Ablaut in Hul'q'umi'num' TT Progressive Transitive Verbs:

An Optimality Theory Analysis

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Hul'q'umi'num'[1] is a dialect of the Salishan language family. Hul'q'umi'num', and hən̓q̓əmin̓əm̓ and Halq'eméylem are spoken on the east coast of Vancouver Island, B.C. (Dunlop et al., 2018), spanning from the city of Duncan (sʔaməna?north) to Nanaimo (snəneyməx^{w}) (Bianco, 1996). A Map is included in Appendix A. First Peoples' Cultural Council (FPCC, 2022) reported a combined total of 105 fluent speakers for the 3 dialects Hul'q'umi'num', and hən̓q̓əmin̓əm̓ and Halq'eméylem. More statistics from the report are included in Appendix B.

Hul'q'umi'num' phonology contains the following contrastive features: place, manner, glottalization, labialization, and stress. Phonetic features include voicing, and vowel lengthening and reduction. Vowels include contrastively long and short /a e i o u/ and schwa; /u/ is rare (cite). Sound inventory charts are included in Appendix C. Phonetics, phonology and morphology – concatenative and non-concatenative – are strongly intertwined in Hul'q'umi'num'.

Non-concatenative processes that can be used to form a progressive[2] verb include ablaut (aka apophony), metathesis of whole vowels and stress shift (often requiring schwa insertion and whole vowel reduction) (Urbanczyk, 2011). Appendix D includes a summary of allomorphs (including non-concatenative processes) that are used to form progressive verbs.

Verb roots come in many shapes, including bi-obstruent only roots (TT), where T is any obstruent (Suttles, 2003).[3] This analysis addresses the inflection of progressive transitive verbs (t-PROGs) of root shape TT. The suffix '*-t*' is used to form transitive verbs (Suttles, 2003). In the case of a TT root, the form of a transitive verb would then be TT-t. The morphophonological processes used to inflect a progressive transitive verb vary based on the root form. Ablaut is the primary process that forms a t-PROG from a TT-t verb. These TT roots are assumed to be underlyingly vowelless and will surface with /ə/ (Jones, 1978 p. 38). TT roots surfacing as plain verbs with a whole vowel is considered in fact to be a TVT root, which is distinct from the TT root form and excluded from this analysis.[4]

The phenomenon under analysis is ablaut in TT roots to form t-PROGs and the alternation between [ə]~[e] and [ə]~[a], conditioned by the labialization of the second obstruent, T2.

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[1]Though often referred to as Halkomelem, FPCC's report says there is no language name to encompass the dialects.

[2] Urbanzcyk uses 'imperfective' to categorize 'progressive' verbs. I will use 'progressive' as it is what's used in the Hukari Peter (1995) dictionary.

[3] See Suttles (2003, pp. 135-136) for an extensive list of verb root shapes.

[4] I would add examples if I had more time/space.

Labialized (rounded) obstruents in Hul'q'umi'num' are exhaustively /kʷ, k̓ʷ, xʷ, qʷ, q̓ʷ, x̌ʷ/. The obstruents under analysis are shown in Figure 2. There are also /w, w̓/, rounded plain and glottalized resonants respectively.[5] The intention of this paper is to conduct an OT analysis to explain this phenomenon, and it will ultimately show that it is constrained by phonological place features of the T2, with agreement in backness dominating agreement in height. There are however conflicting generalizations that must be reconciled before doing so.

Figure 2.

	Obstruents				Resonants	
	Plosives			Spirants		
	Plain	Glottalized	Voiced	Voiceless	Plain	Glottalized
Labial	p	p̓	{b}	{f}	m	[m̓]
Dental	(tᵊ)	t̓ᵊ	–	θ	–	–
Alveolar	t c	t̓ c̓	{d}	s	n	[n̓]
Lateral	ƛ̓	–	–	ɬ	l	[l̓]
Palatal	(č)	–	{j}	(š)	y	[y̓]
Velar	(k)	(k̓)	–	x	{r}	–
Lab. velar	kʷ	k̓ʷ	–	xʷ	w	[w̓]
Uvular	q	q̓	–	x̌	–	–
Lab. uvular	qʷ	q̓ʷ	–	x̌ʷ	–	–
Laryngeal	–	ʔ	–	h	–	–

Urbanczyk (2011) (citing Jones, 1978) explains this phenomenon within an illustration of forming the t-PROG from transitive by metathesis:

> When a biconsonantal obstruent-only root has the control transitive suffix /-t/, the [progressive] often has the shape TTVt, where T stands for an obstruent and V is either [a] or [e] the choice being predictable, based on whether there is a rounded consonant (p. 477).

She illustrates this with examples (1) from Hukari (1978). I have added the root as found in the Cowichan Dictionary (Hukari & Peter, 1995).

(1)	Plain	Gloss	Transitive	Progressive transitive
a.	Not in dictionary	'split, tear'	sq̓et	seq̓t
b.	pəqʷ	'break (substance)'	pqʷat	paqʷt
c.	t̓əq̓ʷ	'break (rope, string)'	t̓q̓ʷat	t̓aq̓ʷt
d.	Not in dictionary	'pull'	xʷk̓ʷat	xʷak̓ʷt

[5] Consonants are categorized as A. obstruents and resonants, or B. stops, fricatives and sonorants. I will be following the categorization in A due to the grouping of sounds in the analysis.

Suttles (2003) explains the same phenomenon

> With -t 'transitive,' TəT roots appear as TT followed by either a full vowel /e/ or /a/, or a schwa in the [transitive], and their progressives are formed by inserting a full vowel /e/ or /a/, between the two consonants (p. 154).

He separates his examples into two categories: TTA → TAT (2) and TTə → TTA (3).

(2)		Plain	Gloss	Transitive	Progressive transitive
	a.	Not in dictionary	'split, tear'	sq̇et	seq̇t
	b.	k̓ʷəɬ	'spill'	k̓ʷɬet	k̓ʷeɬt
	c.	t̓əq̇ʷ	'break (rope, string)'	t̓q̇ʷat	t̓aq̇ʷt
	d.	t̓ᶿəx̌ʷ	'washed, get washed'	t̓ᶿx̌ʷat	t̓ᶿax̌ʷt
	e.	t̓əkʷ	'stuck'	t̓k̓ʷat	t̓ak̓ʷt

This example set is followed by "The vowels here seem predictable; if the second consonant is rounded, the vowel is /a/; if not, it is /e/."

(3)		Plain	Gloss	Transitive	Progressive transitive
	a.	Not in dictionary	'speared'	θq̇ət	θeq̇t
	b.	c̓əq̇ʷ	'pierced, shot'	c̓q̇ʷət	c̓aq̇ʷt
	c.	Not in dictionary	'pushed'	θx̌ət	θex̌t
	d.	θək̓ʷ	'stretched taught'	θk̓ʷət	θek̓ʷt

This example set is followed by "In this set, it appears that only if the second consonant is a rounded uvular, the vowel in the progressive is /a/."

However, there are a few gaps and inconsistencies that must be addressed. The first (Problem A) pertains to a gap in examples. As mentioned above, labialized obstruents in hul'q'umi'num' are /kʷ, k̓ʷ, xʷ, qʷ, q̇ʷ, x̌ʷ/. Urbanczyk (2011) included no examples with the velar fricative /xʷ/ or uvular fricative /x̌ʷ/. Suttles (2003) included no examples with the velar fricative /xʷ/. I will return to this later.

The second (Problem B), pertains to the use of examples with /kʷ k̓ʷ/. Both Suttles' and Urbanczyks' examples illustrate that in transitive verbs where T_2 is /kʷ/ is followed by a whole vowel, that vowel will become /a/, otherwise it will become /e/. In all three of their combined examples, however, the whole vowel in the transitive is /a/ also. All examples whose plain forms are in the Cowichan Dictionary (1995) surface with a schwa between the two obstruents. Urbanzcyk (and Jones, who she cited), don't address differences of vowels in the transitive form. Because of this, I decided to do an exhaustive search of data. I did this by filtering the Cowichan Dictionary (using a Python script and regex patterns) for all TT examples where T_2 is labialized and found some important information:

Labialized uvular obstruents /qʷ, q̓ʷ, x̌ʷ/:

1. There are 2 TT t-PROGs whose T2 is /x̌ʷ/.
2. There are 2 TT t-PROGS whose T2 is /qʷ/.
    a. In the transitive form, 1 is followed by a schwa.
3. There is 1 TT t-PROG whose T2 is /q̓ʷ/.
4. All 5 t-PROGS have the vowel /a/.

Labialized velar stops /kʷ, k̓ʷ/:

1. There are 3 TT t-PROGs whose T2 is /kʷ/.
2. There are 4 TT t-PROGs whose T2 is /k̓ʷ/.
3. Of those 7, in the transitive form:
    a. 4 of the T2 are followed by a schwa.
    b. 3 of the T2 are followed by /a/.
4. Of those 7, 4 have notes in the t-PROG lexical entry that the vowel can either be /a/ or /e/ or have 1 entry for each option.

Labialized velar fricative /xʷ/:

1. There are 4 TT t-PROGs whose T2 is /xʷ/.
    a. In the transitive form, all 4 are followed by /a/.
    b. Therefore, none are followed by schwa.

Place	Manner	Sound	#	TTA → TAT	TTə → TAT	TTA/ə → TET
Velar	stop	/kʷ/	3	2 (ambivalent)	0	1
		/k̓ʷ/	3	2 (ambivalent)	0	1
	fricative	/xʷ/	4	0	No TTə	4
Uvular	stop	/qʷ/	2	1	1	0
		/q̓ʷ/	1	1	No TTə	0
	fricative	/χʷ/	2	2	No TTə	0

Prior to providing details on the filtered dictionary data, I had raised Problem A: That there are no examples of velar fricatives provided by either Urbanczyk or Suttles'. From this data, though scant, I will conclude that this ablaut occurs with labialized uvular stops and fricatives (plain and glottalized) and does not occur with labialized velar fricatives. This contradicts the generalizations Urbanczyk's generalization of this phenomenon including all labialized consonants, and Suttles' including velar where the transitive form contains a whole vowel. Problem B was that the examples with velar stops were precarious, particularly in Suttles' two-part generalization. He says TTə → TAT will only occur if T2 is a rounded uvular. First, I take issue with this generalization for three reasons. The first being that he only provided one velar example to illustrate this. The second, the example only used a velar stop (3d), not a velar fricative. The third comes as a result of searching the dictionary: the resulting vowel is ambiguous, permitted to be /a/ or /e/ (Fig 1).

Figure 1.

θék̓ʷ't [*θkʷ'ə-t-PROG] taughtening it, stretching it taut. (BC 20DEC79) (Also θakʷ't.) ʔii č toʔ yəθekʷ't tᵉə niʔ məqʷitᵉ'eʔ ʔə tᵉənʔ sqeləc'. Are you evening out (pulling) the thick part in your spinning? (RP 14DEC81)

(Hukari & Peter, 1995, p. 177)

Of the 6 entries in the Cowichan dictionary of TT t-PROGs where T2 is a velar stop, four are marked as ambiguous. This leans some support back to his generalization. Let's see how one more scholar generalizes this phenomenon.

Jones (1978) cited by Urbanczyk (2011), says

> ... vowel appearing in [+*progressive*] forms is conditioned by the second consonant of the root. The vowel appears as /a/ if [T]2 is a labialized back stop, /k^w, $\dot{k}^w$, q^w, $\dot{q}^w$/, or a labialized uvular fricative, /$\check{x}^w$/…" (p. 39).

This puts Jones and Suttles in disagreement, with Jones saying that velar stops participate in this ablaut, and Suttles saying that they do not. The data agrees with both of them in regard to velar fricatives being excluded from this phenomenon. So, what about velar stops? The data for velar stops is ambiguous, which seems to reconcile their difference of opinion. This poses the question: What feature(s) are common to uvular stops and fricatives, and *sometimes* velar stops? Answering this question is crucial for a clean OT analysis, lest one of the constraints be "*the vowel appears as /a/ if T2 is /q^w, $\dot{q}^w$, $\check{x}^w$/ and sometimes /k^w, $\dot{k}^w$/, otherwise it is /e/.*"

Suttles (2011) provides the following information on the phonology:

Velars:

> "/x/ is a strongly palatalized front velar spirant, phonetically [x^y]. It is the reflex of Proto-Salish *x, which has become /š/ in Island dialects of Halkomelem and in neighbouring Coast Salish Languages." "/k/ is a plain, and /$\dot{k}$/ a glottalized, unrounded front velar stop. These are less strongly palatalized than the spirant," and "Labialized velars. /k^w/, /$\dot{k}^w$/ and /x^w/ are, respectively, a plain stop, glottalized stop, and a spirant […] accompanied throughout by the lip-rounding of /w/." (p. 7)

Uvulars:

> "/q/ and /$\dot{q}$/ are a plain and glottalized stop produced further back than English /k/, probably varying in place of articulation from uvular to back velar. The limited occurrence of /k/ and /$\dot{k}$/ may permit a wider range of articulation than might be permitted otherwise." and "Labialized uvulars. /q^w/, /$\dot{q}^w$/, and /$\check{x}^w$/ have a uvular or near-uvular place of articulation and are accompanied throughout by lip rounding. /q^w/ and /$\dot{q}^w$/ are not always easily distinguished from /k^w/ and /$\dot{k}^w$/ but the uvulars have a different resonance produced by a different shape of the oral chamber and there may be some uvular friction. /$\check{x}^w$/

> is more easily distinguished from /xʷ/ because of its more audible friction or uvular vibration." (p. 8)

Vowels:

> "The /e/ is realized as a low to mid-front vowel, [ɛ] or high [æ]. The /a/ is low and central to back, usually close to [ɑ]." And "The schwa phoneme /ə/ when stressed appears in most environments as a mid-central [;], but before /x/ it is fronted and higher, approaching [i]; before /y/ it is also fronted, approaching [ɛ]; before /w/ it is lower and back, approaching [ɑ]; and before rounded velars it seems mid-back, toward [o]." (p. 9-10)

This provides little guidance in determining common features, but I'm going to try by making some assumptions. The first assumption is that there must be a feature that is not common between /a/ and /e/. That appears to be backness, where /e/ is [+ATR] and /a/ is [-ATR], i.e., front and back respectively. The velar fricative /x/ is said to be palatal (high) and front (I assume the labialized counterpart is likewise front), having become /š/ in some dialects. Suttles also says that /x̌ʷ/ is more easily distinguished from /xʷ/, which has me more comfortable in distinguishing it this way, resulting in it patterning with the palatal fricative /č/ rather than /x̌ʷ/. For these reasons I assume that /x/, /xʷ/, and /e/ are commonly [+front].

Before moving on to distinguishing velar from uvular, and labialized from non-labialized, I need to additionally point out that there are no TT plain, transitive or t-PROG verbs where T2 is /k/, /k̓/ or /x/. There are entries for TT verbs (of each inflectional form) where T2 is any of /q/ /q̓/, and /x̌/, all preceded by /e/ in the TT t-PROG, as predicted by all generalizations presented thus far. I'm not entirely sure what role that has to play, but should be made clear in case someone use this to further their own work).

Back to distinguishing between place. In a footnote, Suttles says that there is a wider range in place of articulation for both the velar and uvulars, indicating that velars as identified in the orthography by /k/ and /k̓/ could be ambiguous in place, as is the inflected t-PROG from where one of those are T2, which could indicate causation. He does however distinguish velars [+front] and uvulars as [+back]. Therefore, I will assume velar stops to be [±back] and uvular stops and fricatives [+back].

Based on Suttles' explanation that a stressed schwa is raised before a velar fricative ([+high]), mid before a rounded velar, and low before a /w/, I will boldly assume that labialization also causes lowering in tongue height. This results in the following: plain velar and uvular stops are [-low], plain and labialized velar fricatives are [-low], and labialized uvular and velar stops are [+low], /e/ is [-low] and /a/ is [+low].

In conclusion, the generalization I propose is that the vowel and T2 in Hul'q'umi'num' TT t-PROG verbs must agree in place.

Research Question: What constraints and ranking determines transitive progressive (t-PROG) verb outputs with correct ablaut?

I propose the following constraints:

- **IDENT(IO):** Assign one violation for every consonant in the output whose feature is not equal to the corresponding consonant in the input. (Faithfulness)
- ***ə:** Assign one violation for every schwa in the output
- **AGREE(Height):** Assign one violation for every VT pair that disagree in height. (Markedness)
- **AGREE(Back):** Assign one fatal violation for any VT pair that reliably disagree in backness. Assign one non-fatal violation for any VT pair that may agree/disagree in backness. (Markedness)

As mentioned above, there are no instances of TT t-PROG verbs where T2 is a plain velar. (4) shows examples of TT t-PROG verbs where T2 is a labialized velar stop (a-d) and fricative (e-f).

(4)		Plain	Gloss	t-PROG	Gloss
	a.	pəkʷ	'dust: dust, flour spreads'	pe̓kʷt	'dusting it: making dust'
	b.	pəkʷ	'dust: dust, flour spreads'	pa̓kʷt	'dusting it: making dust'
	c.	θəkʷ	'stretched taut'	θe̓kʷt	'taughtening it, stretching it taut'
	d.	θəkʷ	'stretched taut'	θa̓kʷt	'taughtening it, stretching it taut'
	e.	c̓əxʷ	'more, increase'	c̓exʷt	'more: adding more to it'
	f.	θəxʷ	'disappear into the horizon (or for an unlimited time)'	θexʷt	'making it disappear, ending it'

4a,b and 4c,d each share a root, and the same meaning for the t-PROG output, though the surface forms differ by vowel /a/ ~ /e/, indicating ambiguity. 4e and 4f both surface with /e/ before the labialized velar fricative.

(5)		Plain	Gloss	t-PROG	Gloss
	a.	šəq	'finished (with work)'	šeqt	'finishing it'
	b.	θq̓ət*	'spear it'	θeq̓t	'spearing it'
	c.	θx̌ət*	'push it'	θex̌t	'pushing it'

*Plain forms aren't in dictionary and have been replaced here with transitive verbs

(5) shows TT t-PROG verbs where T2 is a uvular stop (a,b) and uvular fricative (c). (6) shows TT t-PROG verbs where T2 is labialized a uvular stop (a,b) and labialized uvular fricative (c).

(6)		Plain	Gloss	t-PROG	Gloss
	a.	c̓əq̓^{w}	'pierced, shot'	c̓aq̓^{w}t	'piercing it, shooting it'
	b.	pq^{w}at*	'break (substance)'	paq^{w}t	'breaking (substance) it'
	c.	łəx̌^{w}	'flow, come out (speak)'	łax̌^{w}t	'spitting'

Data in (4)-(6) are from the Cowichan Dictionary (Hukari & Peter 1995) and are in APA orthography.

Tableaux 7-14 illustrate the rankings for **AGREE(Height)** and **AGREE(Back).** This ranking is only crucial in the case of plain uvulars due to the place values I've assigned above.

(7)

/c̓əx^{w}t/	**AGREE(Height)**	**AGREE(Back)**
☞ a. c̓ex^{w}t		
b. c̓ax^{w}t	*!	*

(8)

/c̓əx^{w}t/	**AGREE(Back)**	**AGREE(Height)**
☞ a. c̓ex^{w}t		
b. c̓ax^{w}t	*!	*

(9)

/ pəkʷt/	**AGREE(Back)**	**AGREE(Height)**
☞ a. pe̤kʷt	*	*
☞ b. pakʷt	*	

(10)

/ pəkʷt/	**AGREE(Height)**	**AGREE(Back)**
☞ a. pe̤kʷt	*	*
☞ b. pakʷt		*

In tableaux 9 and 10, it is shown that height will be fatal if only one of candidates violates **AGREE(Back)**.

(11)

/c̤əq̤ʷt/	**AGREE(Height)**	**AGREE(Back)**
☞ a. c̤aq̤ʷt		
b. c̤eq̤ʷt	*!	*

(12)

/c̤əq̤ʷt/	**AGREE(Back)**	**AGREE(Height)**
☞ a. c̤aq̤ʷt		
b. c̤eq̤ʷt	*!	*

(13)

/ θəq̤t /	**AGREE(Back)**	**AGREE(Height)**
a. θeq̤t	*!	
☞!b. θaq̤t		*

(14)

/ θəq̤t /	**AGREE(Height)**	**AGREE(Back)**
☞ a. θeq̤t		*
b. θaq̤t	*!	

Tableaux 7-14 show that the constraint ranking must crucially be **AGREE(Height) >> AGREE(Back), though** in the case of /kʷ/, height and back might both win. Tableaux 15 and 16 shows a crucial ranking of **IDENT(IO) >> AGREE(Height)**.

(15)

/pəkʼʷt/	**AGREE(Height)**	**IDENT(IO)**
a. pekʼʷt	*!	
☞!b. pekʼt		*

(16)

/pəkʼʷt/	**IDENT(IO)**	**AGREE(Height)**
☞a. pekʼʷt		*
b. pekʼt	*!	

Tableaux 17 and 18 shows a crucial ranking of ***ə >> IDENT(IO)**.

(17)

/łəx̌ʷt/	**IDENT(IO)**	***ə**
☞!a. łax̌ʷt	*!	
b. łəx̌ʷt		*

(18)

/łəx̌ʷt/	***ə**	**IDENT(IO)**
☞ a. łax̌ʷt		*
b. łəx̌ʷt	*!	

Together, these give us the constraint ranking of: ***ə >> IDENT(IO) >> AGREE(Height) >> AGREE(Back)**. Summary tableaux 19-21 illustrate this in the cases of T2 being a labialized velar stop, labialized velar fricative, and plain uvular stop.

(19)

/θəxʷt/	*ə	IDENT(IO)	AGREE(Height)	AGREE(Back)
☞ a. θexʷt				
b. θaxʷt			*!	*
c. θəxʷt	*!			
d. θext		*!		
e. θaxt		*!	*	*
f. θəxt	*!	*		

(20)

/pə̓kʷt/	*ə	IDENT(IO)	AGREE(Height)	AGREE(Back)
☞ a. pe̓kʷt			*	
☞ b. pa̓kʷt				*
c. pə̓kʷt	*!		*	*
d. pe̓kt		*!		
e. pa̓kt		*!	*	*
f. pə̓kt	*!	*		

(21)

/θəq̓t/	*ə	IDENT(IO)	AGREE(Height)	AGREE(Back)
☞ a. θeq̓t				*
b. θaq̓t			*!	
c. θəq̓t	*!			*
d. θeq̓ʷt		*!	*	*
e. θaq̓ʷt		*!		
f. θəq̓ʷt	*!	*	*	*

This are limited number of TT t-PROG verbs where T2 is a back obstruent. Therefore, it is with trepidation that I assume this constraint ranking to be correct. There is also work to be done on tongue position with contrasting back obstruents. It will help to do ultrasound research to determine contrasting height and backness features for labialized vs non-labialized back obstruents.

Jones (1978) and Urbanczyk (2011) both note that this phenomenon can occur in other inflectional forms such as with an /-əm/ suffix. It would be worthwhile investigating other inflectional forms, both to see if it's less restricted than only to transitive verbs, but also to get a larger dataset.

This analysis reconciled three contradictory generalizations of ablaut in TT t-PROG verbs. It did so by rationalizing freedom of place for velar stops, excluding velar fricatives from back obstruents, and associating labialized back obstruents with [+low]. Future research should take note that the labialized velar fricative patterns differently than the other back obstruents, and labialized velar stop ambiguously. That seems to have been overlooked by the three scholars whose work was referenced early on. I am unsure of the implications that has elsewhere in the phonology, though that leaves a trove of potential research that can be undertaken.

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Appendix A

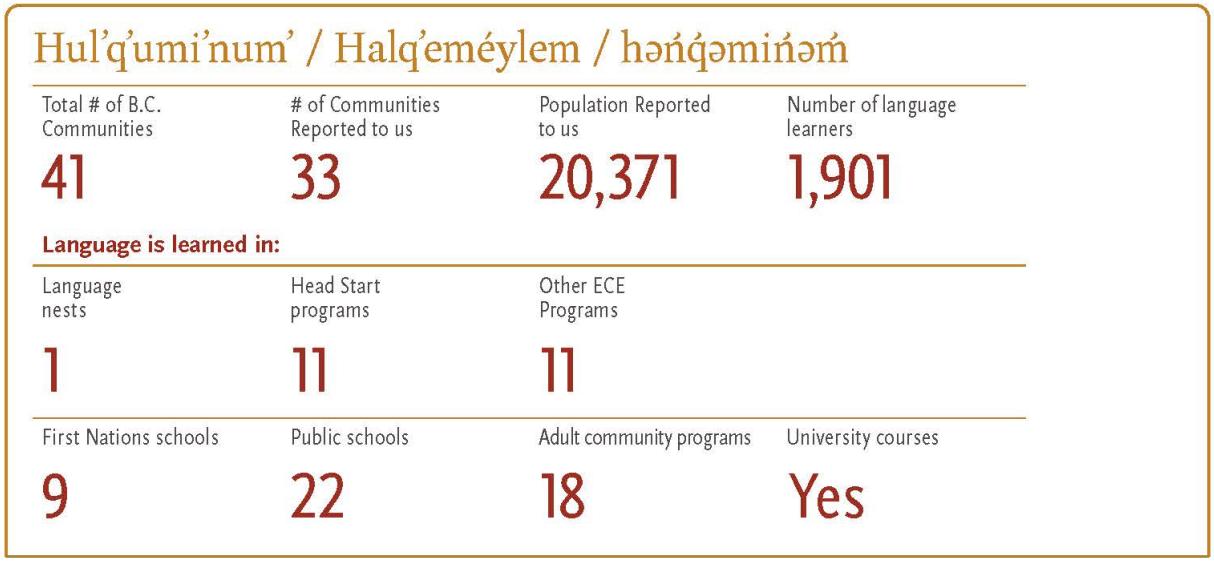
Map illustrating the areas in which the hul'q'umi'num', hən̓q̓əmin̓əm̓ and Halq̓eméylem dialects are spoken.

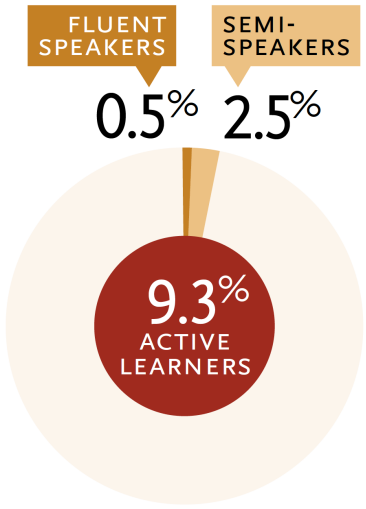
Zhang, n.d.

Appendix B

Speaker Statistics for Hul'q'umi'num', Halq'eméylem, and hən̓q̓əmin̓əm̓ (FPCC, 2022)

B.C. First Nations Language	Response Rate[34]	2022 REPORT		
		Number of Fluent Speakers	Number of Semi-speakers	Total Speakers
Hul'q'umi'num' / Halq'eméylem / hən̓q̓əmin̓əm̓	33/41	105	512	617





Appendix C

Hul'q'umi'num' Sound Inventory (Bianco, 1996)

(1) **Consonant Phonemic Inventory**[3]

Stops	p	t^{θ}	t	c	č		k	k^{w}	q	q^{w}	
	p'	$t^{\theta'}$	t'	c'	č'	ƛ'		$k^{w'}$	q'	$q^{w'}$	
Fricatives		θ	s		š	ɬ		x^{w}	χ	$χ^{w}$	
Sonorants	m		n		y	l		w			h
	m'		n'		y'	l'		w'			ʔ

Vowel Phonemic Inventory

i (ii)		u (uu)
e (ee)	(ə)	
		a (aa)

Appendix D

Allomorphs of different bases (Urbanczyk, 2011, p. 479).

(9) Summary

Allomorph	Base
CV-	CVC…
Cə-	TəC, TəH, CV:C
hə́-	Rə́C…
Ablaut	Tə́CC…
Stress shift + metathesis	TTAT
Stress shift + epenthesis	CCVC
Schwa deletion	TATəTəm
Resonant glottalization	All non-initial resonants