WHAT DETERMINES STRESS IN SK'WUL7MESH (SQUAMISH)?

Leora Bar-el and Linda Tambarri Watt
University of British Columbia

1. INTRODUCTION

The goal of this paper is to outline what determines stress in Sk'wul7mesh. Our basic claim is that stress is determined by three factors: (1) position (2) the lexicon (3) vowel features. Using an Optimality Theoretic framework (OT) we argue that the Sk'wul7mesh stress assignment pattern can be captured via the interaction of stress assignment constraints (McCarthy and Prince 1993), prosodic affix faithfulness constraints (Alderete 1997) and peak prominence constraints (Kenstowicz 1996). This paper will contribute to the literature on Sk'wul7mesh stress patterns (Davis (1984), Demers and Horn (1978) and Kuipers (1967)), by contributing new data and examining the generalizations in an OT framework.

We begin our discussion with an overview of the relevant properties of the Sk'wul7mesh language. In Section 2 we provide a descriptive look at Sk'wul7mesh stress assignment in bisyllabic roots by introducing the relevant data that reveal the basic stress pattern in the language. In Section 3, we incorporate these generalizations into an OT framework and demonstrate that the Sk'wul7mesh facts. Looking beyond simplex forms, in Section 4 we present some morphologically complex forms and outline three types of lexical suffixes that interact with stress assignment; we then incorporate the two prosodic affix faithfulness constraints into the ranking. With a closer examination of vowel quality, in Section 5 we identify the vowel place specification that will be assumed for the inputs; we incorporate both feature faithfulness constraints and peak prominence constraints into the established constraint hierarchy. Using Kenstowicz’s (1996) analysis of quality-sensitive stress, we demonstrate that Sk'wul7mesh provides further evidence for the necessity of sonority driven constraints. We conclude our discussion in Section 6 and provide an outline for further research.

1. RELEVANT PROPERTIES OF THE SK'WUL7MESH LANGUAGE

1.1. Consonant Inventory

Sk'wul7mesh has a total of 30 consonants in its phonemic inventory. The chart in (1) below categorizes the phonemes by place and manner features.

<table>
<thead>
<tr>
<th>Stops</th>
<th>Labial</th>
<th>Dental</th>
<th>Palatal</th>
<th>Lateral</th>
<th>Velar</th>
<th>Uvular</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>t, ts</td>
<td>tf</td>
<td>k</td>
<td>q</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p'</td>
<td>t', ts'</td>
<td>t'f</td>
<td>k'</td>
<td>q'</td>
<td>?'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labialized Stops</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labialized Ejective</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ejectives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labialized Ejective</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m</td>
<td>n</td>
<td>s</td>
<td>f</td>
<td>j</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Fricatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glides</td>
<td>i</td>
<td>u</td>
<td></td>
<td></td>
<td>w</td>
<td>h</td>
<td></td>
</tr>
</tbody>
</table>

(Kuipers 1967:p.22)

It is clear from the chart in (1) above that the variety of stops are distinguished through labialization and glottalization. Unlike all other stops, the ejective lateral stop [t'] does not have an unglottalized counterpart. Furthermore, the labial ulavial fricative [x'] has a non-labial counterpart, whereas the labial velar fricative [x'] does not. As is shown below, the Sk'wul7mesh vowel inventory is not as clear cut as its consonant inventory.

1.2. Vowel Inventory

Kuipers (1967) describes the Sk'wul7mesh vowel system as one that contains three full vowels and a schwa; he claims that the presence or absence of schwa is to a large extent predictable if the morphological structure if the word is given’ (1967:22). Consequently, he would probably present the underlying vowel inventory as follows:

(2)

(1) a

(2) i u

Other Salishanists have claimed that schwa is not part of the vowel inventories of various Salish languages. Czaykowska-Higgins (1993), for example, identifies the same three-way contrastive vowel system for Nooksack (Moses-Columbia Salish) as underlying and claims that schwa is not an underlying vowel since its position and surface form is completely predictable. Within a framework of cyclic stress assignment, she further argues that the difference in stress assignment between roots with full vowels (strong roots) and roots with schwa (weak roots) derives from the fact that the full vowels are present underlingly while schwa is not. Following Kuipers (1967), we assume that schwa is predictable in Sk'wul7mesh and thus is not part of the vowel inventory (see Section 5 for a detailed discussion of underlying Sk'wul7mesh vowels).

1.3. Acoustic Correlates of Stress

The acoustic correlates of stress in Sk'wul7mesh pitch and length. A preliminary look at sound waves seem to indicate that vowels with primary stress have the highest pitch, vowels carrying secondary stress have the second highest pitch and stressless vowels have the lowest pitch. We leave this issue to further research.

1.4. Stressed and Unstressed Vowel Systems:

Sk'wul7mesh surface vowels have been observed to fall into two sets: stressed and unstressed3. These two sets are given below (note that the positions of these vowels is based on Ladejöfog's (1993) cardinal vowel chart4):

3This chart is based on Kuipers’s discussion of the Skwul7mesh consonants; for expository purposes, we have presented a simplified version of the consonant inventory and converted all characters to their IPA counterparts.

4The reader is referred to Kuipers (1967) for other documented phonetic vowel realizations.
linguistically, the pattern tends to be the opposite as observed by Mascaró (1978) for Catalan; Mascaró explains the by the examples in (4) below, each containing full vowels in the initial syllable:

The pattern shown in (3) above suggests

2.1. Stress patterns in bisyllabic roots

The basic stress assignment pattern in Skwxwú7mesh is revealed through an examination of three types of bisyllabic roots: (1) roots containing full vowels in their initial syllable (2) roots containing schwa in their initial syllables and a full vowel in their second syllable and (3) roots containing schwa in both syllables. In the following three subsections, the relevant data is introduced and the basic stress pattern is discussed.

2.1.1. Roots containing initial full vowels

It is observed in Skwxwú7mesh that in bisyllabic roots, primary stress falls on the leftmost full vowel of the prosodic word6. At this point in the analysis, we assume that the appropriate prosodic category to describe stress position is the prosodic word; evidence for labelling prosodic word as the domain for stress in Salish is related to the fact that non-repetituous prefixes are outside the stress domain (Urbanczyk 1996). This pattern is illustrated by the examples in (4) below, each containing full vowels in the initial syllable:

(4a) [t'šímaʔ] <tshámay3> 'lady'
(b) [p'ťúts'ax] <p'uts'ux> 'cradle'
(c) [mʃ̌xal] <mikwil> 'black bear'
(d) [sp̌'aqmx] <sp'ágem> 'flower'
(e) [ť'ľíx̌am] <t'ílem> 'muscle'
(f) [ʃ̌ǩ'ťám] <shik'wem> 'bathe'

It has been observed that vowel quality is factor in the assignment of stress in Skwxwú7mesh (see Section 5 for further discussion); the examples in (4) above illustrate that regardless of the quality of the second vowel in a bisyllabic form, the first vowel will bear stress, providing that it is a full vowel. Examples (4a) and (4b)

2.2. Foot Form

The forms given in (4) and (6) above demonstrate that in Skwxwú7mesh, stress prefers to fall on the leftmost syllable. Trochaic feet are defined as being left-headed at either the moraic or syllabic level (McCarthy and Prince 1995); therefore the data makes it clear that Skwxwú7mesh prefers to build trochaic feet. Since there is no evidence for weight sensitivity in Skwxwú7mesh, we will assume that codas of consonants are non-moraic, thus, in the examples below, only two moras surface. Consider the following forms:

<table>
<thead>
<tr>
<th></th>
<th>Ft</th>
<th>Ft</th>
<th>Ft</th>
<th>Ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>7a</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
<tr>
<td>5a</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
<tr>
<td>5b</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
<tr>
<td>5c</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
<tr>
<td>5d</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
</tbody>
</table>

The gloss for this word is not certain.
Since each of the forms contain two syllables and two moras, it is ambiguous as to whether these feet are moraic or syllabic. If independent evidence for the moraic status of coda consonants is available, defining these feet as syllabic trochees will still predict the correct foot structure.

2.3. Stressed schwa

There is an obvious resistance in Sk̲’gw̲s̲w̲u7mesh to stress schwa; this has been noted by Kuipers (1967) as well. This resistance is attested in various other Salish languages (cf. Bianco (1996) for Cowichan (Coast), Hess (1977) for Northern Lushootseed (Central Coast), Shaw and Roberts (1994) for St’a:micx (Interior) and various others. Furthermore, various languages unrelated to Sk̲’gw̲s̲w̲u7mesh exhibit the same pattern; Watt (1998b) claims that schwa never receives stress in Molisano (southern Italian). Kenstowicz (1996) provides data from Kobon (Papua New Guinea), Chukchee and Ajlutor (Palo-Siberian), Mordvin and Mari (Finno-Ugric) and shows how the preference to stress full vowels over schwa patterns cross-linguistically.

The markedness of stressed schwa can be explained by sonority; this notion has been worked out by Kenstowicz (1996). In his sonority-based approach, the resistance to stressing schwa is explained by the fact that schwa is the least sonorous vowel and the less sonorous a vowel is, the worse peak it makes. The issue of sonority with respect to stress will be discussed in greater detail in Section 5.

2.4. Exceptions

Borrowed words are exceptions to the regular pattern; these forms can be explained by the generalization that their stress is assigned in the same way that it is assigned in the language from which they were borrowed. Consider the following examples, all of which were at one point borrowed into Sk̲’gw̲s̲w̲u7mesh from French:

\[
\begin{align*}
(8a) & \text{latám} & \text{<latám>} & \text{‘table (from French la table)'} \\
(8b) & \text{kapú} & \text{<kapú>} & \text{‘coat (from French capote)’} \\
(8c) & \text{kʷafú} & \text{<kwashúi>} & \text{‘pig (from French cochon)’} \\
\end{align*}
\]

(Kuipers 1967)

This data suggest that although the forms have been modified to accommodate the Sk̲’gw̲s̲w̲u7mesh vowel and consonant inventory, the French stress system has been retained in these forms. However, recent collected data suggests that these forms are pronounced slightly differently; consider the forms in (13) below:

\[
\begin{align*}
(9a) & \text{latám} & \text{<latám>} & \text{‘table’} \\
(9b) & \text{kapú} & \text{<kapú>} & \text{‘coat’} \\
(9c) & \text{kʷafú} & \text{<kwashúi>} & \text{‘pig’} \\
\end{align*}
\]

The inconsistency between the vowel quality of the first syllable in each of the forms in (12) and (13) may be attributed to sound change over the past few decades, this suggests that the full vowels in the initial syllables of the forms in (12) reduced to schwa over time. This would not be considered an unusual pattern since the change has created forms that are entirely expected in the Sk̲’gw̲s̲w̲u7mesh system (i.e. stress the leftmost full vowel of the prosodic word). Interestingly, this data confirms the second part of Kenstowicz’s (1996) proposal of margin constraints, schwa makes a better margin than [a] which explains why the sound change might have occurred.

Now that the basic stress pattern has been established in addition to some generalizations about foot structure and the status of schwa, an analysis can be presented.

3. BASIC STRESS PATTERN: AN OT ANALYSIS

The basic claim of OT is that the patterns of each and every language can be explained via the ranking of universal constraints\(^6\), the purpose of this section is to demonstrate that a particular ranking of five stress constraints

\(\begin{align*}
(10) & \text{Head-L: Align L(H,Ft):} & \text{for every head, align that head with the left edge of a foot} \\
(11) & \text{Align L(Ft, PWD):} & \text{for every foot, align the left edge of that foot, to the left edge of the prosodic word} \\
\end{align*}\)

\(\text{A second alignment constraint is needed to position the foot at a particular edge of the prosodic word}^{13}\).

It was also determined in Section 2 that feet are binary at the syllabic level, therefore, it is necessary to activate some constraint which prefers (σσ) over (σoσ). The stress assignment constraint which controls for foot binarity at the syllabic level is formalized as follows:

\(\begin{align*}
(12) & \text{Foot Bin}_2: & \text{feet are binary at the syllabic level} \\
\end{align*}\)

To ensure that syllables are parsed into feet, a constraint prohibiting unparsed syllables is required. This constraint is formalized below:

\(\begin{align*}
(13) & \text{Parse-σ:} & \text{parse all syllables into feet} \\
\end{align*}\)

Finally, a peak prominence constraint is required in order to account for the different pattern exhibited in words containing schwa in a stress-bearing position; The constraint below indicates that schwa is not a preferred vowel for stress (Kenstowicz 1996).

\(\begin{align*}
(14) & \text{*P/σ:} & \text{schwa cannot head a foot} \\
\end{align*}\)

These five constraints can capture the stress assignment pattern observed in Sk̲’gw̲s̲w̲u7mesh via the following ranking\(^5\):

\(\begin{align*}
\cdot\text{P/σ >> Head-Left , Parse-σ >> Foot-Bin}_2 , \text{Align-L (Ft, PWD)} \\
\end{align*}\)

The next subsection will justify this constraint ranking with a series of tableaux.

3.2. Crucial Rankings

Bisyllabic words reveal only one crucial ranking; however, the tableaux in this section include all the crucial rankings which are established in the remaining sections of the paper. To begin, the following tableaux

\(\begin{align*}
(15) & \text{*P/σ >> Head-Left , Parse-σ >> Foot-Bin}_2 , \text{Align-L (Ft, PWD)} \\
\end{align*}\)

\(\text{Until further examination of the effect of prefixes on stress assignment, we assume prosodic word as the relevant prosodic category since there is evidence that reduplicated prefixes can bear stress:}

\(\text{[pɔ[pɔ-pɔ]=76]^9 \text{ push-push-sibth} \text{ ‘many kittens’}}\)

\(\text{We are assuming that all feet have heads; thus, candidates without heads will not be generated. If, under a different analysis, these candidates were to be generated, a constraint banning headless feet would rule those candidates out.}\)
demonstrates crucial ranking between Head-Left and *P/o.

(16)  
<table>
<thead>
<tr>
<th></th>
<th>*P/o</th>
<th>Head-Left</th>
<th>Parse-α</th>
<th>Foot-Bin&amp;</th>
<th>Align L (Pt, PrW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*a. (stąqέw')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. (stąqέw')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Crucially ranking *P/o higher than Head-Left reveals the preference in Skewwú7mesh to stress the rightmost vowel (that is, to stray from the trochaic rhythm) in order to avoid stressing schwa. The next three tableaux show how the established ranking will predict the three types of bisyllabic roots. Firstly, we will look at a word which contains a schwa at its left edge and a full vowel at its right edge.

The constraints *P/o and Head-Left alone will not rule out all of the relevant candidates generated; thus we have to assume the three other constraints which were outlined in subsection 3.1. The tableau in (17) below incorporates the remaining constraints into the ranking and the correct optimal output is still predicted.

(17)  
<table>
<thead>
<tr>
<th></th>
<th>*P/o</th>
<th>Head-Left</th>
<th>Parse-α</th>
<th>Foot-Bin&amp;</th>
<th>Align L (Pt, PrW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*a. (stąqέw')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. (stąqέw')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. stą(qέw')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. stą(qέw')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The established ranking suggest that Head-Left and Parse-α are not crucially ranked with respect to each other; thus, candidates (c) will not be ruled out by its Parse-α violation because the optimal candidate violates Head-Left. As a result, candidate (c) will be ruled out by Foot-Bin&.

The tableau in (18) below examines a bisyllabic form in which both syllables contain full vowels. The optimal candidate is correctly predicted by the ranking and does not incur any violations.

(18)  
<table>
<thead>
<tr>
<th></th>
<th>*P/o</th>
<th>Head-Left</th>
<th>Parse-α</th>
<th>Foot-Bin&amp;</th>
<th>Align L (Pt, PrW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*a. (stąnάj')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. (stąnάj')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. stą(nάj')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. stą(nάj')</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Finally, the tableau in (19) below reveals how the established constraint ranking will deal with bisyllabic forms which contain a schwa in both syllables.

(19)  
<table>
<thead>
<tr>
<th></th>
<th>*P/o</th>
<th>Head-Left</th>
<th>Parse-α</th>
<th>Foot-Bin&amp;</th>
<th>Align L (Pt, PrW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*a. (χątsέθ)</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. (χątέθ)</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. χątsέθ</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. χątέθ</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is clear that even though each of the candidates violates *P/o, the optimal candidate is still predicted since it violates no other constraints.

These constraints and rankings are not enough to predict correct outputs in some morphologically more complex words. When roots combine with some lexical suffixes, stress becomes morphonologically conditioned in addition to being phonologically conditioned. The following section will provide an analysis the combination of lexical suffixes and roots, and the effects these combinations have on stress.

4. Skw̓xw̓u7mesh Lexical Suffixes

In recent work on Salish phonology, the phonology/morphology interface with respect to stress placement has received some attention. It has been observed that some Skw̓xw̓u7mesh lexical suffixes attract main stress (Kuipers 1967, Demers and Horn 1978, Davis 1984). In this section, the interaction between phonological stress assignment and morphological structure will be explained in an OT framework through the interaction of Stress Assignment constraints with Faithfulness constraints. The goal of this section will be to show that some affixes have metrical structure in the input. This approach was inspired by Izsadi’s (1991) work on stress in Interior Salish and Alderete’s (1997) analysis of Root-Controlled Accent in Cupeilo. Like Nxa’mscin (Moses Columbia) (Czyzowska-Higgins 1993), an Interior Salish language, Skw̓xw̓u7mesh distinguishes different types of roots and lexical suffixes with respect to how they influence stress. The distinction in roots and lexical suffixes will be referred to as accented versus unaccented. The data analyzed indicate that accented roots are ones containing two syllables, and unaccented roots have only one syllable. For example, /pos/, the word for ‘cat’, is an unaccented root because it consists of only one syllable, and /mtʃsəhi/, the word for ‘black bear’, is an accented root because it consists of two syllables. Three types of lexical suffixes have been noted in the collected data. They will be referred to as unaccented, accented and inherently accented. Unaccented lexical suffixes do not attract stress, accented lexical suffixes retain stress when attached to an unaccented (one syllable) root and inherently accented lexical suffixes retain stress without exception. This research is concerned with a total of nine lexical suffixes. In choosing lexical suffixes which represent the various distinctions with respect to stress, Kuiper’s (1967) Squamish dictionary was consulted. Since few lexical suffixes remain productive, the nine particular lexical suffixes listed in (20) below, are analyzed in this paper as a result of their productivity amongst the Skw̓xw̓u7mesh speakers.

(20)  
<table>
<thead>
<tr>
<th>Orthography</th>
<th>Phonetic</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNACCENTED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>=ach</td>
<td>=ats'</td>
<td>'hand'</td>
</tr>
<tr>
<td>=lyeqw</td>
<td>=iyeqw'</td>
<td>'on top of head'</td>
</tr>
<tr>
<td>=us</td>
<td>=us'os</td>
<td>'face'</td>
</tr>
<tr>
<td>=nas</td>
<td>=ens'</td>
<td>'chest'</td>
</tr>
<tr>
<td>=shen</td>
<td>=fon</td>
<td>'foot/ankle'</td>
</tr>
<tr>
<td>=mut</td>
<td>=mot</td>
<td>'separate piece'</td>
</tr>
<tr>
<td>ACCENTED</td>
<td>=ʔaw'txw</td>
<td>=ʔaw'tx'</td>
</tr>
<tr>
<td>INHERENTLY</td>
<td>=ulih</td>
<td>=qit</td>
</tr>
<tr>
<td>ACCENTED</td>
<td>=alih</td>
<td>=aʔ</td>
</tr>
</tbody>
</table>

Unlike roots, lexical suffixes cannot be distinguished in terms of their structure as a result of their
Phonological similarity. For example, the lexical suffix -atf/ which means 'times/instances' is inherently accented and the lexical suffix -atf'/ is unaccented. Both of these lexical suffixes consist of a VC sequence and yet they have very different effects on word level stress. All of the possible combinations of roots and lexical suffixes are illustrated below.

### 4.1. Roots plus Lexical Suffixes

A comparison of (a) and (c), and (d) and (f) demonstrates that phonologically similar words have different stress patterns.

<table>
<thead>
<tr>
<th>(21a) Unaccented Root with Unaccented Lexical Suffix</th>
<th>(21b) Unaccented Root with Accented Lexical Suffix</th>
<th>(21c) Unaccented Root with Inherently Accented Lexical Suffix</th>
<th>(21d) Accented Root with Unaccented Lexical Suffix</th>
<th>(21e) Accented Root with Accented Lexical Suffix</th>
<th>(21f) Accented Root with Inherently Accented Lexical Suffix</th>
</tr>
</thead>
</table>
| 4.1.1. Unaccented Lexical Suffixes

The following data demonstrate that unaccented lexical suffixes do not attract primary stress. It is clear that the basic trochaic pattern is maintained for words containing these suffixes since words bisyllabic words follow the same patterns described in Section 3. Specifically, bisyllabic words which contain a full in initial position have initial stress, bisyllabic words containing a schwa in the leftmost syllable and a full vowel in the rightmost syllable have final stress and words with two schwas have initial stress. Trisyllabic words in the following data also clarify that parsing of feet is left to right in Sk' weaponry since the initial syllable carries main stress and the final syllable bears secondary stress. If feet are parsed from right to left, stress would be incorrectly predicted to fall on the penultimate syllable.

This pattern exhibited with lexical suffixes is typical of Salish languages (Bianco 1995, Czyzynska-Higgins 1993 and others). Interior Salish has been described as having strong and weak roots which correspond to the stress properties which have been outlined for accented and unaccented roots in Sk' weaponry (Bianco 1995 and Idsardi 1991). A similar pattern has been noted in Cupello, an unrelated Taktic language which was spoken in Southern California (Alderete 1997) and Slavic (Czyzynska-Higgins 1993), among others.

### 4.1.1. Unaccented Lexical Suffixes

4.1.1.1. Inherently Accented Suffix

This pattern cannot account for:

| Inherently Accented Suffix >> Accented Root >> Accented Suffix >> Unaccented Root >> Unaccented Suffix |
|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|

This analysis cannot account for:

i) $\langle t'\text{jetj}\text{ep}'\text{ty}'\text{eq}'\rangle$ /$t'\text{jetj}\text{ep}'\text{ty}'\text{eq}'$/

At this point in the analysis, there is only one example of a bisyllabic root + [iv'eq']; therefore it is not yet clear whether other words of the same syllabic structure will pattern similarly with respect to stress assignment. Until further research, we assume that this suffix is unaccented.

---

These data clearly reveal that stress assignment is not determined purely phonologically since phonologically similar words have different stress patterns; rather, it is determined both phonologically and morphologically. Furthermore, the examples in (21) demonstrate the hierarchical nature of stress assignment in Sk' weaponry with respect to lexical suffixes; if an unaccented root combines with an inherently accented lexical suffix, the root receives primary stress. If an unaccented root combines with an accented lexical suffix, the lexical suffix receives primary stress. If an unaccented root combines with an inherently accented lexical suffix, the lexical suffix receives primary stress. The primary stress hierarchy with respect to these combinations is as follows.
It is interesting to note that, consistent with the basic stress pattern, the bisyllabic form in (22d) above 
[5x'=ts'~7m] demonstrates that the unaccented suffix bears stress in order to avoid stressing schwa.

The analysis of the basic stress assignment presented in Section 3 above can capture the pattern of 

bisyllabic forms in (22-27) above, however, problematic to this analysis is trisyllabic words. Since these words 

are parsed into two feet, the present grammar can generate candidates in which there are two adjacent stressed 
syllables are stressed as potential optimal candidates. Candidate (a) in the following tableau is the form which 

should be generated by the grammar, however, candidates (b) is predicted to be optimal by this 

ranking. This is shown in the tableau in (28) below (note that the * indicates the incorrect surface form).

<table>
<thead>
<tr>
<th>/\jet\jpos/</th>
<th>*P/,</th>
<th>Head-Left</th>
<th>Parse-\sigma</th>
<th>Foot Bin\gamma</th>
<th>Align L(Ft, PrW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ((/\jet/)(/\jpos/))</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>*P=</td>
<td>b. ((/\jet/)(/\jpos/))</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c. /\jet/pos/</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>d. /\jet/pos/</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Since words never surface with adjacent stresses in Skwy\wv\wz\mesh it is evident that stress clash is prohibited. In 

order to reflect this in that grammar it is necessary to introduce a rhythm constraint. This constraint will be defined 

as follows.

\[ *66: \text{adjacent stressed syllables are prohibited} \]

At this point, the no clash constraint \(*66\) does not require crucial ranking, however, in comparing (c) and (d) with 

(a), it is clear that Parse-\sigma outranks Foot Bin\gamma. Also, a comparison of candidates (d) and (a) reveals that Parse-\sigma 

outranks Align L (Ft, PrW).

As demonstrated in (30) above, the addition of an anti-stress clash constraint correctly predicts (a) as the optimal 
candidate. At this point, there remains one crucial ranking that can be established with unaccented suffix data, an 
examination of the form [/\jpos/\wz\jpos/] in the following tableau, demonstrates that *P/\ crucially outranks Parse-\sigma.
In this subsection it has been observed that words containing unaccented lexical suffixes follow the basic stress pattern. Their increased morphological complexity, and hence length, has revealed the existence of an anti-stress clash constraint in the grammar. Accented lexical suffixes differ from unaccented lexical suffixes in that they attract stress in certain environments; as a result, some words containing accented lexical suffixes are problematic for the present analysis, as is expected. The next subsection will demonstrate that the introduction of another constraint will capture the pattern of the accented suffixes.

### 4.1.2. Accented Lexical Suffixes

Accented lexical suffixes can bear stress, but do not always bear stress. When they are suffixed to unaccented roots (monosyllabic roots), they receive primary stress; when they are suffixed to accented roots (bisyllabic roots), they receive either secondary stress or no stress at all, depending on where primary stress falls. This is to say that if the leftmost syllable of the root bears primary stress, the accented lexical suffix will not bear secondary stress. Secondary stress is entirely predictable since it falls on alternating syllables preceding or following syllables bearing primary stress.

In the present analysis, as is expected. The next subsection will demonstrate that the introduction of another constraint will capture the pattern of the accented suffixes.

### Table 3 (31)

<table>
<thead>
<tr>
<th>Root</th>
<th>Accent</th>
<th>Primary Stress</th>
<th>Secondary Stress</th>
<th>Parse- σ</th>
<th>Foot-BinG</th>
<th>Align</th>
<th>LF(Pr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(t')&lt;sep'ɛʔɔw 'ugly faced'</td>
<td>*(t')&lt;sep'ɛ'ʔɔw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>(t')&lt;sep'ɛ'ʔɔw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>(t')&lt;sep'ɛ'ʔɔw'ʔɔw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

These data are inconsistent with our analysis of the basic stress assignment pattern observed in Skwxwú7mesh; given the analysis presented in Section 4, we would predict that in a bisyllabic form (in this case, a monosyllabic root + a monosyllabic lexical suffix) the leftmost syllable (namely, the root) would receive stress; however, in the word [sλəkw̓əməʔ'iʔəmʔaw'tx̄'w̄], stress falls on the rightmost syllable (the lexical suffix). Since the constraint ranking, as presently stated, will predict the incorrect candidate to be the optimal one, it becomes necessary to introduce a faithfulness constraint which is morphologically conditioned. Since phonologically conditioned constraints cannot predict morphologically conditioned stress, we propose that accented lexical suffixes are prominent in the input and appeal to prosodic affix faithfulness to account for their tendency to attract stress. In his analysis Cupeño, Alderete (1997) proposes a correspondence constraint that governs the relation of prominence in the input and the output. To ensure that the correct optimal candidates are selected, the following faithfulness constraint is assumed:

**Every prominence in an affix in the input must have a prominence in the output**

In other words, accented suffixes are specified for prominence in the input and that prominence should be respected in the output. Introducing MAX-Pₐf predicts the optimal candidate in /sλəkw̓əməʔ'iʔəmʔaw'tx̄'w̄/ 'tent'.

### Table 4 (34)

<table>
<thead>
<tr>
<th>Root</th>
<th>Accent</th>
<th>Primary Stress</th>
<th>Secondary Stress</th>
<th>Parse- σ</th>
<th>Foot-BinG</th>
<th>Align</th>
<th>LF(Pr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/sλəkw̓əməʔ'iʔəmʔaw'tx̄'w̄/ 'tent'</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>(t')&lt;sep'ɛ'ʔɔw'ʔɔw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>(t')&lt;sep'ɛ'ʔɔw'ʔɔw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

The tableau in (34) demonstrates that MAX-Pₐf crucially outranks Head-L. In looking at phonologically more complex words it is evident that there is crucial ranking with respect to MAX-Pₐf. The word /sλəkw̓əməʔ'iʔəmʔaw'tx̄'w̄/ 'barn' demonstrates that *P₀ crucially outranks MAX-Pₐf.

---

12 Thus far, this is the only suffix recorded that displays this tendency towards receiving stress; further research will confirm the proposal that there is a class of lexical suffixes in which prominence exists in the input.
4.1.3. Inherently stress;

The final class of lexical suffixes that will be addressed is the inherently accented suffix which attracts the next subsection will introduce this data and another prosodic faithfulness constraint.

4.1.3.1. Inherently Accented Lexical Suffixes:

Inherently accented lexical suffixes receive primary stress without exception; secondary stress falls on every other syllable preceding or following it. Consider the examples below:

<table>
<thead>
<tr>
<th>(35)</th>
<th>st'qew' [aw'tx]</th>
<th>*P/a</th>
<th>MAX-PAt</th>
<th>Head-Left</th>
<th>Parse-σ</th>
<th>Foot-Binγ</th>
<th>Align L (P, PrW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>s'qew' [aw'tx]</td>
<td>*</td>
<td>*</td>
<td>MAX-PAt</td>
<td>Head-Left</td>
<td>Parse-σ</td>
<td>Foot-Binγ</td>
<td>Align L (P, PrW)</td>
</tr>
<tr>
<td>b.(st'qew'')(aw'tx)</td>
<td>*</td>
<td>*</td>
<td>MAX-PAt</td>
<td>Head-Left</td>
<td>Parse-σ</td>
<td>Foot-Binγ</td>
<td>Align L (P, PrW)</td>
</tr>
<tr>
<td>c. (st'qew'')(aw'tx)</td>
<td>*</td>
<td>*</td>
<td>MAX-PAt</td>
<td>Head-Left</td>
<td>Parse-σ</td>
<td>Foot-Binγ</td>
<td>Align L (P, PrW)</td>
</tr>
</tbody>
</table>

The example in (36d) above demonstrates that it is more important to stress the inherently accented suffix than it is to avoid stressing schwa.

Since inherently accented lexical suffixes get stress without exception and accented lexical suffixes are not always stressed, it follows that these differences must be accommodated for in grammar.

4.1.3.1.1. MAX-Ft:

All prosodic structure in the input must have a correspondence of structure in the output. In other words, inherently accented lexical suffixes are footed in the input, and the output should be faithful to the structure in the input. Consider the tableau in (40):

The example in (36d) above demonstrates that it is more important to stress the inherently accented suffix than it is to avoid stressing schwa.

A comparison of candidates (b) and (c) in the tableau in (40) above demonstrates that it is more important to avoid a stress clash than to stress a schwa; hence, *P/a crucially outranks MAX-PAt, furthermore a comparison of candidates (a) and (b) demonstrate that MAX-Ft crucially outranks *P/a.

In this section it was demonstrated that the stress is phonologically determined in words of the structure root and that it is morphologically and/or phonologically determined in words of the structure root * accented/inherently accented lexical suffixes. To account for the latter, two prosodic faithfulness constraints were introduced. In conjunction with the phonologically driven constraints on stress assignment, these two constraints predicted optimal candidates for the apparently exceptional forms.
5. Vowel Quality: Beyond Schwa

As outlined in Section 1, most phonetic vowels in Skwxwú7mesh can bear stress while certain vowels cannot. The goal of this section is to account for the surface realizations of Skwxwú7mesh vowels; specifically, we will account for the fact that high vowels in Skwxwú7mesh cannot bear stress. We begin this part of our analysis with a discussion of full vowel place specifications.

5.1. Place Specifications

Although eight full vowels surface phonetically in Skwxwú7mesh, the three front vowels are non-contrastive with respect to each other and the three back vowels are non-contrastive with respect to each other. To account for these facts, we follow Kuipers (1967) in assuming a three-way underlying vowel distinction; thus, underlingly, we assume that there are three place specifications: [FRONT], [BACK] and [LO]. This is shown in (41) below (the vowels in slanted brackets correspond to each group of vowels; these symbols will be represented in the input):

\[
\begin{array}{|c|c|c|}
\hline
  & /i/ & /u/ \\
\hline
[FRONT] & e & o \\
\hline
[LO] & a \\
\hline
\end{array}
\]

Following Kuipers (1967), we assume that schwa is predictable in Skwxwú7mesh, thus we do not identify schwa in the input. Instead, we assume that constraints on syllable structure will force epenthetic schwa to surface in output forms, though we do not make reference to these constraints in this analysis as this related discussion is beyond the scope of this paper.

5.2. Quality-Sensitivity: Kenstowicz

Kenstowicz (1996) analyzes the effect of vowel quality on determining the location of stress. He proposes that stress seeks out the most optimal vowel as determined by the two sonority scales given in (42) below:

\[(42a) \quad a > e, o > i, u \quad \text{lower} > \text{higher} \\
(42b) \quad a, e, o, i, u > ' \quad \text{peripheral} > \text{central}\]

Following Prince and Smolensky (1993) who use the sonority hierarchy in syllabification to argue for a Peak-Prominence constraint, Kenstowicz argues for a prominence hierarchy, where the more sonorous the phoneme, the more likely it is to be a peak and the less sonorous the phoneme, the more likely it is to be a margin. He shows that there are languages which define metrical stress through the alignment of the prominence scales in (42) above with the peak-trough scales for metrical feet. Kenstowicz claims that the hierarchies are derived from the following constraint rankings that are fixed in UG; thus, individual grammars cannot reverse any of these orderings (note that P refers to peak and T refers to trough):

\[
\begin{array}{|c|c|c|c|}
\hline
& \text{'black bear'} & *P/\text{HI} & \text{Max-}\text{HI} & \text{Head-Left} \\
\hline
\text{a.} \quad (m/\text{fz}/\text{z}) & * & * & * \\
\text{b.} \quad (m/\text{z}/\text{h}) & * & * & * \\
\text{c.} \quad (m/\text{z}/\text{f}) & * & * & * \\
\hline
\end{array}
\]

Within an OT framework, Kenstowicz gives evidence for dividing Prince and Smolensky’s Peak-Prominence constraint into micro-constraints by showing how other constraints can be ranked within the micro-constraints. Using Kenstowicz’s model, the phonetic realizations of stressed vowels in Skwxwú7mesh can be explained.

Recall that the Skwxwú7mesh grammar prefers to stress a full vowel that is not at the left edge of a foot over stressing a schwa that is at the left edge of a foot; in Section 3, this resistance to stressing schwa was captured by ranking the peak-prominence micro-constraint *P/3 higher that the Head-Left alignment condition. Turning to the full vowels, it is observed that the high vowels [i] and [u] never appear in stressed position in Skwxwú7mesh. The behavior of the high vowels differs from the behavior of schwa of schwa in two ways; firstly, while schwa will bear stress when there is no other full vowel available, the high vowels never bear stress. Secondly, there are no forms in which stress will fall on a second syllable in order to avoid stressing a high vowel at the left-edge of a foot. Instead, we observe that leftmost full front/back vowels that bear stress are [e] or [e] for the front vowels and [o] or [o] for the back vowels. To explain the resistance of Skwxwú7mesh to stressing the high vowels [i] and [u], we assume the following peak-prominence constraint:

\[(44) *P/[\text{HI}]: \quad \text{vowels with the specification [HI] cannot head a foot}\]

This constraint will rule out candidates in which [i] or [u] bears stress, since they are the high vowels of Skwxwú7mesh.

Although it assumed that all peak-prominence micro-constraints are present in the Skwxwú7mesh grammar, constraints such as *P/e,o and *P/a are not crucial to the selection of the correct optimal candidate. Since [e], [o] and [a] are the preferred vowels for stress in Skwxwú7mesh, *P/e,o and *P/a will consistently be violated by optimal candidates and have thus been omitted from the ranking.

5.3. Feature Faithfulness

Since the front and back vowels are non-contrastive, it is necessary to assume two possible inputs: one that includes the place specification [HI] and one that does not. Assuming that the feature [HI] is present in the input, crucial ranking of *P/3i higher than faithfulness to the feature [HI] will be established. The relevant faithfulness constraint is given in (45) below:

\[(45) \quad \text{Max-}\text{HI}: \quad \text{Any place feature [HI] present in the input must have a correspondent in the output}\]

The crucial ranking is shown in the tableau in (46) below (for expository purposes, we present the feature [HI] with the vowel [i]):

\[
\begin{array}{|c|c|c|c|}
\hline
\text{/mi/x/Al} & ' \text{black bear}' & *P/\text{HI} & \text{Max-}\text{HI} & \text{Head-Left} \\
\hline
\text{a.} \quad (m/\text{fz}/\text{z}) & * & * & * \\
\text{b.} \quad (m/\text{z}/\text{h}) & * & * & * \\
\text{c.} \quad (m/\text{z}/\text{f}) & * & * & * \\
\hline
\end{array}
\]

If it is assumed that the feature [HI] is not present in the input, a second faithfulness constraint must be assumed. This constraint is given in (47) below:
However, crucial ranking between *P/H and DEP-HI cannot be established. This is demonstrated in the tableau below:

<table>
<thead>
<tr>
<th>/m\x</th>
<th>A/</th>
<th>'black bear'</th>
<th>*P/H</th>
<th>DEP-HI</th>
<th>Head-Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>*a. (m\x</td>
<td>a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. (m\x</td>
<td>d</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. (m\x</td>
<td>d</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Because *P/H is never violated by the optimal candidate, it is impossible to demonstrate crucial ranking with *P/a; however, we will assume based on Kenstowicz’s sonority hierarchy that *P/a crucially outranks *P/H. The following tableau incorporates these constraints into the established ranking (note that we are not assuming that the feature [\textit{hi}] is in the input):

<table>
<thead>
<tr>
<th>/m\x</th>
<th>A/</th>
<th>‘black bear’</th>
<th>Max-P</th>
<th>*P/a</th>
<th>Max-P</th>
<th>-P</th>
<th>Head-Left</th>
<th>Parsec</th>
<th>Foot Bing</th>
<th>Align L (Ft, Pr/W)</th>
<th>*P/H</th>
<th>DEP-HI</th>
</tr>
</thead>
<tbody>
<tr>
<td>*a. (m\x</td>
<td>a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. (m\x</td>
<td>d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. (m\x</td>
<td>d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Notice that the front vowel in the first syllable in [m\x|a|] is transcribed with an [e] instead of an [e]; this may be related to consonant-vowel interaction in Sk'\textasciicircum{w}x\textasciicircum{w}mesh. The next subsection will address this issue in further detail.

5.4. Consonant-vowel interaction

A preliminary examination of consonant-vowel interaction suggests that the post-vellar consonants may have a lowering effect on front and back vowels in Sk\textasciicircum{w}x\textasciicircum{w}mesh. Consider the examples in (50) and (51) below:

(50a) [m\x|a|] 

(50b) 

(50c) 

(50d) 

(50e) 

All the front and back vowels in (50) occur adjacent to postvellar consonants and are realized as [e] and [o], respectively; the front and back vowels in (51) are realized as [e] and [o], respectively and do not occur in the same environment. The phonetic realization of vowels adjacent to postvellar consonant in Salish has been analyzed by Shahin (1997) for St'\textasciicircum{w}\\textasciicircum{w}mesh (Interior Salish). Further examination of vowel quality and context will help to determine what is responsible for the variation of front and back vowels in Sk\textasciicircum{w}x\textasciicircum{w}mesh.

6. Conclusion

This paper has attempted to demonstrate how position, the lexicon and vowel quality interact in determining how stress is assigned in Sk\textasciicircum{w}x\textasciicircum{w}mesh. We have shown that the basic stress pattern can be captured via the ranking of five stress assignment constraints. Data on lexical suffixes suggest that a stress clash constraint and two prosodic faithfulness constraints are required to account for the fact that accented lexical suffixes do not attract stress, accented suffixes attract stress only when suffixed to unaccented roots and inherently accented suffixes always attract stress. Finally, we have shown that a second prominence constraint banning [\textit{hi}] vowels in stressed position is needed to account for the fact that [\textit{i}] and [\textit{u}] never bear stress. Although a complete analysis of consonant-vowel interaction has not yet been established, the pursuit of this issue may prove to explain why certain variants of front and back vowels surface. Examination of other Sk\textasciicircum{w}x\textasciicircum{w}mesh lexical suffixes as well as the examination of the quality of vowels in various contexts will confirm the generalizations and analysis proposed in this paper.

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### APPENDIX: KEY TO THE ORTHOGRAPHY

<table>
<thead>
<tr>
<th>orthography</th>
<th>phonetic symbol</th>
<th>orthography</th>
<th>phonetic symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>p</td>
<td>kw</td>
<td>k'</td>
</tr>
<tr>
<td>p'</td>
<td>p'</td>
<td>kw'</td>
<td>k''</td>
</tr>
<tr>
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<td>xw</td>
<td>x'</td>
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<td>m'</td>
<td>k</td>
<td>q</td>
</tr>
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<td>t</td>
<td>t</td>
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