Lillooet stress shift and its implications for syllable structure and prosody*

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1. Introduction

This paper examines the phenomenon of stress shift in Lillooet, a Northern Interior Salish language. Lillooet stress shift is best viewed not as a single process, but rather as a cluster of properties that conspire to shift stress as far to the right edge of a word as possible while still obeying unrelated constraints. It will be argued here that Lillooet in fact has two types of stress shift: one bounded, the other unbounded. Section 2 provides an account of bounded stress shift within the rule-based metrical stress theory of Hayes (1991). The stress shift data also have implications for an analysis of Lillooet syllable structure. Section 3 will show that although Lillooet permits surface consonant clusters in coda position, the stress facts suggest that final clusters are not integrated into the syllable, which is argued here to be maximally CCVC. Additional consonants are in fact prosodically licensed only by moras that are not integrated into syllabic structure, as has similarly been claimed by Bagemihl (1991) for Bella Coola, another Salish language. Section 4 presents data involving unbounded stress shift which do not have a ready analysis within Hayes' (1991) framework. It will also be seen that two otherwise general constraints on Lillooet stress may be violated, and this mystery will be considered from the perspective of Optimality Theory, which is designed to address the surface violation of phonological constraints (McCarthy and Prince (1993), Prince and Smolensky (1993)).

There are other aspects of stress shift that will not be addressed here. One, for example, is the behaviour of so-called strong suffixes, which invariably attract stress. As this is partly an idiosyncratic morphological property, it will not be addressed here. Rather, this paper seeks to explain the purely phonological properties of Lillooet stress shift. A more inclusive description of stress shift that outlines the stress-related properties of specific affixes may be found in van Eijk (1981b, 1984: 20-24).[1]

All of the data in this paper are from van Eijk (1981a, 1981b, 1984), although some data have been re-checked with informants. For additional data consult van Eijk (1983).

2. Bounded stress shift

Lillooet has the following inventory of vowel phonemes according to Remnant (1990: 57):

(1)

i		u
	ə	
	a	

Van Eijk (1984: 2) includes the retracted counterparts of each of these phonemes in his inventory; the discrepancy is ignored in this paper as it is not particularly relevant to stress. For discussion consult van Eijk (1984) and Remnant (1990), especially the former for a general sketch of the language, which is not given here.

Some aspects of Lillooet stress are predictable (such as the process of stress shift examined here), while others are not. For example, stress can be seen to be unpredictable and contrastive in the following minimal pairs:

(2)

a.	máqaʔ	'snow'	maqáʔ	'poison onion'
b.	t͡ɬ'ámin	'fur'	t͡ɬ'amín	'axe'

The simplest case of stress shift is illustrated in (3). To use van Eijk's (1984: 20-24) neutral terminology: in root-suffix combinations, stress moves rightward two vowels at a time from the underlyingly stressed vowel of the root—as far as possible—as long as it does not fall on the last vowel of the word. Hyphens represent morpheme divisions:

(3)

a.	cún	'to order'
	cún-ɬkaxʷ	'you ordered him'
	cún-tumuɬ	'order us!'
	cun-tumúɬ-kaxʷ	'you ordered us'
	cun-tumúɬ-kal'ap	'you folks ordered us'
b.	cúɬ-un'	'to point at'
	cúɬ-un'-ɬkaxʷ	'you pointed at him'
	cuɬ-un'-túmuɬ	'point at us!'
	cuɬ-un'-túmuɬ-kaxʷ	'you pointed at us'
	cuɬ-un'-tumuɬ-kál'ap	'you folks pointed at us'
c.	qan'ím	'to hear'
	qan'ím-ɬkal'ap	'you folks hear'
	qan'im-ɬkal'áp ha	'do you folks hear?'
d.	ʔúxʷalmixʷ	'Indian, person'
	ʔuxʷalmíxʷ-kan	'I am an Indian'
	ʔuxʷalmíxʷ-am	'to do something the Indian way'
e.	sútik	'winter'
	sutik-áka	'northern wind'
f.	sáwɬənmin	'to ask about'
	sawɬənmín-ɬkan	'I asked about it'
g.	pún	'to find'
	pún-ɬkan	'I found him'
	pún-itas	'they found him'
	pun-c-al-ít-as	'they found me'
	pun-ci-háswit	'they found you'
	pun-tumúl-itas	'they found us'

h.	núk'ʷʔan	'to help'
	núk'ʷʔan-ɬkan	'I helped him'
	nuk'ʷʔan-ítas	'they helped him'
	nuk'ʷʔan-c-ál-it-as	'they helped me'
	nuk'ʷʔan-cí-haswit	'they helped you'
	nuk'ʷʔan-tumul-ítas	'they helped us'

Note that in (3c) *qan'ím* 'to hear', the underlying stress is on the second syllable, and that as suffixes are added, the stress shifts rightward two vowels at a time, counting from the underlyingly stressed vowel. Hence, the form *qan'im-ɬkal'áp ha* 'do you folks hear?' results, with stress shifted onto the fourth vowel from the left. This shows that the left edge of the metrical parsing domain of stress shift is not defined morphologically (e.g., a word edge) but rather is located at the underlyingly stressed syllable of the root. The edge of the metrical parsing domain is called the 'counting base' by van Eijk, since it is from this vowel that stress shifts rightward as suffixes are added.

The pre-tonic vowels that serve as the counting bases in the assignment of stress receive secondary stress. This is illustrated in (4):

(4)

a.	ʔúxʷalmixʷ	'Indian, person'
	ʔùxʷalmíxʷ-kan	'I am an Indian'
b.	cúɬ-un'	'to point at'
	cùɬ-un'-tùmuɬ-kál'ap	'you folks pointed at us'

Because this secondary stress is entirely predictable, van Eijk does not mark it in his transcriptions. Questions about secondary stress will be raised upon inspecting some more complicated data below, and these will be addressed accordingly.[2]

Consonant clusters (either root-final or arising from concatenation of lexical suffixes or enclitics) count like vowels with regard to the distribution of stress:

(5)

a.	ʔáw't	'late'
	ʔaw't-kál'ap	'you folks are late'
b.	χʷʔúcin	'four'
	χʷʔucin-álqʷ	'four sticks'
c.	ʔúxʷalmixʷ	'Indian'
	ʔuxʷalmíxʷ-c	'to speak Indian'
d.	ʕʷúy't	'to sleep'
	ʕʷuy't-íc'aʔ	'pyjamas, nightie'
e.	χáw'ən'	'low'
	χaw'n'-ílx	'to humble oneself'
	χaw'n'-ilx-kál'ap	'you folks humble yourselves'

f.	pán'-c	'to share somebody's meal'
	pan'-c-kál'ap	'you folks share somebody's meal'
g.	súp-c-am'	'to scratch one's mouth, lips'
	sup-c-ám'-ɬkan	'I scratch my lips'
h.	cúɬ-un'-ɬkan	'I point at it'
	cuɬ-un'-ɬkán kɬ	'I will point at it'
i.	p'án't	'to return'
	p'an't-kál'ap	'you folks returned'
j.	q'ʷezílx	'to dance'
	q'ʷezilx-kál'ap	'you folks danced'

In (5a) *ʔaw't-kál'ap* 'you folks are late', it can be seen that stress shifts only one syllable, not two. Of course, if stress were to shift two syllables to the right, it would have to fall on the final syllable—a possibility that is generally excluded. In this case, then, stress would be expected to remain in its underlying position in the root: **ʔáw't-kal'ap*. Instead, the *w't* consonant cluster seems to behave as if it were a vowel with regard to the calculation of stress shift, forcing stress onto the adjacent syllable. The same observation extends to the other data in (5), and it suggests that root-final and word-final consonant clusters are moraic, i.e., weight-bearing. The prosodic unit relevant to stress shift is therefore the mora, not the syllable.

Consonants may not bear stress, and so if a consonant cluster is in a position to which stress would be assigned, the cluster is ignored:

(6)

a.	cúkʷ-al'-c	'to finish eating'
b.	cúkʷ-al'-c-kan	'I am finished eating'
c.	cukʷ-al'-c-kál'ap	'you folks are finished eating'

The consonant cluster data of (5) have significant implications for syllable structure, which will be discussed in section 3. The data are listed above only to show that moras (not syllables) are relevant for stress shift.

The data presented so far represent the core case of stress shift. Hayes' (1991) metrical stress theory is adequate to characterize it, since the stress generally moves rightward in a binary fashion from the stressed vowel of the root. A prerequisite to this analysis, though, is to consider how best to represent the underlying primary stress, since it was seen from the minimal pairs in (2) to be distinctive, and moreover it locates the edge of the metrical parsing domain. Because underlying stress will have to be stated with a word's lexical entry, it will simply be stipulated that underlyingly stressed syllables are assigned prominence on line 1 (the mora row) of the metrical grid. The contrast between the words in (2a) will therefore be represented as follows:[3,4]

(7)

```
a.                  b.

 x                        x
 µ  µ                  µ  µ
máqa?               maqá?
'snow'              'poison onion'
```

The stress rule is stated formally in (8), followed by general comments on each part of the rule. Derivations will then be given to illustrate each aspect of this rule:

(8)
  a. Final moras are extrametrical.
  b. Parse the word (beginning with the underlying grid mark) from left to right into moraic trochees, i.e., feet containing two light syllables (the first being more prominent than the second) or a single heavy syllable.
  c. End Rule Right (at word level).

Final moras are extrametrical (8a) because stress generally does not shift onto the final syllable. Stress may shift onto the final syllable, however, if that syllable is bimoraic, i.e., contains a consonant cluster in addition to a vowel, as was seen in (5b,c). This is permitted by final-mora extrametricality, but would not be permitted by final-syllable extrametricality. The word is parsed left to right (8b) because the target of stress shift is determined by counting in a binary fashion from the left, starting at the stressed vowel of the root. The word is parsed into moraic trochees because consonant clusters behave like vowels with regard to the calculation of stress shift (recall the data from (5); see also section 3 below). This fact could not be accommodated by parsing instead into syllabic trochees, for example, since the consonant clusters do not form syllables themselves. End Rule Right (8c) places a grid mark on line 2 (word level) at the right edge, making that syllable the most prominent in the word. This accounts for the fact that the rightmost strong syllable always receives primary stress.

Consider now some derivations illustrating rule (8). First, some examples without stress shift are (3b) *cúɬ-un'* 'to point at' and *cúɬ-un'-ɬkax̌ʷ* 'you pointed at him', which have the following underlying representations:

(9)

```
'to point at' (3b)      'you pointed at him' (3b)
 x                       x
 µ     µ                 µ    µ        µ
cúɬ-<un'>               cúɬ-un'-ɬk<ax>ʷ
```

The words are then parsed left to right into moraic trochees. The first example has a single mora, hence can form only a degenerate foot:

(10)

```
(x)                     (x    .)
 µ     µ                 µ    µ        µ
cúɬ-<un'>               cúɬ-un'-ɬk<ax>ʷ
```


Next, End Rule Right puts a grid mark atop the rightmost prominent mora. Because there is only one such element in each word, the effect is essentially vacuous and stress is correctly placed on the initial syllable. In neither example has stress shifted from its underlying position in the root, since each word contains only a single foot:

(11)

```
(x)                     (x    )
(x)                     (x    .)
 µ     µ                 µ    µ        µ
cúɬ-<un'>               cúɬ-un'-ɬk<ax>ʷ
```

Consider now some longer forms of these words, in which stress shift does occur. The underlying forms of (3b) *cuɬ-un'-túmuɬ* 'point at us!' and *cuɬ-un'-tumuɬ-kál'ap* 'you folks pointed at us' are shown in (12):

(12)

```
 x                        x
 µ   µ      µ  µ          µ   µ     µ µ    µ   µ
cuɬ-un'-túm<uɬ>          cùɬ-un'-tùmuɬ-kál'<ap>
```

Note again that each word starts with an underlyingly prominent mora and final-mora extrametricality. The words are parsed into moraic trochees as follows:

(13)

```
(x    .)   (x)            (x    .)  (x .)  (x)
 µ    µ     µ  µ           µ    µ    µ µ    µ   µ
cuɬ-un'-túm<uɬ>          cùɬ-un'-tùmuɬ-kál'<ap>
```

In each case, the final mora forms a degenerate foot. When End Rule Right applies, primary stress is correctly placed on this rightmost foot:

(14)

```
(          x)             (                x)
(x    .)   (x)            (x    .)  (x .)  (x)
 µ    µ     µ  µ           µ    µ    µ µ    µ   µ
cuɬ-un'-túm<uɬ>          cùɬ-un'-tùmuɬ-kál'<ap>
```

Note finally that these representations also indicate correctly the locations of secondary stress, pursuant to the data in (4b).

Some exceptions to the general process of stress shift are now detailed. First, the mid central vowels ə and ʌ (so-called 'weak vowels,' often referred to collectively as 'schwa') may not be the targets of stress shift, although they otherwise behave like full vowels. Note, for example, that where a weak vowel is not in a position to receive the stress, it nevertheless counts for the assignment of stress, just like a full vowel:

(15)
  a. ɬáp-ən — 'to forget'
     ɬap-ən-ɬkál'ap — 'you folks forgot it'

b.	k'ʷəzúsəm-ɬkaxʷ	'you worked'
	k'ʷəzúsəm-ɬkan	'I work(ed)'
	k'ʷəzusəmɬkáxʷ ha	'did you work?'
	k'ʷəzusəm-ɬkán kɬ	'I will work'
c.	ʔít͡ɬ'əm	'to sing'
	ʔít͡ɬ'əm-ɬkál'ap	'you folks sing'
	ʔít͡ɬ'əm-ɬkáxʷ ha	'do you sing?'
d.	sáwɬənmin	'to ask about'
	sawɬənmín-ɬkan	'I asked about it'
e.	táɬ-ləx-wi	'stand up, you folks!'
	taɬ-ləx-wí maɬ	'stand up then, you folks!'

The underlying forms of (15d) *sáwɬənmin* 'to ask about' and *sawɬənmín-ɬkan* 'I asked about him' are given below:

(16)
```
 x                     x
 μ  μ   μ              μ  μ  μ     μ
sáwɬənm<in>           sawɬənmín-ɬk<an>
```

When the word is parsed into moraic trochees, schwa in each example is the weak element of the moraic trochee:

(17)
```
(x   .)               (x   .) (x)
 μ  μ   μ              μ  μ  μ     μ
sáwɬənm<in>           sawɬənmín-ɬk<an>
```

Finally, End Rule Right applies, shifting stress in the longer word but not in the shorter one:

(18)
```
(x    )               (       x)
(x   .)               (x   .) (x)
 μ  μ   μ              μ  μ  μ     μ
sáwɬənm<in>           sawɬənmín-ɬk<an>
```

In cases where stress is expected to fall on a weak vowel, however, it skips instead to the next vowel—if that vowel is non-final—otherwise stress does not shift at all. This is illustrated in (19):[5]

(19)

a.	záx-al'qʷəm'		'tall'
b.	záx-al'qʷəm'-ɬkan	(*zax-al'qʷə́m'-ɬkan)	'I am tall'
c.	zax-al'qʷəm'-ɬkál'ap	(*zax-al'qʷə́m'-ɬkal'ap)	'you folks are tall'

The underlying metrical representations of (19b) *záx-al'qʷəm'-ɬkan* 'I am tall' and (19c) *zax-al'qʷəm'-ɬkál'ap* 'you folks are tall' are as follows:

(20)
```
 x                        x
 μ  μ    μ       μ        μ  μ    μ      μ  μ
záx-al'qʷəm'-ɬk<an>      zax-al'qʷəm'-ɬkál'<ap>
```

In parsing the shorter word (19b) *záx-al'qʷəm'-ɬkan*, schwa must form a degenerate foot because it is the final metrical mora. The schwa in (19c) *zax-al'qʷəm'-ɬkál'ap*, on the other hand, is able to head a moraic trochee:

(21)
```
(x   .)  (x)              (x   .)  (x     .)
 μ  μ    μ       μ        μ  μ    μ      μ  μ
záx-al'qʷəm'-ɬk<an>      zax-al'qʷəm'-ɬkál'<ap>
```

When End Rule Right applies, stress is shifted onto schwa in each example, incorrectly deriving **zax-al'qʷə́m'-ɬkan* and **zax-al'qʷə́m'-ɬkal'ap*.

(22)
```
(         x)              (        x      )
(x   .)  (x)              (x   .)  (x     .)
 μ  μ    μ       μ        μ  μ    μ      μ  μ
zax-al'qʷə́m'-ɬk<an>      zax-al'qʷə́m'-ɬkal'<ap>
```

It seems that in order to prevent stress from shifting onto schwa, schwa must be explicitly excluded from being able to head a moraic trochee. This is stated in (23), which also excludes consonants from the same position (since consonants may not bear stress), though presumably this would otherwise be required by sonority constraints:

(23)

Only syllables with full vowels are stress-bearing. Neither schwa nor a moraic consonant may head a bimoraic foot, i.e., they must occupy the weak, second element of the moraic trochee.

An obvious question concerns how to represent this property of schwa in the metrical grid. L. Downing (p.c.) suggests that schwa simply not be parsed if it is not able to occupy the weak, second element of the bimoraic foot. Under this analysis, then, the representations of (22) above would instead appear as in (24) below:

(24) a. b.

```
(X      )            (                       X)
(X    .)             (X    .)               (X)
 µ    µ       µ          µ    µ     µ       µ     µ     µ
záx-al'qʷəm'-ɬk<an>    zax-al'qʷəm'-ɬkál'<ap>
```

These representations allow the correct placement of stress, since the moraic schwa is not incorporated into a well-formed foot. An empirical concern, however, is that the representations in (24) predict that schwa can never bear secondary stress. In fact, schwa can apparently bear secondary stress in the words of (34), to be discussed in section 4:

(25)

ləʕʷ-ən-túmuɬ	'hide us!'
ləʕʷ-ən-tùmuɬ-kál'ap	'you folks hide us!'

Because van Eijk (1984) does not examine secondary stress nor indicate it in his transcriptions (the forms in (25) were elicited during subsequent fieldwork, which has not yielded a consistent picture of secondary stress), the issue must be left for future research. In the meantime, representations like (24) will suffice.

A larger concern is how to explain (23), which stipulates that schwa may not head a stressed syllable. Although schwa in many languages behaves asymmetrically with respect to full vowels (e.g., vowel harmony in Pashto (Penzl 1955: 19, 21-22)), it is rare for this asymmetric behaviour to be observed in stress systems.[6] Hayes (1991: 39-40), for example, is confident enough about this that he makes the strong claim that metrical structure refers solely to syllable structure. The Lillooet data, however, strongly suggest that the stress rules actually must look below the root node for place features.

It is consoling to note that if metrical structure is indeed referring to the featural content of vowels, schwa in Lillooet has been claimed to be maximally underspecified (i.e., lacking features) at underlying representation, since the distinction between weak vowels and full vowels is relevant to other areas of Lillooet phonology (Remnant 1990). For example, weak vowels are more easily elided from certain positions as suffixes are added than are full vowels, and weak vowels are also epenthetic in some environments (van Eijk 1984: 6). Moreover, the phonetic realization of weak vowels may vary widely (van Eijk 1984: 12), suggesting that its features may be supplied via processes like spreading. Finally, weak vowels and full vowels behave asymmetrically with respect to a process of consonant retraction. This process regularly retracts only full vowels when they precede either a uvular consonant or /z z'/ (Remnant 1990: 60-61). Schwa does not retract to [ʌ] as would otherwise be expected on the basis of a separate retraction process that is triggered by a floating adversative morpheme which targets alveopalatal consonants and all vowels, including schwa (Remnant 1990: 86-94). See section 3 below as well as Remnant (1990) and Matthewson (in preparation) for further discussion of retraction in Lillooet.

If the stress rules in Lillooet indeed must refer to vocalic place features, it is plausible that the absence of such features on a segment (as Remnant 1990 proposes for schwa) is sufficient to prohibit the construction of metrical structure over the segment. However, it is not clear how to handle monosyllabic words with (stressed) schwa; this problem will be picked up in section 4, where it will be given a principled explanation.[7]

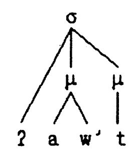
3. Implications for syllable structure

Recall the rather interesting behaviour of consonant clusters as outlined above in (5). Only root-final and word-final consonant clusters behave as if they are heavy, i.e., bimoraic (e.g., (5a) *ʔaw't-kál'ap* cf.

**ʔáw't-kal'ap* 'you folks are late'), while medial clusters do not (e.g., (3g) *pùn-c-aɬ-ít-as* cf. **pùn-c-áɬ-it-as* 'they found me'; (3c) *qan'ím-ɬkal'ap* cf. **qan'im-ɬkál'ap* 'you folks hear'). This suggests that coda consonants are not invariably moraic, and hence that weight is not assigned to consonants only by virtue of their position. This is especially evident from a form like (3g) *pùn.ca.lí.tas* 'they found me', which would be syllabified as indicated by the periods. If the *n* in the coda of the first syllable (*pun*) were moraic, we would expect stress to shift only as far as the next syllable, yet this does not occur, as indicated above.

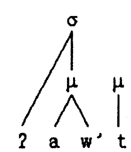
Similarly in (3c), *qan'ímɬkal'ap* 'you folks hear', stress shift does not occur, yet the final consonant *m* of the root *qan'ím* must form a coda according to the sonority hierarchy. Although it forms a coda, then, it does not seem to be moraic, since it does not count for the assignment of stress. The other striking point to note about this word is the medial cluster *mɬk*; if only final clusters behave as if they are heavy, the syllable division of this word must be *qa.n'ím.ɬka.l'ap*, with the *ɬk* cluster forming a complex onset. The maximal syllable structure, then appears to be CCVCC. But because the coda behaves as if it is heavy only when it contains two consonants, the moraic representation of a root like (5a) *ʔaw't* 'late' would appear rather oddly as in (26):

(26)



This representation is unusual in that it suggests that syllabification allows only a single consonant to be adjoined to the vowel's mora, whereas additional consonants are assigned weight by position. In order to maintain a more consistent statement of weight and syllable structure in Lillooet, perhaps Bagemihl's (1991: 596) Simple Syllable Hypothesis (SSH) may be adopted here, permitting extrasyllabic consonants to be licensed solely by moras. Under this account, the maximal syllable in Lillooet would be CCVC (identical to the syllable size that Bagemihl (1991) proposes for Bella Coola, except that Bella Coola also has long vowels), with only vowels being linked to moras. The single permissible coda consonant, if present, is not linked to its own mora (since it does not bear weight), but instead adjoins to the vowel's mora. Consonants that cannot be integrated into this CCVC syllable are instead moraically licensed, and are not attached to the syllable. Under this account, (5a) *ʔaw't* 'late' would instead have the following representation:

(27)



(27) differs from (26) in that it respects the maximal CCVC syllable size, since the final *t* is not part of the syllable.

It is beyond the scope of this paper to give a complete justification of the representation proposed in (27). Recall that it is the number of moras rather than syllables that is implicated in stress shift. In order to formulate the rule of stress shift (as in (8) above), either representation (26) or (27) will suffice, though the former is perhaps an unprecedented representation and hence would have to be defended just as (27) would.

A proper defence of the SSH (27) probably would require lengthy discussion and proposals about Lillooet prosodic morphology, and it is not obvious that Lillooet can offer the same evidence from reduplication that Bagemihl (1991) is able to find in Bella Coola to justify his proposal. However, perhaps independent evidence for the SSH in Lillooet may be adduced from a process of retraction harmony discussed by Remnant (1990: 86-94).[8] Remnant proposes a floating adversative morpheme (comprising a floating tongue root node) which spreads bidirectionally through a word, including prefixes and suffixes, retracting all vowels and alveopalatal consonants. There are several exceptional forms, though, in which retraction does not spread onto affixes, but is confined to the root. Interestingly, many of these exceptional forms have consonant clusters similar to the root-final clusters that count as moraic in calculating the target of stress shift. If the analogy is correct, the SSH as in (27) could account for the blocking of retraction in such forms if retraction harmony were regarded not as a long-distance process (as Remnant (1990) regards it), but instead as a more local process, e.g., restricted to syllabically licensed segments. The idea is worth pursuing, since Remnant (1990: 95) speculates only that retraction harmony is blocked in the exceptional forms because of level ordering within the lexical phonology, though she does not attempt an analysis.

To conclude this section, derivations of words having consonant clusters are now given. (5b) *χʷʔucin-álqʷ* 'four sticks' has a final cluster in its lexical suffix *-alqʷ*, and so the final, moraic consonant *q* is extrametrical. In (5j) *q'ʷezilx-kál'ap* 'you folks danced' there is a medial consonant cluster *lx*, the second consonant of which is moraic as per the discussion above. The underlying forms are therefore are follows:

(28)
```
     x                        x
     μ μ   μ   μ              μ μ μ   μ    μ
  χʷʔucin-ál<qʷ>            q'ʷezilx-kál'<ap>
```

When these words are parsed into moraic trochees, the initial mora of (5j) *q'ʷezilx-kál'ap* must form a degenerate foot, because the second syllable is underlyingly stressed. After parsing, the representations are:

(29)
```
     (x .) (x)                (x) (x .) (x)
     μ μ   μ   μ              μ   μ μ   μ    μ
  χʷʔucin-ál<qʷ>            q'ʷe zilx-kál'<ap>
```

Finally, End Rule Right derives the output, with stress having shifted in each word:

(30)
```
     (       x)               (             x)
     (x .) (x)                (x) (x .) (x)
     μ μ   μ   μ              μ   μ μ   μ    μ
  χʷʔucin-ál<qʷ>            q'ʷe zilx-kál'<ap>
```

The interesting point to note concerning (5b) *χʷʔucin-álqʷ* is that stress may fall on the final syllable because only the final consonant (which is moraic) is extrametrical. This illustrates that the final extrametrical constituent is indeed a mora, not a syllable.

Finally, the metrical grid derived for (5j) *q'ʷezilx-kál'ap* predicts that the initial two syllables bear secondary stress. In fact, according to a transcription from recent fieldwork, secondary stress surfaces only on the second syllable: *q'ʷezìlx-kál'ap*. This constitutes evidence for D. Pulleyblank's (p.c.) suggestion (see n. 4) that words having non-initial phonemic stress be represented underlyingly by initial invisibility. Under

this approach, both the initial and final moras of (5j) *q'ʷezilx-kál'ap* will be extrametrical and the output will be as in (31) rather than as in (30):

(31)
```
          (       x)
          (x .) (x)
      μ   μ μ   μ    μ
  <q'ʷe> zilx-kál'<ap>
```

In this representation, the initial syllable is correctly predicted not to bear secondary stress.

4. Unbounded stress shift

The data presented so far have been given a fairly simple treatment within the metrical stress theory of Hayes' (1991). The facts presented next are more problematic for Hayes' theory, and these will be shown to be better accommodated by the Optimality Theory (OT) of McCarthy and Prince (1993) and Prince and Smolensky (1993).[9] First, note that roots with a weak vowel retain stress when combined with a suffix containing another weak vowel:

(32)

a.	mə́c	'to write'	mə́c-ən	'to write it'
b.	lə́ʕʷ	'to hide'	lə́ʕʷ-ən	'to hide it'

However, when combined with a suffix having a full vowel, stress shifts to the first full vowel, as shown in (33):

(33)

a.	mə́c	'to write'
	məc-xál	'to write (int.)'
b.	lə́ʕʷ	'to hide'
	ləʕʷ-ən-ɬkán	'I hid it'
	ləʕʷ-átkʷaʔ	'to hide water or liquor'
	ləʕʷ-ən-túmuɬ	'hide us!'
c.	qʌ́l	'bad'
	qʌl-ɬkál'ap	'you folks are bad'
	qʌl-ɬkán	'I am bad'
	qʌl-ɬkáxʷ	'you are bad'
d.	ʕə́l-ʕəl	'strong'
	ʕəl-ʕəl-ɬkán	'I am strong'
	ʕəl-ʕəl-ɬkál'ap	'you folks are strong'

As more suffixes are added, the first full vowel serves as the counting base and the stress moves rightward according to the usual binary pattern:[10]

(34)

a. ləʕʷ-ən-túmuɬ 'hide us!'

b. ləʕʷ-ən-tumuɬ-kál'ap 'you folks hide us!'

In the introduction it was stated that Lillooet stress shift is best viewed not as a single process, but as a cluster of processes. The data considered in this section particularly illustrate this property, since stress shift continues to behave phonologically (rather than morphologically, as with strong suffixes that invariably attract stress), yet the phonological conditions involved are much different than those involved in section 2. Specifically, the stress shift in (33) cannot be said to be bounded, as can the stress shift outlined in section 2. In other words, stress in (33) does not fall within a specific distance of a boundary or another stress by counting moras. Rather, this variety of stress shift seeks out full vowels as the preferred stress-bearing units. Because Hayes (1991: 26) addresses only the bounded, rhythmic property of stress systems, his metrical theory has little to say about data like (33).

But the most striking feature in (32)-(33) is that two otherwise general constraints on stress are violated. (32b) *lə́ʕʷ-ən* 'to hide it' shows that schwa may bear stress despite the constraint against this (recall the data in (19)), and (33b) *ləʕʷ-ən-ɬkán* 'I hid it' shows that the syllable associated with the final mora may bear stress, although this is generally disallowed (recall the data in (3)). These constraints can be abbreviated as in (35):

(35)

a. *STRESSED ə (=23)

b. *FINAL μ STRESS (=8a)

Besides allowing constraints to be violated at surface structure, Optimality Theory is concerned with formally capturing the mechanism whereby clashes between competing constraints are resolved. Consider how OT might be applied to Lillooet.

The form (32b) *lə́ʕʷ-ən* 'to hide it' shows that in a word containing only schwas, stress occurs on the vowel that violates the fewest constraints. By remaining in its root position, it violates only *STRESSED ə. If stress were to shift onto the final syllable (**ləʕʷ-ə́n*), however, it would additionally violate *FINAL μ STRESS. The representation violating fewer constraints is therefore preferred. The form (33b) *ləʕʷ-ən-ɬkán* 'I hid it' is revealing, though, since it presents a clash between these two constraints, and shows that *STRESSED ə is a stronger prohibition than *FINAL μ STRESS. If stress were to remain on the root syllable in (33b) (**lə́ʕʷ-ən-ɬkan*), it would violate *STRESSED ə, but it would satisfy *FINAL μ STRESS. However, stress shifts onto the final syllable—the only one that contains a full vowel—even though this violates the separate constraint against a final stressed mora.

In the terminology of Optimality Theory, this interaction is formally expressed as a dominance relation between constraints. Because *STRESSED ə is a stronger constraint than *FINAL μ STRESS, the former is said to dominate the latter, and the relation is expressed as (36):

(36)

*STRESSED ə > > *FINAL μ STRESS

OT regards rankings like these as language-particular statements. While (36) is descriptively adequate as an account of the Lillooet data, McCarthy (to appear: 17) notes that constraint hierarchies can also be argued to have some explanatory value if the opposite ranking describes a dominance relation in an existing (or at least

possible) language. The reversed ranking in this case would be *FINAL μ STRESS > > *STRESSED ə, which is perhaps more plausible than even the actual Lillooet ranking (36). Final extrametricality is extremely common in languages (Hayes 1991: 45-49), whereas stress prohibitions on specific vowels are rare and controversial (see n. 6, n. 7, above). Moreover, there is evidence that even Lillooet permits schwa to bear stress via regular, bounded stress shift (see n. 5). If there is indeed dialectal variation, it might be possible that rankings such as (36) and its reversed counterpart are what characterize the variation. There has not been any research in this area, but it is worth pursuing.

Before concluding this section, consider a final set of data exhibiting unbounded stress shift. Full vowels followed by a glottal stop ʔ behave like weak vowels in that they do not retain stress if there is a full vowel following. In the following examples, stress shifts onto the full vowel of the suffix rather than be retained by the root, which has a full vowel followed by a glottal stop:

(37)

a. q'aʔ 'to eat' q'aʔ-ɬkán 'I eat'

b. caʔxʷ 'glad' caʔxʷ-kán 'I am glad'

These data may be collapsed immediately with those containing schwa in (33). L. Downing (p.c.) has suggested that perhaps sequences of full vowels followed by glottal stop are in fact derived from underlying /əʔ/. There is good evidence for this. First, van Eijk (1984: 35 n. 14) notes that no Lillooet words have the surface sequence [əʔ]. Second, Remnant (1990: 12 n. 5, citing M. D. Kinkade (p.c.)) attributes this absence to a rule that regularly lowers /əʔ/ to [aʔ] in Interior Salish. Because (37) contains all of the examples cited by van Eijk and none have full vowels other than [a] preceding the glottal stop [ʔ], it seems likely that these forms in fact contain underlying weak vowels rather than full vowels. The data in (37) are therefore to be included with those in (33)—clearly a desirable result, since it circumvents having to allow stress rules to look below the root node for laryngeal features, which would otherwise be necessary.[11]

More could be said about Optimality Theory. For example, if extended more fully as conceived by McCarthy and Prince (1993) and Prince and Smolensky (1993), it would employ the ranking of constraints to choose the correct output from an infinite set of candidates—a procedure that differs considerably from a rule-based, derivational approach to phonology as exemplified by the application of Hayes' (1991) metrical stress theory in section 2. See also McCarthy (to appear: 18-21) for some discussion. In its simplistic presentation here, though, OT can be seen to adequately characterize the otherwise problematic data in (32)-(33).

5. Conclusion

This paper represents a tentative theoretical examination of Lillooet stress shift, and as such it has not offered a single, coherent explanation. Stress shift has been shown to comprise at least two phonologically distinct parts. Bounded stress shift was characterized by Hayes' (1991) metrical stress theory (section 2), while unbounded stress shift was given an interpretation within Optimality Theory (section 4). Stress shift was also shown have implications for Lillooet syllable structure (section 3).

Epenthesis and consonant retraction are processes that potentially bear on an analysis of stress shift. A better grasp of the former will surely yield results in understanding stress shift. Despite van Eijk's excellent data, the close analysis presented here has revealed several areas in which more detailed descriptions of Lillooet are necessary, particularly with regard to secondary stress and possible dialectal variation in stress assignment.

Notes

*Thanks to the following persons for helpful discussion and suggestions concerning several parts of this paper: Henry Davis, Laura Downing, M. Dale Kinkade, Lisa Matthewson, Doug Pulleyblank, and Pat Shaw. Henry Davis and Lisa Matthewson also elicited some data for me from their Lillooet informants under the auspices of Social Sciences and Humanities Research Council of Canada grant 410-92-1629 awarded to Patricia A. Shaw.

[1]The neighboring Thompson language likewise has particular morphemes with stress-related properties (Thompson and Thompson 1992: 22-24, 27-30), but it does not also have a binary stress system like Lillooet. In this regard, Lillooet is apparently unique within Salish.

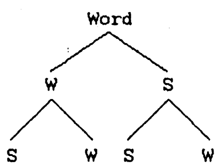
[2]An immediate question, however, concerns whether words that have not undergone stress shift also have secondary stress. Although this is beyond the scope of this paper (which is concerned only with secondary stresses resulting from stress shift), there may be predictable, post-tonic (binary) secondary stress. This is not mentioned by van Eijk, and the question is left open here.

[3]For typographical convenience, prosodic prominence and constituency are depicted in grid notation rather than with metrical trees whose nodes are labeled (S)trong and (W)eak. The representations in (i-ii) are therefore notational variants of the pattern v̀vv́v:

(i)

```
(       x   )
(x .)  (x .)
```

(ii)



[4]D. Pulleyblank (p.c.) suggests that underlying stress contrasts be represented instead by initial invisibility of the first syllable of words having primary stress on the second syllable. This would circumvent having to stipulate an underlying grid mark for all words, since words could simply be parsed into moraic trochees or degenerate feet if necessary, and the correct result would be obtained. Under this proposal, (7a-b) would differ instead as follows:

(i)

a.	b.
μ μ	μ μ
máqaʔ	<ma>qáʔ
'snow'	'poison onion'

(i(a)) would be parsed into a single moraic trochee, correctly giving initial underlying stress, while (i(b)) would permit only a degenerate foot to be planted, since the initial syllable is lexically marked as invisible. Primary stress in (i(b)) would therefore fall on the second syllable as desired. This is shown below:

(ii)

a.	b.
(x .)	(x)
μ μ	μ μ
máqaʔ	<ma>qáʔ
'snow'	'poison onion'

This proposal faces two problems. The first, and smaller, problem is that the metrical stress rule to be proposed below will require invisibility of the final mora because of the robust generalization that stress never shifts onto the final mora. In deriving words with non-initial underlying stress, then, invisibility will have to be invoked at both edges of the word, whereas a more constrained theory of extrametricality might permit this only at a single edge.

A more difficult problem for the proposal illustrated in (i)-(ii) is posed by roots of three or more syllables that have primary stress on the third syllable (or beyond). Possible examples include the following (from van Eijk 1983):

(iii)

a.	ɣək'ak'ík'	'to rattle (like wooden pegs)'
b.	kək'ʷəlxáoz'	'indolent' (Mount Currie dialect)
c.	məšmintwál'ən	'to put things close together'
d.	mətšal'íw'šəm	'to paint one's body'
e.	mʌt͡ɬ'oṣáonkten	'kidney, kidneys'
f.	mik'iláw'šxən	'bannock'
g.	mik'iɬóɬyaʔ	'kind of oil (sticky, like pitch)'
h.	n'an'atxʷxín	'slipper'
i.	nək'uším	'to change one's mind'
j.	nəq'ʷčamúm'ɬ	'sumac (plant)'
k.	xʷənaʔmán	'to curse somebody'

In such cases, the first two or more syllables would have to be marked as invisible. Assuming that these syllables could be treated as a phonological constituent, as is preferred by Hayes' (1991: 47) theory of extrametricality, the constituent would clearly have to be larger than the invisible mora in (i(b)), and so there would be some inconsistency with regard to what initial constituents could be marked as invisible.

For the purposes of this paper, the underlying representations will be given as in (7). The more important facet of the analysis will be the rules deriving metrical stress shift, which simply build feet on whatever underlying representation is supplied by the lexicon. Because either form of underlying representation can be adopted without any particular consequences for the stress rule, then, the first proposal is adopted here only for the sake of concreteness. There are consequences for secondary stress, though, and at the end of section 3 it will be seen that an example like (5j) favours Pulleyblank's proposal despite the potential problems noted above.

[5]Interestingly, the bad example in (19b) has been collected in independent fieldwork, suggesting that schwa may indeed bear shifted stress. However, if this were generally possible, the starred example in (19c) should also be expected to be correct, yet some informants give *zax-al'qʷəm'-ɬkál'ap*, showing an inconsistency even with identical stems. The contradictions may be due to dialect differences between informants. This paper will assume the correctness of van Eijk's data since they are internally consistent, though a fuller account should attempt to explain the difference.

[6]Hayes (1991: 40 n. 2) cites Cohn's (1989: 175) analysis of Indonesian as a possible precedent for the same restriction that schwa may not bear stress. Kager (1990) handles the same restriction in Dutch by treating schwa as moraically weightless. This analysis would not work for Lillooet, however, since schwa does indeed count as a mora with regard to stress placement; it simply may not bear stress itself.

[7]M. D. Kinkade (p.c.) suggests that the data in (19)—which showed that schwa may not be the target of stress shift—are really just another instance of consonant clusters, analogous to (5)-(6), since the schwa in (19) might only be inserted late in the derivation. The main difficulty in such an analysis is the lack of a coherent account of epenthesis. This is discussed at length by van Eijk (1984: 25-35), who notes that the distribution of schwa is one of the most complex problems of Lillooet phonology, since schwa is sometimes inserted, sometimes elided. Van Eijk cites the following data to show that stressed weak vowels contrast, and hence must be present underlyingly:

(i)

a.	ka-ɬɔ́k a	'to deflate, go down (like dough)'
	ka-ɬʌ́k a	'to get very tired, to conk out'
b.	pɔ́t-ɔn	'to cover'
	ka-pʌ́t a	'to get squished'

Because van Eijk presents schwa as underlying in the stress-shift data he cites (and van Eijk is the major source of data), this paper will retain van Eijk's assumption in this regard, for two reasons. First, there is no indication from his examples containing schwa whether it might be epenthetic or underlying, or even whether it might be elided; to indiscriminately omit schwa from underlying forms would surely result in errors for data like (i), in which weak vowels do indeed seem to be underlyingly present. Second, a consistent explanation of epenthesis in Lillooet has not yet been proposed; see Matthewson (in preparation) for discussion in this regard. But if Kinkade is correct, and if a full account of schwa epenthesis can be formulated, then the data in (19) will indeed fall together with the consonant cluster data in (5)-(6), allowing a simplification of the stress rule. Nevertheless, schwa will remain problematic in other areas of stress shift, as we shall see in section 4.

[8]Thanks to L. Matthewson for bringing to my attention the Remnant (1990) thesis and the possible relevance of Lillooet retraction harmony for syllable structure.

[9]Thanks to D. Pulleyblank for sharing these articles with me and noting their relevance for Lillooet stress.

[10]Although van Eijk (1984: 20) claims that the counting base for regular, binary stress shift is the first full vowel, L. Downing (p.c.) notes that the stem vowel *ə* in the examples in (34) instead could be the counting base. To settle this issue would require words with several schwas following the root, which unfortunately do not exist according to van Eijk (1984: 24 n. 2). His claim is therefore based solely on

analogy to the data in (33), in which a full vowel attracts stress from preceding syllables headed by schwa. Evidence for Downing's suggestion comes from a recent transcription of (34) which was given as (25), repeated below as (i):

(i)

lə̀ʕʷ-ən-túmuɬ	'hide us!'
lə̀ʕʷ-ən-tùmuɬ-kál'ap	'you folks hide us!'

The fact that the root vowel *ə* bears secondary stress suggests that it—and not the first full vowel of the word—has served as the original counting base.

[11]Van Eijk (1984: 21) claims that there is another alternation involving vowels followed by glottal stop. Stress may fall on a full vowel followed by a glottal stop only when the following suffix contains a weak vowel:

(i)

a.	lúc'	'tight'
b.	luc'-aká?-əm	'to hold on tightly (int.)'
c.	lúc'-aka?-min	'to hold on tightly (trans.)'

Given everything that has been seen to this point, stress is not expected to shift in any of the examples of (i). The condition that allows stress to shift onto an underlyingly weak vowel in (b) is very unusual, especially since the target is part of the same lexical suffix *-aká?* 'hand' in both (b) and (c). An analysis will not be given here as it is not clear even under Optimality Theory how to handle these data. Unfortunately, these are the only forms that van Eijk cites in support of his general claim, and they have not been re-checked with the Lillooet informants. More data should be gathered to support van Eijk's claim.

References

Bagemihl, Bruce (1991) "Syllable Structure in Bella Coola," *Linguistic Inquiry* 22(4): 589-646.

Cohn, Abigail C. (1989) "Stress in Indonesian and Bracketing Paradoxes," *Natural Language and Linguistic Theory* 7(2): 167-216.

Hayes, Bruce (1991) *Metrical Stress Theory: Principles and Case Studies*, ms., UCLA.

Kager, René (1990) "Dutch Schwa in Moraic Phonology," pp. 241-255 in Michael Ziolkowski, Manuela Noske, and Karen Deaton, eds., *CLS 26: Papers from the 26th Regional Meeting of the Chicago Linguistic Society*, vol. 2, Chicago: Chicago Linguistic Society.

Matthewson, Lisa (in preparation) "Retraction in St'át'imcets," University of British Columbia.

McCarthy, John J. (to appear) "A Case of Surface Constraint Violation," ms., to appear in special issue of *Canadian Journal of Linguistics*, "Constraints, Violations, and Repairs," eds. Carole Paradis, Emanuel Nikiema, and Darlene LaCharité.

McCarthy, John J. and Alan S. Prince (1993) *Prosodic Morphology I: Constraint Interaction and Satisfaction*, ms., University of Massachusetts and Rutgers University.

Penzl, Herbert (1955) *A Grammar of Pashto: A Descriptive Study of the Dialect of Kandahar, Afghanistan*, Washington, D.C.: American Council of Learned Societies.

Prince, Alan, and Paul Smolensky (1993) *Optimality Theory: Constraint Interaction in Generative Grammar* (Technical Report #2 of the Rutgers Center for Cognitive Science), ms., Rutgers University.

Remnant, Daphne Elizabeth (1990) *Tongue Root Articulations: A Case Study of Lillooet*, MA thesis, University of British Columbia.

Thompson, Laurence C., and M. Terry Thompson (1992) *The Thompson Language* (*University of Montana Occasional Papers in Linguistics*, no. 8), Missoula: Linguistics Laboratory, University of Montana.

van Eijk, Jan (1981a) *Cuystwí Malh Ucwalmícwts: Teach Yourself Lillooet: Ucwalmícwts Curriculum for Advanced Learners*, Mount Currie, B.C.: Ts'zil Publishing House.

van Eijk, Jan (1981b) "Stress in Lillooet," pp. 84-90 in A. Mattina and T. Montler, eds., *Working Papers of the XVI ICSL* (*University of Montana Occasional Papers in Linguistics*, no. 2), Missoula: University of Montana.

van Eijk, Jan (1983) *A Lillooet-English Dictionary*, ms., Mount Currie Cultural/Curriculum Development.

van Eijk, Jan (1984) *The Lillooet Language: Phonology, Morphology, Syntax*, ms., Mount Currie, B.C. Near-final version of doctoral dissertation, University of Amsterdam.