Phonetic, Phonological, and Morphological Sources of Vowel Reduplication: The Innovation of V_1 Reduplication in Salish[*]

Gloria Mellesmoen
University of British Columbia

Abstract: Examination of Salish reduplication often focuses on three core patterns: C_1C_2, C_1, and C_2 reduplication. Descriptions of individual languages also include vowel (V_1) reduplication, though little is known about the synchronic status and diachronic development of V_1 reduplication in Salish. In this paper, I provide an overview of attested V_1 reduplication patterns in Salish and evaluate the synchronic and diachronic status of this fourth reduplicant shape in the language family. Previously described V_1 reduplication patterns fall into three categories: (i) $V{:}$ patterns (vowel length), (ii) V…V patterns (non-adjacent copies), and (iii) VʔV patterns (near-adjacent copies). I detail a diachronic trajectory that results in the innovation of V_1 reduplication. I argue that V_1 reduplication is an innovation that has emerged due to a combination of certain phonetic (echo vowels), phonological (translaryngeal harmony), and morphological (presence of -ʔ-) properties found across the family. Differences between languages with V_1 patterns reflect different stages of the trajectory.

Keywords: vowel (V_1) reduplication, historical Salish, innovation, non-concatenative morphology

1 Introduction

Reduplication is present in all 23 Salish languages. Vowel (V_1) reduplication is attested in certain Salish languages, including Comox-Sliammon (e.g., Mellesmoen et al. 2020) and Coeur d'Alene (e.g., Reichard 1938).[1] Despite reports of V_1 reduplication in twelve languages, across different branches of the family, it has not featured in typological overviews (e.g., Kinkade & Czaykowska-Higgins 1998). Based on available descriptions of individual languages, little can be said about the synchronic typology or diachronic status of V_1 reduplication in Salish.

I outline the broad typology of reduplicative morphemes in Salish in Section 2 before establishing the synchronic distribution of V_1 reduplication in Section 3. Patterns that fall under the umbrella of V_1 reduplication in Salish include (i) $V{:}$ patterns (vowel length), (ii) V…V patterns (non-adjacent copies), and (iii) VʔV patterns (near-adjacent copies). In Section 4, I consider the possible origin of the VʔV patterns which connects the innovation of V_1 reduplication to other phonetic, phonological, and morphological properties of Salish languages. Section 5 concludes.

2 Reduplication in Salish

There are four main reduplication types in Salish: C_1C_2 reduplication, C_1 reduplication, C_2 reduplication, and V_1 reduplication. Examples of each type of reduplication in Comox-Sliammon are provided in Table 1.[2]

---

[1] To facilitate cross-linguistic comparison across dialects and different sources, I use the exonyms standard in Salish historical linguistics.

[2] As shown in Table 1, V_1 reduplication always occurs in combination with another type of reduplication. Examples in this table come from fieldwork with Elsie Paul and Freddie Louie. I am very grateful to them for their time and patience, as well as for teaching me about their language.

Table 1: Four reduplicant shapes in Comox-Sliammon

Word	C_1C_2	C_1	C_2	V_1
supayu	*səpsupayu*	*suspayu*		*suʔuspayu*
'axe'	'axes'	'little axe'		'little axes'
tih	*tihtih*		*tihih*	
'big'	'big (PL)'		'got big'	
ʔimaš	*ʔəmʔimaš*	*ʔiʔimaš*		
'walk'	'walking (around)'	'walking'		

The labels refer to which segments are copied and abstract away from cross-Salish variation in vowel presence and quality (with C_1C_2, C_1, and C_2 reduplication), or with epenthetic consonants (with V_1 reduplication). Languages can have more than one morpheme within each category. For example, Comox-Sliammon has three types of C_1 reduplication (see, e.g., Watanabe 2003): diminutive (e.g., *suspayu* 'little axe'), imperfective (e.g., *ʔiʔimaš* 'walking'), and plural (*ʔaʔmut* 'they are at home'). The total number of distinct reduplicative morphemes in any given Salish language, as well as across Salish, is therefore not limited to four. In fact, Kirkham (1993) used a similar four-way distinction to classify seven unique reduplicative morphemes in Lushootseed.[3]

While Kirkham (1993) recognizes vowel reduplication as part of the typology of reduplicative patterns, the inclusion of V_1 reduplication is a departure from most other descriptions of Salish reduplication; only C_1C_2 reduplication, C_1 reduplication, and C_2 reduplication processes are typically included (e.g., Kroeber 1999).

I define vowel reduplication patterns in this paper as instances where a vowel is copied independent of any copied consonants (i.e., any consonant associated with the reduplication is a fixed or epenthetic segment). V_1 reduplication is more marginal than the other three types of reduplication; its presence versus absence (within a language), inclusion in different language descriptions, and apparent productivity are more variable. Previous descriptions of V_1 reduplication are summarized in the next section.

3 V_1 reduplication in Salish from a synchronic perspective

V_1 reduplication occurs in fewer Salish languages than the other three types of reduplication (C_1C_2, C_1, and C_2). It has been described in twelve languages (three Southern Interior languages, five Central Salish languages, two Tsamosan languages, Bella Coola, and Tillamook). The distribution of V_1 reduplication across different sources is summarized in Table 2. I set Nooksack aside because it is restricted to a single lexical item.[4]

---

[3] I diverge from Kirkham (1993) in notation and use the labels C_1 reduplication, C_1C_2 reduplication, C_2 reduplication, and V_1 reduplication instead of CV, CVC, VC, and V to better capture the similarities and abstract over differences to facilitate cross-Salish comparison.

[4] Galloway (1984) includes an entry "ʔ//-ʔV//" which he speculates may refer to plural actors. He provides a single example, given in (i). Compare this with the Lushootseed word in (ii), which has a similar form but lacks reduplication.

(i)   *čǽ<ʔæ>x̌* (cf. *čæx̌* 'play')
       'in a bunch playing'   (Galloway 1984:83)

(ii)   *čáʔa*
       'play(ing)'   (Bates et al. 1994:339)

Table 2: Summary of V$_1$ reduplication patterns in the literature

	Language	Source	Function
Interior Salish	Coeur d'Alene	Reichard (1938)	Inchoative
	Okanagan	Watkins (1970)	Inchoative
	Kalispel-Spokane-Montana Salish	Vogt (1940) / Thomason (1997)	Inchoative, Plural
Central Salish	Lushootseed	Hess (1967)	Plural
	Comox-Sliammon	Watanabe (2003) / fieldwork	Plural
	Twana	Drachman (1969)	*unclear*
	Northern Straits	Raffo (1972)	Aspectual
	Nooksack	Galloway (1984)	*unclear*
Tsamosan	Quinault	Modrow (1971)	Comparative
	Lower Chehalis	Robertson (2014)	Plural
	Bella Coola	Nater (1984)	Diminutive
	Tillamook	Edel (1939)	*unclear*

V$_1$ reduplication in Salish can be categorized into three major types based on their surface form: (i) VʔV patterns (adjacent copies), (ii) Vː (non-adjacent copies), and (iii) V…V patterns (near-adjacent copies). The three types are summarized in (1).

(1) | Type | Realization |

VʔV   vowel and copy separated with a glottal stop that would not otherwise be present
Vː   long vowel
VCV   vowel and copy separated by a segment that does not participate in reduplication

Table 3 provides an overview of which types are present in each of the languages, based on previous descriptions. Eight of the ten vowel reduplication patterns proposed in Salish fall into the VʔV pattern. There are two examples of Vː reduplication and one example of V…V reduplication.

Table 3: Categorization of V$_1$ reduplication patterns in the literature

	Language	Function	Category
Interior Salish	Coeur d'Alene	Inchoative	VʔV
	Okanagan	Inchoative	VʔV
	Kalispel-Spokane-Montana Salish	Inchoative, Plural	VʔV
Central Salish	Lushootseed	Plural	Vː
	Comox-Sliammon	Plural	VʔV
	Twana	*unclear*	VʔV
	Straits (Songish)	Aspectual	VʔV
Tsamosan	Quinault	Comparative	VʔV
	Lower Chehalis	Plural	V…V
	Bella Coola	Diminutive	Vː
	Tillamook	*unclear*	VʔV

In the sections 3.1 to 3.3, I summarise each subtype with illustrative examples and discuss other morphemes that belong in that category, in addition to the ones explicitly labeled as reduplication in previous descriptions.

3.1 Adjacent copies (V:): vowel length

V_1 reduplication may result in two adjacent copies of the vowel; however, two adjacent vowels may be realized as a long vowel (V:). The V: pattern is found in Bella Coola, as described by Nater (1984) and Lushootseed, as described by Hess (1967) and Bates et al. (1994). I provide examples from Lushootseed in (2), where V_1 reduplication is associated with plurality.[5]

(2)   Lushootseed plural V_1 reduplication

a.	*stúutubš*	'boys' (cf. *stubš* 'man')	(pg. 229)
b.	*tiiʔił*	'those' (cf. *tiʔił* 'that')	(pg. 228)
c.	*šaadᶻal*	'several go outside' (cf. *šədᶻál* 'go outside')	(pg. 210)
d.	*słáaładəyʔ*	'girls' (cf. *sládəyʔ* 'woman')	(pg. 141)
e.	*gʷáadgʷad*	'talk, converse' (cf. *gʷəgʷá(d)txʷ* 'berate/scold someone')	(pg. 96)
f.	*háadᶻ-adiʔ*	'long(sided house)' (cf. *ʔiłs(h)ádᶻəb* 'taller')	(pg. 106)

(Bates et al. 1994)

The V: pattern of V_1 reduplication can also be described as vowel lengthening, which is part of the grammar of certain Salish languages. For example, the V: pattern in Lushootseed bears resemblance to the lengthening that marks diminutive in Tsamosan (see Mellesmoen 2022 for an analysis of Upper Chehalis diminutives). Examples from Upper Chehalis and one from Cowlitz are provided in (3a) and (3b), respectively.

(3)   Tsamosan diminutive V:

a.	*latá:m* (cf. *latám*)	'little table'	Upper Chehalis	
b.	*ʔé:mχkʷu* (cf. *ʔə́mχkʷu*)	'little cedar-basket'	Cowlitz	(Kinkade 1993a:15)

The fact that the pattern in Lushootseed in (2) is labelled as reduplication and the one in Tsamosan in (3) is labelled as vowel lengthening raises the following question: do these patterns involve different phonological processes and, if so, is there a structural difference between a doubled and a lengthened vowel? Assuming that reduplication is triggered by prosodic affixation (e.g., McCarthy & Prince 1994), vowel reduplication and lengthening each are analyzed as the addition of a mora. Cross-linguistic work on reduplication has included both consonant gemination and vowel lengthening as examples of reduplication (Rubino 2005), which supports the inclusion of V: patterns in this overview of patterns of vowel reduplication in Salish. Future work on vowel reduplication should explore lengthening processes across Salish languages.

---

[5] The vowel is doubled in the examples, which is identical to how long vowels are transcribed for the language. As there is no evidence for another analysis (e.g., an intervening glottal stop), I analyze this as a doubled vowel realized as a long vowel (/VV/ > [V:]). Urbanczyk (1996:31) chooses to set this type of reduplication aside in her dissertation, highlighting similar questions about its realization that make it unclear if it should be considered as reduplication *or* the addition of a mora. Crucially, her theoretical approach does not assume the affixation of prosodic units triggers reduplication. Both options can be classified as reduplication in my approach because the addition of a mora can trigger reduplication.

3.2 Non-adjacent copies (V…V): copies separated by other segments

A copied vowel may appear in a non-adjacent position relative to a base, such that at least one segment stands between a vowel and its copy V…V, excluding cases where the intervening segment is a glottal stop that is part of the same morpheme as the reduplication or if the reduplication of the vowel triggers epenthesis (see Section 3.3).

Plural V_1 reduplication in Lower Chehalis is an example of non-adjacent vowel reduplication. The examples in (4) from Robertson (2014) show the root vowel is reduplicated and positioned after the second consonant of the root. Infixation occurs with longer roots, as shown in (4c). A glottal stop follows the reduplicated vowel.[6] This is a V…V pattern because the vowel and its copy are separated by segmental content that does not participate in reduplication (e.g., /ɬ/ in 5a).

(4)   Lower Chehalis plural V_1 reduplication

    a.   *cúɬ~uʔ*
       foot~PL
       'feet'

    b.   *x̣á<ʔ>q~aʔ*
       child<PL>~PL
       'children'

    c.   *c̓í<ʔ>k̓ʷ<iʔ>t*
       light<PL><PL>
       'lamps, lights'   (Robertson 2014:119)

Robertson (2014:118–119) considers whether this pattern is best categorized as vowel harmony or reduplication, concluding that reduplication is the better analysis, even though vowel reduplication is "very rare crosslinguistically and not previously described in Salish". Potential ambiguity between patterns of vowel harmony and reduplication also extend to another widespread pattern in Salish: transitivizer vowels. Across many Salish languages, the quality of the vowel in a transitivizing suffix is determined by the vowel in the stem. Examples from Comox-Sliammon (Watanabe 2003), Squamish (Jacobs 2012), and Lillooet (Van Eijk 1997) are provided in (5) to (7).[7] The vowel associated with the transitivizing suffix in each of these examples is a copy of the root vowel.[8]

(5)   Comox-Sliammon transitive -Vt (V…V pattern)

    a.   *θap-at*   'bathe it'
    b.   *hig-it*   'burn in'
    c.   *wut-ut*   'bend it'   (Watanabe 2003:214–215)

---

[6] An additional infixed glottal stop is also present in (4b,c).

[7] While translations in (6) do not suggest transitivity, these forms are transitive. The translations given here come directly from Dyck (2004:290).

[8] The full pattern is more complicated: for example, the transitivizer may have no vowel, rather than a copy, when added to a schwa-based root in Squamish (Dyck 2004:290).

(6)   Squamish transitive -Vt (V…V pattern)

    a.   *čáw-at*   'help'
    b.   *cíxʷ-it*   'reach'
    c.   *šúkʷut*   'bathe'   (Dyck 2004:290)

(7)   Lillooet transitive -Vn/-Vṅ (V…V pattern)

    a.   *ḱáx̣-aṅ*   'to dry smth.'
    b.   *níḱ-iṅ*   'to cut smth.'
    c.   *púɬ-uṅ*   'to boil smth.'   (Van Eijk 1997:110)

Link vowels have not typically been labelled as reduplication in previous work. For example, Jacobs (2012) describes the process as vowel harmony. The difference between vowel harmony and reduplication relies on phonological analysis. If the transitivizer has an underlying vowel that receives place features from the root vowel, harmony is the better analysis. However, if the vowel associated with the transitivizer is not present underlyingly, it must be either epenthetic or reduplicated. Epenthesis of a vowel with the same quality as the root vowel or the reduplication of the root vowel yields the same surface form. Given that epenthesis of non-[ə] vowels is typically more restricted (e.g., [u] would be unexpected as an epenthetic vowel across the family), the reduplication analysis is more consistent with the grammar of epenthesis (relative to reduplication) in Salish. Future work on vowel reduplication should explore morpheme-triggered vowel harmony processes across Salish languages.

3.3   Near-adjacent copies (VʔV): copies separated by other Segments

The most common type of V_1 reduplication in the literature involves a near-adjacent copy of the vowel, such that the two identical vowels that are *only* separated by a glottal stop (VʔV). Glottal stops in VʔV reduplication are either epenthetic to avoid vowel hiatus or are present in the input as part of the morpheme triggering reduplication. VʔV reduplication differs from V…V reduplication with respect to the source of the intervening vowel: the glottal stop in VʔV reduplication is only present because a morpheme was added, while an intervening glottal stop in V…V reduplication would be present without the reduplicative morpheme.

The VʔV pattern of V_1 reduplication has been described in eight languages, including three Southern Interior Salish languages (Okanagan, Kalispel-Spokane-Montana Salish, Coeur d'Alene), three Central Salish languages (Comox-Sliammon, Twana, and Northern Straits), one Tsamosan language (Quinault), and Tillamook. I discuss Interior Salish in Section 3.3.1 and Central Salish in 3.3.2. I set Tillamook, Quinault, and Twana aside because the available data are quite limited and further work would be needed to explore the V_1 reduplication in each of the languages.[9]

3.3.1   VʔV in Southern Interior Salish

V_1 reduplication is associated with an inchoative function in three Southern Interior Salish languages. The Kalispel-Spokane-Montana Salish varieties have both an inchoative V_1 and a plural

---

[9] Drachman (1969) states that V_1 reduplication in Twana is associated with a diminutive. However, a copied vowel also appears following roots of shape CVʔ- (i.e., a V…V pattern) without diminutive marking, so Drachman's (1969) examples do not provide enough context or a translation to determine when and where a diminutive is present.

V₁ reduplication process marking plurality, shown in (8) and (9), respectively. Vogt (1940) distinguishes them by reference to stress: the inchoative copies a stem vowel, while the plural copies a stressed vowel.

(8)　Kalispel (Kalispel-Spokane-Montana Salish) inchoative V₁

    a.　*naʔás*　　'He gets wet' (cf. *nas* 'wet')
    b.　*qʷuʔúł*　'He gets dusty.' (cf. *qʷuł* 'dusty')　　　　　　(Vogt 1940:64)

(9)　Montana Salish (Kalispel-Spokane-Montana Salish) plural V₁

    a.　*čłíʔip*　　'They hunted something.'
    b.　*čłpʔntéʔes* 'They hunted it.'
    c.　*cíʔitxʷs*　'Their house.'
    d.　*nx̣éʔesls*　'They're happy.'　　　　　　　　　(Thomason 1997:354)

    V₁ reduplication shown in (8) and (9) corresponds to an infixed -ʔ- in Carlson and Flett's (1989) Spokane dictionary in the same position, but without a copied vowel. For example, the word *čłíʔip* in (9a) corresponds to *čłíʔp* in Carlson and Flett (1989:204). It is possible that dialect differences may play a role, as Thomason (1997) is describing Montana Salish and Carlson and Flett (1989) are describing Spokane. However, while Carlson (1972:10) does not transcribe plurals or inchoatives with an extra vowel, he acknowledges that there is an "aspirated release[, which] is heard of as a voiceless vowel of the same quality" as the stressed vowel in a V́ʔ sequence. Therefore, the accounts do converge on a surface vowel following a glottal stop, even if this vowel is not transcribed in the dictionary forms.
    Watkins (1970) includes V₁ reduplication in his account of Okanagan. Though V₁ reduplication is transcribed as two adjacent vowels, Watkins (1970:35–36) clarifies that all VV sequences "are separated in articulation by [a glottal closure] when the second member [bears primary stress]".

(10)　Okanagan inchoative V₁

    a.　*knłaʔát́*　　'I got wet.' (cf. *łat́* 'It is wet.')　　　　(pg. 107)
    b.　*qʷaʔác*　　'It is getting warm.' (cf. *qʷacqʷəct* 'warm weather')　(pg. 100)
    c.　*q̓ʷuʔúc*　　'He's getting fat.' (cf. *sq̓ʷuct* 'fat')　　　(pg. 65)
　　　　　　　　　　　　　　　　　　　　　　　　　　　(Watkins 1970)

    While V₁ reduplication is not explicitly described in other sources, the Colville-Okanagan dictionary records two forms for some inchoatives, one with just an infixed -ʔ- and one with an infixed -Vʔ- sequence where the vowel has the same quality as the stressed vowel (Mattina 1987). Examples are given in (11).

(11)　Variable forms of Okanagan inchoatives

    a.　*ciʔíx ~ cʔix*　　　'it gets warm'
    b.　*spuʔúl̓ ~ spʔul̓*　'smoke from a fire'　　　　　　(Mattina 1987:12,134)

    Reichard (1938) also describes V₁ reduplication in Coeur d'Alene, which marks an inchoative, as in Kalispel-Spokane-Montana Salish and Okanagan. Examples are given in (12).

(12) Coeur d'Alene inchoative V$_1$

    a.   *hənta\?axálp*   'I felt pungency.'
    b.   *hənta\?ašálp*   'I felt sweetness.'

                       (Reichard 1938, as cited/transcribed in Barthmaier 1996:22)

The transcription and vowel system used by Reichard (1938) has been a point of debate among researchers. Sloat (1968) notes that her decision to write down echo vowels is misguided, because they are predictable. He concludes that the small, raised vowels she includes "may be omitted from her transcriptions without loss of information" (Sloat 1968:10). Additionally, he suggests that Reichard "has quite misrepresented the inceptive morpheme of certain roots" and further proposes that "the repeated vowel should be omitted from all such forms" (Sloat 1968:11). However, Reichard (1938) transcribes the inchoative vowels differently than typical echo vowels in her transcription (V'V vs. V'ᵛ) and distinguishes them in labels (echo vowel vs. medial reduplication).

Overall, V$_1$ reduplication in these three Southern Interior Salish languages are similar in form (V\?V) and meaning (inchoative), with Kalispel-Spokane-Montana Salish having a second V$_1$ process marking a plural. For each language, there is also uncertainty regarding the status of the vowel associated with the inchoative: does it have a phonetic, phonological, or morphological source? The uncertainty surrounding the status of the vowel in Southern Interior Salish will be a central part of the diachronic discussion in Section 4.

3.3.2   V\?V in Central Salish

V\?V reduplication has been found in Comox-Sliammon and Songish. It marks plurality in Comox-Sliammon and "actual" (imperfective) aspect in Songish. Examples from Comox-Sliammon are provided in (13). It is typically found in combination with another type of reduplication. Unlike in other languages, there is consensus across descriptions of Comox-Sliammon: the forms in (13) involve a reduplicated vowel (CV\?V reduplication in Watanabe 2003, C reduplication + a misaligned L'- prefix which surfaces as a V\? sequence in Blake 2000, and C$_1$ + V$_1$ reduplication in Mellesmoen et al. 2020).

(13) Comox-Sliammon plural V$_1$ reduplication

    a.   *pa\?apya\?*   'one by one' (cf. *papya\?* 'just one')
    b.   *sa\?asya\?*   'two by two' (cf. *sasya\?* 'just two')
    c.   *ƛ̓a\?aƛ̓ak̓ʷ*   'flickering on and off' (cf. *ƛ̓ak̓ʷit* 'extinguished')

                             (Mellesmoen et al. 2020:75,79)

Raffo (1972) includes vowel reduplication in her description of the actual aspect in the Songish dialect of Straits, as shown in (14). Vowel reduplication can accompany an infixed -\?-, which is one of the allomorphs of the actual.

(14) Northern Straits (Songish) aspectual V$_1$ reduplication

    a.   *x̣é\?ec̓-*   'weighing'
    b.   *hé\?ek̓ʷ-*   'remembering'
    c.   *x̣á\?a-*   'crying'   (Raffo 1972:22)

It is hard to draw conclusions about whether the vowel is phonologically or lexically conditioned in the Songish variety of Northern Straits, as the given examples are provided are not full words. This potential type of reduplication has not been described for other dialects of Northern Straits, where this allomorph of the actual would just be analyzed as a fixed segmental affix (-ʔ-). This pattern resembles the Southern Interior inchoatives, where the status of the vowel (phonetic, phonological, morphological) is unclear, rather than Comox-Sliammon, where the status of the vowel is quite clear.

3.4   Summary: types of V_1 reduplication

Patterns previously described as vowel reduplication fall into three categories determined by surface realization (VʔV, Vː, and V…V). The Vː and V…V patterns raise questions about the relationship between reduplication and other phonological processes, such as lengthening and harmony. If we accept that length is a potential realization of reduplicated vowels, for example, there are other instances of vowel length across the family that could be labelled as V_1 reduplication. Further phonological analysis and exploration of reduplication-adjacent processes is needed. In the next section, I focus on the VʔV patterns in greater detail and use them to sketch out a potential diachronic trajectory that would lead to the innovation of V_1 reduplication in Salish.

4 V_1 reduplication in Salish from a diachronic perspective

V_1 reduplication in Salish is attested across all major branches of the family. When something is found scattered across different branches of a language family, this is often taken as evidence for an old process that descends from an earlier ancestor language (Campbell 2013). In Section 3, I summarized the widespread nature of V_1 reduplication and highlighted how these processes vary across descriptions and how they are associated with different meanings, including aspect, plurality, and diminutivity. The lack of a consistent meaning and differences in surface form suggests that there is no single Proto-Salish morpheme that would correspond to V_1 reduplication. While V_1 reduplication is widespread enough to warrant inclusion in the typology of Salish reduplication, the facts do not support reconstructing V_1 reduplication to Proto-Salish.

V_1 reduplication in Salish is best analyzed as an independent innovation across the family. The fact that V_1 reduplication has emerged in different parts of the family does not support the reconstruction of a Proto-Salish reduplicative morpheme, but instead reflects a combination of certain phonetic, phonological, and morphological properties found across Salish. In fact, some of these factors may be traced back to Proto-Salish.

In this section, I argue that the innovation of V_1 reduplication reflects a common trajectory of diachronic change driven by shared linguistic (phonetic, phonological, and morphological) factors. In sections 4.1 and 4.2, I outline my assumptions about the life cycle of phonological change and propose a trajectory that would allow for the shared innovation of the VʔV pattern of V_1 reduplication across Salish. I detail a phonetic source (echo vowels) in Section 4.3, a phonological source (translaryngeal harmony) in Section 4.4, and a morphological source (glottal stop infix) in Section 4.5. A possible diachronic trajectory is summarized in section 4.6.

4.1   The life cycle of phonological processes

The life cycle of phonological processes connects synchronic processes to diachronic changes (Ramsammy 2015). The life cycle of phonological changes is well-suited to investigations of

closely related languages because microvariation between synchronic grammars can provide insight into diachronic trajectories that have shaped that variation. In fact, one of the central claims of the life cycle of phonological processes is that "the synchronic phonology of one variety may reflect a historical stage of a more advanced dialect or a potential future stage of a more conservative dialect" (Ramsammy 2015:34).

Phonological processes originate as non-cognitively controlled phonetic effects, before undergoing phonologization and becoming cognitively controlled phonetic effects (Bermúdez-Otero 2007).[10] Cognitively controlled phonetic implementation rules may show language-specific patterns. The next step is stabilization, where the new phonological process applies as a phonological rule at the phrase level. There are two stages of domain narrowing: the phonological rule first begins to apply at the word level before eventually applying at the stem level. The final step is either lexicalization or morphologization, where the phonological process is no longer active in the phonology but may become a morphological operation or be crystalized in lexical items. The life cycle is summarized in Table 4.

Table 4: Cycle of change for sound patterns (adapted from Bermúdez-Otero 2007:504)

Stages	Process	Change
Phase I	Phonologization	Cognitively controlled pattern of phonetic implementation emerges from some physical or physiological phenomenon
Phase II	Stabilization	Categorical phonological process emerges (corresponding to Phase I phonetic rule)
Phase III	Domain Narrowing	Reanalysis of categorical phonological pattern (e.g., sensitivity to morphosyntactic structure emerges and domain of application narrows)
Phrase IV	Lexicalization/ Morphologization	Patterns no longer phonologically controlled: become morphological operation *or* lexicalized

Prior to stabilization, the emerging process is gradient and may show varying sensitivity to linguistic and extra-linguistic factors (Ramsammy 2015). Following stabilization, the gradient phonetic process becomes a discrete phonological process, which applies at the phrase domain (i.e., the process behaves like a postlexical rule and may show some degree of variable application). It is only following domain narrowing that the innovated process enters the word and stem domains (and then behaves like a lexical rule). With each instance of domain narrowing, the phonological process is evaluated in a smaller domain, and can interact with morphological edges and structure at or beneath the level of the word.

The process driving domain narrowing is input restructuring (Bermúdez-Otero 2007): the output of a phrase-level phonological grammar can eventually be reinterpreted as the output of the word-level phonological grammar, which drives a reanalysis of the order of phonological processes (and their domain of application). The different stages of the life cycle and the corresponding domains are summarized in Table 5.

---

[10] The terms "phonologization" and "stabilization" are used to distinguish the emergence of gradient phonetic rules from categorical phonological ones. Phonologization here refers specifically to the phonetic rules.

Table 5: Phonetic and phonological domains

(Gradient) Phonetic Rules		(Categorical) Phonological Rules			Lexical Representation
Automatic Phonetic Patterns	Phonetic Implementation	Phrase-Level Phonological Grammar	Word-Level Phonological Grammar	Stem-Level Phonological Grammar	Underlying Form of Lexical Item/Morpheme

Phonologization (Stage I)

Stabilization (Stage II)

Domain Narrowing I (Stage III)

Domain Narrowing (Stage III)

Lexicalization/ Morphologization (Stage IV)

4.2 The life cycle of V_1 reduplication in Salish

Adopting the model of phonological change described by Bermúdez-Otero (2007) and Ramsammy (2015), I analyze the emergence of V_1 reduplication involving the reanalysis and restructuring of phonological patterns that have originated in automatic phonetic patterns.

The descriptions of VʔV reduplication in Section 3.3 describe synchronic microvariation that provides insight into diachronic trajectories. For example, compare vowel reduplication in Comox-Sliammon V_1 reduplication with Songish: aspectual V_1 reduplication in Songish alternates with an infixed -ʔ- (alternating between [ʔV] and [ʔ]), while no alternation is observed in Comox-Sliammon (always [ʔV]). The Southern Interior Salish languages show yet another pattern: the realization of a second vowel after the glottal stop may be briefer in its acoustic realization, ranging from an aspirated release/voiceless vowel in Kalispel-Spokane-Montana Salish described by Carlson (1972) to fuller echo vowel in Coeur d'Alene described by Barthmeier (1996). Using microvariation between varieties of Salish languages as a starting point, the life cycle of phonological processes provides insight into the innovation of V_1 reduplication.

The patterns described as V_1 reduplication represent patterns in stages II to IV of the life cycle of phonological processes. Accordingly, I posit that the availability of reanalysis as an innovation is mediated by the general grammar of the language. The innovation of V_1 reduplication is linked to an infixed glottal stop (Section 4.3), which creates the environment for the phonetic and phonological factors to apply. I propose that V_1 reduplication first emerges as echo vowels (Section 4.4), which are variable in occurrence. Echo vowels emerge from non-controlled transitory phonetic patterns as a variable phonetic implementation rule in Stage I (phonologization) before undergoing stabilization to result in a categorical (predictable) epenthetic vowel in these environments in Stage II. A second precursor is a phonological process of translaryngeal harmony (at Stage II or III), which allows for an epenthetic vowel to take on the qualities of the vowel on the other side of a laryngeal segment (Section 4.5). The presence of an infixed glottal stop (-ʔ-) marking a morphological contrast in combination with either of the two phonological processes

mentioned allows for domain narrowing and eventual reanalysis of the morpheme as one that triggers reduplication (Stage IV). Assuming a prosodic affixation approach to reduplication, the restructured input at Stage IV includes a prosodic unit.

4.3 Morphological precursor: presence of an infixed glottal stop

V_1 reduplication in Salish is predominantly associated with an inchoative or plural function. Each of these functions can be linked to a morpheme involving the affixation of a glottal stop (or a general process of glottalization).

A clear source for V_1 reduplication in Southern Interior Salish is the inchoative -ʔ-, which is seen across the Interior Salish languages (e.g., Van Eijk 1987). Given that V_1 reduplication has emerged in three of the four Southern Interior Salish languages, it is pertinent to consider its absence in Moses-Columbia Salish. Willett (2003) provides the examples in (15), which show the infixed inchoative -ʔ-. For some, but not all examples, she includes an additional vowel, which resembles V_1 reduplication. Compare the lack of a second vowel in (15a) with the presence of one in (15b).

(15)   a.   ṗi<ʔ>q   'It's cooked.'   (cf. *kn ṗiqm t ntitiyáx* 'I cooked some salmon.')
       b.   *kn ṣ-ła̲<ʔ>a̲ṫ-míx* 'I'm getting wet.' (cf. *kckmnánaʔn łȧ̲ṫ* 'I dumped smth. wet on it.')
                                                              (Willett 2003:127,164,448)

While Moses Columbia Salish is not reported to have V_1 reduplication, there are some cases where an additional vowel is present, which suggests that vowel reduplication could emerge over time.

The source of plural V_1 reduplication in Kalispel-Spokane-Montana Salish is also an -ʔ- infix, though the position is different (stress-aligned). There is not a clear connection between Kalispel-Spokane-Montana Salish and the Central Salish languages, but the aspectual V_1 reduplication in Songish is a surface form of the -ʔ- allomorph of the actual (see, e.g., Montler 1986). The Comox-Sliammon pattern does not have a clear synchronic source, which reflects its later stage in the life cycle of phonological processes. This is discussed further in Section 4.5.3.

The presence of an infixed glottal stop in the language is a precursor to the innovation of V_1 reduplication as it yields the environment where the phonetic (Section 4.3) and phonological factors (Section 4.4) apply.

4.4 Phonetic precursor: echo vowels

Changes to the phonological grammar of a language often have phonetic origins (Ohala 1993; Garrett & Johnson 2013; Sóskuthy 2013). I propose that the existence of echo vowels in a language may contribute to the development of VʔV patterns. Echo vowels have been described for a number of languages of the Americas, including in Tsimshian and Salish languages (Bessell 1993:337). Echo vowels may follow a Vʔ sequence, or sometimes Vh, and are "a brief 'echo' of a preceding vowel following the release of the glottal constriction" (Bessell 1993:337). Echo vowels are sometimes transcribed as Vʔ^V. The ^{V} in Vʔ^V mirrors the vowel quality of the V, but these are sometimes described as "aspirated", "devoiced", or "brief" (e.g., Carlson 1972).

Echo vowels are not required by the phonology, but instead are often produced to aid the transition between consonants (Kinkade 1993b; Barthmaier 1998). As echo vowels are surface-level phonetic transitions, they are subject to variability. For example, Egelhoff and Babel (2018) describe the phonetics of echo vowels in Gitksan, a Tsimshianic language, and find considerable

variation in their realization between speakers, which cannot be divided neatly by dialect.[11] While they note that there is no single conclusive explanation for their results, individual factors pertaining to whether a consultant is producing a citation form or their physiological state (e.g., fatigue) are possible explanations. This description suggests that echo vowels in Gitksan are gradient phonetic patterns. I assume that the same is true for echo vowels in Salish, though I assume that the phonologization of echo vowels is the first stage of developing the VʔV variety of V_1 reduplication.

4.4.1 Stage I: phonologization of echo vowels (Okanagan and Kalispel-Spokane-Montana Salish)

The first stage of the phonological life cycle, phonologization, requires an automatic phonetic pattern to become a phonetic implementation rule. At Stage I, echo vowels would graduate from being a more universal automatic phonetic transition to part of a language-specific phonetic implementation, which may differ between languages as it is no longer driven purely by universal phonetic factors. Moses-Columbia Salish provides a good point of comparison for Southern Interior Salish because it is the only one without V_1 reduplication. Bird and Czaykowska-Higgins (2016) analyze consonant clusters and the presence vs. absence of a voiced or voiceless schwa, as well as the duration of these epenthetic or transitional elements. Counter to their hypotheses, they find that transitional schwas are not required for sonorant-obstruent sequences. The sonorant-obstruent sequence may have an epenthetic (voiced) vowel, but this is optional. This suggests that epenthetic vowels or transitory vocalic units are not required in these positions for sonority. However, they note that when the sonorant segment is a glottal stop, an echo vowel is recorded. The striking finding of this acoustic study is that a sonorant-obstruent coda is a perfectly licit combination and does not trigger any phonetic transitional element or obligatory phonological repair. There is something specific about ʔC sequences that results in an echo vowel after the /ʔ/. This suggests that phonologization has occurred in Moses-Columbia Salish: an echo vowel is obligatory with a glottal stop, but not in other environments where a transitional vowel would be expected. This establishes that echo vowels are present in Moses-Columbia Salish and that these show some language-specific patterns in phonetic implementation. I take this as evidence that the precursor to developing vowel reduplication is present in Southern Interior Salish, even if the pattern has not developed past Stage I in most of the languages.

While Carlson (1972) does not include V_1 reduplication in his description of Spokane (Kalispel-Spokane-Montana Salish), he acknowledges that there is an "aspirated release[, which] is heard of as a voiceless vowel of the same quality" as a stressed vowel in a Vʔ sequence. This corresponds to Vogt's (1940:16) observation that when a glottal stop is in a coda position, there is frequently a very brief "unvoiced echo-vowel" that follows, which may be absent in word-final position. The description of this echo vowel suggests that it is variably present, which provides a potential explanation for differences between sources: the inchoative -ʔ- infix may be accompanied by an echo vowel.

Cross-dialectal and individual variation, as Egelhoff and Babel (2018) describe for Gitksan, would contribute to how prominent a second vowel component is following a glottal stop in a coda position, which would further affect how it would be perceived by those listening. This also effects how they would be recorded, depending on how regular and strong the acoustic correlates of the echo vowel are for a particular dialect of the language, or for an individual. For Okanagan and

---

[11] The Gitksan pattern is different in distribution, however: there are no minimal pairs contrasting a VʔV and a Vʔ sequence (Egelhoff & Babel 2018), whereas this contrast is possible in Salish.

Kalispel-Spokane-Montana Salish, where reports regarding the presence or absence of a vowel vary, it seems as though V_1 reduplication represents the phonologization of a transient vowel, which now is a phonetic implementation rule (Stage I).

4.4.2 Stage II: stabilization of echo vowels (Coeur d'Alene)

Echo vowels often sound like two vowels separated by a glottal stop. For example, de Jong Boudreault (2009) notes that echo vowels in the Mixe-Zoque language Sierra Popoluca are often perceived as a VʔV sequence. The fact that researchers describe vowel reduplication in Kalispel-Spokane-Montana Salish and Okanagan as VʔV patterns suggests that echo vowels associated with the inchoative are perceived similarly. This highlights a route for reanalysis: if echo vowels often sound like VʔV sequences, they may eventually be learned as such, which in turn contributes to the actuation of the change, in the sense of Ohala (1981). This provides the conditions for stabilization in Stage II, where a pattern enters the phonological grammar. At Stage II, the vowel will be slightly more robust than a transient echo vowel.

The Coeur d'Alene pattern represents a Stage II pattern, Reichard (1938) distinguishes echo vowels from inchoative V_1 reduplication. She uses V'V to mark VʔV and V'ᵛ for Vʔ^V. This suggests that the vowel associated with the inchoative is qualitatively distinct from a transitory echo vowel. Further, Barthmaier (1996:4) revisits Reichard's description of Coeur d'Alene, noting the existence of echo vowels, which occur "usually but not always, after a glottal stop", and similarly differentiates between brief echo vowels and full echo vowels. Barthmaier (1996:6) excludes the true (brief) echo vowels in his transliteration, but retains the full vowels, which are the ones found in V_1 reduplication. This suggests that Reichard's cases of medial reduplication do involve a full vowel component, rather than just a transitory or brief vocalic portion. This suggests that the vowel in Coeur d'Alene is not just a phonetic echo vowel, but instead may reflect a categorical phonological rule. Coeur d'Alene is further in the life cycle than the other Southern Interior Salish languages, such that V_1 reduplication is driven by the phonology. Coeur d'Alene has a Stage II VʔV pattern.

4.5 Phonological precursor: translaryngeal harmony

Translaryngeal harmony is a phonological process which may contribute to the innovation of V_1 reduplication. Complete vowel harmony across a segment is common cross-linguistically, including across laryngeal segments (Rose & Walker 2011). Vowel harmony across a /ʔ/ or /h/ is called translaryngeal harmony; this type of harmony has been described as a constraint on morpheme shape in languages, including Kashaya (Buckley 1992), but also applies across morpheme boundaries in other languages, including Nenets (Odden 2005:234).

In the previous section, the contribution of echo vowels to the development of V_1 reduplication was considered. The echo vowels match the quality of the vowel before the glottal closure, so they may be perceived as two separate, though identical, vowels. Translaryngeal harmony across a glottal stop yields a similar surface form. A VʔV sequence could arise from an echo vowel, translaryngeal harmony, or V_1 reduplication triggered by the affixation of a morpheme. In fact, Borroff (2007:110) describes a general process of "echo-epenthesis" that results in VʔV sequences and proposes that this arises from a translaryngeal harmony process, where "two underlying vowels coalesce but may retain both moras". If there are two moras, this means that the second vowel is a full vowel, rather than just a brief echo vowel. Translaryngeal harmony in these circumstances is a phonological process, not a phonetic one.

313

The presence and application of translaryngeal vowel harmony is variable across Salish languages. For example, there are examples where the inchoative *-ʔ-* in Lillooet triggers vowel epenthesis, but this vowel is [ə], as shown in (16). The quality of the vowel does not match or assimilate to the vowel on the other side of the glottal stop; translaryngeal harmony is not a regular phonological process in the language.

(16)   Lillooet: no translaryngeal harmony

   qʷaʔəź̓   'to get blue'   (Van Eijk 1997:67)

If the inchoative *-ʔ-* is affixed and a vowel is epenthesized for sonority purposes, a grammar with a translaryngeal harmony rule makes different predictions than one without. Specifically, if Lillooet had a process of translaryngeal harmony, then the [ə] in (16) would be under pressure to take on the quality of the [a]. This would resemble the VʔV pattern found in Coeur d'Alene. However, Coeur d'Alene does not appear to have translaryngeal harmony: for example, Reichard (1938:542) reports that VʔV sequences without matching vowels are possible in the language, including [aʔi] and [iʔa], for example. Translaryngeal harmony does not appear to be a conditioning factor for Coeur d'Alene. As I argue in Section 4.3.2, echo vowels are the precursor to Coeur d'Alene (and Southern Interior Salish) reduplication.

4.5.1   Stage I: phonologization (Northern Straits – Saanich)

Leonard (2019) also discusses translaryngeal vowel harmony as an optional process in the Saanich dialect of Northern Straits (citing Montler 1986 who shows that translaryngeal harmony is optional), which suggests that it is a more variable phonetic process, rather than a regular phonological rule. Examples from Saanich given in (17) correspond to ones with vowel reduplication in the Songish dialect of Northern Straits described in Section 3, restated in (18). The Saanich forms do have an additional vowel following the glottal stop, but it has [ə], rather than a copied vowel.

(17)   Northern Straits (Saanich): no translaryngeal harmony (or reduplication)

   a.   *x̣éʔət̓ᶿt*   'to measure, weigh something'
   b.   *héʔək̓ʷ*   'remembering'   (Montler 2018:883,1226)

(18)   Northern Straits (Songish) aspectual V₁ reduplication

   a.   *x̣éʔec̓-*   'weighing'
   b.   *héʔek̓ʷ-*   'remembering'   (Raffo 1972:22)

The forms in (17) show that the infixed glottal stop triggers epenthesis, but there is no translaryngeal harmony between the vowels. This suggests that epenthesis is phonologically motivated, but translaryngeal harmony remains a gradient phonetic process and therefore the vowel is realized as [ə] in most cases. Given that the harmony is optional and variable in application (Montler 1986), this is a Stage I pattern.

4.5.2 Stage II-III: stabilization (Northern Straits – Songish)

Vowel reduplication in Songish likely has a similar motivation to [ə]-epenthesis in Saanich: the infixation of a glottal stop triggers a phonological repair to supply a vowel. In Saanich, [ə] is inserted. In Songish, the fact that the vowels match suggests two possible analyses: (i) epenthetic [ə] and subsequent feature sharing across a glottal stop (translaryngeal harmony), or (ii) reduplication of a full vowel. Raffo (1970) notes that the reduplication of a vowel can be accompanied by vowel reduction (to /ə/), which is in line with the general reduction of unstressed vowels in the language. Nolan (2017) describes a process of assimilation of /ə/ across a glottal stop in the Songish dialect, though states that this is not full assimilation (acoustic values are in the vicinity of the full vowel but do not quite match) and is restricted to /e/ and /a/.

Processes of translaryngeal harmony and unstressed vowel reduction may be in competition in Songish, such that translaryngeal harmony may occur but be subsequently reduced to [ə], which limits the number of forms that surface with V_1 reduplication. There is acoustic evidence of some degree of assimilation in these environments in Nolan (2017), which correspond to where Raffo (1970) describes V_1 reduplication.

Translaryngeal harmony in Songish appears to be a phonological process that applies earlier in the derivation, prior to vowel reduction, while Saanich only has an optional process of harmony that applies as a gradient phonetic process. The V_1 reduplication process that Raffo (1970) describes involves translaryngeal harmony across a glottal stop, but the actual morpheme has not yet undergone reanalysis as a reduplicative morpheme (e.g., a mora).

4.5.3 Stage IV: morphologization (Comox-Sliammon)

Comox-Sliammon has productive translaryngeal harmony across both /ʔ/ and /h/ (Blake 2000). A schwa is epenthesized in both (19a) and (19b), but it is realized as [o] because it assimilates the following /u/.

(19)   Comox-Sliammon translaryngeal harmony (root: čʔ- 'be on top of')

    a.   [čoʔomɪxʷtən]   'rug on floor'
    b.   [čɛʔnʌčtɪn]   'small blanket to sit on'   (Blake 2000:94)

An epenthetic vowel adjacent to a glottal stop will take on the properties of the vowel on the other side. This means that if a vowel is epenthesized to break up a coda ʔC cluster, this vowel will always be a copy of the preceding vowel. A phonological grammar with translaryngeal harmony can then produce VʔV sequences with an infixed glottal stop. There is no synchronic glottal stop infix in Comox-Sliammon, however, though Blake (2000) suggests that it is a misaligned L'- affix, where L stands for an archiphoneme that is related to Proto-Salish *l and may be realized as a [ẇ], [ẏ], or [ʔ]. It surfaces as an infix due to the phonological grammar. This affix can be linked to other markers of plurality in Central Salish languages, which often use a -l- (or -y-) infix to mark plurality (e.g., -l- in Halkomelem in Hukari 1984).

There is no infix in Comox-Sliammon independent of reduplication and a vowel is always copied. Descriptions agree that both vowels are full nuclear vowels. I analyze Comox-Sliammon as a Stage IV language: an older affix of some kind (likely an infixed glottal) was reanalyzed as an affixed mora, in addition to a glottal stop or a floating laryngeal feature. The reduplication of a vowel in Comox-Sliammon follows from the fact that the lexical entry for plural V_1 reduplication contains an empty prosodic unit that needs segmental content.

4.6   The innovation of V_1 reduplication

I propose that a combination of phonetic, phonological, and morphological factors contribute to the likelihood a language will innovate V_1 reduplication. The relevant factors include echo vowels (phonetic), translaryngeal harmony (phonological), and a glottal stop infix (morphological).

The existence of an infixed glottal stop alone does not guarantee the innovation of V_1 reduplication, as is evident from the Northern Interior languages, which retain an infixed -ʔ- to mark the inchoative without V_1 reduplication, in contrast to the Southern Interior languages, which have V_1 reduplication processes. Patterns of V_1 reduplication in different languages reflect different stages in a diachronic trajectory, and mark different synchronic outcomes of similar innovations. While the V_1 reduplication processes cannot be traced back to any *single* source, I propose that all the VʔV patterns originate from a glottal infix.

The glottal stop infix yields the surface conditions where other phonetic and phonological processes will motivate an echo or epenthetic vowel, which then may agree with the preceding vowel in quality. Having either an echo vowel that can be misperceived as a full vowel or an epenthetic vowel that undergoes harmony creates conditions that are ambiguous on the surface between vowel reduplication or regular phonological processes. This ambiguity allows for restructuring and the reanalysis of the input. In the Southern Interior languages, V_1 reduplication is a Stage I (phonetic implementation rule) or Stage II (phrase-level phonological process). In the Central Salish languages, V_1 reduplication is Stage II and III (phonological process applying at the phrase or word) or Stage IV (morphologized). Comox-Sliammon represents the final stage in the development of V_1 reduplication: a reanalysis of the input from a fixed segment to a morpheme that triggers reduplication.

5   Conclusion: V_1 reduplication and the typology of Salish reduplication

While V_1 reduplication cannot be reconstructed to Proto-Salish, the VʔV type is an innovation that can be connected to phonetic, phonological, and morphological properties of Salish languages. VʔV patterns include identical vowels with three sources, which also reflect stages of the proposed life cycle. At the first stage, there is phonetic variability in the presence of echo vowels. Next, the pattern is phonologized and there are predictable epenthetic vowels (with harmony) or reduplication as a repair. Then, the lexical entry of a morpheme is restructured, such that it is always marked by vowel reduplication. The innovation of V_1 reduplication is therefore supported by pre-existing phonetic biases (echo vowels), phonological processes (translaryngeal harmony), and the morpheme inventory (-ʔ-): the likelihood a language will innovate V_1 reduplication depends on whether they have the right combination of precursors and pressures in their grammar.

The VʔV patterns, as well as the V: and V…V patterns described in Section 3, deserve further consideration as a part of the typology of Salish reduplication. While V_1 reduplication has a marginal status in documentation and description, this reflects different phonological analyses. The three V_1 reduplication patterns overlap with what others may label as feature sharing, vowel epenthesis, link vowels, or harmony processes. As analyses under these labels may correspond to V_1 reduplication itself, or earlier stages in its innovation (e.g., translaryngeal harmony affecting an epenthesized /ə/), future phonological descriptions should consider the possibility that V_1 reduplication may be an appropriate label for some of these phenomena.

A further motivation for reassessing the role of V_1 reduplication in Salish on documentation is how its inclusion might help learners, or how its absence may hinder them. Depending on the phonological grammar of the language, it may also be beneficial to consider which type of label

(and corresponding analysis) would be more useful in documentation and descriptive materials aimed at learners and teachers. If V_1 reduplication is excluded from documentation, this means that learners will not have explicit description or instruction related to when and where an extra vowel is needed, and when it might be important for identifying a meaningful morpheme. Considerations related to the teaching and learning of reduplication more generally deserve further study.

References

Barthmaier, P. T. (1996). A dictionary of Coeur d'Alene Salish from Gladys Reichard's file slips. (MA thesis, University of Montana).

Barthmaier, P. (1998). Lushootseed vowels: A preliminary phonetic study. *Papers for ICSNL* 33:1–11.

Bates, D., Hess, T., & Hilbert, V. (1994). *Lushootseed dictionary.* Seattle, WA: University of Washington Press.

Bermúdez-Otero, R. (2007). Diachronic phonology. In P. de Lacy: *The Cambridge handbook of phonology*, Cambridge, UK: Cambridge University Press, 497–517.

Bessell, N. J. (1993). *Towards a phonetic and phonological typology of post-velar articulation.* (Doctoral dissertation, University of British Columbia).

Bird, S., & Czaykowska-Higgins, E. (2016). Parsing Salish consonant clusters. In M. Ball & N. Müller (eds.), *Challenging Sonority: Cross-linguistic evidence*. Sheffield: Equinox, 159–199.

Blake, S. J. (2000). *On the distribution and representation of schwa in Sliammon (Salish): Descriptive and theoretical perspectives.* (Doctoral dissertation, University of British Columbia).

Borroff, M. (2007). *A landmark underspecification account of the patterning of glottal stop.* (Doctoral dissertation, State University of New York, Stony Brook).

Buckley, E. (1992). Kashaya laryngeal increments, contour segments, and the moraic tier. *Linguistic Inquiry 23*(3):487–496.

Campbell, L. (2013). *Historical linguistics*. Edinburgh, UK: Edinburgh University Press.

Carlson, B. F. (1972). *A grammar of Spokan: A Salish language of Eastern Washington.* (Doctoral dissertation, University of Hawai'i at Manoa).

Carlson, B. F., & Flett, P. (1989). *Spokane dictionary.* Missoula, MT: University of Montana Occasional Working Papers in Linguistics.

Czaykowska-Higgins, E., & Kinkade, M. D. (1998). Salish languages and linguistics. In E. Czaykowska-Higgins & M. D. Kinkade (eds.), *Salish languages and linguistics: Theoretical and descriptive perspectives*. Berlin, Germany: Walter de Gruyter, 1–68.

de Jong Boudreault, L. J. (2009). *A grammar of Sierra Popoluca (Soteapanec, a Mixe-Zoquean language).* (Doctoral dissertation, University of Texas at Austin).

Drachman, G. (1969). *Twana phonology.* (Doctoral dissertation, Ohio State University).

Dyck, R. A. (2004). *Prosodic and morphological factors in Squamish (Sḵwx̱wú7mesh) stress assignment.* (Doctoral dissertation, University of Victoria).

Edel, M. M. (1939). The Tillamook language. *International Journal of American Linguistics* 10(1):1–57.

Egelhoff, M., & Babel, M. (2018). Phonetics of Gitksan echo vowels. In L. Matthewson, E. Guntly, & M. Rochemont (eds.), *Wa7 xweysás i nqwal'utteníha i ucwalmícwa: He loves the people's language*s. Vancouver, BC: UBCWPL.

Galloway, B. (1984). Nooksack reduplication. *Working Papers of the Linguistics Circle* 4(2):81–100.

Garrett, A., & Johnson, K. (2013). Phonetic bias in sound change. *Origins of sound change: Approaches to phonologization* 1:51–97.

Hess, T. (1967). *Snohomish grammatical structure.* (Doctoral dissertation, University of Washington).

Hukari, T. E. (1984). The truth about Cowichan imperfectives. *Working Papers of the Linguistics Circle* 4(2):147–161.

Jacobs, P. (2012). Vowel harmony and schwa strengthening in Sḵwx̱wu7mesh. *Papers for ICSNL* 47:99–146.

Kinkade, M. D. (1993a). The non-lexical basis for a Tsamosan branch of Salish. *Papers for ICSNL* 28:175–204.

Kinkade, M. D. (1993b). The Chimerical Schwas of Salish. Paper presented at 32nd Conference on American Indian Languages, Ninety-second annual meeting, American Anthropological Association, Washington, D.C.

Kirkham, S. P. (1993). Reduplication in Lushootseed: a prosodic analysis (Unpublished ms, University of Victoria).

Kroeber, P. D. (1999). *The Salish language family: Reconstructing syntax.* Lincoln, NE: University of Nebraska Press.

Leonard, J. (2019). *The phonological representation and distribution of vowel in SENĆOŦEN (Saanich).* (Doctoral dissertation, University of Victoria).

Mattina, A. (1987). *Colville-Okanagan Dictionary.* Missoula, MT: University of Montana Working Papers.

McCarthy, J. J., & Prince, A. (1994). Prosodic morphology. *Linguistics Department Faculty Publication Series 15.*

Mellesmoen, G. (2022) DIG Reconstruction and the Secret Life of Proto-Salish Diminutives: An Amphichronic Analysis of Diminutives in Upper Chehalis. *Papers for ICSNL 57*:67–86.

Mellesmoen, G., Davis, H., & Matthewson, L. (2020). Decomposing distributive numerals in ʔayʔaǰuθəm (Comox-Sliammon Salish). *Proceedings of Sinn und Bedeutung* 24(2):72–89.

Modrow, R. H. (1971). *The Quinault Dictionary.* Quinault Indian Tribe.

Montler, T. (1986). *An outline of the morphology and phonology of Saanich*, *North Straits Salish.* Missoula, MT: University of Montana Press.

Montler, T. (2018). *SENĆOŦEN: A dictionary of the Saanich language*. Seattle, WA: University of Washington Press.

Nater, H. (1984). *The Bella Coola language.* Ottawa, QC: National Museums of Canada.

Nolan, T. (2017). *A phonetic investigation of vowel variation in* Lekwungen. (MA thesis, University of Victoria).

Odden, D. (2005). *Introducing phonology.* Cambridge, UK: Cambridge University Press.

Ohala, J. J. (1981). The listener as a source of sound change. In C. S. Masek, R. A. Hendrick, & M. F. Miller (eds.), *Papers from the Parasession on Language and Behavior.* Chicago: Chicago Linguistics Society, 178–203.

Ohala, J. J. (1993). Sound change as nature's speech perception experiment. *Speech Communication* 13(1–2):155–161.

Raffo, Y. A. (1972). *A phonology and morphology of Songish, a dialect of Straits Salish.* (Doctoral dissertation, University of Kansas).

Ramsammy, M. (2015). The life cycle of phonological processes: Accounting for dialectal microtypologies. *Language and Linguistics Compass* 9(1):33–54.

Reichard, G.A. (1938). Coeur d'Alene. In F. Boas (ed.), *Handbook of American Indian languages* 3. Washington, DC: Smithsonian Institute, 515–707.

Robertson, D. (2014). ɬəẃáɬməš (Lower Chehalis) morphosyntax. *Papers for ICSNL* 49:89–153.

Rose, S., & Walker, R. (2011). Harmony systems. In J. Goldsmith, J. Riggle, A. C. L. Yu (eds.), *The handbook of phonological theory*. London, UK: Blackwell, 240–290.

Rubino, C. (2005). Reduplication: Form, function and distribution. *Studies on Reduplication 28*: 11–29.

Sloat, C. (1968). A skeleton key to Reichard's Coeur d'Alene transcriptions. *Anthropological Linguistics 10*(5):8–11.

Sóskuthy, M. (2013). *Phonetic biases and systemic effects in the actuation of sound change.* (Doctoral dissertation, University of Edinburgh).

Thomason, S. G. (1997). Plurals and transitivity in Montana Salish. *Papers for ICSNL* 32:352–362.

Urbanczyk, S. (1996). *Patterns of reduplication in Lushootseed.* (Doctoral dissertation, University of Massachusetts).

Van Eijk, J. (1987). Interior Glottalization and the Suffix -(V)p in Lillooet, Shuswap and Thompson. *ICSNL* 22:41–48.

Van Eijk, J. (1997). *The Lillooet language: Phonology, morphology, syntax.* Vancouver, BC: UBC Press.

Vogt, H. (1940). *The Kalispel language, An outline of the grammar with texts, translations, and dictionary.* Oslo, Norway: Norske Videnskaps-Akademi.

Watanabe, H. (2003). *A morphological description of Sliammon, Mainland Comox Salish: With a sketch of syntax.* Osaka, Japan: Gakuin University.

Watkins, D. (1970). *A description of the phonemes and position classes in the morphology of Head of the Lake Okanogan Salish.* (Doctoral dissertation, University of Alberta).

Willett, M. L. (2003). *A grammatical sketch of Nxa'amxcin (Moses-Columbia Salish).* (Doctoral dissertation, University of Victoria).