Mora Affixation and Halkomelem Imperfective Allomorphy*

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Abstract: This paper presents an extensive compilation of Hul'q'umi'num' (Central Salish) allomorphs associated with imperfective meaning. First, we classify each of the observed patterns of allomorphy by whether they exhibit phonological, morphological, or lexical conditioning. In order to account for the allomorphy associated with the imperfective morpheme formally, we propose an analysis in which the range of phonologically conditioned allomorphs can be accounted for by prefixing a segmentally empty mora. Each allomorph, attached to a base, arises as the optimal way to fill a mora, given phonotactic patterns of the language. This result is particularly striking given that one of the allomorphs is the deletion of a schwa which appears more like reduction (rather than *addition* of prosodic material) on first pass. This result supports morpheme-based concatenative approaches to morphology, in particular the Minimal Reduplication (Saba Kirchner 2013) or Generalized Nonlinear Affixation (Bermúdez-Otero 2012) frameworks, in which reduplication is considered to be phonological in nature.

Keywords: ablaut, allomorphy, imperfective, metathesis, prosodic morphology, reduplication

1 Introduction

Halkomelem (Central Salish) has one of the widest range of allomorphs to express imperfective aspect in the Salish language family.[1] This range of patterns in the Hul'q'umi'num' dialect (also referred to as Island Halkomelem) is presented below, and includes C_1V- reduplication (1a), C_1ə- reduplication (1b), ablaut (1c), metathesis (1d), a glottal stop infix (1e), C_1ə- reduplication with the aspiration of a sonorant (1f), schwa deletion (1g), and schwa insertion (1h). In addition, a concurrent glottalization process, affecting sonorant consonants, accompanies the non-concatenative allomorph, as illustrated below (where the relevant portion is underlined). Unless otherwise noted, all examples given in this paper are from Hukari and Peter's (1995) *Cowichan Dictionary*.

(1) Allomorphs of the Hul'q'umi'num' imperfective

	Perfective		**Imperfective**		**Allomorph**
a.	łíc̓ət	'cut it'	<u>łí</u>łəc̓ət	'cutting it'	C_1V- reduplication
b.	té:m̓	'call, holler'	<u>tə</u>té:m̓	'calling, hollering'	C_1ə- reduplication
c.	łəp̓t̓$^{\theta}$t	'slurp it'	ł<u>é</u>p̓t̓$^{\theta}$t	'slurping it'	ablaut

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[1] We label this "imperfective", following Hukari (1978), but remain agnostic as to whether it is more accurately defined as "progressive" (as Suttles 2004 labels it in Musqueam). It is also a cognate to the "actual" morpheme in Klallam and Northern Straits (see Montler 1986). In addition to this, we also use the term "sonorant" in lieu of "resonant" (commonly used in Salish literature).

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d.	pqʷát	‘break it (substance)’	páqʷt	‘breaking it’	metathesis
e.	hésəm	‘sneeze’	hé̱ʔsəm̓	‘sneezing’	glottal stop infix
f.	ləc̓ət	‘fill it’	ẖəl̓c̓t	‘filling it’	sonorant aspiration
g.	łát̓ə̱q̓ʷəm	‘snore’	łát̓q̓ʷəm̓	‘snoring’	schwa deletion
h.	t̓kʷəwəł	‘patch a canoe’	t̓ə̱kʷəẇəł	‘patching a canoe’	schwa insertion

A central puzzle that arises from the data in (1), and the question of how to understand the patterns associated with the imperfective in Halkomelem, is whether or not there is a single underlying form, from which the allomorphs can arise. Following Urbanczyk’s (1998) analysis of the Upriver Halkomelem pattern, a closely related dialect, we propose that the imperfective in Hul’q’umi’num’ is a segmentally empty mora prefix /μ-/ that triggers a range of non-concatenative processes, including reduplication, ablaut, and deletion. The goal of this paper is to present a comprehensive description of the imperfective allomorphy patterns and sketch a preliminary analysis using a mora affixation approach. The first step is to present data that encapsulates the range of patterns, and classify them by the kind of conditioning that is relevant: phonological, morphological, or lexical (Section 2). We then present our analysis in Section 3, and subsequently discuss some of the outstanding issues before summarizing our findings in Section 4.

2 Hul’q’umi’num’ imperfective allomorphy

For the most part, the choice of allomorph depends on the base: it is largely phonologically conditioned. Table 1 provides a preview of how this section is divided by type of conditioning. First, we outline the phonological conditions that determine the selection of allomorphs (1a–f) in Section 2.1), leaving discussion of (1g–h) for the section on morphological conditioning (Section 2.2), and other instances of schwa insertion (1h) for the section on lexical conditioning (Section 2.3). A final section summarizes our findings (Section 2.4).

Table 1: Overview of conditions on imperfective allomorphy

Type of Conditioning	**Forms**
Phonological (Section 2.1)	C_1 Reduplication (1a–b,f) Ablaut (1c) Metathesis (1d) Glottal stop infix (1e)
Morphological (Section 2.2)	Schwa deletion (1g) Schwa insertion (1h)
Lexical (Section 2.3)	Schwa insertion (1h)

2.1 Phonological conditioning

The phonological conditions that mediate the form of the imperfective allomorph are based on several factors, including whether or not the stem begins with a consonant cluster, whether the vowel is schwa or one of the other (“full”) vowels, whether the primary place of articulation for the consonants is glottal, and whether or not the consonants are obstruent or sonorant segments. These conditions mean that not all stems with the same shape will form the imperfective in the same way. For example, consider a stem with the shape CəCəC: if the first consonant is a sonorant, it will have reduplication in addition to the aspiration of a sonorant (as was shown in 1f), but if the first

consonant of the root (C_1) is an obstruent and the second (C_2) is a sonorant, the imperfective is realized with C_1ə- reduplication, and no aspiration of sonorant segments.[2] Because the type of segment is key to understanding the conditions, we adopt the following abbreviations to refer to the relevant classes of sounds: V = any full (non-schwa) vowel, C = any consonant aside from glottal consonants, H = glottal consonants, T = obstruent consonants, and R = sonorant consonants. We will use X to refer to any following segmental material (where the type of sound is not immediately relevant to the current discussion), and this may refer to multiple segments.

If the stem is of shape CVX, and it begins with a single consonant that is not glottal (/ʔ/ or /h/) followed by a full vowel, the imperfective is marked by a copy of the first CV sequence. Note that the copied consonant can be either an obstruent or a sonorant and that the first syllable may be open (2a) or closed (2b).

(2) C_1V- reduplication:

	Perfective		**Imperfective**	
a.	ɬic̓ət	‘cut it’	ɬíɬəc̓ət	‘cutting it’
	ɬíməṯ	‘lick it’	ɬíɬəmə̓ṯ	‘licking it’
	ṯíləm	‘sing’	ṯíṯələm̓	‘singing’
	lémət	‘look at’	lélələm̓ət	‘looking at’
b.	kʷíntəl	‘fight’	kʷíkʷən̓təl	‘fighting’
	yeq̓	‘topple down’	yéy̓əq̓	‘toppling down’

If the first consonant is a glottal stop or fricative, the imperfective allomorph is a glottal stop infix, as illustrated below with /ʔ/-initial stems (3a) and /h/-initial stems (3b).[3]

(3) Glottal infix:

	Perfective		**Imperfective**	
a.	ʔíməš	‘walk’	ʔíʔməš	‘walking’
	ʔákʷəṯ	‘hook it’	ʔáʔkʷəṯ	‘hooking it’
	ʔáluχət	‘collect, gather, select’	ʔáʔləχət	‘collecting, gathering, hunting’
b.	hésəm	‘sneeze’	héʔsəm̓	‘sneezing’
	hakʷəš	‘use it, wear it’	háʔkʷəš	‘using it, wearing it’
	híkʷət	‘rock (baby)’	híʔkʷət	‘rocking (a baby)’

When the stem does not meet either of these conditions then the choice of allomorphs depends on a combination of other factors, noted above.

Ablaut is found in the imperfective forms of roots with a CəCTX, where the vowel is a schwa and followed by a consonant cluster with an obstruent as the second consonant of the cluster. The imperfective is formed with ablaut, and the initial consonant can be an obstruent (4a–b) or sonorant (4c).

[2] See also Baker, Urbanczyk, & Hul’q’umi’num’ Language Academy (2019) for further discussion of the phonological conditions that have been identified for other verbal meanings: the largest number of classes occurring with imperfective verbs.

[3] The pattern in (3a) could alternately be analysed as the reduplication of a glottal stop.

(4) Ablaut:

	Perfective		**Imperfective**	
a.	łəpʔ̓ᵗ̓t	‘slurp it’	łepʔ̓ᵗ̓t	‘slurping it’
	səwq̓	‘look for’	sew̓q̓	‘looking for’
b.	c̓əƛ̓qʷ̓t	‘grind it’	c̓aƛ̓qʷ̓t	‘grinding it’
c.	yəm̓q̓šət	‘scrub feet ceremoniously’	yem̓q̓šət	‘scrubbing feet ceremoniously’
	məlxʷt	‘rub oil, grease on it’	mel̓xʷt	‘rubbing oil on it’

The stems that undergo the ablaut pattern in (4) are frequently formed from tri-consonantal roots: these are roots that have three consonants and lack an underlying full vowel. The quality of the vowel is phonologically predictable for the most part: it is [a] if there is a rounded consonant following it (4b), otherwise it is [e] as in (4a,c). See Jones (1976) for further discussion of this.

If the stem begins with an obstruent cluster, then a process of metathesis occurs.[4] The vowel in the perfective forms is switched in position with the second consonant of the root (C_2).

(5) Metathesis:

	Perfective		**Imperfective**	
a.	pqʷat	‘break it (substance)’	paqʷt	‘breaking it’
	ƛ̓qʷ̓at	‘break it’	ƛ̓aqʷ̓t	‘breaking it’
	xʷkʷ̓at	‘pull it’	xʷakʷ̓t	‘pulling it’
b.	sq̓et	‘tear/split it’	seq̓t	‘tearing/splitting it’

Interestingly, these stems are formed with a biconsonantal root, plus the control transitive suffix. Due to phonotactic considerations, the only stems that begin with clusters involve obstruents. The vowels are identical to the ablaut vowels found, and are thus also subject to the same conditions as stated above.

When the stem is RəCəX, the imperfective forms appear to have /h/ in addition to a difference in vowel position. This may be described in a number of ways, including metathesis, insertion of a schwa in roots without an underlying vowel, or deletion of a root vowel. We refer to it as sonorant “aspiration”, which refers specifically to an input sonorant segment being realized as /h/ in the output. This could alternately be treated as spirantization, debuccalization, or devoicing (or some combination of these processes).

(6) Reduplication and aspiration of sonorant (h-):

	Perfective		**Imperfective**	
a.	ləm̓ət	‘fold, hem it’	həl̓mət	‘folding it’
b.	məq̓ət	‘swallow it’	həm̓q̓ət	‘swallowing it’
c.	nəqəm	‘dive’	həṉqəm̓	‘diving’
d.	wəɬəθət	‘be rough on’	həw̓ɬθət	‘being rough on’
e.	yəkʷət	‘scrub, rub together’	həy̓kʷ̓ət	‘scrubbing, rubbing together’

[4] This is referred to as metathesis because the difference between the perfective and imperfective forms is position of the vowel, with respect to the consonants in the stem. However, this may alternately be analysed as insertion of a vowel in different positions in the stem if the roots are considered to be underlyingly without vowel.

Instead of classifying this as a case of metathesis with *h*- epenthesis, we follow Hukari (1977) in analyzing it as C_1 reduplication in combination with sonorant aspiration. Hukari (1977:48) provides evidence that sonorant aspiration is "phonologically conditioned and not contingent upon any one morphological category, ruling out the possibility that it is simply morphologically conditioned suppletion". He notes the condition for sonorant aspiration being when the stem begins with the sequence Rə-, leading to the intermediate structure R_iəR_i. He provides evidence from three reduplication patterns, including imperfective reduplication. We provide examples from reduplicated resultative (7a) and plural (7b) forms listed in Hukari (1977), as well as stems with multiple reduplication (7c) to illustrate that this is a property of reduplication in general. Note that resultatives are formed by reduplication, and the prefixing of /s-/. Resultative and plurals also co-occur with /i/ in the stressed syllable.

(7) Sonorant aspiration in other reduplicative contexts:

a. *Resultative*

ləc̓	'get full'	səl̓íc	'be full'
məq̓	'get full (person)'	səm̓íq̓	'be full'
nəqʷ	'doze off'	sən̓iqʷ	'asleep'

b. *Plural*

yəx̣ʷəléʔ	'eagle'	həyíx̣ʷəléʔ	'eagles'
ləxʷtən	'blanket'	həlíx̣ʷtən	'blankets'
yə́nəs	'tooth'	həyínəs	'teeth'
smə́yəθ	'deer'	səmíyəθ	'deer [PL.]' (/s-həmíyəθ/)
snə́xʷəł	'canoe'	səníxʷəł	'canoes' (/s-həníxʷəł/)

c. *Diminutive & imperfective*

meʔš	'take off something	hiʔhəm̓əš	'taking off something [DIM.]'
məq̓ət	'swallow	hiʔhəm̓q̓ət	'swallowing [DIM.]'

While others have analyzed the /h/ as epenthetic in the Upriver dialect of Halkomelem (Urbanczyk 1999; Zimmermann 2013), this is unlikely given that there is good evidence that /ʔ/ is the default epenthetic consonant instead, rather than /h/. The following example illustrates that vowel hiatus can be resolved by glottal stop epenthesis elsewhere in the language (Gerdts & Werle 2014).

(8) Glottal stop epenthesis (Gerdts & Werle 2014:265):

a. [sukʷəʔelə]
/sukʷə-elə/
sugar-container
'sugar bowl'

b. [pəlipəʔələp]
/pəlipə=ələp/
paper(PL)=2PL
'your (pl.) paper'

A number of additional stem shapes retain stress on the base in the imperfective, and form the imperfective with C_1ə- reduplication. All are phonologically conditioned. Some begin with /ə/ as the vowel, as shown in (9a), with bare roots, and in (9b), where the stem has the shape TəRəX. Two additional phonologically-conditioned imperfective patterns are shown in (9c), with a long vowel, and in (9d) with a vowel-glottal stop sequence.[5]

(9) C_1ə- reduplication with non-initial stress:[6]

	Perfective		**Imperfective**	
a.	tə́s	'arrive'	tətə́s	'arriving'
	q̓əp	'gather'	q̓əq̓ə́p	'gathering'.
b.	t̓ə́m̓ət	'pound on it, beat drum'	t̓ət̓ə́m̓ət	'pounding on it, beating a drum'
	θə́ləqt̓	'divide in half'	θəθə́l̓əqt̓	'dividing in half'
	xʷə́l̓əkʷ̓t	'wrap it up'	xʷəxʷə́l̓əkʷ̓t	'wrapping it up'
	x̣ə́l̓əm	'write'	x̣əx̣ə́l̓əm̓	'writing'
	cə́ləẇt	'turn it over'	cəcə́ləẇt	'turning it over'
	cə́m̓ət	'pack it on one's back'	cəcə́m̓ət	'putting it on one's back'
	ɬə́lət	'bail it out'	ɬəɬə́l̓ət	'bailing it out'
	xʷ-p̓ə́ləc̓t	'turn it inside out'	xʷ-p̓əp̓ə́ləc̓t	'turning it inside out'
	q̓ʷə́ləm	'barbecue'	q̓ʷəq̓ʷə́ləm̓	'barbecuing'
	q̓ʷə́maʔqʷ̓t	'pull out s.o. hair'	q̓ʷə̀q̓ʷə́maʔqʷ̓t	'pulling hair out'
	q̓ʷə́məwst	'pluck a fowl'	q̓ʷə̀q̓ʷə́məẇst	'plucking a fowl'
c.	té:m̓	'call, holler'	tətéːm̓	'calling, hollering'
	kʷe:l	'hide oneself'	kʷəkʷé:l̓	'hiding'
	p̓a:m	'swell up'	p̓əp̓á:m̓	'swelling up'
d.	seʔ	'lifted'	səséʔ	'lifted'
	c̓eʔt	'put it on'	c̓əc̓éʔt	'putting it on'
	k̓ʷiʔ	'rise'	k̓ʷək̓ʷíʔ	'rising'
	t̓áʔt	'pull it apart'	t̓ət̓áʔt	'pulling it apart'
	kʷaʔt	'take it apart'	kʷəkʷáʔt	'taking it apart'
	q̓aʔ	'together'	q̓əq̓áʔ	'joining together'

Having discussed the major patterns of phonological conditioning, we now turn to morphological conditioning.

2.2 Morphological conditioning

Up until now we have not discussed the schwa deletion allomorph. This occurs with a very restricted set of stems: triconsonantal roots that take the 'middle' suffix, as illustrated below. Urbanczyk (2011) notes that every triconsonantal root (to the exclusion of one) in the *Cowichan*

[5] We have only found one example in which initial stress is associated with C_1ə- reduplication, though note that this could be more wide-spread.

(i) C_1ə- reduplication with initial stress:
k̓ʷəɬ 'spill' (perfective) k̓ʷə́k̓ʷəɬ 'spilling' (imperfective)

[6] Stress patterns are from an unpublished manuscript of the *Cowichan Dictionary* that was annotated with stress by Bianco (1996), as part of her MA thesis research. Many thanks to Tom Hukari for sharing this.

Dictionary follows this pattern, so the pattern is quite robust. Note that there is an alternation between /ə/ and ∅, with the schwa occurring in the perfective, which has three syllables, while the imperfective lacks a schwa and has two syllables. Syllable boundaries are indicated with a period in (10).

(10) Schwa deletion:

Perfective		**Imperfective**	
c̓á.t̓ə.q̓ʷəm	‘fall apart (from cooking)’	c̓át̓.q̓ʷəm̓	‘falling apart (from cooking)’
ƛ̓é.pə.x̌əm	‘fall (leaves)’	ƛ̓ép.x̌əm̓	‘falling (leaves)’
ɬá.t̓ə.q̓ʷəm	‘snore’	ɬát̓.q̓ʷəm̓	‘snoring’

The pattern is interesting for a couple of reasons. First, the perfective form has an ablaut vowel, that usually occurs only with the imperfective aspect. The sets below are minimal pairs that illustrate how the same roots have a schwa in the root for the perfective forms with a control transitive, while the imperfective forms have the ablaut vowel in the root. In (11a–c), the verbs with the control transitivizer are in (i), while those with the middle suffix are in (ii).

(11) Triconsonantal roots:

a. √root = ‘dry’

	Perfective		**Imperfective**	
i.	c̓éy̓xʷt	‘dry it’	c̓éy̓xʷt	‘drying it’
ii.	c̓éy̓əxʷəm	‘dry: get dry (weather)’	c̓éy̓xʷəm̓	‘dry: getting dry (weather)’

b. √root = ‘whittle, gnaw away at wood”

	Perfective		**Imperfective**	
i.	x̌ə́t̓k̓ʷt	‘whittle on it’	x̌ét̓k̓ʷt	‘whittling on it’
ii.	x̌ét̓ək̓ʷəm	‘gnaw’	x̌ét̓k̓ʷəm̓	‘gnawing’

c. √root = ‘fry’

	Perfective		**Imperfective**	
i.	c̓̌ə́kʷx̌t	‘fry it’	c̓̌ékʷx̌t	‘frying it’
ii.	c̓̌ékʷəx̌əm	‘spatter’	c̓̌ékʷx̌əm̓	‘spattering’

This pattern, with an ablaut vowel in the perfective, only seems to occur with the ‘middle’ suffix on triconsonantal roots. Thus, it can be treated as a case of morphological conditioning — of the perfective. As we discuss in Section 3.3 below, the mora affixation analysis we pursue in this paper can straightforwardly account for deletion.

In addition to the triconsonantal ablaut pattern in (10–11), morphologically complex words also show a difference in how the imperfective is formed, depending on what the following suffixes are. The words in (12) illustrate this point.

(12) Root = /t̓ᶿiq̓ʷ/ ‘punch, hit with jabbing motion’

a. /-t/ ‘control transitive’

Perfective		**Imperfective**	
t̓ᶿiq̓ʷət	‘punch, hit with a fist’	t̓ᶿít̓ᶿəq̓ʷət	‘punching, hitting with a fist’

b.	/-els/	‘activity’		
	Perfective		**Imperfective**	
	t̓$^{\theta}$q̓^{w}éls	‘punch, stab’	t̓$^{\theta}$ít̓$^{\theta}$əq̓^{w}əl̓s	‘punching’
c.	/-aləs-t/	‘eye, control transitive’		
	Perfective		**Imperfective**	
	x^{w}t̓$^{\theta}$q̓^{w}aləst	‘punch someone in eye’	x^{w}t̓$^{\theta}$əq̓^{w}ələst	‘punching s/o in eye’

Notice that when the suffixes /-els/ ‘activity’ and /-aləs-t/ ‘eye + control transitive’ are added, the root vowel is sometimes deleted (12b–c), so both perfective stems begin with a cluster. Interestingly, the imperfective is dependent on what the root is in (12b), not what the surface form is, which begins with a cluster. In contrast, the imperfective is determined by other factors in (12c), and is formed by schwa insertion.

2.3 Lexical conditioning

Finally, we discuss cases for which neither phonological nor morphological conditions appear to be sufficient to predict the form of the imperfective. There are a few sets of verbs which appear to meet the phonological conditions for the patterns outlined above, but have a different form for the imperfective form than would be expected. These we classify as lexically conditioned. The first pattern, of schwa insertion, is presented in (13).

(13) Schwa insertion:

	Perfective		**Imperfective**	
a.	t̓$^{\theta}$łek̓^{w}t	‘pinch’	t̓$^{\theta}$ə́łək̓^{w}t	‘pinching’
	cláq^{w}t	‘put it through’	cə́ləq^{w}t	‘putting it through’
b.	θx̣asəm	‘park, come to a stop’	θə́x̣əsəm̓	‘parking, coming to a stop’
	qp̓asəm	‘look down’	qə́p̓əsəm̓	‘putting head down’
	qp̓iləm	‘to land’	qə́p̓ələm̓	‘landing’
	c̓tem	‘crawl’	c̓ə́təm̓	‘crawling’
	ptém̓	‘ask’	pə́təm̓	‘asking’
c.	t̓k^{w}əwəł	‘patch a canoe’	t̓ək^{w}əẁəł	‘patching a canoe’
d.	x̣łiləws	‘suffer’	x̣ələləẁs	‘suffering’

Note that the perfective forms above begin with an obstruent cluster, and thus would meet the conditions described in Section 2.1 for metathesis. However, the imperfectives in (13) are formed by schwa epenthesis. We have organized them according to their morphological structure, with the idea that some forms may also be subject to morphological conditioning. For example, in (13a), these appear to be triconsonantal roots with the control transitivizer.

There are also a number of imperfective forms in which the consonant alternates unexpectedly. We note that some of these may be reflecting the previous form of the consonant in the reduplication pattern.

(14) Consonant alternations:

	Perfective		**Imperfective**	
a.	c̓əlcəs	‘change hands (paddling)’	c̓ak̓ʷəl̓cəs	‘changing hands (paddling)’
	celqəm	‘follow’	cəkʷəl̓əl̓qəm̓	‘following’
	cəstəxʷ	‘do what with’	cekʷəstəxʷ	‘doing what with’
	ctamət	‘what happened’	cəkʷstam̓ət	‘doing what’
b.	šak̓ʷət	‘bathe him/her’	šaxʷək̓ʷət	‘bathing him/her’
c.	kʷələšt	‘shoot it’	heʔkʷəl̓əšt	‘shooting it’
			həy̓kʷəl̓əšt	‘shooting it’

Finally, the imperfective forms below have the vowel /a/. Note that this vowel is different than the usual ablaut vowel /e/. Recall that a condition on /a/ is the presence of a rounded consonant. Also, ablaut tends not to occur with initial open syllables. The vowel /a/ could have an additional semantic function, as yet to be determined.

(15) Unexpected ablaut forms:

	Perfective		**Imperfective**	
a.	ƛ̓ələmθət	‘drive, steer’	ƛ̓al̓əm̓θət	‘driving, correcting self’
b.	xʷ-yənəməs	‘smile’	xʷ-yan̓əm̓əs	‘smiling’
c.	xʷčenəm	‘run’	xʷan̓čənəm̓	‘running’

Though these forms may not be predicted via the generalizations we have provided regarding choice of allomorph, note that they do all show the glottalization of sonorant segments (a process found to accompany imperfective allomorphy).

2.4 Summary

For the most part, the choice of allomorph is predictable, based on the segmental content of the root in combination with other affixes. The key determinants for choice of allomorph are summarized in Table 2 below.

Table 2: Summary of imperfective allomorphs and conditions

Type	**Allomorph**	**Base**	
Reduplication	CV-	Consonant-Vowel-Consonant	CVC-
	Cə-	Obstruent-Schwa-Consonant	TəC-
		Obstruent-Schwa-Sonorant-Schwa	TəRəX-
		Obstruent-Schwa-Glottal	TəH-
		Consonant-Long Vowel	CV:C-
	hə́-	Sonorant-Schwa Roots	Rə́C-
Infix	-ʔ-	Glottal-Vowel-Consonant	HVC-
Ablaut	Ablaut	Obstruent-Schwa-Cluster	Tə́CC-
Metathesis	Metathesis	Triconsonantal: All Obstruents	TTAT-
Epenthesis	Epenthesis	Triconsonantal: Other (Exceptions?)	CCVC-
Schwa Deletion	Schwa deletion	Morphological Conditioning (-əm)	TATəTəm

Accompanying changes include the aspiration of sonorant segments in reduplication, differing placement of stress, and the glottalization of sonorants that are in a non-initial position. Having provided an overview of the range of patterns, we now turn to our analysis.

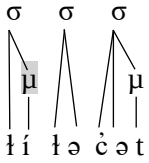
3 Analysis

Our analysis of the imperfective is couched within Optimality Theory (Prince & Smolensky 1993), in which ranked and violable constraints evaluate the well-formedness of candidates. We follow others' approaches to this pattern in assuming that the imperfective morpheme is a segmentally empty mora (Urbanczyk 1998). This is consistent with analyses of the cognate pattern in Straits (Stonham 1994; Bye & Svenonius 2012), a closely related and neighbouring language. The mora is segmentally empty in the input and is filled by various processes in the phonological grammar, such as reduplication or ablaut, depending on what the segmental content of the base is. First, we will provide an analysis of the forms that have initial stress (Section 3.1), followed by forms with non-initial stress (Section 3.2), and then illustrate how mora affixation accounts for the forms that are morphologically conditioned (Section 3.3).

3.1 Initial stress

We start by analyzing the stems that surface with C_1V- reduplication. The following representation illustrates how the mora is filled by reduplication. The imperfective mora is indicated with shading to differentiate it from moras that are assigned by the phonological grammar. We assume that schwa is not moraic (Shaw et al. 1999), but codas are.[7]

(16) Mora affixation:



Reduplication is accomplished via fission of an input segment into two output segments, in order to fill an empty prosodic unit (Bye & Svenonius 2012; Saba Kirchner 2013; Urbanczyk 1998; Zimmermann 2013, and others). This fission process, which creates a one-to-two mapping between the input and output forms, violates INTEGRITY (McCarthy & Prince 1999).

(17) INTEGRITY: No element of the input has multiple correspondents in the output.

The representation of the reduplicant is provided below, with the INPUT-OUTPUT mapping to indicate the fission of segments. We assume that both the consonant and vowel undergo fission.

[7] See also Blake (2000) for arguments of this nature pertaining to Comox-Sliammon, another Central Salish language, as well as Dyck (2004) for evidence that schwa is not moraic in Squamish, and Leonard (2019) for arguments that schwa is not moraic in SENĆOŦEN.

(18) Representation of reduplicated word:

INPUT /µ-ɬ i c̓-ət/

OUTPUT ɬ i ɬ ic̓ət

We include the full vowel here, as we also assume that imperfective is a stem-level process, and that vowel reduction occurs at the word-level (see the analysis in Mellesmoen & Urbanczyk *to appear* of multiple reduplication in Hul'q'umi'num' for more details).

Another way that the mora can be filled is by glottal stop insertion, which violates DEP-C.

(19) DEP-C: Every consonant in the output has a correspondent in the input.

Constraints on well-formedness determine the correct allomorph. In addition to the two Faithfulness constraints introduced so far, we also need a constraint to compel filling in the empty mora, and adopt *FLOAT, which bans unaffiliated prosodic units (Saba Kirchner 2013:232).

(20) *FLOAT: ∀*p* ∈ O, where *p* is a prosodic unit: ∃*s*, where *s* is a segment, and *p* dominates *s*.

As illustrated in the tableau below, INTEGRITY is ranked lower than DEP-C, which demonstrates reduplication is the preferred allomorph over glottal stop insertion.

(21) Tableau showing imperfective reduplication:

	/µ-ɬic̓-ət/	*FLOAT	DEP-C	INTEGRITY
a.	µ ɬíc̓ət	*!		
b. ☞	ɬíɬəc̓ət			**
c.	ɬíʔc̓ət		*!	

Candidate (21a) is ruled out because it has a segmentally empty mora in violation of *FLOAT, as represented with a mora preceding it. Candidate (21c) — with the glottal stop infix — is ruled out by DEP-C. And candidate (21b) is selected as optimal, even though it violates INTEGRITY twice, once for the consonant and once for the vowel.

The ablaut pattern is accounted for because full vowels are moraic, so strengthening of schwa to a full vowel fills the mora. A change in the quality of the vowel violates the faithfulness constraint IDENT-V (after McCarthy & Prince 1999:294).

(22) IDENT-V: Correspondent segments have identical values for the vowel features.

In order to rule out candidates with glottal stop insertion, a constraint against schwa-glottal stop in coda position must be active in the language (see Bessell & Czaykowska-Higgins 1993; Blake 2000).

(23) *əʔ]$_{\sigma}$: Schwa is not permitted before a glottal stop that is in a coda.

The constraint in (23) is active throughout the Salish language family and is never violated in Hul'q'umi'num', so it is ranked the highest and undominated in the present analysis.

(24) Tableau showing high ranking of əʔ]$_{\sigma}$ constraint:

	/μ-łəpt̓$^{\theta}$-t/	*FLOAT	*əʔ]$_{\sigma}$	DEP-C	IDENT-V	INTEGRITY
a.	μ łəpt̓$^{\theta}$t	*!				
b. ☞	łépt̓$^{\theta}$t				*	
c.	łəʔpt̓$^{\theta}$t		*!	*		
d.	μ łəłəpt̓$^{\theta}$t	*!				*

Because schwa is not moraic, reduplication will not fill the mora, ruling out candidate (24d), as indicated by the floating mora. With this constraint ranking established, the metathesis pattern arises due to the mora being a prefix and filled by a full vowel.

(25) Tableau showing metathesis:

	/μ- pq^{w}-t/	*FLOAT	*əʔ]$_{\sigma}$	DEP-C	IDENT-V	INTEGRITY
a.	μ pq^{w}át	*!				
b. ☞	páq^{w}t					
c.	pəʔq^{w}t		*!	*		
d.	μ pə́pq^{w}t	*!				*

Candidate (25a) represents the perfective form, with the vowel associated with the control transitive suffix appearing on the surface. It and candidate (25d) are both ruled out because they have a floating mora. However, if (25a) were to incorporate the mora into the stressed vowel (**pq^{w}át*), it would be ruled out by an Alignment constraint on the mora prefix, as the mora is not as close to the left edge as the mora in the (25b).

In terms of understanding why reduplication is marked with stems that begin with a glottal consonant, we note that if reduplication were to occur, the form would have an intervocalic /h/ with a following schwa [Vhə]. This fits with the overall pattern in the language: an examination of the *Cowichan Dictionary* reveals that intervocalic /h/ only occurs before schwa in the context of sonorant aspiration and with multiple reduplication (see below). We propose the constraint in (26) to reflect this generalization.

(26) *Vhə: Schwa is not permitted after /h/ when a full vowel precedes it.[8]

[8] We recognize that there are some interesting phonotactic restrictions between schwa and glottal consonants related to their (lack of) place specification in the phonology. We leave this for further research.

Because this constraint seems to be active throughout the language, we also include it with the highest ranked (undominated) constraints in the constraint hierarchy, as illustrated below.

(27) Tableau showing high ranking of *Vhə constraint:

	/µ- hes-əm/	*FLOAT	*Vhə	*ə?]$_\sigma$	DEP-C	IDENT-V	INTEGRITY
a.	µ hésəm	*!					
b. ☞	hé?səm				*		
c.	héhəsəm		*!				*

We now turn to the cases of sonorant aspiration. As discussed above, Hukari (1977) provides evidence that /h/ arises in some reduplicative contexts as the result of sonorant aspiration, rather than epenthesis. We simply propose a constraint *R_iəR_i, based on Hukari's observation, leaving investigation of phonetic motivation for future research.

(28) *R_iə$R_{i:}$ Schwa is not permitted between a series of identical sonorants.

The repair to avoid this structure is to have the sonorant aspirate (or devoice) to [h]. We propose that this violates a faithfulness constraint on sonorant segments.[9]

(29) IDENT-SON: Correspondent sonorant segments are identical in their features.

Recall that all codas are moraic, so having the sonorant fill the coda position adds a mora. Having reduplication of the sonorant and schwa would not add a mora (30c), as illustrated in the tableau below.

(30) Tableau showing imperfective reduplication with sonorant aspiration:

	/µ-lə̀c̀-ət/	*FLOAT	*Vhə	*ə?]$_\sigma$	*R_iəR_i	DEP-C	IDENT-V	INTEG	IDENT-SON
a.	µ lə̀c̀ət	*!							
b. ☞	hə̀l̀c̀ət							*	*
c.	µ lələ̀c̀ət	*!			*			*	
d.	lə̀l̀c̀ət				*!			*	
e.	lé c̀ət						*!		
f.	lə?c̀ət			*!		*			

[9] We note that nothing in our analysis hinges on whether or not /h/ treated as a sonorant (or obstruent) segment.

Having analyzed the range of patterns that have initial stress, we turn now to the imperfective verbs that have non-initial stress.

3.2 Non-initial stress

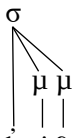
As noted above, the class of verb stems in which the imperfective has non-initial stress utilize C_1ə-reduplication. Given our assumptions above about schwa being non-moraic, these pose a potential problem for our analysis. Because schwa is not moraic, C_1ə- reduplication would not fill the mora. The question then arises as to how a mora could be filled with this set of stems. There are several avenues to explore, and we present a few possible solutions here.

One possibility is that C_1ə- is moraic somehow and does fill the mora. This would violate a constraint against schwa being non-moraic, that is otherwise obeyed in Hul'q'umi'num'. Other languages in the region have moraic schwa, such as Kwakw'ala (Bach 1978; Saba Kirchner 2013), so there must be a constraint that says moraic schwa is marked, that is violated in the languages that have it. There could be something about foot structure that permits schwa to be moraic in these situations. As typological evidence to support this, it has been proposed that languages can have variable weight for schwa, sometimes non-moraic, moraic, and even being bimoraic (Shih 2018). We leave this idea as a potential avenue for further research noting that there are several instances of moraic mismatches throughout Central Salish, and that stress is not a reliable indicator of weight, given the non-uniformity of weight hypothesis and the proposal that weight assignment is process-specific, not language-specific (Gordon 2006).

A second related possibility is that there is a type of minor syllable in Hul'q'umi'num' that is related to moraic licensing and a difference between obstruents and sonorants. For example, earlier proposals about moraic structure have proposed that onsets link directly to the mora, as in the representation of the initial syllable in (31b) (see also McCarthy, Kimper, & Mullin 2012). It could be that there is a difference in how obstruents link to syllables, depending on whether there is a full vowel (31a), with direct association to the syllable or whether there is a schwa following, and that the retention of stress on the base provides a context for licensing the minor syllable, with the structure in (31b).

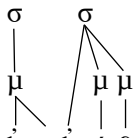
(31) Obstruent-schwa minor syllables:

a. *perfective*



'rise'

b. *imperfective*



'rising'

While we note that these two approaches in which schwa is moraic are promising, there is much research on metrical and syllable structure of Hul'q'umi'num' to be undertaken before we can determine the precise reasons why schwa might be moraic in this context (see Bianco 1996 for a discussion of stress patterns and sonority effects on permissible codas in Hul'qumi'num').

We sketch a third possible approach, and outline a preliminary analysis of TəRəX stems, drawing on proposals from previous research (Kurisu 2001; Urbanczyk 1999). In this approach we look for explanation on how the mora is filled, based on the cooccurrence of sonorant glottalization. Examples from (9b) are repeated below, organized according to whether the sonorant is glottalized

(32a), has a glottalized sonorant to begin with (32b), no sonorant glottalization occurs (32c), and secondary stress has been documented (32d).

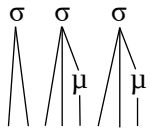
(32) Cə- Reduplication with TəRəX Stems:

	Perfective		**Imperfective**	
a.	tə́m̓ət	‘pound on it, beat drum’	tətə́m̓ət	‘pounding on it, beating a drum’
	θə́ləqt	‘divide in half’	θəθə́l̓əqt	‘dividing in half’
	x̣ə́l̓əm	‘write’	x̣əx̣ə́l̓əm̓	‘writing’
	cə́ləẇt	‘turn it over’	cəcə́l̓əẇt	‘turning it over’
	łə́lət	‘bail it out’	łəłə́l̓ət	‘bailing it out’
b.	cə́m̓ət	‘pack it on one’s back’	cəcə́m̓ət	‘putting it on one’s back’
	łə́n̓əm̓	‘weave’	łəłə́nəm̓	‘weaving’
c.	xʷə́ləkʷ̓t	‘wrap it up	xʷəxʷə́ləkʷ̓t	‘wrapping it up’
	xʷ-p̓ə́ləc̓t	‘turn it inside out’	xʷ-p̓əp̓ə́ləc̓t	‘turning it inside out
	q̓ʷə́ləm	‘barbecue’	q̓ʷəq̓ʷə́ləm̓	‘barbecuing’
d.	q̓ʷə́maʔqʷt	‘pull out s.o. hair’	q̓ʷə̀q̓ʷə́maʔqʷt	‘pulling hair out’
	q̓ʷə́məwst	‘pluck a fowl’	q̓ʷə̀q̓ʷə́məẇst	‘plucking a fowl’

When a sonorant is glottalized, it is most frequently pronounced as a sequence of sonorant and glottal stop. The order of these articulations depends on two factors: syllable position and the quality of the preceding vowel. If the preceding vowel is schwa (regardless of syllable position), a glottalized sonorant is pronounced as a sonorant followed by a glottal stop. If the preceding vowel is non-schwa, then the glottalized sonorant is pre-glottalized if it is in an open syllable, otherwise it is post-glottalized. We propose that the syllable structure for a word like *łəłə́l̓ət* ‘bailing it out’ is as in (33a), with the sonorant in the coda and the glottal stop in the onset of the following syllable. The imperfective mora is represented with shading. This ordering of articulations is consistent with the constraint *əʔ]$_{\sigma}$, as the reverse order would place the glottal stop in the coda of schwa-vowelled syllable.

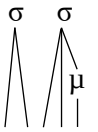
(33) Representation of glottalized sonorants and syllabic affiliation:

a. *imperfective*



‘bailing it out’

b. *perfective*



‘bail it out’

This proposal is consistent with the observations that glottalized sonorants can function as two segments for syllable-based observations (Urbanczyk 1992).[10] Further evidence comes from what we have learned regarding how L1 speakers of Salish languages have developed writing systems. The orthography presented in the *Cowichan Dictionary* represents ejectives with a single character with underlining [q̲, p̲, t̲, …], but glottalized sonorants as a sequence of glottal stop plus sonorant. Similarly, the SENĆOŦEN orthography developed by Dave Elliott Sr. represents ejectives with

[10] See also Blake (2000) on how the glottal stop portion of a glottalized sonorant can serve as the coda of a syllable in Comox-Sliammon.

single characters, like *B, D, J*, while glottalized sonorants are spelled as a sequence of glottal stop and sonorant (Elliott & Poth 1990; Montler 2018). The order of sonorant-glottal stop in (33) is taken from the *Cowichan Dictionary*, which represents glottalized sonorants as sequences of segments, depending on the conditions noted above. Notice that in (33a) the imperfective has one more mora than the perfective, because the sonorant is in the coda position.

If the sonorant coda is able to fill the mora, the question arises as to why reduplication occurs, as it would incur a violation of INTEGRITY, without being compelled by *FLOAT. We follow others' approach to Upriver Halkomelem allomorphy, that reduplication is needed to create a distinct stem from the perfective stem (Kurisu 2001; Urbanczyk 1999).

(34)

	/μ - łəl -ət/	DISTINCTSTEM	INTEGRITY
a. ☞	łəłélʔət		**
b.	łélʔət	*!	

Preliminary evidence that this could provide a possible explanation comes from two sources. First, the retention of stress on the base, may indicate that the bases may require some identity relation. Second, there are a few forms with a similar shape that do not have reduplication, indicating that Cə- reduplication does not always occur with TəRəX stems.

(35) No Reduplication:

Perfective		**Imperfective**	
ł-čəməx̣	'chew gum'	ł-čəm̓əx̣	'chewing gum'

Having presented an analysis of the phonologically conditioned allomorphs, we now turn our attention to the morphologically conditioned pattern.

3.3 Morphologically conditioned forms

Recall that when one compares the perfective and imperfective forms of triconsonantal roots with the middle suffix, there are two interesting features: the ablaut vowel occurs with the perfective and this seems to be the only instance in which the imperfective appears to be formed by schwa deletion.

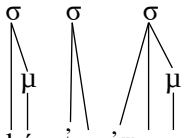
(36) Triconsonantal roots with middle suffix:

Perfective		**Imperfective**	
c̓á.t̓ə.q̓ʷəm	'fall apart (from cooking)'	c̓át̓.q̓ʷəm̓	'falling apart (from cooking)'
ƛ̓é.pə.x̌əm	'fall (leaves)'	ƛ̓ép.x̌əm̓	'falling (leaves)'
łá.t̓ə.q̓ʷəm	'snore'	łát̓.q̓ʷəm̓	'snoring'

While we do not have a full account of how the perfective word-form arises, we note that if one compares the two word-forms, schwa deletion results in C_2 being in the coda, and thus adding a mora, as illustrated below.

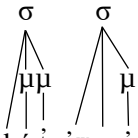
(37) Representation of /ə/ deletion and syllabic affiliation

a. *perfective*



‘snore’

b. *imperfective*



‘snoring’

Notice that the perfective form on the left has two moras overall, while the imperfective on the right has three moras. The imperfective mora is filled by the coda consonant in (37b).

4 Conclusion and discussion

In this paper, we have provided an extensive range of allomorphs that express imperfective meaning in Hul’q’umi’num’. These have been classified according to the phonological conditions as well as some morphological conditions. The imperfective forms with initial stress were straightforwardly analyzed as affixation of a mora, including those that are morphologically conditioned. We also observed that the imperfective forms with non-initial stress are all formed with C_1ə- reduplication, and outlined a couple of approaches one can take to analyze them.

This analysis fits in with other approaches to reduplication which are seen as phonological repairs, to avoid unaffiliated prosodic units (Bermúdez-Otero 2012; Bye & Svenonius 2012; Saba Kirchner 2013; Zimmermann 2013, and others). Mora affixation is consistent with an approach to morphology as completely concatenative, without reference to processes, such as actual metathesis. While we have used process-based terms to describe some of the patterns, in essence these processes are all epiphenomenal, to describe the pattern in comparison to the perfective base, which provides the phonological conditions.

In developing this analysis, we also note that many of patterns that arise are due to the ability of the imperfective mora to be filled by linking to positions that moras would usually be associated with, resulting in having moraic codas and full vowels while not permitting moraic schwa. This attachment of a floating morpheme to a position it would usually occupy has been described as vacuous docking by some researchers.[11] We speculate that Hul’q’umi’num’ imperfective allomorphy is as diverse as it is, because it permits vacuous linking of moras to coda positions and full vowels. In other Central Salish languages like Squamish and Comox-Sliammon, the cognate morpheme only has reduplicative allomorphs, suggesting that vacuous docking of a mora may not be permitted.

While the subpattern of C_1ə- reduplication is not straightforwardly analyzed with our assumptions about moraic structure, we note that this is the most comprehensive analysis presented of the allomorphy. Because much of the analysis relies on independently motivated phonotactic constraints in Salish, we are confident that a unified solution of the problematic cases can be arrived at once more research is done on moraic structure and other aspects of prosody, such as syllable and foot structure.

[11] The prevention of this in other languages is referred to as a ban against the vacuous association of moras with underlying segmental material. It is formalized in other approaches with the constraint NoVacuousDocking (Saba Kirchner 2013) or using Coloured Containment (Zimmermann 2013).

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