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Date September 24, 1990
ABSTRACT

This thesis examines retraction and pharyngealization processes in Lillooet, an Interior Salish language spoken in south central British Columbia. Pharyngealization occurs predictably whenever a vowel immediately precedes a pharyngeal glide. Retraction, on the other hand, is a process whereby vowels and, in some cases, alveo-palataals are articulated with a retracted tongue root, and is caused by four distinct sets of triggers: uvular consonants, /z z'/ (which is a segment peculiar to Lillooet and not like the English /z/), a floating adversative morpheme, and a floating Tongue Root node that is lexically specified on a stem.

In the thesis I present an analysis of these problems within a non-linear framework, adopting the model of phonological geometry proposed in Sagey (1986), and further developed in Clements (to appear). In addition, I adopt the theory of Radical Underspecification presented in (Archangeli and Pulleyblank 1986, 1987) and Archangeli (1988).

It is shown that the data of Lillooet motivate the addition of a fourth articulator node, Tongue Root, which dominates the feature [epiglottis]. Two rules of retraction involve spreading of a Tongue Root node which is unspecified for [epiglottis]. The first rule operates locally triggered by the class of consonants which have a Tongue Root node, that is, the uvular consonants and /z z'/.

This rule precedes Redundancy Rules which specifies vowels, thereby preventing the rule from applying to schwa, which is analyzed as lacking place features. The second retraction rule applies long distance and follows these Redundancy Rules; schwa thus undergoes this rule. The rule of pharyngealization spreads the feature [+epiglottis] to the preceding vowel.

Apart from the specific descriptive conclusions offered, a number of important points emerge concerning the consonant inventory of Lillooet. For example, the discussion in the thesis proves the existence of a class of pharyngeal segments distinct from the uvulars. Again, the evidence adduced refutes speculations that pharyngeal consonants must be characterized by a set of laryngeal features.
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Chapter 1

1.0. Introduction

This thesis examines retraction harmonies involving both pharyngeal and uvular segments in Lillooet\(^1\), an Interior Salish language spoken in south central British Columbia. It is closely related to the other Interior Salish languages, in particular the neighbouring language Thompson, and shares a number of areal features with other languages of the region including the Athapaskan language Chilcotin as well as the Tsimshianic languages Nisgha and Gitksan. The two main dialects of Lillooet are Mount Currie (M) and Fountain (F). In both dialects, pharyngealization of vowels is a common process that occurs predictably whenever a vowel immediately precedes a pharyngeal glide. Retraction, on the other hand, is a process whereby vowels are articulated with a retracted tongue root; this retraction is caused by an immediately following uvular,

\(^{1}\)All the data and some of the descriptive information on Lillooet have been taken from van Eijk (1985) as well as personal communication with Jan van Eijk to whom I am very grateful. Some of the theoretical issues raised in this paper are further developments of issues raised in Bessell & Remnant 1989. Needless to say, all errors are mine.
an immediately following /z/, and a floating Tongue Root node. Thus, the environments in which retraction can occur are more widespread; however, its distribution is subject to other factors in the grammar such as rule ordering.

The outline of the thesis is as follows. In Chapter 1, I introduce the topic and raise questions concerning the characterization of back articulations in a Feature Geometric model, paying particular attention to Lillooet. Chapter 2 provides a detailed survey of relevant literature for the issues that are raised in the thesis, while Chapter 3 looks at the phonemic and phonetic inventory of Lillooet and discusses general principles of Lillooet phonology. Chapter 4 presents detailed analyses of retraction and pharyngealization. Finally, Chapter 5 summarizes the theoretical arguments that have been proposed throughout the thesis.

1.1. Theoretical Outline

Central to the issue of retraction harmonies is the characterization of "back" articulations in feature hierarchical terms. My objective is to show that within the

---

\(^2\)Note that the Lillooet /z/ is significantly different from the English /z/. I discuss this segment and the effects it causes in detail in sections 1.2.1., 1.3.1., 3.1.1.1., and 4.1.2.
framework of Feature Geometry (Clements 1985, Sagey 1986, McCarthy 1988, among others) an adequate way of distinguishing between the effects of pharyngeal harmony and those of uvular harmony on adjacent vowels must be encoded within the feature geometric model. I propose a slight but significant change to current models such as those proposed in the works cited above by including a fourth articulator node: Tongue Root and a feature [epiglottis] which is dependent on the Tongue Root node. In addition, an explanatory account of the two distinct processes of harmony in Lillooet may be achieved by combining the effects of using a feature geometric model (including my proposed changes) with Underspecification Theory (Kiparsky 1982, Archangeli 1989, Archangeli & Pulleyblank 1986, 1987, Steriade 1987b, among others). Underspecification Theory implies a sort of rule ordering; that is, the ordering in which features obtain their non-distinctive + or - value in relation to phonological rules.

Little formal research to date has dealt adequately with the issue of characterizing "back" articulations -- that is, those articulations that are produced in the posterior region of the vocal tract. In the last few years this line of investigation has become an important consideration as researchers have found that the early propo-
sals for models of Feature Geometry such as Clements (1985) and Sagey (1986) simply did not account for bodies of data exhibiting uvular and pharyngeal interactions with other segments. Because of its two harmony processes that require back features, Lillooet offers an interesting challenge for any theory that attempts to characterize back articulations. As mentioned above, both uvular consonants and pharyngeal consonants cause harmony processes, but, crucially, the process triggered by uvulars is different from that triggered by the pharyngeals. This difference is manifested by three separate sets of surface vowels: the plain vowels, the retracted ("uvularized") set, and the pharyngealized set.

The fundamental outline of the theory of Feature Geometry is that features are arranged hierarchically in a tree structure where features that pattern together as a natural class are dominated by a given node. All nodes and features in turn are on separate tiers, permitting rules to access the necessary feature or node and either spread association lines or delete association lines. The diagram in (1) shows the feature geometric model proposed in Sagey (1986), and is the basic model that I assume.
Note that Sagey incorporates the place features under their own node and that these place features are based on articulatory notions: i.e. vocal tract anatomy.

Carthy (1988) raises the question of whether a pharyngeal node should be included under a place node, but provides no solution. McCarthy (1989) and Bessell and Remnant (1989) provide the most detailed studies to date of adequate representations for the "back" articulations. McCarthy (1989) suggests a fourth articulator node: Pharyngeal and a feature [tglottal] to account for the set of "gutterals" in Arabic. Bessell & Remnant (1989) propose a Tongue Root node constituting the fourth articulator node which dominates the feature [±epiglottis]. In Chapter 4, I develop the arguments for the Tongue Root node and the feature [±epiglottis] and show how they are fundamental to the phonology of Lillooet.

A second sub-theory of phonological structure, which is central to the present work, is Radical Underspecification Theory as presented in Archangeli & Pulleyblank (1986) and Archangeli (1989). The principal tenets of this theory are that (i) no redundant information is present at the underlying level, and that (ii) Redundancy Rules present in Universal Grammar (default rules) or language specific rules (complement rules) serve to fill in the default values of features. For example, if α is the maximally underspecified segment found in Universal Grammar, then default rules would apply at a given point in the
grammar to fill in the maximally underspecified slot with each of the feature values which collectively define a. However, if in language X it can be shown that \( \beta \) is in fact the maximally underspecified segment, then one or more complement rules which preempt the regular universal default rule(s) apply to fill in \( \beta \) as the maximally underspecified segment. By incorporating complement rules which automatically apply before the default rules, the universally marked value of a given feature which functions as the unmarked value in the language in question can properly be assigned to the feature.

1.2. Lillooet Facts

Lillooet, as mentioned briefly above, has two separate processes in which posterior consonants (that is, uvulars and pharyngeals) affect vowels. Retraction (so called in van Eijk 1985) is a process in which vowels are affected by a following uvular to create a retracted articulation, and pharyngealization, which behaves somewhat like retraction, is one in which a vowel preceding a pharyngeal consonant pharyngealizes (as opposed to retracts).

1.2.1. Retraction

Van Eijk (1985:3) characterizes retraction as "basi-
cally velarization", with the tongue-root pulled back in the throat so that, in the case of retracted alveopalatals /č ʃ/, only the tip of the tongue is used in articulation. The set of retracting consonants (i.e. triggers) consists of the uvulars /q q' qʷ q¹ʷ X Xʷ/ and the coronals /z z'/.

Those segments that may be retracted (i.e. targets) are the full vowels /i u æ/. These are normally realized phonetically as [ɛ o æ], but in their retracted form as [ɛ o a]. Further, the lax central vowel schwa (/ə/, phonetically [ə]) is retracted to [ʌ] when it occurs in a form with a floating Tongue Root node, as shown in 1.2.1.2. and 1.2.1.3. In addition, the consonants /č š l l'/ may be retracted, meaning that they are doubly articulated using both the tip of the tongue and the tongue dorsum. See Chapter 3 for a complete discussion of the full phonemic inventory of Lillooet consonants and vowels.

1.2.1.1. Retraction from uvulars and /z z'/

The uvular consonants will retract an immediately preceding vowel if that vowel is one of the set of full vowels: /i u æ/. Examples of this process are given in (2a) below. In the case of target vowels /u æ/, retraction triggered by /z z'/ is identical to that by uvulars as can be seen in (2b). However, /i/ does not retract when
followed by /z z'/. I argue in Chapter 4 section 4.1.2. that retraction is ruled out when the trigger and target are doubly linked to a node within the structure, in this case the Dorsal node. (2b) shows retraction of /æ/ to [a] and (2c) gives the ungrammatical form in the failure of /i/ to retract to [ɛ]. If /z z'/. /z z'/ were to retract a preceding /i/ we would expect the ungrammatical surface form found in (2c).

(2a) /'iq/ —> [x'ɛq] "to arrive here"
/suq'em/ —> [suq'em] "to skin an animal"
/mæqæ?/ —> [maqæ?] "snow"

(b) /muzmit/ —> [mɔzmet] "pitiful"
/xniz'æz'/ —> [xnez'az'] "gooseberry bush"

(c) *[xnɛz'az']

In addition, the uvulars and /z z'/ will not retract /θ/, as can be seen by the forms in (3a) and the corresponding ungrammatical forms in (3b).

(3a) /xθz'p/ —> [xθz'p] "embers"
/q'eq'az/ —> [q'eq'az] "blue"

(b) *[x^nθz'p]
*[q'eq'az]

I argue in Chapter 4 that /θ/ does not retract in this environment because it is the maximally underspecified vowel whose value is filled in after the retraction rule has applied.
1.2.1.2. Retraction from a Floating Morpheme

In addition to retraction triggered by uvular consonants and /z z'/, the aforementioned vowels, along with /ɬ/ and the consonants /č š l l'/, are retracted when the adversative morpheme is present, as the data in (4) show.

\[
\begin{align*}
/\text{q@l}/ & \rightarrow [\text{qÂl}] \quad "\text{bad}" \\
/\text{q@l-wil'x}/ & \rightarrow [\text{qÂlwêl'x}] \quad "\text{to get spoiled}" \\
/\text{L@6}/ & \rightarrow [\text{LÂc}] \quad "\text{to cave in}" \\
/\text{?a1s}/ & \rightarrow [\text{?a1s}] \quad "\text{sick}" \\
/\text{Lut}/ & \rightarrow [\text{LÂt}] \quad "\text{to squash a bug}"
\end{align*}
\]

In addition, minimal pairs such as the sets in (5) and (6) exist.

\[
\begin{align*}
(5a) \quad /\text{L@k}/ & \rightarrow [\text{LÂk}]^3 \quad "\text{get deflated, go down (of dough)}" \\
(b) \quad /\text{L@k+(adversative)}/ & \rightarrow [\text{LÂk}] \quad "\text{get pooped, conk out}"
\end{align*}
\]

I postulate one underlying representation for the stem /L@k/, rather than suggesting that the retracted vowels are phonemic, as van Eijk (1985) claims, and that there is a second underlying representation: /LÂk/.

Instead, the adversative morpheme, which is analyzed as a floating Tongue Root node, is affixed to the stem, and generally all those segments that are susceptible to retraction will retract.

---

\(^3\)I use L to signify a dental lateral fricative.
(6a) /kayı-kay/ $\rightarrow$ [kaykay] "blue-jay" (refers to the sounds it makes when forecasting good news or good weather)

(b) /ček-az-ček-az/ $\rightarrow$ [cakacakaz] "blue-jay" (refers to the sound it makes when forecasting bad news or bad weather)

However, a discrepancy exists between the application of the rule triggered by a floating morpheme, which involves spreading Tongue Root, and the application of the retracting rule triggered by the uvulars and /z z'/, also involving Tongue Root spreading. The coronal consonants are never affected by the other retractors: uvulars and /z z', while they are targets for retraction triggered by the floating morpheme. The examples in (7a) show forms in which a coronal immediately precedes a /z z' and (7b) show coronals followed by uvulars. In neither case is a coronal consonant retracted.

(7a) [ʔočz] "good, straight (forward), o.k.
[ʔočz'qazm'] "to steer a canoe"
[čstaqt'sqhaz] "the squirrel"

(b) [čaqčqet] "tame"
[šqlawʔoq] "real beaver (i.e. not money)"
[šx'eqš] "to smile"
[štəw'palqʷ] "cottonwood cambium layer"
[qʷel'qʷəl'lt] "to talk, have a conversation"
1.2.1.3. Retraction from a Floating Feature

Other cases of retraction exist in which all of the vowels and the coronal consonants are retracted; however, in these cases neither a retracting trigger segment (i.e. a uvular or /z z'/) nor the adversative morpheme is evidently present. Examples of this type of retraction are:

(8) /k\usæ?/  -->  [k\ossæ?] 4 "to urinate"
/ʃæll/  -->  [ʃall]  "to drip in a string (like syrup)"

The neighbouring Tsimshianic languages Nisg̱a'a and Gitksan have glottals that cause some sort of retraction of the preceding vowel (Shaw 1987, Hunt 1990), as does Arabic where the glottals behave in the same manner as the other "gutterals" (McCarthy 1989, and see Chapter 2 for some discussion of Arabic emphasis). Lillooet glottals, however, do not appear to affect the vowels in any such way. The data in (9) show this fact⁵.

---

⁴ I mark retraction on coronal consonants by underlining the retracted segment.

⁵ We find no cases of [θ?] in Lillooet (van Eijk 1985:44). M. D. Kinkade (p. c.) informs me that /θ/ is regularly lowered to [a/z] before a /ʔ/ throughout Interior Salish which accounts for the apparent gap in the data.
(9)i \( /\text{p}'\text{æ}x^W/ \rightarrow \text{[p}'\text{æ}x^W] \) "more"
(9)ii \( /\text{š-qaXæ}/ \rightarrow \text{[šqaXæ]} \) "dog"
(9)iii \( /\text{š-pzu}/ \rightarrow \text{[špzu]} \) "wild animal"
(9)iv \( /\text{pu'y}'\text{æ}x^W/ \rightarrow \text{[p'o'y}'\text{æ}x^W] \) "smoke coming up"
(9)v \( /\text{p}'i/ \rightarrow \text{[p}'e]\) "to squeeze out"
(9)vi \( /\text{p}'i/ \rightarrow \text{[sp}'ɛ?l'wæʃ] \) "squeezed in the middle"

(9ii) shows a form in which retraction does occur on the segment that is followed by the uvular fricative, but crucially, not on the vowel that precedes the glottal. In (9v) and (vi) we see a contrast between the non-retracted root that contains a glottal (9v) and the retracted root (9vi). This indicates that retraction in (9vi) (and also the first example in (8) \( /k'\text{wa}\) "to urinate" ) is not due to the glottal. Instead, I propose it is due to a floating Tongue Root node which is lexically specified on the stem (see Chapter 4 for the motivation and analysis of this claim).

To summarize the facts of retraction exemplified in data sets (2)-(9), I present the chart in (10). The horizontal axis at the top shows the segment that can be retracted and the vertical column on the left side indicates the environment. A / marks retraction while an x
indicates no retraction.

(10)  

\[
\begin{array}{cccccccc}
\text{i} & \text{u} & \text{æ} & \emptyset & \text{@} & \text{š} & \text{š} & \text{l} & \text{l}' \\
\end{array}
\]

\[
\begin{array}{cccccccc}
/q,q',q^w,q'^w,x,x^w \\
z,z'
\end{array}
\]

Adversative Morpheme & Lexical Floating Node

1.2.2. Pharyngealization

The pharyngeals in Lillooet distinguish themselves from the uvulars both articulatorily (and audibly, van Eijk p. c.) and by triggering a vowel harmony process which is different from that of the retraction. The vowels /i æ @/ underlyingly precede pharyngeal consonants while /u/ does not appear to occur in this environment. The phonetic realization of the vowels /æ @/ when pharyngealized is basically that of the retracted vowels with the addition of pharyngeal constriction superimposed on the vowel. The effects of pharyngealization and retraction are neutralized, however, with /i/. (11) and (12) demonstrate the corresponding sets of phonetic segments originating from the phonemic vowels /æ @/ when in the environment of pharyngeals.

---

6 This chart is taken from van Eijk (1985:13-14). The diacritic ^ over vowels denotes pharyngealization. For example, [â] is a pharyngealized [a].
(11) /e^G/ /e^G, //e^Gw/ /e^Gw/
[â^G] [â^G] [â^G], [â^G], slow speech
[â:] [â:] [â:] [â:], fast speech

(12) /æ^G/ /æ^G, /æ^Gw/ /æ^Gw/
[â:q] [â:q] [â:q] [â:q], slow speech
[â::] [â::] [â::] [â::], fast speech

(11) shows that where /θ/ is underlying the surface realization is either [â] or [ð] depending on the value for [round] of the following pharyngeal. Distributional restrictions indicate that the value of the underlying vowel in (12) must be /æ/ and not /u/. That is, given that the value for height of the surface vowel is always [+lo] and that the value for [round] is predictable (due to the following pharyngeal's value for [round]), only the full vowel /æ/ underlyingly precedes a pharyngeal

Following Hayes (1981), I propose that the number of skeletal slots representing /θ/ differs from the number for /i æ u/. In effect, /θ/ has one timing slot while the

---

7 I have characterized the relative length of segments using [:] and [::] so as to demonstrate the difference in length between [θ] and the full vowels. My representation differs slightly from that of van Eijk who uses parentheses, as shown below to indicate the relative shortness of schwa.

/e^G/ /æ^G/
[â^G] [â^G] slow speech
[â(:)] [â:] fast speech

8 This observation is due to P. Shaw (p.c.).
others have two. Suffice it to say that it is possible to distinguish between /@/ and the full vowels on the basis of length. The bottom line of each chart shows that compensatory lengthening occurs with the deletion of the pharyngeal during fast speech.

Independent motivation for proposing a difference in the number of skeletal slots for /@/ and /i æ u/ comes from stress placement. In root-suffix combinations, stress will shift two vowels to the right from the root vowel to a full vowel, but not to [@] which is overlooked by the stress rule. In a root with /@/, stress remains on the root if the suffix contains /@/, but will shift from the root to a suffix containing a full vowel\(^9\). Some examples of the movement of stress are given in (13) below.

\[(13a) /\?ux\^wælmix\^w/ \ [\?ox\^wælmex\^w] "Indian, person" \\
/\?ux\^wælmix\^w-kæn/ [\?ox\^wælmex\^w-kæn] "I am an Indian person"
\]

\[(b) /zæx-æl'q\^w@m\'/ [zæxæl'q\^w] "tall" \\
/zæx-æl'q\^w@m'-Lkæl'æp/ [zæxæl'q\^w@m'Lkæl'æp] "you folks are tall"
\]

\*[zæxæl'q\^w@m'Lkæl'æp]

\[(c) /mèc-@n/ [mèc@n] "to write it, (tr.)" \\
/mèc-xæl/ [mècxæl] "to write, (intr.)"
\]

\(^9\text{For more details of Lillooet stress see van Eijk (1985:20-24).}\)
I have not included the facts about /i^w/ in the charts in (11) and (12) for two reasons. First, the data are very scarce -- I am aware of only three instances of this sequence which are\(^\text{10}\):

\begin{align*}
(14) \quad /li^w/ & \rightarrow [lε^w] \quad \text{"to take apart, to tear down"} \\
/li?i^w/ & \rightarrow [lε?ε^w] \quad \text{"to scatter (e.g. people leaving a meeting)"} \\
/ci?i^w/ & \rightarrow [cε?ε^w] \quad \text{"to bleed"}
\end{align*}

Second, the effects of pharyngealization and retraction are neutralized to [ε] where /i/ is concerned. Postulation of /i/ as the underlying vowel in the examples in (14) is based on distributional evidence. We have already established that the surface forms [â] and [ɔ] are derived from underlying /æ/ and /θ/ when they are immediately followed by a pharyngeal, as shown in the charts in (11) and (12) above. A surface realization of [ε] with a superimposition of pharyngealization, stemming from underlying

\(^{10}\)It is possible that the second vowel in both [lε?ε^w] "to scatter" and [cε?ε^w] "to bleed" are echo vowels and therefore do not have the status of a full vowel. For the purposes of this analysis, this fact does not matter because the pharyngeal is predicted to retract the vowel in either case. If they are echo vowels, then the correct underlying representations would be /li^w/ "to scatter" and /ci^w/ "to bleed". Glottalization would spread from the glottalized pharyngeal to the vowel and result in an echo vowel. [+epiglottis] (see the analysis in Chapter 4 section 4.2.) would then spread from the pharyngeal and we obtain the correct surface form.
/i/, is precisely what we would expect to find given the patterning of retraction versus pharyngealization. That is, a pharyngealized vowel has the focus of a retracted vowel with pharyngeal constriction. Thus, retracted /æ/ is [a], while pharyngealized it is [â]. In the case of /i/ ([ε]) the pharyngeal constriction appears to be missing. However, it is not clear to me that pharyngealization of a front vowel would be possible in Lillooet. In order to make the pharyngeal constriction the tongue must be pulled back in the vocal tract such that the front vowel is phonetically back. M. D. Kinkade (p. c.) points out that the front vowel in Columbian may be pharyngealized, and D. Odden (p. c.) informs me that the Arabic front vowels is indeed pharyngealizable, but are phonetically backed. Further phonetic investigation is required in order to suggest a resolution for this problem. Furthermore, as the first and third examples in (14) show, /i/ does not round when adjacent to a rounded pharyngeal, while the other vowels /æ ø/ do. In Chapter 4, I suggest that the failure of [round] to spread to the front vowel reflects a language particular constraint that rules out front rounded vowels.
1.3. Analysis and Proposed Feature Geometric Model

Sagey's (1986) model of Feature Geometry shown in (1) above is not sufficiently enriched with regard to features characterizing the back articulations to account for the data presented in section 1.1. She assumes the features [hi,back,lo], following Chomsky and Halle (1968), under the Dorsal node to characterize these segments. However, the features themselves are problematic when attempting to account for attested data. First, spreading [-lo] does not characterize the fact that the [+lo] vowels actually lower slightly with retraction. That is, in cardinal vowel terms [a] is lower than [æ] (Clark and Yallop 1990:68). Second, Sagey cannot distinguish the retracted consonants from their non-retracted counterparts at a surface level because both are specified as [-hi,-lo] in her system. (See Chapter 2 section 2.1. for discussion of this point.) Third, articulatorily, the tongue body movements are not reflected in the feature values. So, for example, the uvulars are characterized as [-high], but they actually involve raising the tongue body. (See Chapter 2 section 2.1 and references therein for a more detailed account of the problems of [high,back,lo] with regard to posterior consonants.)

I suggest enriching Sagey's model under the Place
node with an additional node: Tongue Root. I propose a fourth articulator node, as argued for in Cole (1987), Bessell & Remnant (1989), McCarthy (1989), and Bessell (1990). Moreover, I suggest that Tongue Root dominates the feature [±epiglottis] ([±epi]), which reflects the additional pharyngeal constriction on pharyngealized vowels, as argued for in Bessell & Remnant (1989). In addition, I adopt the proposed changes to the root node in McCarthy (1988, 1989), and changes to the structure of the dorsal node as argued for in Odden (1989). I assume, then, the following tree structure.

(15)

```
  [sonorant
   vocoid
   approximant]
   [nasal]

LARYNGEAL NODE
[cg] [sg] [st.vc] [sl:vc]

PLACE NODE

LABIAL
[dist] [ant] [lat]

CORONAL

DORSAL

TONGUE ROOT
[epiglottis]
[hi] [ATR] [lo] [back] [rnd]
```

1.3.1. Retraction

Cole (1987), Bessell & Remnant (1989), and McCarthy (1989) argue for a complex structure for the representa-
tion of uvulars along the lines that Keating (1987) proposes for palatals. I suggest a similar proposal in that uvulars are complex structures and are co-articulated involving the Tongue Root node and the Dorsal node. The base underlying structure of uvulars is found in (16). At the underlying level, there is no need to specify any structure below the Dorsal and Tongue Root nodes because the class of uvulars are defined as the only segment with both a Dorsal and a Tongue Root node.

(16)

```
PLACE NODE
  DORSAL
  TONGUE ROOT
```

Uvulars are redundantly realized as [-epi], their full phonetic representation shown in (17) below.

(17)

```
PLACE NODE
  DORSAL
  TONGUE ROOT
  [-epiglottis]
```

The retraction rule spreads the [Tongue Root] node onto the Place node of the preceding vowel. (18) gives the formalization of the retraction rule triggered by a uvular consonant. The default value for [epiglottis], which as stated above is [-epi], is filled in at a later stage in the derivation.

---

11 Detail above the Place node has been omitted.
(18)\[vocalic\]
\[\text{Place} \quad \text{Tongue Root}\]

Scansion applies at a minimal level (Archangeli and Pulleyblank 1987), and targets a preceding Dorsal node on a [+vocalic] segment. Schwa is not targeted by the rule because at the point of application, schwa is not specified for a Dorsal node.

Retraction triggered by /z z'/ parallels that of retraction triggered by uvulars except that in the case of /z z'/, /i/ does not retract. As noted previously, /z z'/ is different from the English /z/. Instead, the Lillooet /z/ has a dental articulation with the sides of the tongue raised giving it a lateral-like quality. In addition, Thompson and Thompson (1986:60) point out that the Thompson /z/ involves "a certain amount of retroflexion, giving them an r-like quality". D. Odden (p. c.) informs me that retroflexion may involve retraction of the tongue root as the tip of the tongue is raised to form contact between the "tongue undersurface and [the] postalveolar region" (Clark and Yallop 1990:80). (19) shows the underlying representation for /z/. It is important to note that /z/ is triply articulated, which accounts for its rarity.
in the world's languages\textsuperscript{12}.

(19) \(/z/\)

\[
\begin{array}{ccc}
\text{Place} & \quad & \\
\text{CORONAL} & \quad & \text{DORSAL} & \quad & \text{TONGUE ROOT}
\end{array}
\]

The spreading rule formulated in (18) above will apply in the case of /z/ retraction, as well as for retraction triggered by a uvular consonant. The singly linked Dorsal node and its dependent feature \([-\text{back}]\) is specified so as to rule out the application of the rule to the sequence /iz/, which has the structure in (20)\textsuperscript{13}.

(20) \[i \quad z\]

\[
\begin{array}{c}
\text{Place} \\
\text{Dorsal} \\
\text{[-back]}
\end{array}
\]

In the case of consonant retraction, spreading of Tongue Root causes secondary articulation. I claim that the alveo-palatals are specified for a Dorsal node which serves to distinguish them from the other coronals and plays an important role in the formalization of the retraction rule. Keating (1987) proposes that palatals are doubly articulated involving the Coronal and Dorsal nodes. Lillooet has no palatals, but two series of coronals: the

\textsuperscript{12}Kinkade (p.c.) informs me that this segment is only found in Lillooet, Thompson, and Chilcotin.

\textsuperscript{13}See Chapter 4 for details of the argument.
dental coronals, consisting of /t ʎ' L n n' c' z z'/, and the alveo-palatal coronals, which are /č š l 1' y y'/.

These series can be distinguished by invoking a Dorsal node for the alveo-palatalts. The retraction rule that targets the consonants and vowels scans the minimal level, and targets the Dorsal node. Crucially, at the point at which this rule applies, the value for the unmarked vowel, schwa, must be filled in so that it may be targeted. As with the vocalic retraction described above, [ϕepiglottis] is redundantly filled in as [-epiglottis]. (21) shows spreading from a floating tongue root node onto the Place node of the consonant. Because the trigger of the rule is a floating segment it is not docked to a skeletal slot and therefore requires no more structure than that pictured.

(21) \[ \begin{array}{c}
\text{Tongue Root} \\
\text{Place} \\
\text{Dorsal}
\end{array} \]

1.3.2. Pharyngealization

Pharyngealization of vowels involves both tongue body retraction and lower pharyngeal constriction, and occurs whenever a vowel is immediately adjacent to a following pharyngeal consonant. In Feature Geometric terms, then, a feature [+epiglottis] which is dominated by a Tongue Root
node, representing a pharyngeal consonant, spreads onto the Place node of any immediately adjacent preceding vowel. The Tongue Root causes retraction of the vowels as in the case of the uvular retraction discussed above, but in addition, the feature [+epi] causes a superimposition of pharyngeal constriction on the vowels. This accounts for the fact that uvular harmony and pharyngeal harmony result in two different sets of surface vowels.

Furthermore, the charts in (11) and (12) indicate that the vowel's surface value for [round] is determined by the pharyngeal consonant's value for that feature. However, rounding is a pervasive process in the language and is therefore independently motivated. (22) shows the rule of pharyngealization.

(22) [+vocalic]  
\[\text{Place}\]  
\[\text{Tongue Root}\]  
\[\text{[+epi]}\]

In summary, the rule of retraction spreads the articulator node Tongue Root, which is unspecified for a feature value of [epi]. A Redundancy Rule that applies at a later point in the grammar serves to fill in the unspecified value as [-epiglottis]. Pharyngealization, on the other hand, involves a rule of [+epiglottis] spreading
onto a Tongue Root node, which is present due to node generation.
Chapter 2

2.0. Introduction

In this Chapter, I look at various different attempts to characterize back articulations within generative phonology and point out, in some cases, where previous proposals cannot account for attested data in some of the world's languages. The first phase of Generative Phonology culminates in 1968 with the publication of The Sound Pattern of English (hereafter SPE), though much descriptive and theoretical work prior to this date considered back articulations. In fact, [flat] was used to characterize pharyngealization; however, it was also used to characterize rounding and velarization. Jakobson, Fant, and Halle (1952) characterize flattening as:

...chiefly generated by a reduction of the lip orifice (rounding) with a concomitant increase in the length of the lip constriction... Instead of the front orifice of the mouth cavity, the pharyngeal tract, in its turn, may be contracted with a similar effect of flattening. This independent pharyngeal contraction, called pharyngealization, affects the acute consonants and attenuates their acuteness. (p. 31)

Jakobson and Halle (1956) further define flattening as follows:

acoustically - flat phonemes in contradistinction to the corresponding plain ones are characterized by a downward shift or weakening of some of their upper frequency components;
genetically - the former (narrowed slit) phonemes in contradistinction to the latter (wider slit) phonemes are produced with a decreased back or front orifice of the mouth resonator, and a concomitant velarization expanding the mouth resonator. (p.31)

In other words, [flat] covers labialization, velarization, and pharyngealization. McCawley (1967) (discussed in Hyman 1975 and Anderson 1985) notes that [flat] causes a problem of rule formulation because a segment that is [+flat] must be specified in some other way for its roundness or pharyngealization, etc.

Anderson (1985) also points out that both Caucasian languages\(^{14}\) and Salishan languages create problems for [flat] because they each contain contrasting segments that cannot be accounted for within the Jakobsonian system.

In the northwest Caucasian languages Ubykh and (the Bzyb dialect of) Abkhaz, however, independent contrasts of retroflexion and rounding are reported among affricates in the alveopalatal region. Ubykh also displays independently contrastive plain, rounded, pharyngealized, and rounded-pharyngealized uvular stops. Bzyb Abkhaz has uvular fricatives of five distinct types: plain, rounded, "palatalized" (involving an increase in the length of the constriction), pharyngealized, and rounded-pharyngealized. A contrast of rounding is also reported for distinctively pharyngeal fricatives in some languages of the Salishan family, such as Colville. (p. 124)

\(^{14}\)See section 2.3.1. below for more discussion of the Caucasian back consonants.
The SPE method of accounting for these segments proved to be problematic early on (Brame 1970); however, early proposals in feature geometry (Clements 1985, Sagey 1986) used the same features to describe the same segments, only the features were arranged hierarchically. Much can be said for the explanatory value of feature geometry, yet if the feature system that it has inherited is not capable of accounting for a particular aspect of phonological behaviour, then the arrangement of features in a hierarchical structure will prove to be no more successful than its predecessor.

In the remainder of this Chapter I examine proposals for back articulations, including several dealing with northwest coast languages in particular.

2.1. Chomsky and Halle (1968)

Chomsky and Halle (1968) characterize velars, uvulars, and pharyngeals using [high], [back], and [low] as shown in (23).

(23) SPE characterizations

<table>
<thead>
<tr>
<th></th>
<th>k</th>
<th>q</th>
<th>g</th>
<th>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>back</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>high</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>low</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

However, the processes of Lillooet retraction and pharyngeal...
gealization cannot be accounted for using these features. In the case of pharyngealization, pharyngeal constriction is superimposed on the vowel quality. The spreading of the feature [+back] from the pharyngeal onto the back vowels would apply vacuously. Similarly, while spreading of [+low] appears to characterize nicely the process for the high vowels, it cannot account for the changes in low vowels. As for retraction, which is the effect the uvulars have on vowels, if the features [-high,-low] spread onto the vowel, we would expect the low vowels to raise, which does not occur; in fact, low vowels lower slightly.

Additional arguments against using SPE features are based on articulatory factors from McCarthy (1989). He argues that the SPE analysis of "gutterals" (which include uvulars, pharyngeals, and laryngeals) can be grouped as a natural class by the features [-ant,-high] and can be distinguished from one another with [low] and [back]. However, this analysis does not correctly characterize the articulatory gestures involved. The features [high,back,low] refer in SPE to tongue body movements. Uvulars are classified as [-high], but, in fact, involve raising the tongue body. Pharyngeals are [+low,+back], but appear to involve the tongue root, epiglottis, and pharyngeal wall. Finally, laryngeals are specified as
[+low] in spite of the fact that the tongue body is not involved in the articulation of laryngeals whatsoever (McCarthy 1989:34-35).

2.2 Place Feature Geometry

Sagey (1986) proposes a model of feature geometry that incorporates the place features under their own node. Her motivation for advancing such a proposal is based on articulatory notions: i.e. vocal tract anatomy.

(24)

The primary problem with Sagey's model of feature geometry is that it ignores any sort of tongue root articulation. She relies on the SPE method of accounting for back articulations which, as mentioned above, use [high, back, low] to distinguish velars, uvulars, and pharyngeals and which I have shown in section 2.1. to be problematic.

Other proposals for place feature geometry include
that of Pulleyblank (1987) found in (25) and Steriade (1987a) in (26).

Steriade (1987a) proposes that the Dorsal node be a special vowel tier that dominates only the vocalic features. In contrast, the Sagey and Pulleyblank models include both vocalic and consonantal features under the Dorsal node. Steriade adds a Velar node to accommodate the tongue body consonantal feature (which she does not specify).

If, as Steriade proposes, the features on the Dorsal tier are available only for vowels, the three consonantal places: velar, uvular, pharyngeal, cannot be distinguished by using [high] [back] and [low]. Both Pulleyblank (1987) and Steriade (1987a) include [ATR] ([advanced tongue root]) in their tree geometries. The question of the com-
patibility of [ATR] with the feature and node I propose in this thesis remains to be seen. (However, see Cook (1989) and Czaykowska-Higgins (1987) for some discussion of this issue.)

Czaykowska-Higgins (1987) proposes two features, Upper Pharynx and Lower Pharynx, to account for these back articulations. The chart in (27) shows the distribution of these features over the relevant segments.

\[
\begin{array}{c|c|c|c|c|c}
 & q & \bar{q} & q & \bar{q} & c r^{15} \\
[\pm \text{Upper Pharynx}] & + & - & + & + & - \\
[\pm \text{Lower Pharynx}] & - & + & + & + & - \\
\end{array}
\]

\( q \) = pharyngealized uvular (N.W. Caucasian)

\( c r \) = emphatic pharyngeal (Palestinian Arabic)

\( c r \) = rhotacized consonant or vowel

Czaykowska-Higgins claims that the pharyngealized uvular [q] and the emphatic pharyngeal (i.e. uvularized pharyngeal) [\( c \bar{r} \)] are in effect the same thing. She adopts Sagey's basic model of feature geometry using articulatory notions, but incorporates Upper Pharynx and Lower Pharynx to arrive at the universal representation of feature geometry shown in (28).

\[15\]See Czaykowska-Higgins (1987) for more detail on these features and for a broader explanation of the articulatory behaviour of the vocal tract in relation to these features.
An interesting aspect of the Czaykowska-Higgins model is that the tongue root node is immediately dominated by the supra-laryngeal node. She argues that, on the basis of cross-linguistic evidence — in particular, evidence from West Greenlandic Eskimo consonantal assimilation — the tongue root node must be a sister to the place node and not a daughter of it.

The problem with the Czaykowska-Higgins model of feature geometry is that there is no clear motivation for having two features under the Tongue Root node. The absence or presence of the Tongue Root node and one of the two proposed features (for example, [±LP]), in addition to the independently required Dorsal node can capture the necessary facts, as shown in (29).

\[(29)\]

<table>
<thead>
<tr>
<th>Feature</th>
<th>q</th>
<th>9</th>
<th>q9</th>
<th>cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsal</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Tongue Root</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>[± Lower Pharynx]</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>
2.3. Recent Studies

2.3.1. McCarthy (1989)

McCarthy (1989) addresses the problem of characterizing the phonological behaviour of back consonantal articulations within a place-of-articulation theory. He attempts to account for the behaviour of the set of "gutterals" in Arabic which includes uvular fricatives, pharyngeals, and laryngeals, by positing a node Pharyngeal that dominates a feature [glottal]. The structural representation is given in (30).

(30)

McCarthy argues for place-of-articulation theory over articulator theory, advocated in Sagey (1986) and Halle...
(1989), on the grounds that the gutterals are articulated using three different articulators, yet clearly function together as a natural class. Articulator theory is based on the presupposition that each feature is executed by a particular active articulator. Place-of-articulation theory, on the other hand, claims that the place of articulation, and not the active articulator, is the determining factor in the forming of natural classes. Both theories are grounded in vocal tract anatomy. McCarthy presents five arguments based on "co-occurrence restrictions, vowel lowering, avoidance of syllable-final position, transparency to assimilation, and degemination" (p. 4ff) that show without a doubt that the gutterals do function together as a natural class, and therefore, according to McCarthy, must be dealt with in a place-of-articulation theory.

Clements (to appear) suggests a restructuring of the root node so that it consists of the major class features [sonorant], [vocoid], and [approximant]. The definitions of these features are "... [vocoid] is simply the inverse of [consonantal]; an [approximant] is defined by Clements as "any sound produced with an oral tract stricture open enough so that airflow through it is turbulent only if voiceless" (McCarthy 1989:3), and [sonorant] maintains its
common meaning. McCarthy adopts Clements' proposal and classifies the gutterals: /X ñ H 97 h/\textsuperscript{17} as [+approximant] thereby grouping these segments into a natural class.

Arabic emphatic coronal consonants (see Al-Ani (1970), Brame (1970), Broselow (1979), Ghazeli (1977), Harrell (1957), and Heath (1987) among others for information on different Arabic dialects and emphasis in Arabic), which are similar in nature to Lillooet's retracted segments, are represented in McCarthy (1989) as doubly articulated, involving both Coronal and Dorsal nodes; uvulars are also co-articulated involving the Dorsal and Pharyngeal nodes. Pharyngeals, uvulars and coronals are classified as redundantly [-glottal], whereas the laryngeal consonants are specified [+glottal]. This feature, then, enables McCarthy to capture the patterning of the laryngeals /? h/ with pharyngeals and uvulars as a natural class. McCarthy argues that laryngeals are only specified for the feature [glottal] if the system has true pharyngeals.

The Lillooet facts show that the occurrence of true pharyngeals is not a sufficient condition for specification of laryngeals as [glottal]. As seen in (31a-c),

\textsuperscript{17}I use ñ to refer to a voiced uvular fricative in Arabic and a velar resonant in Lillooet.
retraction triggered by an uvular is not blocked by /?/. Glottal stop is the only consonant transparent to retraction.

(31a) i  [læ?]  "to get close"
   ii  [la?qʃ]  "to go ashore"

(b) i  [ʔɔq'ɑʔ]  "to drink"
   ii  [ʔɔ?q araʔ]  "to drink a little bit"

(c) i  [Χ'ɛq]  "to arrive here"
   ii  [kɛʔX]  "cranky like a baby"

If Lillooet pharyngeals are indeed true pharyngeals, which, on the basis of their behaviour with regard to vowel harmony, I claim they are, then specifying the laryngeal /?/ as [+glottal] in a case where it is preceded by a full vowel and followed by a uvular should block retraction of the vowel because spreading the trigger's pharyngeal node would be blocked by the pharyngeal node of the glottal as shown in (32).

(32)  

A problem that McCarthy faces is that his proposed feature geometric model is not able to characterize pharyngealized uvulars found in Bzyb Abkhaz (Colarusso
1975) or uvularized pharyngeals reported for Palestinian Arabic (Card 1983, cited in Czaykowska-Higgins 1987). The inventory of post-velar consonants in Bzyb Abkhaz is given in (33) below.

(33)  
\[ q^y, x^y, y^y, h, h^w, q^w \]

McCarthy's model has no way of distinguishing segments under the pharyngeal node as is necessary in order to account for pharyngealized uvulars. The feature [glottal], which is dominated by the pharyngeal node, serves to distinguish laryngeals from other segments characterized under the pharyngeal node, but it bears no relevance to secondary pharyngealization.

McCarthy's proposal does capture the fact that laryngeals class together with pharyngeals and uvulars in Semitic. It seems that a similar patterning of laryngeals with uvulars occurs in Nisgha (Shaw 1987), though, as shown above, Lillooet does not group laryngeals with any of the other post-velar consonants.

---

\(^{18}\) indicates palatalization, ' represents glottalization, \(X\) is a voiceless uvular fricative with \(y\) being its voiced counterpart and \(X\) is a voiceless pharyngealized uvular.
2.3.2. Halle (1989)

Halle (1989), in a response to McCarthy, defends articulator theory as developed in Sagey (1986). He classifies the "gutterals" as \([-\text{consonantal}\] because of their "glide-like" quality. In addition, he claims, on the basis of x-ray tracings, that both uvulars and pharyngeals are produced with a lower pharyngeal constriction and are therefore best represented by the feature \([+\text{constricted pharynx}]\) \([+\text{CP}]\), which is dominated by a Tongue Root node.

Halle proposes changing the Laryngeal node to Glottal along lines suggested by McCarthy. In order to capture the grouping of laryngeal features with the uvulars and pharyngeals which makes up the entire set of gutteral segments, he makes sisters of the Tongue Root node and the Glottal node under a Larynx node. The structure he proposes is found in (34).

\[
\begin{array}{l}
\text{(34) PLACE} \\
| \\
\text{LARYNX} \\
| \\
\text{Tongue Root} \\
| \\
\text{Glottal} \\
\text{[ATR]} \\
\text{[CP]} \\
\text{[c.gl]} \\
\text{[sp.gl]} \\
\text{[st.vc]} \\
\text{[sl.vc]} \\
\end{array}
\]

Halle's arguments for his proposal appear fairly strong. First, physiologically, grouping the pharyngeal and laryngeal segments together under one node reflects
the fact that one set of muscles control both the epiglottis, which plays a part in pharyngeal articulations, and the larynx, which is obviously fundamental in laryngeal articulations. Citing Czaykowska-Higgins (1987) (and references therein), Halle claims support, on the basis of voicing quality, for his proposed features [ATR] and [CP], which are dominated by the Tongue Root node. In particular, he states that both [ATR] and [CP] can be shown to "induce noticeable modifications in voice quality. Thus, in some African languages, [-ATR] vowels are said to be pronounced with creaky, bright, brassy voice, whereas [+ATR] vowels are pronounced with breathy, muffled, or hollow voice (p. 18).

In summary, the primary differences between the proposal by McCarthy and that by Halle are assumptions regarding articulator versus place-of-articulation theory, and the representation of uvulars and pharyngeals which follows from the choice of theory. Much of the Halle paper is concerned with showing the advantage of articulator theory over place-of-articulation theory, but his assumptions regarding the gutteral argumentation are based on the proposal that all gutterals are [-consonantal].

A potential problem for Halle (but one that remains, of course, an empirical issue) is the status of uvulars.
He claims that they are not doubly articulated, providing, however, only the muscular facts discussed above as evidence for his claim. Given the strong arguments in Cole (1987) and McCarthy (1989) (and as suggested in Czaykowska-Higgins (1987)) for representing uvulars as a complex structure along the lines suggested in Keating (1987) for palatals, the issue remains contentious.

2.4. Other Proposals

In this section I discuss some of the treatments various researchers have given for retraction phenomena. Cook (1987) proposes an analysis for Chilcotin flattening, which is a process that closely resembles Lillooet retraction. Though he does not propose a formalized model of a feature geometric tree, he does invoke a feature [RTR] which when applied in an autosegmental fashion according to his formalized rules accounts for the flattening process in Chilcotin.

Doak (1987) uses [CP] and [RTR] to account for progressive and regressive harmony in Coeur d'Alene. She claims that these features reflect the nature of pharyngeal constrictions, which, according to Ladefoged (1982), are of two differing types: (i) pulling back of the epiglottis (which represents [CP]) and (ii) retraction of
the tongue root (which represents [RTR]) (p. 4). Doak does not attempt to position these features in a larger framework, namely, within a theory of feature hierarchy, and therefore gives no indication of the status of these features within Universal Grammar.

Bessell (1990), on the other hand, proposes the structure in (35) to account for the very same phenomenon that Doak is concerned with.

(35) PLACE
    | Tongue Root

However, Bessell makes use of just one feature [Tongue Root] under the place node to account for the two types of harmony. Using only one feature captures the fact that the two types of harmony result in the same set of surface vowels. That is to say, /i/ --> [ɛ] and /u/ --> [o] in both regressive and progressive harmony. Doak's analysis relies on spreading two different features for two different rules where only one set of vowels surfaces.

Bessell's system, which is largely derived from Bessell and Remnant (1989), parallels the one that I propose in detail in Chapter 4. Where we differ is in the necessary features required to account for the Coeur d'Alene data as opposed to the Lillooet data. Lillooet requires an extra feature to characterize the two sets of
surface vowels triggered by retraction and pharyngealization. In the following chapter, I present the facts of Lillooet phonology, and in Chapter 4, I give a detailed account of retraction and pharyngealization as well as an analysis of the phenomena.
3.0. Introduction

This chapter explicates the general details of Lillooet phonology as presented in van Eijk (1985). Certain aspects of the Lillooet sound system, such as the classification of segments in the phonemic inventory and the pervasive processes of rounding in the language, require investigation in order to explicate fully the processes of retraction and pharyngealization. In addition, I examine the extensive phonetic vocalic inventory as well as the relatively small phonemic inventory.

In section 3.1., I present van Eijk's classification of the Lillooet consonantal inventory; and in section 3.2., I examine the vocalic inventory paying particular attention to the effects of retraction and pharyngealization on the vowels.

3.1. Consonantal Inventory

The places of articulation of the consonant inventory found in (36) below are: labial, dental (second and third columns), alveopalatal, velar (unrounded and rounded), uvular (unrounded and rounded), pharyngeal (unrounded and
Van Eijk divides the system into obstruents and resonants with the obstruents being voiceless while the resonants are voiced, thereby including the set of /z z' ð ð' q q'/ as resonants. He states that the uvular glides (which I classify as pharyngeals) and /z z'/ (in addition to ñ ñ') are resonants because (i) "they oppose plain vs. glottalized members" and (ii) "like the other resonants, they do not occur in the positions C_C and C_#" (p. 3). However, the phonological behaviour of /z z' ð ð' q q'/ indicate that these segments pattern with the obstruents with regard to retraction. In the case of /z z', these segments function as retracting segments, patterning with the uvular obstruents. The pharyngeals also pattern with the retracting segments in that they have pharyngealizing effect on vowels. Furthermore, van Eijk's first argument concerning plain vs. glottalized members, which I state above, cannot serve to distinguish resonants from obstru-

19 I use L to stand for the dental, lateral fricative: /l/ and ñ for the velar resonant /y/.
ents because the stops also oppose a plain and a glottalized series. Moreover, his second argument concerning the impossible canonical position of these segments does not necessitate a distinction between resonants and obstruents as the restriction could be construed to be on voicing in those positions, for example. Therefore, I find no compelling evidence for classifying /z-z'/ as resonants. Nevertheless, I have chosen to leave the pharyngeals as resonants on the basis of their phonetic description (see section 3.1.4.), while /z-z'/ are classed as obstruents.

The status of /h/ and /ʔ/ in the system is not entirely clear. Van Eijk points out that the relation between /h/ and /ʔ/ does not parallel that of the other resonants, which have a clear pairing of plain and glottalized segments. However, there are cases in which they do pattern together as plain and glottalized counterparts (see van Eijk pp. 16, 31-33, 36-37). For the purposes of this thesis, I adopt van Eijk's analysis in which /h/ and /ʔ/ function as resonants.

See Chapter 4 section 4.1.2. for further relevant discussion of /z-z'/ in relation to /i/ and /y/, where I argue that the difference between the three segments can be found in their values for [sonorant] and [vocoid].
3.1.1. Coronals

The coronal consonants can be broken down into two-sub groups: the dentals and the alveo-palatals. The set of dental consonants is made up of /t ɬ' L n n' c'/, while the alveo-palatals are /č š l l' y y'/. I classify /z z'/ on its own as its patterning in the system is anomalous. Phonetically, /z z'/ have a dental articulation with the tongue-tip in contact with the teeth. At times, they may also have a lateral articulation. In addition, /z z'/ pattern with the alveo-palatals in that they are in free variation with /y y' l'/: two alveo-palatal segments. Finally, /z z'/ have a Tongue Root articulation which accounts for its behaviour with regard to retraction. (See section 3.1.1.3. for a fuller discussion of /z z'/.)

3.1.1.1. Dentals

The absence of an expected glottalized counterpart to the dental stop /t/ (i.e. t') appears to indicate a gap in the system. However, the lateral affricate /ɬ'/ functions as the counterpart to /t/. Interestingly, historical evidence shows that Proto-Salish *t' and *ɬ' merged into one phoneme which surfaces as /ɬ'/ in Lillooet (van Eijk 1985:iii). In addition, /L/ is classified as the dental fricative in this system where /s/ is not a phonemic seg-
ment of the language. By grouping /χ'/ and /L/ as the glottalized dental stop and dental fricative respectively, I appear to be discounting their lateral articulation. However, I do not claim that [lateral] is not an operative feature, but that these lateral segments function as the logical counterparts to /t/. Furthermore, the entire set of lateral segments in the language (i.e. /χ' L l 1'/) do not pattern together with respect to retraction. That is to say, both /l/ and /l'/ can be retracted while /χ'/ and /L/ are apparently never susceptible to the process.

The dental affricate /c'/ is distinct from the alveo-palatal consonant /č/ and does not pattern phonetically as the glottalized counterpart. These segments do not share a common point of articulation, and, as in the case of the laterals (/χ' L/ and /l 1'/), /c'/ and /č/ do not behave in the same manner with regard to retraction.

3.1.1.2. Alveo-palatals

The alveo-palatal obstruents /č š l l'/ (phonetically [č š l l']) pattern together with regard to retraction. When /č š/ are retracted they are pronounced as [tš, ʂ]. [ʂ], which is not the standard English [s], resembles the Arabic consonant sad (van Eijk 1985:3). Tritton (1962) describes sad as "... the counterpart of s and is made
with the blade of the tongue against the teeth ridge, the tip being behind the lower teeth" (p. 17). However, van Eijk (1985:3) states that "retraction of the tongue-root ... leaves only the tongue-tip for articulating the closure - in contrast to [θ ʌ], where the whole tongue-blade is left free to make the closure...". Note that a secondary closure is formed in the posterior region of the vocal tract, specifically, a closure involving the tongue dorsum and the velum.

Thompson and Thompson (1986:58), in describing similar segments in Thompson, state that [ɔ] and [s]^{21} "resemble the consonants of English its, sauce, but have in addition a cupping of the tongue in back of the key point of articulation, giving them a dark, hollow timbre. (They are not, however, retroflexed.)"

The laterals /l l'/ are pronounced like the English clear [l]. When retracted these segments are similar to the dark [ɬ] in English^{22}, due to the additional posterior

^{21}Underlining of a segment indicates retraction.

^{22}By stating that the retracted [l] of Lillooet is similar to English dark [ɬ], I am making no claim about the status of velarization vs. uvularization of English [l]. The articulatory facts indicate that in both the English and the Lillooet cases /l/ may be backed. The facts of English dark [ɬ] are of no concern to the present work, and I refer to them only so that the reader may gain a rough idea of the articulation of Lillooet retracted [l]. I am also not claiming that Lillooet [l] is "uvularized". Instead, as
constriction superimposed on the articulation of /l/.

3.1.1.3. /z z'/

/z z'/ have a dental articulation with the sides of the tongue raised giving it a lateral-like quality. Van Eijk (1985:4) describes the articulation of /z z'/ in the following way:

Phonetically, /z z'/ are lax fricatives, varying from a purely dental articulation (with the tongue-tip more forward than in English "z") to an interdental pronunciation (where z z' sound somewhat like lax variants of English voiced "th"); the former pronunciation is generally more common in the Fountain dialect (F), the latter in the Mount Currie dialect (M). . . .

In the Mount Currie dialect [z] alternates with [l] in post-vocalic position, as the example in (36) shows, indicating that there is indeed a "lateral-like" quality to this segment.

shown in Chapter 4, retracted [l] has a Tongue Root articulation, as do the uvular segments, /z z'/, and the pharyngeals.

23 Both M. D. Kinkade and P. Shaw (p. c.) have informed me that the Chilcotin /z/ which, according to Cook (1978), is a borrowing from Interior Salish is lateral-like.

24 Van Eijk mentions that /z'/ may be pronounced as [l'] in post-consonantal position, and that /z/ may be pronounced as [l] before or after vowels. However, he provides no examples of these alternations, and I am not sure whether these variations are restricted to certain lexical items or may occur whenever a /z/ or /z'/ is in one of the above mentioned environments.
However, /l 1'/ may not surface as [z z'], as (37) shows.

(37) /p@l'p/ --> [p@l'p] *{p@z'p}

In both dialects [z] is in free variation with [y] giving it a glide-like quality. The environments in which this alternation occurs are: (i) before a suffix or enclitic beginning in a coronal -- either dental or alveo-palatal -- consonant, and (ii) in word initial position in idiolectal variations and nursery talk. Examples of (i) and (ii) are given in (38a) and (38b) respectively.

(38a) /huz'/ [hɔz'] "to be about to do smt."

/huz'-ti?/ [hɔz'te?]/[hɔy'te?] "that one is about to do smt."

/χ'1æz'/ [χ'laez'] "canoe"

/'læz'-'s/ [\\'laez's]/[\\'lay's] "his canoe"

(b) /z@tp/ [z@tp]/[y@tp] "jelly-like"

/zæxt/ [zæxt]/[yæxt] "long"

As with the [z z']/[l l'] alternation, /y y'/ cannot surface as [z z'], as (39) demonstrates.

(39) /?æyL/ [?æyL] "to have recently done smt."

*{?azL}

/yunhænæ/ [yonhænæ] "Carrier Indian"

*{zonhænæ}

In his study of the acoustic characteristics of
Chilcotin, Latimer (1978) shows that the "flat" (i.e. retracted) segments have lower high frequencies than those of the sharp (i.e. plain) series. Lower frequencies indicate pharyngealization. Furthermore, he provides evidence from palatograms to show that the places of articulation between the two series are indeed different. The plain series has a dental articulation, while the retracted series involves contact behind the alveolar ridge (p. 42). The Lillooet /z z'/ appears to be the same as the Chilcotin "flat" series while the Chilcotin "sharp" series resemble English [z].

3.1.2. Uvulars

The set of uvular consonants in Lillooet consists of the following stops and fricatives: q q' q\textsuperscript{w} q'\textsuperscript{w} x x\textsuperscript{w}. The glottalized stops are pronounced with a fricative off-glide, articulated at the same place, which results in their resembling affricates. Thus, /q'/ is phonetically realized as [q'\textsuperscript{x}] and /q'\textsuperscript{w}/ as [q'\textsuperscript{Xw}]. In addition to the uvulars, Lillooet has a full set of velar consonants: k k'.

\textsuperscript{25}To my knowledge, no acoustic or articulatory work such as spectrograms or palatograms has been done on Lillooet. I make use of the Chilcotin case because of the similar process of retraction and the apparent historical link between the Chilcoten /z/ and the Lillooet /z/ (Cook 1978).
The places of articulation of the velar and uvular sets are very close to one another with the uvulars articulated just slightly back of the velar place of articulation. In addition, velars are almost assimilated (that is to say, are backed) to uvulars when the two are adjacent (van Eijk 1985:11). In this case they are distinguished from one another by the affricate articulation of the uvulars.\(^{26}\)

3.1.3. Pharyngeals

Doak (1987:4) notes that Ladefoged (1982) recognizes two different types of pharyngeal articulations. The first method involves retracting the tongue root, while the second one is carried out by "pulling the epiglottis back toward the back wall of the pharynx" (Ladefoged 1982:149). Epiglottal involvement in a pharyngeal articulation is also claimed by Colarusso (1985), who states that pharyngeal articulation involves "the tongue root [being] thrust down upon the epiglottis, bringing the latter into approximation with the opening of the larynx" (p. 367).

Pharyngeal articulations in Lillooet have been suspect in the literature. Kinkade (1967) states that the

\(^{26}\)VanEijk does not actually provide examples.
pharyngeals of Columbian and Coeur d'Alene are primarily uvular approximants in Lillooet and Thompson. On the other hand, Latimer (1978) and Cook (1983, 1987, 1989) claim that Chilcotin flattening (which is derived from Lillooet retraction) is pharyngealization, but involves a uvular articulation or backing of a velar such that a uvular is articulated.

Van Eijk (1985) classifies the glides /ʔ, ɢ, ɢʷ, ɢᵀʷ/ as uvulars. However, he notes that the articulation of these glides is farther back in the vocal tract than the uvular obstruents, and [ɢ] is similar to the Arabic pharyngeal. Thompson and Thompson (1986), in their discussion of the equivalent segments in Thompson, state that "[p]ostvelar resonants are basically pharyngeals, produced by retraction of the tongue root and general narrowing of the pharynx. The plain ones /ɢ, ɢʷ/ commonly involve some uvular friction or occasionally a uvular trill. They also occasionally have some suggestion of creaky glottal production." (p. 64).

My proposal as to the place of articulation differs from that of van Eijk (1986), Kinkade (1967), and Swoboda (1971) (who does not include any pharyngeal or uvular resonant in the Lillooet consonantal inventory) in that I propose that Lillooet has both a uvular series that
includes stops and fricatives and a pharyngeal series that contains only resonants. The arguments for my analysis are based in part on descriptions regarding the place of articulation, but primarily on the differing effects that the segments I classify as uvulars and pharyngeals have on vowels. Therefore, on the basis of the data presented in this thesis I argue for a reanalysis of previous classifications of the pharyngeal segments. To summarize, I propose the sub-classification found in (40).

\[
\begin{array}{ccc}
\text{stops} & q & q_w \\
\text{fricatives} & q' & q'_w \\
\text{resonants} & X & X_w \\
\end{array}
\]

\( q, q'_w \)

\( q, q'_w \)

3.2. Vocalic Inventory

The vocalic inventories of many Interior Salish languages share one noteworthy property, namely they contain few phonemic vowels while having a wide range of phonetic vowels (see Thompson and Thompson (1986) for Thompson, Reichard (1938) and Doak (1987) for Coeur d'Alene, van Eijk (1985) for Lillooet, and Thompson (1979) for a general discussion of Salish vowels).
The phonemic vocalic inventory of Lillooet is shown in (41) while (42) gives the phonetic vowel inventory\(^{27}\).

\[
\begin{array}{c}
(41) \\
i & u \\
\theta \\
\varepsilon \\
\end{array}
\]

\[
\begin{array}{c}
(42) \\
e & o \\
\hat{e} & \Theta \\
\varepsilon & \Theta \\
\hat{a} & \wedge \\
a\hat{a} \\
\end{array}
\]

The underlying vowels /i u æ θ/ surface approximately as [e o æ θ] in their non-retracted (i.e. plain) state. The phonetic range of the plain vowels is wide due, in part, to free variation. Thus, /æ/ can be either [ɛ] or [æ]; for clarity's sake, I have chosen to represent this vowel as [æ] so as not to confuse it with the retracted form of /i/, which is [ɛ]. Phonetically, the phonemically high vowels in the system are, for the most part, phonetically mid vowels. However, /u/ may be pronounced as [u], although [o] is the common variant.

\(^{27}\)The diacritic ^ over vowels denotes pharyngealization. Therefore â is a pharyngealized a and Ɔ is a pharyngealized ɔ.
In a five vowel system of:

\[(43)\]

\[
\begin{array}{c}
\text{i} \\
\text{u} \\
\text{e} \\
\text{o}
\end{array}
\]

there is a three-way distinction in height. However, a three vowel system such as Lillooet\(^{28}\) has only a two-way distinction is required for height. This means that the vowels that surface as [e] and [o] in a five vowel system will be the mid-vowels, or in an SPE type feature system [-hi,-lo]. In the three vowel system, on the other hand, these segments function as the high vowels, while /a/ functions as the low vowel, and there is no distinctive mid-vowel height. For the purposes of simplicity I have chosen /i/ and /u/ as the underlying forms so that the problem of characterizing vowel height does not interfere with the theoretical issues at hand.

The retracted vowels are realized as [ɛ\(^{29}\),ɔ,a,ʌ]. The underlying vowels can also be pharyngealized; this results

\(^{28}\)See section 3.2.1. below for an explanation of schwa in terms of underspecification theory.

\(^{29}\)An alternate pronunciation of retracted /i/ is [ɛ]. [ɛ] and [ɛ] (which is phonetically that of the sound in the German word "mehr" (van Eijk 1985:3)) are in free variation. So, for example, /χ'iq/ ("to arrive here") is realized as either [χ'ɛq] or [χ'ɛq]. I use [ɛ] to represent the retracted form of /i/.
in a different set of surface vowels from those of retraction. That is, as mentioned previously in section 1.1.2., in addition to the phonetically retracted vowels there are phonetically pharyngealized vowels. In articulatory terms, the difference between the two is that the retracted segments are made with a constriction in the upper portion of the pharynx (i.e. are uvularized) while the pharyngealized segments are both retracted and pharyngealized (i.e. are made with a constriction in the lower portion of the pharynx). (44) shows the effects that the pharyngeals have on vowels.

\[
\begin{align*}
/æ, θ/ &\rightarrow [\mathring{a}] /\mathring{a}w \\
/æ, ð/ &\rightarrow [\mathring{5}] /\mathring{5}w \\
/i/ &\rightarrow [\epsilon] /\mathring{e}w
\end{align*}
\]

Ladefoged (1982) notes that both velarization (which is "raising the back of the tongue"; p. 211) and pharyngealization (where "the root of the tongue is drawn back so that the pharynx is narrowed"; p. 283) are secondary articulations. He states that "[t]here is very little difference between velarized and pharyngealized sounds, and no language distinguishes between the two possibilities" (p. 211). Unfortunately for the case at hand, Ladefoged says nothing about uvularization as a separate process of secondary articulation. It is clear
from the facts of Lillooet retraction and pharyngealization that we need to distinguish phonetically between uvularization (which I call retraction) and pharyngealization.

To summarize the effects of retraction and pharyngealization, I present the chart in (45). The first column shows the phonemic vowel, the second is the plain phonetic form, and the third and fourth give the retracted and pharyngealized forms, respectively.

(45) phonemic phonetic retracted pharyngealized
   /i/   [ɛ]   [ɛ]   [ɛ]
   /u/   [o]   [ɔ]   -
   /æ/   [æ]   [a]   [â]/[5]
   /@/   [@]   [@]   [â]/[5]

3.2.1. Vocalic Underspecification

An underspecification system for the vowels of Lillooet is presented in the feature matrix in (46).

(46) i u æ @
    [lo] +
    [bk] -
    [rd] +

(47) lists the redundancy rules for the vocalic inventory of Lillooet and (48) presents a feature chart for the phonetic inventory.

(47) [φlo] --> [-lo]
    [φbk] --> [-bk]/[+lo]
    [φbk] --> [+bk]
    [φrd] --> [-rd]
An important point evident in the chart concerns the status of /θ/. Schwa is maximally underspecified underlyingly; all of its features are filled in by redundancy rules in the course of the derivation. Evidence for the status of schwa as the maximally underspecified vowel comes from its behaviour with regard to vowel ellipsis and vowel insertion. It is schwa, and only schwa, that is, on the one hand, the epenthetic vowel, and, on the other, subject to ellipsis. Data exemplifying these claims are found in (49) (illustrating epenthesis) and (50) (illustrating ellipsis) below.

(49) i /æw't/ /æ-?-w't/ [æw't] [æ?w't] "to be late" "to be later"

ii /čaqčqet/ --> [čaqčqet]/[čaqčqet] "tame"

iii /wæw@lčkzæ?/ --> [wæw@lčkzæ?]/[wæw@lčkzæ?] "poplar"

With regard to the status of schwa, I follow van Eijk's analysis. For details of the behaviour of schwa with regard to epenthesis and ellipsis see van Eijk (1985:23-35). Space limitations do not allow me to examine this issue further.
3.3. Stress

Stress in Lillooet, as in other Salish languages, is a complex issue (see Czaykowska-Higgins 1985 for an analysis of Columbian stress). Lillooet appears to have phonemic stress (van Eijk 1985:5), as the examples in the following roots show.

(51) a  [máqæ?]  "snow"  
[maqæ]  "poison onion"

(b)  [X'ämén]  "fur"  
[X'âmén]  "axe"

(51a) shows that stress does not play any role in the retraction of vowels as in both forms the vowel preceding the uvular is retracted regardless of the placement of stress.
3.4. Rounding

Rounding in Lillooet is a pervasive process that does not appear to be limited to one rule. That is to say, a rule of spreading [round] is activated by a number of triggers and applies to a number of targets. Though it is not my purpose to present in detail the finer workings of the rounding rules, it is important to consider the various different aspects of rounding given the role [round] plays in conjunction with the rule of pharyngealization. The general process of rounding will round a uvular or velar consonant if it is immediately adjacent to the rounded vowel /u/\(^{31}\). For example,

\[(52) /c'æ?x/ \text{id. } /c'æ?x-uš/ \rightarrow [c'æ?x\,uš] \text{"ashamed"} (/-uš/ \text{"face"}).\]

Other cases exist in which there is no morphophonemic alternation, and therefore it is not possible to state whether the consonants are rounded or unrounded underlingly. Therefore, in keeping with the "no alternation principle" (Kiparsky 1968) I postulate these segments as

---

\(^{31}\)Van Eijk states that rounding of a uvular or velar will occur if the uvular or velar are before or after /u/ (p. 10). However, the only clear example of rounding that he presents is the example given in (52). In this instance, I follow van Eijk as I am making no claims about the entire process(es) of rounding in Lillooet. For my purposes, I am merely concerned with leftward spreading of round from a pharyngeal consonant to a preceding vowel (see Chapter 4 section 4.2.)
underlyingly rounded. We also know that rounded consonants do exist underlyingly because of morphophonemic alternation that leaves a consonant rounded when it is not adjacent to the rounded vowel. For example,

\[ \text{(53) \{paq}\text{\^{o}}?} \] "to be afraid"
\[ \text{\{paq}\text{\^{a}}n/} \] "to scare smb., tr."
\[ \text{\{čok}\text{\^{w}}} \] "finished"
\[ \text{\{ć̆k\text{\^{w}}-cok}\text{\^{w}}} \] "various things are finished"

In the following Chapter, I present in more detail the problem of retraction and pharyngealization and formalize rules to account for these processes. In addition, I present arguments for enriching the Sagey (1986) model of feature geometry to include a fourth articulator node: Tongue Root, and an additional feature: [±epiglottis]. By incorporating these features into the previous model we can systematically account for the apparent anomalous behaviour of vowels in the environment of uvulars, /z z'/, retracted consonants, and pharyngeals.

---

32 B. Bagemihl (p. c.) suggests that deletion or reduplication in these instances could follow rounding of an underlyingly plain consonant.

33 For an analysis of schwa and full vowel alternation in Lillooet reduplication see Remnant (1989).
4.0. Introduction

In this chapter I address the problem of retraction versus pharyngealization in feature hierarchy terms. As mentioned in Chapter 1 and Chapter 3, two separate processes involving uvulars and pharyngeals affect vowels. Retraction is a process in which vowels are "retracted" (i.e. backed and lowered) when immediately followed by a member of the set of uvulars or dental resonants. Retraction of coronal consonants also occurs, although the process is not strictly local as in the case of retraction triggered by a uvular or a /z z'/. Pharyngealization, on the other hand, occurs when a vowel is followed by a pharyngeal consonant and becomes both retracted and "pharyngealized" -- that is, a pharyngeal constriction is superimposed on the retracted vowel.

The organization of this chapter is as follows. First, I present various retraction data and analyses to account for the seemingly disparate processes of simple retraction and retraction harmony. In addition, I propose a representation that characterizes the structural properties of retracting and retracted segments. Then, in section 4.2., I examine the pharyngealization data, present
an analysis to account for the facts, and incorporate relevant facts into the structural model proposed in 4.1.

4.1. The Retraction Problem

Retraction is a process in which a particular set of segments are articulated farther back in the vocal tract than their non-retracted counterparts; the physiological facts of retraction, however, vary from segment to segment. So, for example, tongue movement in the retraction of the coronal consonants does not parallel that of the vowels. For that matter, members of the set of coronals are not physiologically retracted in exactly the same manner. Thus, the retracted laterals [l l'] involve velarization (much like dark [ɔ] in English). The segments [c] and [s], however, move from a point of constriction between the alveo-palatal area and the tongue blade to constriction between the alveolar ridge and the tip of the tongue in the front part of the vocal tract, as well as between the upper section of tongue root and the uvula in the posterior section of the vocal tract.

Retraction of vowels generally means backing and lowering of the vowels; however, even this definition is somewhat vague. In the case of /i/ and /ɘ/, the retracted counterparts: [ɛ] and [ʌ] are indeed lower and farther
back than the non-retracted vowels (which are roughly [e] and [ə]). The low vowel /æ/ backs and lowers slightly to [a]. As for /u/, the retracted form [ɔ] is lowered, but not backed. I present the chart in (54) with the underlying segment (which reflects its position in relation to the other vowels -- i.e. the high vowels are high phonologically, but mid phonetically) in the first column, the phonetic approximation of the nonretracted form in the centre column, and the retracted form on the lefthand side.

\[(54) \begin{array}{ccc}
/i/ & [e] & [ɛ] \\
/u/ & [o] & [ɔ] \\
/æ/ & [æ] & [a] \\
/θ/ & [θ] & [ʌ] \\
\end{array}\]

The triggers for retraction include the set of uvular consonants and the coronal resonants /z z'/. I give the full phonemic chart in (55) with the set of triggering consonants in heavily outlined boxes. The single outlined box indicates the set of retractable consonants.

\[34\] The low vowel /æ/ in its non-retracted phonetic form varies in its pronunciation. Phonetically it alternates between [ɛ] and [æ]. So as not to confuse this vowel with the retracted form of /i/, [ɛ], I have chosen to represent it as [æ].
4.1.1. Retraction Triggered by Uvulars

Uvular consonants cause retraction of an immediately preceding vowel if that vowel is one of the set of full vowels: /i u æ/. (56) shows forms which contain uvulars and a preceding retracted vowel.

(56) a Retraction of /i/

[čeq] idiomatic
[Ă,eq] "to arrive here"
[L eq'] "to steal"
[teq wixw?] "the onion"
[meXæl] "bear"

(b) Retraction of /u/

[ş?eq w?] "to drink"
[2eq w] "dead"
[Loq wket] "to serve (food)"
[qeq w smsm] "to shoot/hunt small animals"
[q eq w o?] "small body of water"

(c) Retraction of /æ/

[šqaXæ?] "dog"
[qyaX] "drunk"
[qw"aq"X] "nightmare"
[paq o?] "to be afraid"
[šneLaqæ?] "well, it's him"
[čaqeq t] "tame"
[maqæ?] "snow"

The alternating forms in (57) indicate that retraction of
the vowels is due to the uvular and not due to inherently retracted segments. Moreover, these forms show that the rule of vocalic retraction triggered by a uvular consonant requires string adjacency. Where another consonant intervenes between the trigger and target, retraction is blocked.

(57)a  

[ʂq'wəm] "to skin an animal"  

[ʂoq'wəm'] "to skin small animals"

(b)  

[q'wɔq'səm'] "to shoot/hunt small animals"  

[q'woʃəm] "to shoot"

The one exception to the above case of consonantal blocking of retraction is glottal stop, which is transparent to the retraction rule. Examples of the transparency of glottals are presented in (58a). The data in (58b), along with (58.a.iii) and (58.a.iv) indicate that the /ʔ/ is independent of the following segment:

(58a)i  

/Læʔ-qš/ [Laʔqš] "to go ashore"  

ii  

/mičʔʔq/ [mečʔq] "to sit down or up"

iii  

/?æʔXæʔ/ [ʔaʔXæʔ] "sacred, supernatural, talented"  

iv  

/zaʔXw/ [zaʔXw] "thaw"

35 The fact that I have examples only involving /æ/ and /u/ does not affect the generalization that /ʔ/ is transparent to retraction, because there are no cases where retraction of /i/ is blocked by /ʔ/.
The set in (58.b.i) shows that the segment is retracted whether a glottal stop is present or not. (58.a.iii) and (58.a.iv) cannot be interpreted as pre-glottalization of the following uvular because Lillooet does not have an underlying glottalized uvular fricative. (58.b.ii) shows a form with a glottal stop followed by a glottalized segment, indicating that the glottal stop is not pre-glottalization of the following stop which retains its glottalization, further supporting the argument that the transparent segment is an independent segment.

4.1.1.1. The Retraction Rule

As discussed in Chapter 2, Sagey's (1986) model of feature geometry given in (24) is not sufficiently rich to account for the retraction data in Lillooet. First, the facts of retraction cannot be captured by spreading one or more of the dorsal features. Second, because retraction is triggered by uvulars, the representation must incorporate this fact by licensing a feature that is shared by both the trigger and target. Thus, we must first examine the representation of uvulars.
I follow Cole (1987), McCarthy (1989), and Bessell and Remnant (1989) in suggesting that uvulars are complex segments involving the Dorsal and Tongue Root (or, in the case of McCarthy 1989, Pharyngeal) nodes. McCarthy (1989) states that "uvular gutturals are produced by a movement of the tongue dorsum upwards and backwards; there is constriction both in the oropharynx and against the soft palate" (p. 38). Furthermore, uvulars are only found in systems with velars, indicating that their presence requires an independently motivated Dorsal node. By postulating uvulars as complex segments, none of the requirements stipulated by Sagey (1988) for the status of a complex segment are violated. Moreover, McCarthy (1989) notes that the move to represent uvulars as complex segments parallels that of representing palatals as complex segments (argued for in Keating 1987), and is therefore not unprecedented. I adopt the structures in (59) proposed by Cole (1987) for velars, uvulars, and pharyngeals.

(59) velars uvulars pharyngeals

Having established the representation of uvulars, I now give the rule of uvular retraction in (60). The Tongue Root node of the uvular spreads onto the Place node of the
vowel.

(60) [+vocalic]

<table>
<thead>
<tr>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsal</td>
</tr>
<tr>
<td>Tongue</td>
</tr>
<tr>
<td>Root</td>
</tr>
</tbody>
</table>

Archangeli and Pulleyblank (1987) propose a maximal/minimal tier scansion parameter that permits a rule to access information on a given tier. In addition, they invoke the Locality Condition in (61), which, when applied with tier scansion, ensures that rules apply locally --- that is, to adjacent segments on a given tier. The combination of maximal/minimal scansion and the Locality Condition permit the application of rules to targets which appear to be an arbitrary distance from the trigger.

(61) Locality Condition

A rule can apply only if a specified target is adjacent to a specified trigger.

In the case of retraction, the trigger and target of the rule must be string adjacent, and the rule must not apply to /Ø/. Maximal scansion involving vowels will scan the nuclear tier while maximal scansion involving consonants scans the skeletal tier. Minimal scansion, on the other hand, is defined as "a rule whose target is node or feature α scans the tier containing α" (Archangeli and Pulleyblank 1987:25). That is, the tier that immediately
dominates the feature or node that spreads is the one that is scanned. Thus, in the case of retraction where Tongue Root spreads, invoking the parameter of minimal scansion ensures that the place node is scanned. Derivations for [mεXεL] "bear", [zɔqʷ] "dead", and [maqə?] "snow" are given in (62a-c). The derivation for [qʷəqʷəz] "blue", where /θ/ does not retract, is given in (63).

(62a)/m i X æ L/

[\[mεXεL\]]

(b) /z u qʷ/

[\[zɔqʷ\]]
Place node scansion and the Locality Condition block the application of the rule when there is an intervening consonant between a vowel and a uvular consonant. I assume that the coronal segments are specified for a Place node and therefore cannot be transparent to retraction, as

\[36\]The phonetic form of /q^w@q^waz/, [q^w@q^waz], shows retraction of /æ/ triggered by /z/. I discuss the details of retraction triggered by /z/ in section 4.1.2., and assume the application of the rule in this example.
shown in (64).

\[ (64)/\text{s} \ u \ \text{s} \ q'\text{w} \ \text{m/} \]

As the data in (58) above show, /?/ does not block retraction. Should /?/ be specified on the Place tier it would behave like /\text{s}/ in (64) above, blocking retraction. However, /?/ -- having no Place features, in fact, only Laryngeal features -- is therefore not specified on the Place tier, and is thus transparent to the retraction rule. Though /?/ intervenes between the target and the trigger at the root node, on the Place tier -- the tier at which the rule applies -- the trigger and target are adjacent. (65) gives the derivation of /Læ?q\text{s}/ "to go ashore".
4.1.2. Retraction triggered by /z z'/

Retraction of the vowels /u ã/ is also triggered by /z z'/, as can be seen in the data sets in (66a-b).

(66a) Retraction of /u/

[k'w'çxæl] "to spread out berries to dry"
[mqzmet] "pitiful"
[k'zjz] "to have twins"
[œmæmzœz'] "girlfriend, mistress"
[œpzçæz?] "bird"
[œk'w'çæz?] "child, offspring"

(b) Retraction of /ã/

[qw'æq'waz] "blue"
[xw'æaz] "not"
[nq'ælæxæz'] "to swim around"
[œkw'æzæz'] "doll"
[œletæz'] "jackpine"
[ææz] "nice"

In order to account for these data we must examine the structural representation of the trigger segment, as
in the case of uvulars. I propose that /z/ is triply articulated, involving the Coronal node, the Dorsal node, and the Tongue Root node, based on the following considerations. First, the alternation between /z z'/ and the other coronal consonants /l l'/ and /y y'/ discussed above in Chapter 3 section 3.1.1.3. suggests that these segments are coronals. Proposing that /z z'/ was not specified for a Coronal node while /l l'/ and /y y'/ were would require feature changing rules to account for the alternation. Furthermore, the phonetic description of a dental articulation (see Chapter 3 section 3.1.1.3.) suggests that Coronal articulation is involved. Second, the behaviour of /z z'/ and /i/ with regard to retraction can be nicely accounted for if /z z'/ has a [-back] specification, thereby requiring a Dorsal node. (See below for discussion of the feature differences between /z/, /i/, and /y/.) Third, evidence from an acoustic study of Chilcotin (Latimer 1978) shows that Chilcotin flat consonants, including /z/ (which was a borrowing from Lillooet and Thompson (Cook 1978)) have lower high frequencies than those of the sharp (i.e. plain) series, indicating a Tongue Root articulation.

The acoustic characteristics of "sharp" [z] are two formants, one at 1550 Hz and the other at 2500 Hz with a concentration of energy around 4500 Hz... [With] "flat" [z] ... there is a
concentration of energy around 4500Hz and there are two formants, but the values of the formants are different. The lower formant hovers about 1000 Hz and the upper, about 2800 Hz. The lower formant of the "flat" [z] has a value 500 Hz less than that of the "sharp" [z]; about the same decrease as in the loci. (Latimer 1978:35)

Latimer goes on to state of the flat [z] that:

...this articulation is actually pharyngealization, which, as one of its effects, lowers the upper frequencies of the segment which is pharyngealized. Pharyngealization is a constriction of the pharynx, normally caused by a retraction of the tongue root towards the wall of the pharynx. This constriction, because it is so far back in the vocal tract, causes the low loci of the "flat" consonants and causes the effect we see on the vowels. (p. 39)

Third, palatography provides additional evidence for the special status of [z] in Chilcotin. Latimer argues that where the plain series is articulated in a "dento-alveolar" region, the "flat" series is clearly "well behind the alveolar ridge ... [and] supports the pharyngealization hypothesis." (p. 42) The fourth argument is based on the fact that these segments are exceedingly rare in the world's languages. M. D. Kinkade (p. c.) suggests that the Lillooet type of /z/ occurs in only two other languages: neighbouring Thompson and Chilcotin. Likewise, triply articulated segments are exceedingly rare. Halle (1982) proposes "three distinct active articulators: the lower lip, the front part of the tongue, and the tongue body"
(p. 98) that may be combined in the articulation of a segment to produce complex segments. He also states that, in theory, triply articulated segments should be possible; however, they are unattested. I claim that Lillooet /z/, characterized in (67), is indeed a triply articulated segment. Furthermore, this proposal is not surprising given that Lillooet /z/ derives from Proto-Salish *y.

\[(67) \quad \text{Place} \quad \begin{array}{c} \text{CORONAL} \\ \text{DORSAL} \\ \text{TONGUE ROOT} \end{array} [ - bk ]\]

The retraction rule formulated in (60) and repeated here in (68) accounts for the data in (66).

\[(68) \quad [ + \text{vocalic} ] \quad \begin{array}{c} \text{Place} \\ \text{Dorsal} \\ \text{Tongue Root} \end{array}\]

As in the derivations in (62), the rule scans at the minimal level targeting the Place tier. (69) gives derivations for /muzmit/ "pitiful" and /xʷʔæz/ "not".

---

37 As mentioned above in section 4.1.1.2., I assume that the Coronals are fully specified.
Retraction triggered by /z z'/ parallels that by uvulars in other ways. For example, consonants that intervene between the trigger and target block retraction, as is shown in the data in (70) and the derivation in
(71)³⁸.

(70) [ʔočz] "good, o.k." [zæw'z@w'et] "to be a bother, a nuisance"

(71) /? u č z/

In addition, both /ə/ and /ʔ/ are transparent to the rule as the derivation of /qæʔz'/ ("tired") in (72) shows³⁹.

³⁸Though it appears that /w'/ should be susceptible to retraction, I argue below in section 4.1.4. that Tongue Root spreading is phonetically vacuous for the glides and therefore does not dock onto the Place node of /w'/ in this example.

³⁹M.D. Kinkade (p. c.) suggests that /θ/ in this form is actually an echo vowel, and that a native speaker would interpret this form as being one syllable. Nevertheless, [θ] does remain transparent to rule.
Thus far, retraction triggered by uvulars and by /z'z/ has behaved in exactly the same manner. However, in the case of retraction triggered by /z'z/, /i/ does not retract. Examples are given in (73).

(73) [xnez'az'] "gooseberry bush"
    *[xnεz'az']
    [L@lkezæ] "from these"
    *[L@kεzæ]

The obvious question at this point is: are uvular- Retraction and z-Retraction two separate processes or are they, in fact, instances of the same phenomenon? Certainly, the similarities between the processes provide compelling evidence to suggest that there is only one rule. First, /æ u/ are target vowels for both rules; second, both /θ/ and /ʔ/ are transparent to the rule; third, any consonant with place features intervening between the trigger and target block application of the rule; and
fourth, the vowels have identical surface realizations, namely [a] and [ɔ]. Nevertheless, the discrepancy in the application of the rule remains. /i/ when preceding a uvular retracts, but does not when it precedes a /z/.

The underspecification chart for vowels in (74) and the chart in (75) provide a possible clue to the anomalous behaviour of /iz/.

(74) i u æ ŋ
    [lo] +
    [bk] −
    [rd] +

Recall that /z/ is specified as [-back]. The chart in (75) shows the underlying specifications of [back] for vowels adjacent to the underlying specifications of [back] for the retracting consonants.

(75) æz uz iz aQ uQ iQ
    [back] φ− φ− -- φφ φφ −φ
    retraction / / X / / / /

Significantly, the sequence /iz/ is specified [-back] on both segments. The Obligatory Contour Principle (Leben 1973, McCarthy 1986), which prohibits adjacent identical elements, creates the structure in (76) where /i/ and /z/ share a Dorsal node. Note that these segments do not share a Place node because /z/ has, in addition to the Dorsal node, a Coronal node and a Tongue Root node.
At the underlyingly level these segments are both specified as [-back]; furthermore, when fully specified, these segments still share a Dorsal node because their dorsal features are identical. Recall from Chapter 3 section 3.1.1.3. that /z/ and /y/ are in free variation before a suffix or enclitic beginning in a coronal — either dental or alveo-palatal — consonant, and in word initial position in idiolectal variations and nursery talk. I argue that the difference between /z/, /y/, and /i/ lies in their values for sonorant and vocoid, as seen in (77), as well as the additional Tongue Root node of /z/, which /i/ and /y/ are not specified for.

(77) /i/ /z/ /y/
    [+sonorant] [-sonorant] [+sonorant]
    [+vocoid] [-vocoid] [-vocoid]

(78) gives the fully specified representation of [iz].
Two possible methods of blocking retraction of /i/ when followed by /z/ come to mind. First, a negative constraint as a Trigger/Target Condition (Archangeli and Pulleyblank 1986) can be imposed on the rule so that segments sharing a feature value or node do not undergo the rule. This constraint is stated in (79) and formalized in (80).

(79) [TR] spreading is blocked if the trigger and target share the Dorsal node.

(80) Place
    Dorsal
    Tongue Root

A second possible way of dealing with the problem of blocked retraction is to specify a singly linked Dorsal node in the structural description of the rule. In light of Hayes (1986) and Schein and Steriade (1986), I suggest that the rule of retraction given in (60), and (68) be
reformalized, as in (81).

(81) [+vocalic]

Place
Dorsal
Tongue Root

Hayes' Linking Constraint (82) ensures that a rule with a structural description that includes one association line will apply to an autosegment that also bears only one line. If the structural description includes two lines then the rule will apply where an autosegment is doubly linked.

(82) Linking Constraint.
Association lines in structural descriptions are interpreted as exhaustive. (p. 331)

In the case of retraction, the rule in (81) will apply to all sequences shown in (75) except /iz/ where the Dorsal node is doubly linked and therefore does not meet the structural description of the rule.

4.1.3. Retraction from a Floating Morpheme

The cases of retraction that we have already looked at involve the targets /æ u/, and in one case /i/, and the triggers /q q' q'' w x x' z'/z'/. However, we find additional cases of retraction where the targets are /i u æ æ θ ĺ ř l l'/ and the trigger is not clearly evident. In
forms such as those in (83) retraction spreads across the word retracting all of the targets.40

(83) /q@l/     [q@l]     "bad"
     /q@l-@l/   [q@l@l]   "good for nothing"
     /q@l-wil'x/ [q@lw@l'x] "to get spoiled"
     /L@č/      [L@č]     "to cave in"
     /L@sp/     [L@sp]     "to cave in"
     /c'ul'/    [c'ul']    "sour, bitter (of berries)"
     /c'a?p/    [c'a?p]    "sour (of smth. fermented)"
     /?æl@/    [?æl@]    "sick"
     /Lut/      [Lut]     "to squash a bug"
     /Lut-un'/  [Lut-un'] "to squash, tr."

We also find alternating pairs, like the ones in (84), where the form is retracted in one case and not in the other.

(84a)i  [L@k]     "get deflated, go down (of dough)"
ii     [L@k]     "get pooped, conk out"
iii    [p@t]     "to get covered up"
iv     [p@t]     "to get squished"
(b) i    [?æmæ]   "good"
ii    [?æmæwel'x] "to get better, to come back to life"
iii   [q@l]     "bad"
iv   [q@lw@l'x] "to get spoiled"
      /-wil'x/ inchoative

A negative connotation appears to be the recurrent semantic theme in all the cases of retraction in data sets

40 I mark retraction of the consonants by underlining the segment in question. To be consistent with the above sections, the retracted vowels are shown in their phonetic form.
(83) and (84). I postulate that retraction is due to a floating adversative morpheme that is affixed to the root and spreads retraction harmony bi-directionally across the word\textsuperscript{41}. Thus, the surface differences in the forms in (84a) are a result of affixation of a morpheme whose realization is retraction harmony. (85) gives the input and surface forms of the retracted and non-retracted pairs in (84a-b)\textsuperscript{42}.

\begin{verbatim}
(85a)
i /L@k/ --> [L@k] "get deflated, go down (of dough)"

ii /L@k - (A)/ --> [L@k] "get pooped, conk out"

iii /p@t/ --> [p@t] "to get covered up"

iv /p@t - (A)/ --> [p@t] "to get squished"

(b) i /?aemæ - wil'x/ --> [?aemæwel'x] "to get better, to come back to life"

ii /q@l - (A) - wil'x/ --> [q@lwel'x] "to get spoiled"
\end{verbatim}

\textsuperscript{41}Another possible way of accounting for the data is to assume that the floating Adversative morpheme is a prefix that spreads Tongue Root leftward through the root and into the suffix(es). I argue below that retraction triggered by the Adversative morpheme is essentially the same as retraction triggered by a floating Tongue Root node that is lexically specified on a root. Data in the latter case show prefixes and suffixes to which retraction spreads, indicating that bi-directional spreading must be involved.

\textsuperscript{42}I use \{A\} to stand for the adversative morpheme.
We have already established that retraction is due to spreading of a Tongue Root node onto an appropriate target. Adversative retraction, therefore, must involve Tongue Root spreading. There is no evidence to suggest that the adversative morpheme need be anything more than a Tongue Root node which, as it has no other characteristics linking it to a root node, is floating.

As stated above, the targets of this rule are the alveo-palatal consonants and all the vowels. At first sight, it appears difficult to group these segments together so that a rule may apply to only this set of segments. However, I propose that the alveo-palatals are specified for a Dorsal node, as are the vowels (with the exception of /θ/ which is unspecified). Keating (1987) provides evidence for palatals as complex segments. Though the alveo-palatals in Lillooet are not strictly palatals in Ladefoged's sense of the word (where he defines palatals as "being made with the front of the tongue approaching or touching the hard palate" 1982: 141), they do make up the set of "back" coronals in Lillooet. Recall that the segments in Lillooet articulated under the Coronal node are divided into two groups: the dentals and the alveo-palatals; the coronal segments are repeated here in (86), where the first two columns are dental, the third
is dental and alveo-palatal, and the fourth is alveo-pala-
tal.

(86)  
  \[ \begin{array}{c}
  \chi' \\
  \zeta \\
  \zeta' \\
  \eta \\
  \eta'
  \end{array} \]

\[ \begin{array}{c}
  \tilde{c} \\
  \tilde{g} \\
  \tilde{l}
  \end{array} \]

I suggest that the difference between the dentals and the 
alveo-palatals is that the dentals are articulated with 
just a Coronal articulator while the alveo-palatals 
involve Coronal and Dorsal, as shown in (87).

(87)  /\tilde{c}\,\tilde{g}\,\tilde{l}\,\tilde{l}'/

To recapitulate, the trigger of adversative harmony 
is a floating morpheme that is characterized by a Tongue 
Root node, and the target of the rule must be a node that 
both the alveo-palatals and the vowels share. I have 
suggested that alveo-palatals are articulated with a 
Dorsal node, like the vowels, and therefore Dorsal is the 
target of the rule. The rule is formalized in (88).
An essential difference between retraction triggered by uvulars and /z z'/ and long distance retraction is that in the former case /∅/ does not retract while in the latter, it does. By ordering simple retraction before the application of the Redundancy Rules and retraction harmony after they apply we can account for the differing behaviour of /∅/. Scansion is at a minimal level which, as in the case of simple retraction, is the Place node. At the point at which the rule applies /∅/ is specified for a Dorsal node, and therefore is a target for the rule. I give derivations of [q\l] "bad", [c'\l'] "sour, bitter", and [?als] "sick" in (89a-c).
(89)a  /q  θ  l/  

Skeletal Tier

Place

Dorsal
Coronal
Tongue Root

(b)  /c'  u  l'/  

Skeletal Tier

Place

Dorsal
Coronal

Tongue Root

[qAI]
[c'ɔl']
In (89a) the rule applies vacuously to /q/ which is specified for both a Dorsal node and a Tongue Root node.

My analysis, thus far, makes a prediction regarding the behaviour of the velar series. As velars are specified for a Dorsal node we would expect them to retract in the same manner as the vowels and alveo-palatal consonants. In Chapter 3, I mentioned that velars and uvulars are auditorily very close to one another, and that velars are assimilated to uvulars when the two are adjacent. Unfortunately, the data on retracted forms are not sufficiently extensive to document a possible uvularization of velars. However, it is clear from the example in (90) that the velars do not block retraction.

(90) [g\kag\kæ] "blue-jay" (refers to the sound it makes when forecasting bad news or bad weather)
My analysis predicts that the velars will participate in retraction harmony and be realized as uvulars. Spectrographic investigation is required to clarify this issue.

Additional data remain that cannot be readily accounted for. Consider the forms in (91).43

(91a) No spreading to suffixes

/Lu-L-t-@n'/ [LɔLt@n'] "to squash it well"
squash-redup-?

/?alš-@m/ [?als@m] "sick"
sick-aspectual

/?alš-@m-Lk-@n/ [als@mLk@n] "I am sick"
sick-aspectual-indicative-1st person

/q@l-æl'qW@m/ [qal'qW@m] "ugly"
bad-outward appearance

/q@l-@m/ [qalm] "that is bad"
bad-that

/q@l-Lk-@n/ [qalLk@n] "I am bad"
bad-indicative-1st person

/q@l-æL-tmixW/ [qalæLtmexW] "storm"
bad-compound former-weather

43 In many cases I have not been able to determine the exact morphemic breakdown or the glosses of the different morphemes. I have tried to be as accurate as possible in representing the underlying forms, but there are, no doubt, errors.
(b) No spreading to prefixes

/\k\~e-p\~e-t-\~e/ [\k\~e\~e-p\~e-t\~e] "to get squished"
suddenly-to cover-reinforcing enclitic

/\k\~e-L@k-\~e/ [\k\~e-L@k\~e] "to get very tired, to conk out"
suddenly-still(?)—reinforcing enclitic

/\~e-L\~e/k/ [\~e-L\~e-k] "lazy, motionless"
stative-still(?)

In every case in (91) we find forms where retraction has not spread beyond certain morpheme boundaries. We know from other forms such as [q\~e-L\~e-w\~e l\~e-x] "to get spoiled" that retraction is not restricted to the root in all cases. I suggest that the variability of retraction in the forms in (91) is a result of level ordering within the lexical phonology (see Kiparsky 1982, 1985, Kaisse and Shaw 1985, among others. See also Bessell 1989 for the domains of retraction in Coeur d'Alene and Czaykowska-Higgins 1990 for Columbian.) That is, retraction precedes the affixation of the morphemes that do not retract. However, a presentation of the lexical phonology of Lillooet is beyond the scope of the present work.

4.1.4. Retraction from a Floating Feature

In addition to the retracted forms stemming from a floating morpheme (Adversative), we find forms containing retracted consonants and vowels that do not have any se-
mantic connection to one another nor appear to be triggered by a uvular or \( /z \, z' / \). Examples of this type of retraction are:

(92) /\text{k'w}u\text{s}æ?/ \quad [k'\text{w}a\text{a}?] \quad "to urinate"

/\text{\`a}l-\text{l}/ \quad [\text{\`a}l]\quad "to drip in a string (like syrup)"

drip-redup(?)

/p\text{\`e}m-p/ \quad [\text{\`e}mp]\quad "fast"

fast-aspectual(?)

/p\text{\`e}m-ilx/ \quad [\text{\`e}mlx]\quad "to hurry"

fast-body

/p\text{\`e}m-p-\text{\`u}t/ \quad [\text{\`e}mp\text{\`u}t]\quad "to run on without being able to stop"

fast-aspectual(?)-out of control

/\text{\`e}-p'\text{\`e}-\text{\`e}-\text{q}æ/ \quad [\text{sp'\text{\`a}qæ}] \quad "nose"

nominalizer-?-nose

/x\text{\`e}uL/ \quad [x\text{\`e}L]\quad "tongue"

/\text{\`e}-\text{\`a}l-\text{\`a}n/ \quad [\text{\`a}l\text{\`a}n]\quad "to bite smth."

bite-transitive

/p\text{\`u}s/ \quad [\text{ps}\text{\`us}]\quad "wild (bitter) cherry"

/p\text{\`e}-\text{p}lænt/ \quad [\text{sp}lænt]\quad "skunk"

nominalizer-skunk

/m\text{\`e}c'\text{\`u}L/ \quad [\text{mac'\text{\`u}L}]

/pu\text{\`u}sæ?/ \quad [\text{su\`u}sæ?]\quad "proper name (from /suspæ?/ "tail")

/grouse-redup

The similarities between the retracted forms in (92)
and the forms that are a result of the floating adversative morpheme are striking. In both cases all the vowels and the alveo-palatal consonants are retracted. Further, we find the same sort of problematic cases where retraction does not spread across certain morpheme boundaries. Examples are given in (93).

(93) /kuš?-æl'men/ [k^w^s?al'men] "to want to urinate"
    /m@lam@n/ [m^l@lam@n] "medicine"
    /š-p'@-l'x^w/ [šp^apl'@x^w] "to stick out a little bit"
    /n-šæl-1-øʃ/ [nsal'1'øʃ] "to drool, slobber"
    /š-æ-æl'-š/ [šš'æl'j'æl'æʃ^w] "to carry smth. in one's mouth"
    /š-p'i?-øl'wæʃ/ [šp'æøl'wæʃ] "squeezed in the middle"
    /ti-k^wušu-æ/ [tek^wsohæ] "the pig"44
    /k^wušu-i/ [k^ws@he] "their pig"

---

44 This form is a borrowing from French couchon "pig". Kinkade (p. c.) informs me that a number of loan-words from English, French, and neighbouring native languages contain retracted segments. Other examples include [p'æsk'æ?] "hummingbird" possibly from Chilliwack Halkomelem and [laplaʃ] "board" from French.
I propose that the forms in (92) and (93) are due to a floating Tongue Root node that is lexically specified on a stem. Retraction harmony triggered by a floating Tongue Root node operates in exactly the same manner as that of retraction harmony triggered by the floating Adversative morpheme. Thus, the rule spreads Tongue Root bi-directionally, scanning at a minimal level (i.e. the Place node) and targeting the Dorsal node. (94a-c) provide derivations for: [sall] "to drip in a string"; [m@lam@n] "medicine"; and [šx'aš'ʌl'š] "to carry smth. in one's mouth".

(94)a /š  æ  l - l/

```
\begin{diagram}
\node{N} \node{x} \node{x} \node{x} \node{x} \node{\text{Skeletal tier}}
\node{\text{Place}}\node{\text{Dorsal}}\node{\text{Coronal}}\node{\text{Tongue Root}}
\node{[+lo]}\node{[sall]}
\end{diagram}
```
Thus far, I have claimed that Tongue Root spreading due to the Adversative morpheme and to the floating feature is bi-directional. I now present evidence from the retraction of suffixes and prefixes to support this claim. The data in (95) show cases of both suffixal and prefixal retraction along with the retraction of the root.
In (95a), the prefix nominalizer (š-) retracts, indicating that retraction has spread leftward from the root. The abundance of forms with a non-retracted nominal prefix leaves no question as to the underlying form of {š-}. (95b) shows cases in which the retraction spreads to the suffix; and (95c) shows both suffixal and prefixal retraction. As long distance retraction triggered by lexically marked stems and the adversative morpheme appears to operate in exactly the same manner I suggest that the same rule applies. Therefore, spreading of Tongue Root must be bi-directional given that forms with lexically marked stems have retracted prefixes and suffixes.

Other cases of retraction for which I have no explanation occur in the data and samples are given in (96)\(^45\). Without further morphemic analysis, which is beyond the scope of this thesis, I cannot speculate as to the reasons that the retractable segments have failed to

---

\(^{45}\)For a more complete list of retracted forms see Appendix 1.
undergo the rule.

(96) [lʌŋkæyæ] [p'ʌɡk'æ?] [c'n'al'oʊəm] [laplaʃ] [welek'] [c'lep']

"cast-iron pot" "hummingbird" "to take aim" "board" "sound made by frogs" "to pinch"

To conclude the discussion of retraction I will show that the two rules I have posited cannot be collapsed. The rule of simple retraction (81), repeated here in (97), targets vowels that immediately precede a uvular or /z z'/ and involves minimal scansion at the level of the Place node. The rule must be ordered before the application of the Redundancy Rules, thereby permitting schwa to be transparent to the rule.

(97) [+vocalic]

```
      /
     /  \  
Place Dorsal Tongue Root
```

The rule of retraction harmony (given in (88) and repeated here in (98)) targets all the vowels and the alveo-palatal consonants. This rule also scans at a minimal level, targeting the Place node. However, it must be ordered after the Redundancy Rules so that schwa will be targeted.
Though the rules are similar in form, it is not enough to say that all retraction is due to one rule that applies at two different points in the grammar: before and after the application of the Redundancy Rules. In the rule of simple retraction it is necessary to state that the target of the rule is a vowel in order to rule out retraction of alveo-palatals. The examples in (99), where we find alveo-palatals that immediately precede a triggering consonant, show that the alveo-palatals do not retract, indicating that they are not targets for this rule. However, as we have seen above, the vocalic status of the targets in the retraction harmony rule must not be included, so as to permit the rule to apply to both consonants and vowels.
One final issue regarding retraction is that of the phonetic implementation of Tongue Root. In the introduction to this chapter I mentioned the wide range of effects that retraction (i.e. Tongue Root) has on the various different segments affected by it. The laterals [l l'] become what has traditionally been called "velarized" (like English dark [ɔ]), and [g s] retract the tongue such that the tip rather than the blade forms contact behind the alveolar ridge, while the tongue root is pulled back in the vocal tract. The vowels, on the other hand, appear, for the most part, to lax -- a characteristic that has traditionally been captured by the feature [+ATR]. It is beyond the scope of this thesis to explicate what the phonetic similarities between the consonantal effects and the vocalic effects of Tongue Root spreading might be. Without a spectrographic, and perhaps palatographic, analysis of the phonetic effects, little can be said about them. Instead, I suggest phonetic implementation rules
that result in the surface characterization of retracted segments described above.

Having stated this, a previously unmentioned language particular fact regarding /y y' w w'/ may be clarified. The alveo-palatal and velar glides are both specified for Dorsal and therefore should undergo retraction harmony. (Recall that they are not targeted for simple retraction because the rule targets only vowels which are arguably distinct from the glides.) I hypothesize that they do in fact undergo retraction; however, retraction is not realized phonetically in Lillooet on these segments because the phonetic spell-out of Tongue Root for vowels or for consonants cannot apply to glides. That is, Tongue Root spreads onto the Place node of the glides, but has no phonetic effect because phonetic implementation rules cannot be realized on a [-vocoid] segment as laxing which is the phonetic spell-out of Tongue Root on a [+vocoid] segment.46 Neither can the phonetic spell-out rules for Tongue Root impose additional constriction in the vocal tract, which is the effect it has on obstruents, on a

---

46 Assuming, for the sake of argument, that the vowels and glides are non-distinct, my analysis does not face a problem because the combination of the major class features [-vocalic, +sonorant], for which the glides are specified, will rule out any secondary phonetic effect of Tongue Root.
[+sonorant] segment. The form in (100a) contains a /y/ and is subject to retraction harmony while the form in (100b) contains /w/.

(100a) /p@y-(A)-p@-p-y-?-t/ [p@yp@yp'y't] "to quarrel"
fight-(A)-redup-redup-interior glottalization

(b) /q@l-(A)-wil'x/ [qAl-wel'x] "to get spoiled"
bad-(A)-inchoative

Targeting the Dorsal node and bi-directional spreading permit the retraction feature, Tongue Root, to spread through the glides (docking onto to them) and onto other segments specified for Dorsal, as the derivation in (101) shows. (Recall that Tongue Root will spread onto the velars because they are specified for a Dorsal node; however, the phonetic facts are questionable.)

(101)/q \(\emptyset\) l - w i l' x/

[Diagram of phonetic tiers]
Thus far, we have accounted for the facts of retraction triggered by (i) the set of uvulars and /z z'/: /q q' q^w q'^w X X^w z z'/; (ii) the floating Adversative morpheme; and (iii) a floating Tongue Root node lexically specified on the stem, by simply motivating a Tongue Root node and spreading this node onto the Place node of a preceding vowel or, in the case of retraction harmony, onto the Place node of the vowels and the alveopalatal consonants. The presence or absence of the Tongue Root node is all that is required to distinguish a plain vowel or alveopalatal consonant from its retracted counterpart. In the next section, I consider pharyngealized segments that will require a feature to distinguish them from the retracted set.

4.2. Pharyngealization

In addition to the retraction processes discussed in section 4.1, Lillooet has a process of pharyngealization which targets vowels immediately preceding a pharyngeal consonant. The characteristics of the pharyngealization rule are similar to those of simple retraction, but the effects are different. The phonetic realization of a pharyngealized vowel is a retracted vowel with a superimposition of pharyngeal constriction. The vowel change is
expressed in (102). Note in the case of /æ/ and /θ/ that
the surface vowel is both retracted (e.g. /æ/ → [a]) and
pharyngealized (e.g. [â] where [Λ] means pharyngeal
constriction). For the moment, I will overlook the effects
of /iقوة/ and return to them later in the discussion.

As pointed out in Chapter 1, distributional facts, in
addition to vowel length, provide the basis on which to
determine the underlying representation of [â] and [§], as
given in (102). Given that (i) the value for [lo] of the
surface vowel is always [+lo] (excluding the value for [ɛ]
which, as mentioned above, I will return to) (ii) the
value for [round] is determined by the value for [round]
of the following pharyngeal (with the exception of /i/),
and (iii) vowel length distinguishes the full vowel from
/θ/, /æ/ can be the only non-high full vowel that precedes
a pharyngeal (as noted by P. Shaw, p.c.). Pharyngealiza-
tion of the non-high vowels is coupled with spreading of
[round] from the trigger. /u/ is specified as [+round],
which means that should /u/ and /æ/ be neutralized to [â]
and [ô] preceding a pharyngeal, [-round] would have to
spread from the pharyngeal in order to obtain the surface
string [âقوة] from /uقوة/. However, spreading an unmarked
feature such as [φround] is ruled out on theoretical
Therefore, we can establish that /æ/ is the only full vowel that precedes a pharyngeal. The phonemic and phonetic values are given in (102).

(102)  
\[
\begin{align*}
/i/ & \rightarrow [ɛ] /_q^1 \\
/æ/ & \rightarrow [â] /_q^w \\
/θ/ & \rightarrow [â] /_q^w \\
\end{align*}
\]

In (103) pharyngealization data are presented. The small set of data indicates the infrequency of pharyngeal segments in the language.

(103a)  
\[
\begin{align*}
/p\varepsilon q-p/ & \rightarrow [pà:p] \\
/\varepsilon q/ & \rightarrow [çâ:] \\
/q'\varepsilon q'/: & \\
/p\varepsilon q^-q_\varepsilon p/-q_\varepsilon p/-q_\varepsilon m/-q_\varepsilon m/- & \rightarrow [ç'\varepsilon 5:ç'\varepsilon 7\varepsilon m] \\
/l\varepsilon q_\varepsilon w/- & \rightarrow [lç:] \\
/p\varepsilon q^-q_\varepsilon w/-q_\varepsilon w/- & \rightarrow [pç':q^w] \\
\end{align*}
\]

"dull, faded (of colour)"
"to tear"
"caught in a trap"
"hard"
"to hide"
"to bump one's head"

Furthermore, there is some question as to whether [round] is privative -- having only the positive value.
In order to capture the fact that the surface vowels in (103) are the same as those derived from retraction (with the addition of a pharyngeal constriction), I propose that pharyngealization involves the Tongue Root node, as in the case of retraction. Nonetheless, we must still distinguish between the retracted vowels and the retracted and pharyngealized vowels (which, for simplicity's sake I call pharyngealized). I adopt the feature [+epiglottis] ([+epi]) first argued for in Bessell and Remnant (1989), which is dominated by the Tongue Root node. Thus, pharyngeal consonants are specified as [+epi] as represented in (104).

(104) /q/  

```
<table>
<thead>
<tr>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tongue Root</td>
</tr>
<tr>
<td>[+epi]</td>
</tr>
</tbody>
</table>
```

Spreading of [+epi] and the filling in of Tongue Root by
node generation will ensure that the vowels are retracted, and, in addition, pharyngealed.

Bessell and Remnant (1989) give the acoustic and articulatory properties of pharyngeals, which I repeat here. Pharyngeal articulations create a constriction caused by pulling the root of the tongue back into the pharyngeal cavity (Pike 1943, Smalley 1961/4, Catford 1977, Laver 1980, Ladefoged 1982, Borden and Harris 1984, Laufer and Bauer 1988). X-ray and cinefluorographic investigations support these descriptions, showing a constriction in the lower pharynx in the region of the epiglottis caused by tongue root retraction (Delattre 1971, Catford 1983, Laufer and Bauer 1988). Traill's (1985) examination of !Xóo- pharyngealized vowels shows vibration of the epiglottis, such that the tip of the epiglottis contacts the back wall of the pharynx. The epiglottis has even been regarded by some (Pike 1943, Laufer and Bauer 1988) as a separate articulator, though it is not clear that its musculature is independent from that of the tongue root.

Acoustically, pharyngealization has distinctive effects, showing F1 and F2 close together, with F1 very high (Klatt and Stevens 1969, Alwan 1986, Butcher and Ahmad, 1987). This high value for F1 is predicted by acoustic theory, given a uniform tube constricted close to
the source of excitation (Delattre 1971), a result suggesting that the place of constriction in pharyngeals is very close to the glottal source. Therefore, in keeping with articulatory theory (Sagey 1986), [+epiglottis] reflects the articulatory facts of pharyngealization.

The rule of pharyngealization which spreads [+epi] onto a preceding vowel, is formalized in (105).

(105) [+vocalic]

Unlike the rule of simple retraction that skips over /@/ by scanning at the level of the Place node before the redundancy rules have applied, this rule targets /@/. By applying the rule of pharyngealization after the feature values for /@/ have been filled permits a coherent accounting of the data. In addition, as in the case of simple retraction, /?/ is transparent to the rule of pharyngealization, indicating that maximal scansion cannot be involved. Examples of the transparency of /?/ are found
In addition to Tongue Root spreading, the pharyngeal's marked value for [round] (i.e. [+round]) also spreads. On the surface, it looks as though Tongue Root spreading and [round] spreading are one process. However, rounding of vowels adjacent to consonants is an independently motivated process in Lillooet which occurs pervasively. Furthermore, rounding of consonants adjacent to a rounded vowel also occurs. In many cases, in particular within roots, it is difficult to determine whether the source of rounding is the vowel or the consonant. However, in the case of pharyngealization, it appears that rounding must originate from the consonant as /θ/ is inherently unrounded. Thus, the sequence [§W] is derived unambiguously (due to vowel length) from /§W/.

Compensatory lengthening results from the deletion of the pharyngeal consonant in fast speech production. The root node of the pharyngeal delinks leaving a vacant

48 Note that in both examples the target vowel is /i/, which I have not yet dealt with. Nonetheless, the issue regarding /i/ --> [ε] does not affect the argument about the transparency of /θ/. Also, see footnote #10 for a discussion of the status of the vowel in these examples.
skeletal slot; the vowel then lengthens to accommodate what would be a loss in timing, and, where a glottlized pharyngeal is delinked, the Laryngeal node docks back onto the x-slot of the vowel. Derivations for [lά:lάː:t] "fast", [sp'άː?] "burned out area", [sc5ː] "stripe", and [p5ː?qʷ] "to bump one's head" are given in (107) - (110).

(107)/l Θ _ G - 1 æ G - t/

First, [+epi] spreads from the pharyngeal onto the immediately preceding vowel. Then the pharyngeal's root node delinks and the root nodes of the vowels spread onto the skeletal slot of the delinked pharyngeal⁴⁹.

---
⁴⁹The question arises whether this could be handled in moraic theory. D. Odden (p. c.) informs me that given Hayes' (1989:258) rule Weight by Position, tri-moraic syllables are possible, as in the case of Estonian.
The derivation proceeds in exactly the same manner as in (107). However, in this case the laryngeal specifications that have been delinked as part of the root node delinking are docked back onto the root node of the vowel.

In (109), both [+epi] and [round] spread from the pharyngeal onto the Place and Dorsal node of the vowel. Note that the consonants are specified for [round] under the
Labial node following Sagey (1986). However, following Odden (1989), I put vocalic [round] under the Dorsal node. Consonantal [round] spreading from the Labial node will automatically dock onto the Dorsal node of the vowel simply because vocalic [round] must be dominated by Dorsal\textsuperscript{50}. Following the spreading of [round], the place node is delinked and the root node of the vowel spreads onto the following skeletal tier.

\[
(110)/p \quad \emptyset \quad q^w \quad q^w/
\]

The derivation proceeds in the same manner as above spreading [+epi] and [+round], delinking the root node of the pharyngeal, spreading the root node, and, finally, docking the delinked Laryngeal node onto the root node of

\textsuperscript{50}Odden also argues for the constituency of BackRound and High-ATR. I have not characterized these constituents here because they are not crucial to the discussion; however, I assume his groupings.
the vowel.

Thus far I have ignored the case of /i\(\text{\textipa{\text{\textae}}}\)/ because it seems to behave differently from /\\(\text{\textipa{\text{\textae}}}\)/ and /\\(\text{\textipa{\text{\textae}}}\)/. We would predict that /i/ followed by a pharyngeal should surface as retracted [ɛ] with a superimposition of pharyngeal constriction; however, the pharyngeal constriction appears to be missing as seen in the examples in (111).

\[(111)/\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}w/ \rightarrow [\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}w] \quad \text{"to take apart, to tear down"}
/\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}i\text{\textipa{\text{\textae}}}/ \rightarrow [\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}] \quad \text{"to scatter (e.g. people leaving a meeting)"}
/\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}w/ \rightarrow [\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}\text{\textipa{\text{\textae}}}w] \quad \text{"to bleed"}
\]

It remains to be seen whether pharyngealization of a front vowel in Lillooet is possible (see section 1.2.2. for a fuller discussion of this issue).

The effects of pharyngeals on /i/ are useful in determining at what level in the tree geometry spreading occurs. If the place node were to spread we would predict that all the surface values would neutralize to [â] in the case of unrounded pharyngeals and [\(\text{\textipa{\text{\textae}}}\)] for the rounded set because the original feature values of the vowel would be erased. However, spreading at the lowest level in the tree, [+epi], results in the correct surface forms in all cases.
As for the spreading of [round], we can draw no conclusions as to whether it is ruled out in the case of /i\(^W\)/ due to a constraint such as the one in (112), or simply because the language has no front rounded vowels and must accommodate by either backing the front vowel or losing the [+round] specification on a [-back] vowel.

\[
\text{(112)} \quad * \quad \strut \\
[-bk] \quad [+rd]
\]

4.3. Summary

To summarize the Lillooet facts: first, uvulars and /z z'/ cause preceding vowels to retract. This rule applies locally and scans at a minimal level targeting the Dorsal node. Retraction harmony spreads a retracting feature through a root and across certain morpheme boundaries. Pharyngealization, on the other hand, is similar to retraction triggered by uvulars and /z z'/ in manner. However, the vowel quality that results from pharyngealization is different from that due to retraction. Furthermore, the pharyngeals delete while the uvulars and /z z'/ never do so.

I have proposed that the retraction and pharyngealization facts can be captured by invoking a node Tongue Root and a feature [\*epiglottis] that account for
the differing phonetic facts. In Chapter 5, I address a number of subsidiary issues that come about from this proposal.
5.0. Articulator co-occurrence


(113)

\[
\begin{array}{c}
\text{Labial} \quad \text{Coronal} \quad \text{Dorsal} \quad \text{Tongue Root} \\
\end{array}
\]

In addition, the theory makes predictions concerning the articulatory status of the Lillooet inventory. The consonantal inventory first presented in Chapter 3 can now be described in terms of major articulators: Labial (L), Coronal (C), Coronal and Dorsal (C&D), Coronal, Dorsal and Tongue Root (C&D&TR), Dorsal (D), Dorsal and Labial (D&L), Dorsal and Tongue Root (D&TR), Dorsal, Tongue Root and Labial (D&TR&L), Tongue Root (TR), and Tongue Root and
Labial (TR&L), as shown in (2). Note that the laryngeals /h ?/ do not have a major articulator because they are not specified under the Place node.

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>C</th>
<th>C&amp;D</th>
<th>D</th>
<th>D&amp;L</th>
<th>D&amp;TR</th>
<th>D&amp;TR&amp;L</th>
<th>TR</th>
<th>TR&amp;L</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>t</td>
<td>c'</td>
<td>c</td>
<td>k'</td>
<td>k'</td>
<td>x</td>
<td>q'</td>
<td>q'</td>
<td>q'</td>
</tr>
<tr>
<td>p'</td>
<td>c</td>
<td>c&amp;D &amp; TR</td>
<td>z'</td>
<td>l'</td>
<td>q'</td>
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<td>n</td>
<td>m'</td>
<td>m'</td>
<td>n'</td>
<td>y'</td>
<td>y'</td>
<td>w'</td>
<td>q</td>
<td>c</td>
</tr>
<tr>
<td>m'</td>
<td>m</td>
<td>m'</td>
<td>m'</td>
<td>n'</td>
<td>y'</td>
<td>y'</td>
<td>w'</td>
<td>q</td>
<td>c</td>
</tr>
</tbody>
</table>

Complex segments are represented as co-occurring articulator nodes which are unordered with respect to one another (Halle 1982, Sagey 1986). Halle (1982:99) gives the following examples of "double occlusions".

(115) labio-velars [kp] Yoruba [akpa] "arm"
coronal-velar [?] Zulu [?]a'[a] "climb"

The tongue root node, as argued in Bessell and Remnant (1989) and Bessell (1990), also participates in the formation of complex segments by co-occurring with the previously established nodes. Thus, the additional combinations, including the triply articulated segments, may be added to the examples in (115) to obtain a fuller

51[?] indicates a coronal-velar click.
set of complex segments.\footnote{Bessell (1990) suggests that Coeur d'Alene retracted /r/ is a complex segment involving the Coronal and Tongue Root nodes.}

\begin{itemize}
  \item labial-tongue root: [\textsuperscript{\textdagger}]\textsuperscript{\textasciitilde}
  \item dorsal-tongue root: [q]
  \item coronal-tongue root: Coeur d'Alene retracted /r/
  \item labial-dorsal-tongue root: [\textdagger]\textsuperscript{l}
  \item labial-coronal-tongue root: unattested
  \item coronal-dorsal-tongue root: Lillooet /z/
\end{itemize}

Bessell and Remnant (1989) also list the Caucasian language Ubykh and colloquial Egyptian Arabic in support of additional co-articulations involving the Tongue Root node. Ubykh pharyngealizes (that is, spreads TR node) a full range of labial segments, including /p, b, p', v, w, m/ (Colarusso 1975), and Egyptian Arabic (Harrell 1957) can spread emphasis (TR node) onto /b, m, f, l/\footnote{Colloquial Egyptian Arabic is also reported to have an emphatic laryngeal: \textdagger.} (as can Moroccan Arabic, Heath 1987).

\section*{5.1. One More Feature}

The feature [epiglottis] has been motivated in order to distinguish the effects of retraction from those of pharyngealization. Furthermore, cross-linguistic variation shows that [epi] is required to account for the differences that pharyngeal harmony may have on segments. So, for
example, Lillooet requires a distinction between the
effects of uvulars and those of pharyngeals, while Coeur
d'Alene has tongue root spreading from uvulars and
pharyngeals, but no distinction in the resulting vowel
quality. Coeur d'Alene, therefore, does not require
[epiglottis] as one of its distinctive features. (See
Reichard 1938, Doak 1987, Bessell and Remnant 1989, and,
in particular, Bessell 1990 for discussion and analysis of
Coeur d'Alene harmony; for Columbian, which has a similar
process, see Czaykowska-Higgins 1990.)

The dependency of [epiglottis] on the Tongue Root
node is parallel to the [round]/Labial dependency discuss-
between [epi] and TR entails that distinctively [+epi]
segments are specified with a TR node. Redundancy Rules
will apply to a Tongue Root node in a simplex structure
filling in [+epi] as the value\(^{54}\). The default rule: \(\phi \rightarrow
[-epi]\) fills in all other TR nodes (that is, those in
complex structures). It may be that the value [-epi] is
never operative in phonologies, i.e., that [epi] is a
privative feature.

\(^{54}\)Note that the Redundancy Rules must apply before the
application of the pharyngealization rule so that the
desired value for [epi] (i.e. [+epi]) is spread onto the
vowels.
5.2. Conclusion

One issue that has not yet been raised in the present work is the relationship between Tongue Root and [advanced tongue root] ([ATR]), which has traditionally been used to account for vowel harmony systems in African languages. These [ATR] harmony systems are in some way similar to retraction harmony in Lillooet and other Salish languages in that the vowel alternation appears to involve tensing versus laxing or tongue advancement (the neutral position) and tongue retraction. However, the differences between the systems are striking. The Salish facts show consonant and vowel interaction with regard to harmony while the African systems involve only vowels. Cook (1989), Czaykowska-Higgins (1987), and Bessell (1990) have all noted the articulatory similarities between [ATR] and Salish retraction (which has been characterized in a number of different ways, most notably [RTR] and Tongue Root spreading). Though it seems that proposing both [ATR] and Tongue Root in a universal feature hierarchy is redundant, at least in part, further research must determine what the correspondences between these features are and how they can be collapsed (or for that matter, distinguished) while maintaining their functions in language systems.
Appendix 1

This appendix contains a list of words containing retracted segments found in van Eijk (1985). Though I have tried to represent accurately the data in van Eijk's work, errors and omissions found herein are due to my oversight. I have here followed van Eijk in his representation of the segments which differ slightly from those used in the body of the thesis. All the retracted segments are indicated by underlining; the phonemic vowels are the same as elsewhere, with the exception of /a/ in the appendix represented by /æ/ in the thesis. The numbers in the lefthand column refer to the page on which the form is given in the grammar.

3. q@l

17. q@q@l

23. q@l-ti?

23. q@l-Lkán

3. q@l-wil'x

28. q@l-al-tmix

26. q@l-al'q@m'

41. n-q@l-@lc'a?

"bad"

"good for nothing, useless" (reduplicative form of q@l "bad"

"that is bad"

"I am bad"

"to get spoiled"

"storm"

"ugly"

"cranky"

124
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>101.</td>
<td>n-q̱l-ánwaš-min</td>
<td>&quot;to dislike smt./smb.&quot;</td>
</tr>
<tr>
<td>119.</td>
<td>q̱l-q̱l-núxʷ-min'</td>
<td>&quot;to be unfriendly to smb. tr&quot;</td>
</tr>
<tr>
<td>110.</td>
<td>q̱l-q̱l-xn-án-čut</td>
<td>&quot;to suffer from lack of help&quot;</td>
</tr>
<tr>
<td>26.</td>
<td>p̱m</td>
<td>&quot;fast&quot;</td>
</tr>
<tr>
<td>5.</td>
<td>p̱mp</td>
<td>&quot;fast&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>p̱mp-sút</td>
<td>&quot;to run on without being able to stop&quot;</td>
</tr>
<tr>
<td>26.</td>
<td>pm-ĩlx</td>
<td>&quot;to hurry&quot;</td>
</tr>
<tr>
<td>41.</td>
<td>pmiml'lx</td>
<td>idiomatic (redup. form of pm-ĩlx)</td>
</tr>
<tr>
<td>5.</td>
<td>Lənkaya</td>
<td>&quot;cast-iron pot&quot;</td>
</tr>
<tr>
<td>42.</td>
<td>c'gmnp</td>
<td>&quot;ringing sound&quot;</td>
</tr>
<tr>
<td>42.</td>
<td>ṯsp</td>
<td>&quot;to trill, vibrate (e.g. a table when hit with a fist)&quot;</td>
</tr>
<tr>
<td>42.</td>
<td>ʔ'q̱lp</td>
<td>(1) &quot;lots of noise (e.g. at a party)&quot; (2) &quot;vibrating sound (more or less like ṯsp)&quot;</td>
</tr>
<tr>
<td>5.</td>
<td>Ḻnp</td>
<td>&quot;sound of things shaking, rattling, to vibrate, make a vibrating sound (e.g. when a logging truck passes)&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>sal</td>
<td>&quot;to drip in a string (like syrup)&quot;</td>
</tr>
<tr>
<td>5.</td>
<td>sáləl</td>
<td>&quot;to drip in a string (like syrup)&quot;</td>
</tr>
</tbody>
</table>
29. n-sál'l'-č "to drool, slobber"
5. č'ālp "vibrating sound (like a string being plucked)"
5. pālpēlt "stubborn"
8. qʷezqʷáz (M) "blue"
8. xʷaz "no, not"
56. xʷáʔz'-aL "good for nothing, unwilling to do anything)"
8. xníz'az' (M) "gooseberry bush"
42. c'ul' "sour, bitter (of berries)"
42. c'aʔp "sour (of smth. fermented)"
108. c'aʔp-áliw'š "to have body-odour"
42. psus "wild (bitter) cherry"
8. psusaz' "wild cherry bush"
8. kʷuxxal (M) "to spread out berries to dry"
8. qáʔz' (M) "tired"
9. zuqʷ "dead"
9. stut (F) "cricket"
9. šuq'w'em "to skin an animal"
9. qʷuq'w'em' "to shoot/hunt small animals"
9. Laʔqš "to go ashore"
10. ?uqʷaʔ "to drink"
10. ?úʔqʷaʔ "to drink a little bit"
59. ś-ʔuqʷaʔ "drink, beverage"
10.  ?á?Xaʔ  "sacred, supernatural, talented" (in some idiolects—otherwise non-retracted)

105.  kwal  "green, yellow"

10.  kwl-iʔ  "green, yellow"

10.  kwl-it  "brass"

105.  š-kwl-al'št  "jade"

109.  kwel-m-ákšt  "yellow tree moss (Evernia vulpina)"

10.  c'em'cm'eq  "to get mired"

10.  X'al  "to bite"

10.  X'al-an  "to bite, tr."

10.  š-X'áX'el'-š  "to carry smth. in one's mw (like a dog carrying a bone)"

10.  Lut  "to squash smth. soft (esp. a bug)"

40.  Lüt-un'  "to squash, tr."

10.  Lût-ën'  "to squash it well"

76.  Lét-Lát  "squishy, soft"

10.  págwuʔ  "to be afraid"

10.  págwʔ-an  "to scare smb., tr."

11.  ná?q'  "rotten"

12.  tágwláwʔa  "the onion"

12.  pág  "white"
<p>| 12. | Št@xʷ | &quot;true, very&quot; |
| 12. | xʷəlp | &quot;breeze&quot; |
| 13. | ɬ'iq | &quot;to arrive here&quot; |
| 13. | kiʔx | &quot;cranky (like baby)&quot; |
| 14. | payt | &quot;fight&quot; |
| 14. | pəyəpy'ət | &quot;to quarrel&quot; |
| 17. | šnɪL-a-qaʔ | &quot;well, it's him&quot; |
| 41. | ?áls | &quot;sick&quot; |
| 17. | ?áls-əm (M) | &quot;sick&quot; |
| 23. | ?áls-əm-Lkan | &quot;I am sick&quot; |
| 23. | ?als-əm-Lkán-κL | &quot;I might get sick&quot; |
| 30. | ?áʔel's-əm | &quot;a little bit sick&quot; |
| 125. | ?alsm-áʔ’am | &quot;to pretend to be sick&quot; |
| 18. | xʷaʔxʷs | &quot;forked&quot; |
| 18. | qʷaʔqʷx | &quot;nightmare&quot; |
| 21. | zaʔxʷ | &quot;thaw&quot; |
| 22. | Lůqʷxit | &quot;to serve (food)&quot; |
| 25. | ka-pət-a | &quot;to get squished&quot; |
| 25. | ka-Lək-a | &quot;to get very tired, to conk out&quot; |
| 12. | šLək | &quot;lazy, motionless&quot; |
| 27. | ciqʷ | idiomatic |
| 27. | čəqʷ-čiqʷ | &quot;red&quot; |
| 27. | c'əqʷʔiqʷ | &quot;salmon stretcher&quot; |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Word</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.</td>
<td>cáqcqet</td>
<td>&quot;tame&quot;</td>
</tr>
<tr>
<td>32.</td>
<td>q'wúq'wu?</td>
<td>&quot;small body of water&quot;</td>
</tr>
<tr>
<td>32.</td>
<td>k'wúsa?</td>
<td>&quot;to urinate (men or animals)&quot;</td>
</tr>
<tr>
<td>32.</td>
<td>k'wus?-ál'men</td>
<td>&quot;to want to urinate&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>k'wus?-ál'nup</td>
<td>&quot;to wet one's bed&quot;</td>
</tr>
<tr>
<td>110.</td>
<td>k'wusa?-xín</td>
<td>&quot;nightslipper&quot;</td>
</tr>
<tr>
<td>32.</td>
<td>šqâxa?</td>
<td>&quot;dog&quot;</td>
</tr>
<tr>
<td>33.</td>
<td>mëlâmën</td>
<td>&quot;medicine&quot;</td>
</tr>
<tr>
<td>34.</td>
<td>sëx-ám</td>
<td>&quot;a man's name, referring to his craziness&quot;</td>
</tr>
<tr>
<td>32.</td>
<td>š-p'i?-él'wáš</td>
<td>&quot;squeezed in the middle&quot;</td>
</tr>
<tr>
<td>36.</td>
<td>k'wusú</td>
<td>&quot;pig&quot;</td>
</tr>
<tr>
<td>36.</td>
<td>ti-k'wusú-a</td>
<td>&quot;the pig&quot;</td>
</tr>
<tr>
<td>36.</td>
<td>k'wusúh-i</td>
<td>&quot;their pig&quot;</td>
</tr>
<tr>
<td>36.</td>
<td>k'wusuh-álc'a?</td>
<td>&quot;pork&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>lës</td>
<td>&quot;to cave in&quot;</td>
</tr>
<tr>
<td>41.</td>
<td>lësp</td>
<td>&quot;to cave in&quot;</td>
</tr>
<tr>
<td>42.</td>
<td>Lëc</td>
<td>&quot;to cave in&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>c'ilip'</td>
<td>&quot;to pinch&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>k'ilip'</td>
<td>&quot;curly&quot;</td>
</tr>
<tr>
<td>69.</td>
<td>š-k'él-k'ilip'q'w</td>
<td>&quot;curly hair&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>welik'</td>
<td>&quot;sound made by frogs&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>mëli-Łëp</td>
<td>&quot;balsam fir&quot;</td>
</tr>
<tr>
<td>40.</td>
<td>c'n'-ál'uš-ën</td>
<td>&quot;to take aim&quot;</td>
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</tr>
<tr>
<td>40.</td>
<td><strong>k'êl</strong></td>
<td>&quot;to make a mark by scratching&quot;</td>
</tr>
<tr>
<td>40.</td>
<td><strong>k'êl-úlm'texʷ</strong></td>
<td>&quot;boundary&quot;</td>
</tr>
<tr>
<td>41.</td>
<td><strong>xʷic'-am-áya</strong></td>
<td>&quot;see-saw&quot;</td>
</tr>
<tr>
<td>41.</td>
<td><strong>mik'il-úlya?</strong></td>
<td>&quot;sticky oil&quot;</td>
</tr>
<tr>
<td>41.</td>
<td><strong>š-pelxʷ</strong></td>
<td>&quot;to stick out&quot;</td>
</tr>
<tr>
<td>41.</td>
<td><strong>šp̃p̃l'’exʷ</strong></td>
<td>&quot;to stick out a little bit&quot;</td>
</tr>
<tr>
<td>100.</td>
<td><strong>pèlxʷ-áníš</strong></td>
<td>&quot;just about showing&quot;</td>
</tr>
<tr>
<td>41.</td>
<td><strong>s-plant</strong></td>
<td>&quot;skunk&quot;</td>
</tr>
<tr>
<td>42.</td>
<td><strong>Lêmk</strong></td>
<td>&quot;broken, not usable any more&quot;</td>
</tr>
<tr>
<td>42.</td>
<td><strong>máč'uL</strong></td>
<td>&quot;pus&quot;</td>
</tr>
<tr>
<td>42.</td>
<td><strong>súspa?</strong></td>
<td>proper name (from súspa? &quot;tail&quot;)</td>
</tr>
<tr>
<td>42.</td>
<td><strong>səxám</strong></td>
<td>proper name (from sxam &quot;foolish, irresponsible&quot;)</td>
</tr>
<tr>
<td>42.</td>
<td><strong>pêpíla?</strong></td>
<td>&quot;to swing (as children's game)&quot;</td>
</tr>
<tr>
<td>42.</td>
<td><strong>χ'l-ilx</strong></td>
<td>&quot;to stand still in the air (e.g. a fishhawk)&quot;</td>
</tr>
<tr>
<td>88.</td>
<td><strong>š-k'êl-t</strong></td>
<td>&quot;mud&quot;</td>
</tr>
<tr>
<td>45.</td>
<td><strong>cêmqʷ</strong></td>
<td>&quot;to get stuck in the mud&quot;</td>
</tr>
<tr>
<td>115.</td>
<td><strong>k'êl-t-úl-wiL</strong></td>
<td>&quot;earthenware pot, crock&quot;</td>
</tr>
<tr>
<td>46.</td>
<td><strong>miXaL</strong></td>
<td>&quot;bear&quot;</td>
</tr>
<tr>
<td>46.</td>
<td><strong>maqa?</strong></td>
<td>&quot;snow&quot;</td>
</tr>
<tr>
<td>46.</td>
<td><strong>maqá? (F)</strong></td>
<td>&quot;poison onion&quot;</td>
</tr>
<tr>
<td>No.</td>
<td>Term</td>
<td>Meaning</td>
</tr>
<tr>
<td>-----</td>
<td>---------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>48.</td>
<td>laplás'</td>
<td>&quot;board&quot;</td>
</tr>
<tr>
<td>61.</td>
<td>ş-micaʔq</td>
<td>&quot;sitting&quot;</td>
</tr>
<tr>
<td>61.</td>
<td>míčaʔq</td>
<td>&quot;to sit down or up&quot;</td>
</tr>
<tr>
<td>63.</td>
<td>n-š-pxil'</td>
<td>&quot;stingy&quot;</td>
</tr>
<tr>
<td>65.</td>
<td>š-c'-q'wul-aka</td>
<td>&quot;thumb&quot;</td>
</tr>
<tr>
<td>65.</td>
<td>š-c'-q'wul-axen</td>
<td>&quot;big toe&quot;</td>
</tr>
<tr>
<td>110.</td>
<td>q'wul</td>
<td>cf. q'wul &quot;full&quot;</td>
</tr>
<tr>
<td>110.</td>
<td>š-q'wul-aʔxen</td>
<td>&quot;hoof&quot;</td>
</tr>
<tr>
<td>66.</td>
<td>liq'</td>
<td>&quot;to steal&quot;</td>
</tr>
<tr>
<td>76.</td>
<td>n-kāh-aw's</td>
<td>&quot;railroad track&quot;</td>
</tr>
<tr>
<td>76.</td>
<td>n-kāh-kh-aw's</td>
<td>&quot;to walk along the railroad track&quot;</td>
</tr>
<tr>
<td>79.</td>
<td>ceq-a-cek-a</td>
<td>&quot;blue-jay&quot; (refers to the sound it makes when it is forecasting bad news)</td>
</tr>
<tr>
<td>82.</td>
<td>kil-uš-Čem</td>
<td>&quot;to be embarrassed, hurt&quot;</td>
</tr>
<tr>
<td>85.</td>
<td>x'wul</td>
<td>name of a mountain</td>
</tr>
<tr>
<td>105.</td>
<td>š-liw-l'ěst</td>
<td>&quot;sharp, little rocks&quot;</td>
</tr>
<tr>
<td>106.</td>
<td>čaʔx-álin</td>
<td>&quot;metal cools off&quot;</td>
</tr>
<tr>
<td>106.</td>
<td>k'x'x-álin</td>
<td>name of a mountain over which the wind (k'x'x-ěm) is always blowing</td>
</tr>
<tr>
<td>107.</td>
<td>xix'-uľ-axw</td>
<td>a place close to Mount Currie</td>
</tr>
<tr>
<td>107.</td>
<td>tě-x'w calibrated</td>
<td>&quot;tongue, part of the mouth&quot;</td>
</tr>
<tr>
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<td>---</td>
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</tr>
<tr>
<td>111.</td>
<td>p'qś</td>
<td>gloss not given</td>
</tr>
<tr>
<td>111.</td>
<td>s-p'qś-gś</td>
<td>&quot;nose&quot;</td>
</tr>
<tr>
<td>111.</td>
<td>p'qśk'a?</td>
<td>&quot;hummingbird&quot;</td>
</tr>
<tr>
<td>120.</td>
<td>št'emalt-x nxlt</td>
<td>&quot;calf&quot; (F)</td>
</tr>
<tr>
<td>160.</td>
<td>kah</td>
<td>&quot;car&quot;</td>
</tr>
<tr>
<td>222.</td>
<td>wa?</td>
<td>expression of disbelief tinged with ridicule, mainly used by men</td>
</tr>
<tr>
<td>222.</td>
<td>?išta?</td>
<td>expression of disbelief; also used when smb. does smth. silly</td>
</tr>
<tr>
<td>222.</td>
<td>?ú-χ'u?-ti?</td>
<td>expression of anger or annoyance, e.g. when noticing that smb. is cheating</td>
</tr>
<tr>
<td>22.</td>
<td>si</td>
<td>&quot;kiss my a...!&quot; (expression of strong disapproval)</td>
</tr>
<tr>
<td>246.</td>
<td>šq nxlt</td>
<td>&quot;story&quot;</td>
</tr>
<tr>
<td>263.</td>
<td>m'qsm'qś</td>
<td>&quot;grouse&quot;</td>
</tr>
<tr>
<td>274.</td>
<td>pāhyqś</td>
<td>personal name</td>
</tr>
<tr>
<td>116.</td>
<td>šk'azyaz'</td>
<td>&quot;doll&quot;</td>
</tr>
<tr>
<td>119.</td>
<td>muzmit</td>
<td>&quot;pitiful&quot;</td>
</tr>
<tr>
<td>125.</td>
<td>šem'amuz'</td>
<td>&quot;girlfriend, mistress&quot;</td>
</tr>
<tr>
<td>104.</td>
<td>k'zuz</td>
<td>&quot;to have twins&quot;</td>
</tr>
<tr>
<td>104.</td>
<td>šk'ezuzalt</td>
<td>&quot;twins&quot;</td>
</tr>
<tr>
<td>69.</td>
<td>špzoẕa?</td>
<td>&quot;bird&quot;</td>
</tr>
<tr>
<td>70.</td>
<td>q'litaz'</td>
<td>&quot;jackpine&quot;</td>
</tr>
<tr>
<td></td>
<td>Word</td>
<td>Translation</td>
</tr>
<tr>
<td>---</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>98.</td>
<td>?az</td>
<td>&quot;nice&quot;</td>
</tr>
<tr>
<td></td>
<td>n-?i?z'@k</td>
<td>&quot;to be in the middle of&quot;</td>
</tr>
<tr>
<td></td>
<td>?iq'</td>
<td>&quot;to scrape&quot;</td>
</tr>
<tr>
<td>82.</td>
<td>cul-l@x</td>
<td>&quot;to stretch oneself reaching for smt.&quot;</td>
</tr>
</tbody>
</table>
This appendix contains a list of all the words containing pharyngealized segments found in van Eijk (1985). The numbers in the lefthand column refer to the page number on which the form is given in the grammar. I have listed van Eijk's underlying form in the second column, and the fast speech form is found in the third column. (The citation form can be obtained by shortening the vowel and adding a post-vocalic pharyngeal consonant.) The colon : is used to indicate relative length of vocalic segments and not to show phonemically long vowels.

<table>
<thead>
<tr>
<th>No.</th>
<th>Phonemes</th>
<th>Form</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.</td>
<td>/pəʔʔq/</td>
<td>[pəʔʔ]</td>
<td>&quot;faded&quot;</td>
</tr>
<tr>
<td>13.</td>
<td>/pəʔp/</td>
<td>[pəp]</td>
<td>&quot;dull, faded (of colour)&quot;</td>
</tr>
<tr>
<td>13.</td>
<td>/q'əʔp/</td>
<td>[q'əʔ]</td>
<td>&quot;caught in a trap&quot;</td>
</tr>
<tr>
<td>13.</td>
<td>/k'əq'w'm/</td>
<td>[k'əq'w:m]</td>
<td>&quot;hard&quot;</td>
</tr>
<tr>
<td>14.</td>
<td>/ləq'ət/</td>
<td>[ləq'ət]</td>
<td>&quot;to bump one's head&quot;</td>
</tr>
<tr>
<td>14.</td>
<td>/sp'aʔ/</td>
<td>[sp'əʔ]</td>
<td>&quot;burned out area&quot;</td>
</tr>
<tr>
<td>14.</td>
<td>/scuʔ/</td>
<td>[scuʔ]</td>
<td>&quot;stripe&quot;</td>
</tr>
<tr>
<td>14.</td>
<td>/ncuʔ'k/</td>
<td>[ncuʔ'k]</td>
<td>&quot;stripe on one's back&quot;</td>
</tr>
<tr>
<td>20.</td>
<td>/ləʔw/</td>
<td>[ləʔw]</td>
<td>&quot;to hide&quot;</td>
</tr>
</tbody>
</table>

134
14. /ləɡwən/ [lɛɡwən] "to hide smth."
16. /-aluɡi w/ [-ælʊː?] "gall" (?)  /liɡw/ [lɛɡw] "to take apart, to tear down"
17. /liʔiɡ'/ [lɛʔɛɡ'] "to scatter (e.g. people leaving a meeting)"
17. /čiʔiɡ'w/ [čɛʔɛɡ'w] "to bleed"
30. /ɪɢwəɡ'w'ɾʊp/ [ɪɡwəɡ'w'ɾʊp] "to burn a little bit"
33. /n-ɡəčúlm'əx w/ [n̥aɡəčúlm'əxw] "to stake a horse"
44. /čəɡ/ [čəɡ] "to tear"
123. /šiɡw/ [šɛɡw] "loose"
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