skips over" the first vowel, schwa, and the full vowel respectively, and the medial syllable receives stress. In m. and n., which each contain [a v a] sequences, stress alternates between the medial and the final (rightmost) nuclear syllables.

1 As always, I express a profound debt of gratitude to my consultant, Mrs. Ruby Peter, who is a special teacher; her generous spirit greatly enriched my first experience of the Cowichan language and of Cowichan culture. My fieldwork was supported by a SSHRC grant #41094160 (T. Hukari) and a grant from the Jacobs Research Fund.

Without any distributional facts concerning the frequency of the occurrence of the patterns illustrated in (1) the questions to be addressed are: "Which patterns are anomalous?" and "What is an explanation for the variation found in those whose occurrences are statistically significant?" In this paper I will argue that alternations in stress patterns in Cowichan are determined in part by a tendency toward overall assignment of stress to the leftmost syllable, and in part by a onomorphy hierarchy of vowels such that more sonorous vowels attract stress away from less sonorous vowels. I will show how the interaction of constraints concerning directionality and the relative sonority of syllable nuclei account for the placement of stress for more than 95% of Cowichan roots.

2.0 PHONOLOGY and ROOT SHAPES

Cowichan is similar to other Salish languages in that it has a rich inventory of consonants while the vowel inventory is simple.

(2) a. Consonant Phonemic Inventory1

<table>
<thead>
<tr>
<th>Obstruents</th>
<th>p</th>
<th>t</th>
<th>ʔ</th>
<th>c</th>
<th>ʃ</th>
<th>k</th>
<th>q</th>
<th>qʷ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonorants</td>
<td>ʔ</td>
<td>s</td>
<td>l</td>
<td>e</td>
<td>h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>m</td>
<td>n</td>
<td>y</td>
<td>l</td>
<td>w</td>
<td>h</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Vowel Phonemic Inventory

<table>
<thead>
<tr>
<th>i</th>
<th>u</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>(uu)</td>
</tr>
<tr>
<td>e</td>
<td>(a)</td>
</tr>
<tr>
<td>(ee)</td>
<td>(aa)</td>
</tr>
</tbody>
</table>

The reduced vowel schwa [ə] and the long vowels [vv] are given in parentheses. Although the status of schwa is not relevant to the following discussion, in Bianco (1996) I argue that schwa is not a phoneme of Cowichan; rather that its occurrence is predictable as the result of the requirements of syllable structure in the language. However, the status of long vowels in Cowichan is not clear to me; their surface shape may sometimes be conditioned by the presence of glottalized sonorant consonants, and may sometimes be the synchronic reflex of historically underlying sequences of vowels plus the glottal segments Q? or [h]. I do not address their phonemic reality further here, but lacking a full analysis for their status, I do not include those roots which contain long vowels in the counts given below.

The counts in (3) show that Cowichan roots do not generally contain more than four consonants with the result that about half of the total number are monosyllabic and roots in the language are generally maximally trisyllabic.

1 The occurrences of [ʔ], [i], [e], [k] are marginal; [e] is found only in deics; [i] and [k] are almost exclusively limited to loanwords; and [e] is found only in forms of the root ʔeʔm'fr'. The symbol [q] represents a voiceless uvular fricative.
3.0 CONSTRAINTS on STRESS

In this paper I apply the tenets of Optimality Theory (Prince and Smolensky, 1993) which assumes that a set of potentially violable universal constraints are ranked against one another in the evaluation of a theoretically infinite number of possible outputs of a form. The ranking of possible candidates provides a language specific output which in the case of this analysis, results in a particular pattern of stress placement. The restrictions on Cowichan stress assignment are from Prince and Smolensky (1993) and McCarthy and Prince (1993a,b) and are given in (4). I discuss the interpretation of the individual constraints as they are introduced.

(4) Constraints on Stress Assignment

FOOT-BIN
Feet are binary at some level of analysis (σ σ)

FOOT-FORM (TROCHAIC)
Ft → (σ, σω) i.e. S=strong (stressed); W=weak (unstressed)

PARSE-SYLL
All syllables must be parsed

ALIGN-PrWd,L Foot,L
Align every prosodic word, left with a foot, left

PEAK-PROM
Primary stress falls on the most sonorous peak in the word (foot)

NON-FINALITY
No prosodic head of the prosodic word is final in the prosodic word

In the following discussion I will show that within a framework of Optimality Theory (OT), stress in Cowichan falls on a particular syllable as the result of its attraction in two, sometimes opposing, directions: (1) towards the leftmost syllable in the word; and (2) towards the most sonorant syllable in the word.

4.0 DATA and DISCUSSION

This analysis of stress assignment in Cowichan is perhaps most easily appreciated if we consider separately the classes of disyllabic and trisyllabic roots. Disyllabic forms most clearly illustrate the tendency towards leftward stress assignment and also present the simplest motivation for the use of templates which distinguish between schwa and full vowels.

4.1 Disyllabic Roots

Although the data in (1) above apparently indicates that stress is randomly assigned, in fact Cowichan most generally exhibits an overall pattern of leftward directionality.

4.1.1 Leftward Directionality

Consider the placement of primary stress which is illustrated in the data in (5).

(5) a. [σ σ ] b. [σ ω, σω] c. [σ ω ] d. [σ ω , ω ω]

mòn?a t'áac? xá2ak* x'éli
offspring roasting stick Sooke go away
x'álam? t'áxpe? x'íwá x'áíni?
chiton salal berries come here woman
qálam xáca? qílax st'í'ta?q*
pamblee swamp digging stick spring salmon
eye swamp digging stick spring salmon

The data in (5) show that directionality of stress assignment in disyllabic roots is leftward when (1) the nuclei of the two syllables are identical, either schwas as in a. or full vowels as in b.; (2) when a full vowel nucleus precedes a nuclear schwa as in c.; and (3) when the nuclei consist of two full vowels.

Within an OT analysis leftward stress placement for the data in (5) is determined by two constraints on foot structure. The constraint FT-BIN requires that syllables are obligatorily parsed into binary feet; a disyllabic root must be parsed as [(σ σ)] and not as *[σ (σ σ)]

In the following section however, we see that leftward directionality in disyllabic roots is not always consistent.

4.1.2 Stress and Schwa

In contrast to the data in (5) above, the data in (6) display rightward directionality which produces iambic feet: i.e. stressed-unstressed syllable sequences (σ θ), in violation of the constraints on foot structure.

(6) a. šāmīn enemy b. c'áx*le? sometimes
c. qamā? nurse (find) d. šx*arwords cloudy
e. taw*ln? raw f. t'ayk*le? blue elderberries

In the following section however, we see that leftward directionality in disyllabic roots is not always consistent.
4.1.2.1 Peak Prominence

Kinkade (1998), among many other researchers, has examined the properties of schwa versus full vowels in Salish languages, particularly with respect to the often acknowledged phenomenon of a preference for stress to fall on full vowels over schwa. (See Carlson 1989, Czaykowska-Higgins 1993, Mathewson 1994, Bianco 1995, and Urbanczyk 1996, among others.) In OT the attraction of stress to full vowels can be interpreted as a constraint upon the relative sonority of vocalic nuclei which arise from a sonority hierarchy of vowels.

Prince and Smolensky (1993:39) propose the constraint Peak-Prominence (PK-PROM) in order to "establish the relation between the intrinsic prominence of syllables and the kind of elevated prominence known as stress." The constraint holds that the element which is the most sonorant (that is, which occupies the highest position on a hierarchy of sonority of sound segments), is the most optimal nucleus of the prosodic constituent syllable. The sonority scale grades phonemes such that [a] is the least sonorant vowel.

(7) PK-PROM
*P/a // \n//
-----

The peak prominence constraint reflects the fact that cross-linguistically obstruents are the least likely segments to occur in the peak (nucleus) position of a stressed syllable, and that vowels (specifically [a]) are the most likely segments to receive stress.

4.1.2.2 Stress and the Sonority Hierarchy

The constraint gives rise to the sonority hierarchy of vowels given in (8) such that [a] is the most sonorant and schwa is the least sonorant vowel on the hierarchy.

(8) Sonority Hierarchy of Vowels
a >> e0 >> iu >> a

Kenstowicz (1994) expands the peak prominence constraint and shows that for some of the world's languages the most optimal target for stress assignment within a word is the syllable which contains the most sonorant nucleus. In order to explain the attraction of stress to more sonorant vowels he formulates the PK-PROM constraint into a set of micro-constraints which apply at every level of the sonority hierarchy. In this way separate constraints for each segment can be ranked according to their relative sonority. The overarching constraint is given in (9).

(9) PK-PROM Constraint
*P/a // \n//
-----

The hierarchy in (9) is expressed as a negative constraint in which each dominance relation is to be considered as a separate (micro-) constraint. Crucially, the constraint must be interpreted as a prohibition against, rather than a requirement for a particular nucleus. The constraint implies an inverse relationship between the position of a vowel on the the sonority hierarchy and its suitability as a nuclear syllable. In other words, the constraint can be interpreted to read "it is more important to avoid stressed [a] than it is to avoid a stressed [e], etc." By transitivity, it is "better" to stress any full vowel than a schwa in a word.

The tableau in (10) demonstrates that the constraint against stressed schwa, *P/a, is ranked above the constraint which requires a trochaic (left-headed) foot.

(10) \[a v] \rightarrow \{a v\}
\hline
*P/a & \*P/a & \*P/a & \*P/a \\
\hline

The result of the constraint hierarchy *P/a >> FT-FORM produces an iambic (right-headed) stress foot for roots which contain [a v] sequences in contrast to the more general trochaic pattern in Cowichan disyllabic roots.

An important tenet of OT provides for violations (\*) of constraints by the most optimal output candidate (\#) iff those violations involve constraints which are ranked lower on the constraint hierarchy than those which are violated by unsuccessful candidates. (By convention the constraint hierarchy is represented horizontally in descending order from left to right.) Thus, although candidate b. displays a required trochaic foot form, it violates the more highly ranked constraint against stressed schwa. This fatal (\#) violation resolves the conflict with the result that the most optimal (not perfect) candidate a is the output.

PARSE (McCarthy and Prince 1993a) is a constraint on licensing of prosodic constituents: segments must be dominated by a syllable node and PARSE-SYLL requires that in turn, syllables must be parsed into metrical feet. The parsing constraint must be more highly ranked than *P/a in order to prevent a lack of footing while also avoiding stressed schwa. I return to the ranking of PARSE-SYLL in section 4.2.2.1.

(11) \[a v] \rightarrow \{a v\}
\hline
*P/a & \*P/a & \*P/a & \*P/a \\
\hline

The data in (6) illustrate the need to distinguish schwa from full vowels. Thus far the ranking which has been established for the constraint hierarchy is PARSE-SYLL >> *P/a >> FT-FORM. I will return to the discussion of disyllabic roots in section 4.2.2.2 when I will consider stress placement with respect to those roots which contain sequences of non-identical full vowels.

In the following section I provide further evidence from trisyllabic roots that the peak prominence constraint is active in the evaluation of stress assignment of stress in Cowichan.

4.2 Trisyllabic Roots

In the previous section I demonstrated that in disyllabic roots which have a [a v] template, stress falls on the full vowel in contrast to the general pattern of leftward directionality. In this section I show that the constraints on directionality and sonority intertwine to produce a variety of patterns in trisyllabic roots. In the following sub-section I demonstrate the ranking of the four constraints on directionality.
4.2.1 Directionality Constraints

In the case of trisyllabic roots whose syllable nuclei contain no full vowels, constraints on foot structure and alignment interact to produce stress in a leftward direction.

(12) *[a a a] Templates

a. tx"a"macan September
b. l"a"k"a"man Esquimalt
c. 7"a"macan wait

4.2.1.1 Parse

The PARSE-SYLL constraint requires syllables to be parsed exhaustively. However, in the case of odd-parity words (i.e. those which have an odd number of syllables), PARSE-SYLL must necessarily conflict with the constraint FT-BIN. (Recall that FT-BIN requires metrical feet to be binary, i.e. bounded into disyllabic feet.) In Cowichan FT-BIN dominates PARSE-SYLL with the result that violation of the lower ranked constraint is unavoidable. For example, a trisyllabic root such as cal"e"qal "yesterday" can be parsed into binary feet as either [(cal (e"qal))] or [(cal (e"qal))]. In OT the domination relation renders the failure to parse one syllable as minimal.

(13) *[a a a] → [(d a a)]

<table>
<thead>
<tr>
<th>tx&quot;a&quot;macan 'September'</th>
<th>FT-BIN</th>
<th>PARSE-SYLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. tx&quot;a&quot;macan</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c. (tx&quot;a&quot;) (ma) (can)</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Candidates (13)b. and c. violate the highly ranked constraint on foot binarity: b. contains a trisyllabic foot, while c. contains three monosyllabic feet.1 Candidate a. is successful because it violates only the lower ranked constraint on parsing and therefore, its violation is minimal and not fatal.

The constraints that I have introduced thus far demonstrate an interaction and therefore, a dominance relation between two pairs which are not otherwise ordered with respect to one another.

(14) *P/a >> FT-FORM
    FT-BIN >> PARSE-SYLL

A fourth possible output candidate in (13) above parses the root as tx"a"(a)(ma)(con). In the following section I demonstrate that the rightward parse is prohibited by an alignment constraint.

Foot Alignment

Alignment constraints as laid out in Prince and Smolensky (1993) require that the edges of grammatical categories coincide with edges of prosodic categories. The constraint ALIGN-ProsodicWord,Left, Foot,Left ensures that feet will be parsed from the left by its requirement for every prosodic word in Cowichan to begin with a foot [(σ(a σ)]). Therefore, the root in (13) must be parsed as [(tx"a"macan) and not as *(tx"a"macan)] although both candidates obey the FT-FORM constraint.

Data from roots which contain *[a ν a] sequences provide evidence for the inviolability of AL-PrWd,L in the constraint hierarchy. They also provide further evidence that when schwa precedes a full vowel it appears to be inviolable as a candidate for stress assignment.

(15) *[a ν a] Templates

a. c"a"wahlam Tofanak
b. q"a"yilał dance
c. k"a"nañiañ over there

d. for trisyllabic roots which contain *[a ν a] sequences such as q"a"yilał 'dance', six possible candidates for evaluation exist.

(16) *[a ν a] Candidates

a. q"a"yilał
b. q"a"yilał
(c. q"a"yilał)
d. q"a"yilał
(e. q"a"yilał)
f. q"a"yilał

Candidates (16)c. and f. are non-optimal because they violate the high-ranking constraint FT-BIN as I demonstrated in the tableau in (13) above. The tableau in (17) demonstrates the evaluation of candidates (16) a. and b. Since neither candidate violates the constraint against stressing schwa, *P/a, the conflict is resolved according to the constraint hierarchy AL PrWd,L >> FT-FORM.

(17) *[a ν a] → *[ν a]

<table>
<thead>
<tr>
<th>q&quot;a&quot;yilał 'dance'</th>
<th>AL-PrWd,L</th>
<th>FT-FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>q&quot;a&quot;yilał</td>
<td>*</td>
</tr>
<tr>
<td>b. q&quot;a&quot;yilał</td>
<td></td>
<td>!</td>
</tr>
</tbody>
</table>

1 For the sake of simplicity in representation I have interpreted the violation of FT-BIN in (13)c. as a single, fatal instance of failure to parse feet into disyllables. Alternatively, each bracketed foot could count as a violation in which case three asterisks would express this interpretation. In practice the inviolability of FT-BIN produces the correct output without my addressing this question further here.

2 Cohn (1989) on Indonesian and Czaykowska-Higgins (1995) on Nua'armi argue that prefixes in these languages constitute independent phonological words which are unaffected by constraints on root stress. My analysis similarly assumes that the alignment constraint entails the exclusion of prefixes with respect to stress assignment in Cowichan.
The tableau in (17) shows that even when \( *P/a \) is obeyed the alignment constraint dominates FT-FORM which ensures that the optimal candidate does not have an initial unfooted syllable. The candidate in (16)d. is vacuously disallowed because the parse \( q"a\) (yišaž) violates AL-PrWd,L and it contains a stressed schwa in violation of \( *P/a \).

The final candidate to consider, \( (q"a)yišaž \) does not violate the highly ranked AL-PrWd,L but is rejected because schwa is stressed as the tableau in (18) demonstrates.

(18) \[ [a\bar{a}a] \rightarrow [a\bar{a}a] \]

The ranking hierarchy \( *P/a \gg \text{FT-FORM} \), which was determined above for disyllabic roots, ensures that stress falls on the full vowel \( [i] \) in (18). The tableau in (19) summarizes the possible permutations of alignment and footing for \( [a\bar{a}a] \) roots. For ease of exposition I represent the root in the tableau as a vocalic template.

(19) \[ [a\bar{a}a] \rightarrow [a\bar{a}a] \]

<table>
<thead>
<tr>
<th>[a\bar{a}a]</th>
<th>FT-BIN</th>
<th>AL-PrWd,L</th>
<th>PARSE-SYLL</th>
<th>*P/a</th>
<th>FT-FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( [\bar{a}\bar{v}\bar{a}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. ( [a(\bar{v}\bar{a})] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c. ( [\bar{a}(\bar{v}\bar{a})] )</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d. ( [a(\bar{v}\bar{a})] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>e. ( [a(\bar{v}\bar{a})] )</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

In summary, (19)e. and f. are disallowed because they are not parsed into disyllabic feet. Candidates b. and d. fail to align a foot with the left edge of the word and are rejected. Candidates a. to d. equally violate the PARSE constraint with the result that no violation is fatal. Therefore, the conflict between a. and c. is settled in favour of a. because candidate c. violates the constraint against stressing schwa. The constraint rankings which have been established thus far are given in (20).

(20) a. FT-BIN \> PARSE-SYLL
   PARSE-SYLL \> *P/a
   *P/a \> FT-FORM
   AL-PrWd,L \> FT-FORM

b. FT-BIN \> PARSE-SYLL \> *P/a \> FT-FORM
   AL-PrWd,L \> FT-FORM

The separate constraint rankings given in (20)a. illustrate that FT-BIN, *P/a and AL-PrWd,L are not ranked with respect to one another and nor are FT-FORM and PARSE-SYLL. The hierarchy given in (20)b. is derived by transitivity from (20)a. The same constraint hierarchy accounts for trisyllabic roots which have the following templates.

(21) a. \[ [a\bar{v}v] \] b. \[ [\bar{v}a\bar{v}] \] c. \[ [a\bar{v}a] \]

<table>
<thead>
<tr>
<th>[a\bar{v}v]</th>
<th>FT-BIN</th>
<th>AL-PrWd,L</th>
<th>PARSE-SYLL</th>
<th>*P/a</th>
<th>FT-FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( [\bar{a}\bar{v}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. ( [\bar{a}\bar{v}\bar{v}] )</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c. ( [a\bar{v}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d. ( [a\bar{v}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

In the tableau in (22) no candidates violate FT-BIN and all equally violate PARSE-SYLL. Candidates c. and d. each fatally fail to align a foot with the left edge of the word, demonstrating once again the inviolability of the alignment constraint. The avoidance of stressed schwa results in the output in a.

(23) \[ [\bar{v}a\bar{v}] \rightarrow [\bar{v}a\bar{v}] \]

<table>
<thead>
<tr>
<th>[\bar{v}a\bar{v}]</th>
<th>FT-BIN</th>
<th>AL-PrWd,L</th>
<th>PARSE-SYLL</th>
<th>*P/a</th>
<th>FT-FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( [\bar{v}\bar{a}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. ( [\bar{v}\bar{a}\bar{v}] )</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c. ( [\bar{v}\bar{a}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d. ( [\bar{v}\bar{a}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

The tableau in (23) shows that the same constraints which produce \( [a\bar{v}\bar{a}] \) and \( [a\bar{v}\bar{a}] \) stress patterns also yield the optimal candidate for roots with \( [\bar{v}\bar{a}\bar{v}] \) sequences. In the tableau in (24) stress predictably falls on the initial syllable, a full vowel, in roots which contain \( [\bar{v}\bar{a}\bar{v}] \) sequences.

(24) \[ [\bar{v}\bar{a}\bar{v}] \rightarrow [\bar{v}\bar{a}\bar{v}] \]

<table>
<thead>
<tr>
<th>[\bar{v}\bar{a}\bar{v}]</th>
<th>FT-BIN</th>
<th>AL-PrWd,L</th>
<th>PARSE-SYLL</th>
<th>*P/a</th>
<th>FT-FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( [\bar{v}\bar{a}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. ( [\bar{v}\bar{a}\bar{v}] )</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c. ( [\bar{v}\bar{a}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d. ( [\bar{v}\bar{a}\bar{v}] )</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>
In (24) once again the same constraint hierarchy seen in the preceding tableaux produces stress on the full vowel. Roots which contain vowel sequences of \{o a v\} exhibit a seemingly anomalous stress pattern. The data in (25) show that stress is placed not on the full vowel but on the initial schwa in contrast with the patterns which avoid stressed schwa.

(25) \{o a v\} Templates

a. yâx'âle? bald eagle
b. òâmak'a? tommy cod
c. hâp'xaw'ê pitlamp

Although the data appear to exhibit an exceptional stress pattern, in fact the ranking of the constraints which produce all of the previous patterns predict a word initial stressed schwa. The tableau in (26) demonstrates the assumed, but as yet unsupported ranking of the alignment constraint above the constraint against stressed schwa.

(26) \[\{o a v\} \rightarrow \{ð a v\}\]

mâx'âye? 'navel' AL-PrWd,L *P/α
a. \(\text{mâx'âye?}\) * !

The tableau in (26) shows that alignment of a foot with the left edge of the word is more crucial than the avoidance of stressed schwa. The constraints must be ranked as AL-PrWd,L >> *P/α. In (27) all candidates are evaluated with respect to the entire constraint hierarchy.

(27) \[\{o a v\} \rightarrow \{ð a v\}\]

\[\begin{array}{llllll}
\text{[iæv]} & \text{FT-BIN} & \text{AL-PrWd,L} & \text{PARSE-SYLL} & \text{*P/α} & \text{FT-FORM} \\
\hline
\text{a.} & {[ð ā v]} & * & * & * & * \\
\text{b.} & {[ð ā v]} & * & * & * & * \\
\text{c.} & {[ð ā v]} & * & * & * & * \\
\text{d.} & {[ð ā ŭ]} & * & * & * & *
\end{array}
\]

The tableau in (27) demonstrates the inviolability of the constraint AL-PrWd,L, even at a cost of inevitably electing a candidate which contains a stressed schwa. Candidates c. and d. are eliminated because they fail to align a foot with the left edge of the word. The remaining candidates, a. and b. equally violate the constraints on parsing and stressing schwa and the conflict is resolved according to the requirement for feet to be trochaic. Thus, candidate a. emerges as the optimal candidate as the result of the hierarchy such that *P/α is ranked lower than AL-PrWd,L but higher than FT-FORM.

In the next section I show how constraints which reflect the sonority hierarchy interleave with directionality constraints in order to account for roots which contain two full vowels.

4.2.2 Sonority Constraints

The trisyllabic roots in (28) and (29) contain \{v v a\} sequences which display alternations in the placement of stress between the first and second full vowels.

(28) \[\{v v a\} \rightarrow \{ð v v a\}\]

a. sek'ían hair
b. òðb'än blood
c. stñi'x-stam made into a woman

(29) \[\{v v a\} \rightarrow \{ð v v a\}\]

a. òk'ían in back of vehicle
b. òch'än Tyee salmon
c. sc'ýyaw' twins

In (28) the data set includes roots which contain full vowel sequences of \{e i\} and \{a i\} which are stressed on first (word initial) syllable. In contrast, the data set in (29) is stressed on the second full vowel, the word medial syllable; the vowel sequences are \{i e\} and \{i a\}.

4.2.2.1 Peak Prominence Revisited

Recall Kenstowicz's (1994) proposal to expand the PK-PROM constraint into micro constraints against the suitability of individual vowels to occur as nuclei of prominent (stressed) syllables. Thus far in the analysis only the constraint against stressed schwa has been relevant to stress assignment in Cowichan. However, *P/α is just the most highly ranked of a series of sonority constraints on nuclear vowels. That is, the second constraint in the hierarchy is *P/β and is read as "avoid stressed [β]", followed by *P/ε (avoid stressed [ε] etc.). I reproduce Kenstowicz's set of micro-constraints in (30).

(30) *P/β >> *P/ε,u >> *P/ε,o >> *P/α

The micro-constraints on peak sonority interact with the already established constraints on directionality and schwa. The following two tableaux contain the same candidates which are evaluated with respect to two pairs of constraints. The first gives support to Kenstowicz's analysis which ranks full vowels individually. The tableau in (31) illustrates the dominance relation between the micro-constraints *P/β and *P/ε for a trisyllabic \{i e a\} template.

(31) \[\{i e a\} \rightarrow \{i e a\}\]

\[\begin{array}{llll}
\text{[iæs]} & \text{FT-BIN} & \text{PARSE-SYLL} & \text{*P/β} \\
\hline
\text{a.} & {[ð k s]} & \text{in back of vehicle} & *P/β \\
\text{b.} & {[ð k s]} & \text{in back of vehicle} & *P/ε
\end{array}
\]

The table in (31) shows that the constraint against stressed [i] dominates the constraint against stressed [ε]. The reverse order produces the incorrect output *Fh'ąq. The same candidates also show that the constraint *P/β dominates FT-FORM in (32).
Candidate (32) b contains a trochaic foot as required by FT-FORM, but it fatally violates the more highly ranked constraint *P/i, with the result that the optimal candidate is an iamb. *P/e is not ranked with respect to FT-FORM because candidate a. in (31) and (32) violates both constraints equally. The ranking hierarchy ensures that a.'s violation is minimal in each case. However, the tableau in (33) shows that when FT-FORM is ranked above *P/i the incorrect output results.

<table>
<thead>
<tr>
<th>w̱e̱zaʔ</th>
<th>'in back of vehicle'</th>
<th>FT-FORM</th>
<th>*P/i</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(w̱e̱zaʔ)aq</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(w̱e̱zaʔ)aq</td>
<td>* !</td>
<td></td>
</tr>
</tbody>
</table>

The alternations in stress patterns shown in (28) and (29), therefore fall out from the peak prominence constraint hierarchy and the ranking of FT-FORM below all of the constraints on peak prominence. That is, for roots which contain [i e a] sequences, stress falls on the initial syllable only if initial nuclear vowel is more sonorant than the medial vowel. On the other hand, when the initial vowel is less sonorant than the medial nucleus then stress is assigned to the more sonorant medial vowel. For example, the roots xʷiy̓aʔa 'twins' [i a] and x̌iy̓aʔa 'Tyee salmon' [i e] are also stressed on the second syllable because [a] and [e] are more sonorant than [i].

The case of trisyllabic roots which contain two non-adjacent full vowels however, do not behave in the same manner as those whose full vowels are contiguous. The root x̌iq̓aʔənem? 'listen' exemplifies the difference wherein the less sonorant [i] is stressed rather than the more sonorant [e]. In tableau (27) above I showed that AL-PrWd, L dominates *P/a to produce stress on initial schwa for roots which contain [a e] sequences. Therefore, by transitivity, inviolable AL-PrWd, L also dominates *P/i.

<table>
<thead>
<tr>
<th>x̌iq̓aʔənem?</th>
<th>'listen'</th>
<th>AL-PrWd, L</th>
<th>*P/a</th>
<th>*P/i</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(x̌iq̓aʔənem?)</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(x̌iq̓aʔənem?)</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Although candidate (34)b. obeys the constraint against stressing [i], it fatally violates the undominated alignment constraint. The dominance relation which falls out from the sonority hierarchy such that *P/a >> *P/i, is demonstrated in (35). Both candidates obey the AL-PrWd, L constraint and the conflict is settled according to the sonority hierarchy.

<table>
<thead>
<tr>
<th>x̌iq̓aʔənem?</th>
<th>'listen'</th>
<th>AL-PrWd, L</th>
<th>*P/a</th>
<th>*P/i</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(x̌iq̓aʔənem?)</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(x̌iq̓aʔənem?)</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ranking *P/a >> *P/i completes the representation of the micro-constraints on peak sonority. The hierarchy within which they are interleaved with constraints on directionality are given below. Ranking of the constraints *P/e and *P/a with respect to one another cannot be conclusively determined because no trisyllabic roots which contain both segments are attested in the data.

(36)

AL-PrWd, L >> *P/a >> *P/i >> *P/e, a >> FT-FORM

The tableau in (37) summarizes the constraints which produce leftward stress (on [i]) for trisyllabic roots whose vowel sequences are [i a e].

<table>
<thead>
<tr>
<th>x̌aʔənem?</th>
<th>'listen'</th>
<th>AL-PrWd, L</th>
<th>*P/a</th>
<th>*P/i</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(x̌aʔənem?)</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(x̌aʔənem?)</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(x̌aʔənem?)</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x̌aʔənem?</td>
<td>'listen'</td>
<td>AL-PrWd, L</td>
<td>*P/a</td>
<td>*P/i</td>
</tr>
<tr>
<td>a.</td>
<td>(x̌aʔənem?)</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(x̌aʔənem?)</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The final tableau concerning trisyllabic roots employs the same constraints which produce stress on the initial syllable for words which contain [i e a] sequences as in (37). The tableau in (38) demonstrates how the same ranking results in a different pattern for roots which contain [a e] sequence.

<table>
<thead>
<tr>
<th>x̌aʔənem?</th>
<th>'listen'</th>
<th>AL-PrWd, L</th>
<th>*P/a</th>
<th>*P/i</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(x̌aʔənem?)</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(x̌aʔənem?)</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>qaʔənem?</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>qaʔənem?</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Having accounted for why [a] and [e] are stressed in preference to [i] in the trisyllabic data given in (28) and (29) above, in the following section I return to disyllabic roots which contain [i a] and [i e] sequences.

4.2.2.2 Non-Finality

The constraint hierarchy for which I have argued in this paper fails to obtain the correct output for one class of Cowichan roots.

(39) a. [i a] Templates  b. [i e] Templates

q̓iʔəc? swing, hammock  f̓iʔəc? left-handed
q̓iʔəc? swing, hammock  s̓q̓əʔəc? respected
f̓iʔəc? salmonberry  x̌əʔəc? dog salmon (after spawning)
The data in (39) contain sequences in which stress falls on [i] despite the constraint hierarchy which predicts that stress will occur on the following more sonorant vowel, [a] or [e]. The tableau in (40) illustrates the problem for the root $\theta^3\alpha^2\eta^*\eta^*\text{"busy"}$. 

\[ (40) \quad [\text{ia}] \rightarrow [\text{ia}] \]

\[
\begin{array}{|c|c|c|}
\hline
\text{constraint} & \text{[ia]} & \text{[ia]} \\
\hline
\text{NON-FIN} & \text{P/a} & \text{P/a} \\
\hline
\text{P/i} & \ast & \ast \\
\hline
\end{array}
\]

According to the constraint hierarchy demonstrated in the previous section, the candidate in (40)b should be the optimal output. However, the correct output contains an initial stressed [i] which fact suggests the necessity of one additional constraint which will prohibit stress from being assigned to the final syllable. Prince and Smolensky (1993:57) propose the universal constraint in (41).

\[ (41) \quad \text{NON-FINALITY} \]

No proodic head of PrWd is final in PrWd.

The constraint NON-FIN, like the alignment constraints, is a concern of postional theory, which in opposition to foot theory and parsing theory, comprise the three components necessary to "map the structure of the basic rhythmic system." In Cowichan the ranking of NON-FIN illustrates the manner in which the sonority constraints are interleaved naturally with other relevant restrictions. It is ranked below the constraint against stressed schwa but above the constraints against stressed full vowels. The tableau in (42) illustrates the ranking of NON-FIN above $\text{P/i}$.

\[ (42) \quad [\text{ia}] \rightarrow [\text{ia}] \]

\[
\begin{array}{|c|c|c|}
\hline
\text{constraint} & \text{[ia]} & \text{[ia]} \\
\hline
\text{NON-FIN} & \text{P/a} & \text{P/a} \\
\hline
\text{P/i} & \ast & \ast \\
\hline
\end{array}
\]

Since NON-FIN dominates the constraint against stressed [i], by transitivity it also dominates $\text{P/e}$ and $\text{P/a}$. However, roots which have [a i] sequences provide evidence that the sonority constraints are divided along the lines of non-finality. The tableau in (43) show that in these instances the full vowel and not schwa receive stress.

\[ (43) \quad [\text{oi}] \rightarrow [\text{oi}] \]

\[
\begin{array}{|c|c|c|}
\hline
\text{constraint} & \text{[oi]} & \text{[oi]} \\
\hline
\text{NON-FIN} & \text{P/a} & \text{P/a} \\
\hline
\text{P/o} & \ast & \ast \\
\hline
\end{array}
\]

The constraint ranking which determines stress assignment for disyllabic and trisyllabic roots in Cowichan is given in (44).

\[ (44) \quad \text{FT-BIN >> PARSE-SYLL >> P/a >> NON-FIN >> P/i >> P/e, P/a >> FT-FORM} \]

\[ \text{AL-PrWd,J} \quad \text{FT-FORM} \]

\[ 4.3 \quad \text{Exceptional Data} \]

Of the stress patterns given in (1) this analysis accounts for the following:

**Disyllabic Roots**

<table>
<thead>
<tr>
<th>Stress Pattern</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>[vv] $\rightarrow$ [iv]</td>
<td></td>
</tr>
<tr>
<td>[va] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[v] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[v] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[v] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[v] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[v] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[v] $\rightarrow$ [ia]</td>
<td></td>
</tr>
</tbody>
</table>

**Trisyllabic Roots**

<table>
<thead>
<tr>
<th>Stress Pattern</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
<tr>
<td>[a] $\rightarrow$ [ia]</td>
<td></td>
</tr>
</tbody>
</table>

With respect to the stress placement patterns as they are represented by templates in (1), stress assignment for some data remains anomalous. However, the total of 21 out of more than 700 disyllabic and trisyllabic roots whose stress placement is not accounted for by this analysis represent less than five percent. Among disyllabic roots, the data include three whose output are [a i] e.g. aki e.g. "fall, stumble" (whose nuclei display equal sonority but which consist of an iambic foot); two whose output is [v i] e.g. kpv "dismay particle" (whose prosodic head is word final and the sonority of whose initial vowel is greater than schwa); and ten whose output is [s v] e.g. ams "eldest brother". (in which schwa is stressed in a position preceding a full vowel).\(^5\)

Among trisyllabic roots with unpredicted stress patterns, the data include four whose output is [a i] which display rightward foot alignment, and one each of [a i] and [a i] whose footed syllables have equal sonority but result in iambic feet.

**5.0 SUMMARY**

I have presented an analysis of stress assignment in Cowichan roots using constraints which are held as universal within Optimality Theory and which demonstrate the adequacy of the model. Following Kenstowicz (1994) I have argued that acknowledgement of the role of sonority is integral to an account of stress placement for Cowichan. The analysis supports Kenstowicz’s account of micro-constraints which give rise to the sonority hierarchy of vowels cross-linguistically. Along with Urbanwicz’s (1996) suggestions concerning stress in Lushootseed, the analysis which I propose may have implications for other Salish languages.
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