

## Evidence from Halkomelem for word-based morphology

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This paper examines a range of word-formation processes in Halkomelem providing evidence for a word-based, relational approach to morphology, where the form of a word is based on its relation to other fully formed words. Evidence is presented that traditional morpheme-based approaches (Kiparsky 1982; Lieber 1992; Selkirk 1982) in which words are constructed incrementally have difficulty. Realizational approaches (Anderson 1992; Embick and Halle 2005; Halle and Marantz 1992; Matthews 1972, 1991; Stump 2001; Wolf 2008) are also problematic. This discussion supports an abstractive, relational approach to word formation (as outlined in Blevins 2006), in which new words are created by analogy, as opposed to a constructive approach to morphology in which words are built up incrementally.

### 1 Introduction

Halkomelem (Central Salish) makes use of a variety of word-formation processes to express *imperfective* aspect (among other distinctions), *diminutive* and *plural* meanings. The following data from the Hul'q'umi'num' (Vancouver Island) dialect, illustrate a range of allomorphy used to express *imperfective* aspect. Interestingly, neither prefixing nor suffixing is used. In (1a) CV-prefixing reduplication is used, in (1b) metathesis, in (1c) apophony (ablaut), in (1d) there is a different pattern of reduplication, in (1e) there is reduplication plus resonant aspiration, and in (1f), *imperfective* aspect is realized by medial vowel deletion. Resonant glottalization also accompanies these stem modifications (as in 1adef). Some of the vowel alterations arise from a regular process of vowel reduction, as illustrated in (1a) in which unstressed full vowels are reduced to schwa.

- (1) Hul'q'umi'num' *imperfective* (from Hukari and Peter 1995)<sup>1</sup>
- |    |   |         |
|----|---|---------|
| a. | t <sup>h</sup> aq̣ <sup>w</sup> əm                  | rotten  |
|    | t <sup>h</sup> at <sup>h</sup> əq̣ <sup>w</sup> əm̄ | rotting |

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<sup>1</sup> Many thanks to Tom Hukari for discussion of the patterns and topics and for generously sharing an electronic version of the *Cowichan Dictionary* that greatly assisted me.

b.	paq <sup>w</sup> at	break it (substance)
	paq <sup>w</sup> t	breaking it
c.	čətǫ́ <sup>w</sup> t	grind, pulverize, smash it
	čətǫ́ <sup>w</sup> t	grinding it, pulverizing, smashing it.
d.	ca <sup>?</sup> ełs	pull off a layer; cut slabs from wood
	cəcałs	pulling off a layer; cutting slabs from wood.
e.	ləčət	fill it
	həlčət	filling it.
f.	šeyəqəm	smoke
	šeyqəm	smoking (fire).

As can be seen from this cursory examination, Halkomelem illustrates a very rich system, and understanding it can serve to shed light on word-formation processes in general.

Two ways of conceptualizing word-formation regards whether the approach is constructional and in isolation or abstractive and relational (Blevins 2006). This is a useful dichotomy to examine because it makes a clear distinction between the multitude of approaches to word formation, grouping several approaches together under some basic assumptions. According to Blevins (2006) constructive models assume that words are created from roots and affixes (i.e. Chomsky and Halle 1968; Halle and Marantz 1993), starting with the root and then adding morphemes or applying “readjustments”, with the root as the basic starting point. Constructivist approaches can also be word-based (Anderson 1992; Beard 1995; Matthews 1972, 1991; Stump 2001). In these cases one starts with a word/lexeme/stem, and then one specifies how morphosyntactic (or derivational) features are realized, with the word/lexeme/stem as the basic starting point. Crucially, in constructive approaches word formation is completed for each individual word in isolation. A constructive approach is contrasted with abstractive approaches to word-formation. Abstractive approaches do not involve adding affixes or applying rules to bases/lexemes, and are crucially conceived of as relational (Blevins 2006; Bybee 1985). In this approach, there are no morphemes *per se*. Rather, concepts like *root* and *affix* are abstractions over shared elements of form and meaning over paradigms or word schemas, much like how *phonemes* are abstractions over the actual distribution of sounds across the entire lexicon of words. Abstractive approaches are paradigmatic, relational and analogical.

The goal of this paper is to examine how the rich system of word-formation processes in Halkomelem used to express *imperfective* aspect can shed light on these two fundamentally different approaches to word-formation. The basic findings support an abstractive, relational, word-based approach (c.f. Leonard and Turner 2010). It turns out that a wide array of phonological and

morphological conditioning is needed to predict the form of a word; this is best done by comparing morphologically similar words, rather than by building each word in isolation. In other words, the principles that are active in determining the correct allomorph are more in keeping with examining the full space of *imperfective* words. This implies that the root is not a unit of word-formation in Halkomelem, even though crucial reference has been made to the root in terms of understanding Salish lexical semantics (Davis and Demirdache 2000) and derivational and inflectional morphology (Wilschko 2009). The paper begins by providing an overview of the key assumptions with several constructivist and relational approaches to morphology (§2). This is followed by an examination of the phonological conditions (§3) and morphological conditions (§4) on the various allomorphs. A final section (§5) summarizes the discussion and provides external motivation for adopting a word-based relational approach to Halkomelem morphology.

## 2 Approaches to morphology

As discussed above, the various different approaches to morphology can be divided into two basic types: constructive and relational. This section outlines some basic assumptions regarding constructive approaches to word-formation versus relational word-based approaches. This is followed by a brief discussion of the kinds of evidence that can be used to tease these approaches apart.

In a nutshell, constructivist approaches are those in which words are built up incrementally. We can loosely categorize these as morpheme-based or as realizational theories. In morpheme-based approaches to word-formation, the lexicon is assumed to be a repository of roots and affixes which are added to some base of increasing size and complexity (Kiparsky 1982; Lieber 1992; Selkirk 1982). These approaches are well-equipped to derive words formed by concatenation of items, such as affixation and compounding. Non-concatenative processes such as metathesis are problematic, because they are process based and thus cannot be stored as items in the lexicon. Within morpheme-based models, there is a core of research aimed at either arguing that metathesis is not a valid word-formation process or by proposing that the reordering of segments follows from affixation of other elements, such as timing units like the mora (Stonham 1994).

In realizational approaches to morphology, morphological operations apply to some base (be it a root or stem) to create a new word. These operations can include affixation as well as non-concatenative operations, such as metathesis. This includes classic realizational theories as proposed by Matthews (1972; 1991), Anderson (1992), Aronoff (1994), and Stump (2001) among others. In these approaches, some base is considered to provide the central formal properties of the word, usually a stem. It is not necessary that the form match the morpho-syntactic features of other words in the paradigm, as research on Latin has shown. Other realizational approaches differ in terms of how the realization occurs, such as in Distributed Morphology (Embick and Halle 2005;

Halle and Marantz 1993), Lexeme-Morpheme Base Morphology (Beard 1995), and Optimal Interleaving (Wolf 2008). In Distributed Morphology (DM), syntax provides morpho-syntactic and semantic features. These are then subject to vocabulary insertion and readjustment rules. It is morpheme-based in the sense that actual vocabulary items are stored in the lexicon and then inserted. However, it is realizational in the sense that the meaning and form are separated, and also in the sense that readjustment rules can apply, accounting for cases of ablaut, metathesis, and reduplication. All realizational approaches are constructive because they start off with a base of some sort that has material added to it or adjusted, according to an ordered set of rules.

These approaches contrast sharply with relational-based word-based approaches, which assume that there are only fully formed words in the lexicon (Blevins 2006). New words are created by analogy to other words in the lexicon. For example, given the relation of *sing:sang*, when faced with the word *bring* one could posit *brang* by analogy. This is, of course, what children do when they have not yet acquired *brought*. There are no intermediate stages; there are no roots or affixes; roots and affixes arise as abstractions of shared form and meaning over words, not because they exist as actual elements in the lexicon.

There are several types of evidence that can be compiled to distinguish these approaches from each other. First, constructivist approaches assume an intermediate stage of word formation. Counter-evidence for this would be if there is one ordering for one word and another ordering for a different word. Second, constructivist approaches assume that words are created in isolation. If the form of a word is influenced by the form of other morphologically related words, this would provide evidence against creating words in isolation. Third, constructivist approaches assume what I will refer to as invariant exponence. Consider that the realization of a meaning in a word is its exponence. Invariant exponence assumes that, if [X] is the exponent of morpho-syntactic feature [+F], then [X] cannot be the exponent of morpho-syntactic feature [-F] (the contrasting morpho-syntactic feature). If some exponent [X] can be associated with the meanings of both [+F] and [-F], this would pose a challenge to the principle of invariant exponence and theories that implicitly assume it. The final type of evidence is more general and is related to cognitive factors regarding the structure of the mental lexicon. If one aims for linguistic theory to model our language faculty, the most perspicuous approach would be one in which there is a close match between the formal theoretical mechanisms and our cognitive system. Constructivist models of morphology make the crucial assumption that there is no connection between morphologically related words, while the relational approach assumes that new words can only be formed by comparing similar words. A brief overview of the psycholinguistic evidence once again supports the relational analogical approach.

The rest of this paper aims to provide the specific details for the types of evidence discussed above. Because the pattern of forming Hul'q'umi'num' *imperfective* verbs is quite complex, it is necessary to first discuss the phonological conditions on choice of allomorph. This is followed by a discussion of morphological conditions. Specific evidence is discussed as the

details of the system are presented. A final section summarizes the Hul'q'umi'num' evidence as well as introducing more general evidence from the mental lexicon. In all cases, constructivist approaches to word-formation are challenged by the findings.

### 3 Phonological conditions

For the most part, the choice of *imperfective* allomorph is predictable, based on the phonological properties of the *perfective* word. The basic phonological factors relevant for determining the form of the *imperfective* relate to 1) whether the word contains a root-initial cluster or not, 2) whether the first vowel is a schwa or full vowel, and 3) whether the consonants are obstruents (T), sonorants (R), or laryngeals (H). The basic patterns are outlined here, as they related to understanding the morphological conditions and evidence to be introduced. See Suttles (2004: §7.2) for a thorough discussion of the full range of conditions on choice of *imperfective* allomorphs in Musqueam Halkomelem.

There are three reduplicative allomorphs. If the *perfective* begins with a single non-laryngeal consonant followed by a full stressed vowel and another non-laryngeal consonant, then CV- reduplication occurs. As one can see below, these have initial stress, with the root vowel reducing to schwa when it is unstressed. Notice that non-initial resonants are glottalized; this occurs with every *imperfective* form.

- (2) CV- reduplication (Leslie 1979: 45; PROG meanings added by SU)
- |    |            |               |
|----|------------|---------------|
| a. | ʰíçət      | cut it        |
|    | ʰíçəçət    | cutting it    |
| b. | kʷíntəl    | fight         |
|    | kʷíkʷəntəl | fighting      |
| c. | ʰímət      | lick it       |
|    | ʰíçəmət    | licking it    |
| d. | yeç        | topple down   |
|    | yéçəç      | toppling down |

Reduplication also occurs if the *perfective* is TəC (T is an obstruent). However, in this case stress remains on the root, and the reduplicative prefix is unstressed.

- (3) Cə- reduplication (Hukari and Peter 1995)
- |    |       |              |
|----|-------|--------------|
| a. | təs   | get near     |
|    | tətəs | getting near |

- |    |                     |                                      |
|----|---------------------|--------------------------------------|
| b. | ləq̣ <sup>w</sup>   | break                                |
|    | lətəq̣ <sup>w</sup> | breaking                             |
| c. | čəq̣ <sup>w</sup>   | pierced, shot                        |
|    | čəčəq̣ <sup>w</sup> | getting pierced, shot                |
| d. | θəḳ <sup>w</sup>   | stretched taut                       |
|    | θəθəḳ <sup>w</sup> | stretching, becoming stretched taut. |

The third reduplicative allomorph occurs when the root begins with a single sonorant followed by a schwa. A process of resonant devoicing also accompanies this allomorph (Hukari 1977; c.f. Urbanczyk 1999), such that the initial sonorant becomes the laryngeal fricative.

(4) Sonorant-schwa reduplication (Hukari and Peter 1995)

- |    |                          |                                 |
|----|--------------------------|---------------------------------|
| a. | ləčət                    | fill it                         |
|    | həlčət                   | filling it                      |
| b. | məḳ <sup>w</sup> ɛls    | pile hay                        |
|    | həṃḳ <sup>w</sup> ɛls  | piling hay                      |
| c. | nəḳ <sup>w</sup> əyət   | bounce a cradle                 |
|    | həṇḳ <sup>w</sup> əyət | bouncing a cradle               |
| d. | wəq̣ <sup>w</sup> ətəm   | downstream: drift downstream    |
|    | həẉq̣ <sup>w</sup> ətəm | downstream: drifting downstream |

This pattern also occurs when the first consonant is a sonorant and the second is a laryngeal.

Apophony (also known as ablaut) occurs to form *imperfective* with a restricted set of stems as well. The words below all have the property of being composed of triconsonantal zero grade roots, that is to say, there is no full vowel. The first two stems are morphologically complex, having the ‘control transitive suffix’ /-t/ attached, though this does not seem to be a necessary condition, as (5cd) illustrate without any further affixes.

(5) Apophony (ablaut) (Hukari 1978)

- |    |                       |             |
|----|-----------------------|-------------|
| a. | ʃəp̣ḷ <sup>h</sup> t | slurp it    |
|    | ʃəp̣ḷ <sup>h</sup>   | slurping it |

b. čət̚q̚ʷt	grind it
čat̚q̚ʷt	grinding it
c. səwq̚	seek
sewq̚	seeking
d. čək̚ʷx̚	fry
ček̚ʷx̚	frying

The quality of the vowel is phonologically predictable. It is [a] if a rounded consonant follows, otherwise it is [e] (Jones 1978). The lack of a stressed schwa with the *imperfective* has been analyzed as a way to avoid stressed schwa with the *imperfective* in Halkomelem (Urbanczyk 2000). In many different derived environments stressed schwa is actively avoided. An instance when one finds a stressed schwa with the *imperfective* is with Cə- reduplication with initial sonorants, as illustrated in (4). Notice that other reduplications involving schwa, as in (3), retain stress on the root vowel.

Apophony can be accounted for in several different ways. For a morpheme-based approach, one could specify an infix /-e-/ with a phonological rule to change the quality to [a] in the context of rounded consonants. For realizational approaches, one would specify a (readjustment) rule where schwa becomes either [e] or [a], depending on the phonological context. The historical origins are most likely related to some form of infix, as several Interior Salish languages illustrate infixal vowels associated with plurality and aspect (Urbanczyk 2004). As such we can see that constructive approaches can readily account for these data, with a minimal number of assumptions.

When the suffix is /-m/, an interesting pattern is found with triconsonantal roots. First, notice that rather than having schwa as the initial vowel, the ablaut vowel shows up with the *perfective* form. The exponent of *imperfective* is schwa deletion in this case.

- (6) Schwa deletion (Hukari 1978)
- |               |   |
|---------------|---|
| a. čát̚əq̚ʷəm | fall apart (from cooking)                   |
| čát̚q̚ʷəm     | falling apart (from cooking)                |
| b. ʎépəx̚əm   | fall (leaves)                               |
| ʎép̚x̚əm̚     | falling (leaves)                            |
| c. ʎát̚əq̚ʷəm | snore                                       |
| ʎát̚q̚ʷəm̚    | snoring                                     |
| d. čək̚ʷəx̚əm | sizzling, sound (e.g., grease in a hot pan) |
| ček̚ʷx̚əm̚    | sizzling sound (e.g., grease in a hot pan)  |

This pattern illustrates a few puzzles for both morpheme-based and realizational theories of morphology. First, schwa deletion cannot be expressed as an item *per se*, so this allomorph of the *imperfective* cannot be a lexical entry. Realizational theories can handle this process-based change though, via some form of stem adjustment. More challenging is the second problem: the ablaut vowel is used for *both* aspectual distinctions. This violates the principle of invariant exponence discussed above. If ablaut is used to express *perfective* AND *imperfective*, there is no real way to tell the two words apart from each other, except for resonant glottalization. For morpheme-based theories, the ablaut vowel would need to be present for both aspectual morphemes. Realizational theories would need to have the same rule for both aspectual meanings. The *imperfective* would also require two additional rules: one for schwa deletion and another for resonant glottalization. This sort of triple exponence is rarely found in languages. It is predicted not to occur in some models (Kurisu 2001) and poses serious challenges to models which rely on principles like the Elsewhere Condition (Anderson 1992; Halle and Marantz 1993). The Elsewhere Condition states that if a specific rule applies, a general rule does not. This is to prevent excessive multiple exponence, where words like *man* would not be pluralized by two operations: the specific ablaut, creating *men*, but not permitting the more general /-s/ affixation, as in the ill-formed *\*mens*. Schwa deletion would be a specific rule here, with ablaut being less specific and resonant glottalization is the general rule. The fact that all three occur is a serious problem.

On the other hand, if word formation is relational, that implies that the form of one word is dependent on the shape of other words in the paradigm. In a relational theory, the only unusual thing is that ablaut has applied to the triconsonantal roots with /-m/ as a suffix. This is truly unexpected, regardless of the approach. Schwa deletion can be understood as being motivated in order to create a distinct word from the *perfective*. Resonant glottalization is also straightforward, because it is a property of all *imperfective* verb forms. An examination of the *Cowichan Dictionary* reveals that every triconsonantal root (except one) falls into the pattern in (6) above. By analogy, this is as expected.

Metathesis occurs with a restricted set of stem shapes. When a biconsonantal obstruent-only root has the control transitive suffix /-t/, the *perfective* 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 (Jones 1978). As one can see, the *imperfective* is formed by switching the order of C<sub>2</sub> and the vowel, with *imperfective* having the target shape TVTt.

- (7) Metathesis (Hukari 1978)
- a. pq<sup>w</sup>at break it (substance)  
     paq<sup>w</sup>t breaking it

- b. ɬq̣˦˦at    break it  
       ɬaɬ˦˦t    breaking it
- c. x˦˦k˦˦at    pull it  
       x˦˦ak˦˦t    pulling it
- d. s̥q̣et      tear/split it  
       s̥q̣t      tearing/splitting it

Morphological processes like metathesis are problematic for morpheme-based models because there is no “sign”; rather the meaning is expressed by reordering segments. Metathesis is not difficult to account for with realizational models, though there is resistance to accepting this as a morphological operation, with the desire to avoid opening the door to such powerful mechanisms as reordering segments.

Metathesis can be seen as a specific instance of stress-shift, where stress generally tends to fall on the initial syllable of *imperfective* verb forms. Other patterns of stress shift are found in which a cluster-initial stem has epenthesis, while the original vowel is reduced to schwa.

- (8)    Stress shift and schwa insertion
  - a. cset                    tell him/her  
       cósət                telling him/her
  - b. tset                    put it near  
       tósət                putting it near
  - c. k̥˦˦s̥áləst            count stitches  
       k̥˦˦s̥ələst            counting stitches
  - d. ɬ̥áləst                slice out a piece of weaving  
       ɬ̥ələst                slicing out a piece of weaving

Notice that in this case, the initial vowel is a stressed schwa, without changing its quality, and more significantly, the full vowel is reduced to schwa, rather than being gone entirely. This seems to suggest that metathesis is the best way to understand the pattern in (7), in which the vowel and consonant shift location. There is a correlation between TTVT -> TVTT, such that the reordering of segments is complete, while if schwa is epenthesized, there is still a remnant of the non-initial vowel. In general if the non-initial vowel reduces to schwa, then the initial vowel is schwa (not a copy of the base vowel). This seems to be one

of the cases where some lexical conditioning is at play, because it is not entirely predictable whether or not stress-shift and metathesis occur, or whether stress-shift and schwa epenthesis occur.

Given the range of phonologically conditioned allomorphy and the range of stem changes, it is tempting to see if there is a unified way to look at the *imperfective*. There seems to be a few conditions that are prevalent, which relate to an emergent target shape, in which the segment-prosody interactions are less marked than in the *perfective*. First, *imperfectives* tend to have initial stress. The only non-initial stressed forms are those with Cə- reduplication in which the initial consonant is not a resonant. It is assumed that this non-initial stress is a way to avoid stressing an affix schwa. Second, root-initial clusters are avoided; a vowel breaks the cluster up, either by metathesis or epenthesis. Third, stressed schwa tends to be avoided. These all relate to having less marked segment-prosody interactions. Sequences of obstruents are marked, and avoided; stressed schwa is marked and avoided. The following chart summarizes the allomorphs that are found with different bases.<sup>2</sup>

(9) Summary

Allomorph	Base
CV-	CVC...
Cə-	TəC, TəH, CV:C
hə-	RəC...
Ablaut	TəCC...
Stress shift + metathesis	TTAT
Stress shift + epenthesis	CCVC
Schwa deletion	TATəTəm
Resonant glottalization	All non-initial resonants

Having examined the basic phonological conditions, and illustrated some of the potential problems for morpheme-based and realizational theories of morphology, the following section turns to the morphological conditions.

#### 4 Morphological conditions

One of the morphological conditions on the expression of *imperfective* aspect has already been discussed: how the realization of triconsonantal roots differs, depending on the affix that is attached. We will go into this pattern in more detail below, as well as introduce a few new morphological conditions. Again, the discussion provided below is not exhaustive, but is focused on those issues that pose challenges to standard morphological theories. In what follows below, more discussion will be given to the ordering of phonological and

<sup>2</sup> The following abbreviations are used: C = any consonant; T = any obstruent; R = any resonant; H = a laryngeal consonant; V = any vowel; A = ablaut vowel.

morphological rules, rather than simply the application of the correct allomorph. We begin by providing evidence that the determination of the correct allomorph is based on the stem, rather than the root.

The following examples illustrate that the root cannot be the determinant. Notice that the words in (10) all have the shared meaning of ‘pierce, shoot’. However, depending on what affix is added, the shape of the *perfective* differs, as does the choice of *imperfective* allomorph. This means that, in general the *imperfective* is phonologically conditioned. If it were always related to what the root is, then each of the forms below should have the Cə-allomorph, as in (10a), which has the bare root.

- (10) Root = ‘pierce, shoot’
- |    |                                    |   |
|----|------------------------------------|---|
| a. | čəq̣ <sup>w</sup>                  | pierced, shot                           |
|    | čəčəq̣ <sup>w</sup>                | getting pierced, shot                   |
| b. | čq̣ <sup>w</sup> eʔəm              | poke through something                  |
|    | čəq̣ <sup>w</sup> əm               | poking through something                |
| c. | čq̣ <sup>w</sup> at                | pierce it, [...]                        |
|    | čəq̣ <sup>w</sup> t                | piercing it, shooting it                |
| d. | čəq̣ <sup>w</sup> nəx <sup>w</sup> | shoot, pierce (manage to)               |
|    | čəq̣ <sup>w</sup> nəx <sup>w</sup> | shooting it, piercing it (managing to)  |
| e. | čq̣ <sup>w</sup> ełs               | poke through (working on a mat)         |
|    | čəq̣ <sup>w</sup> əłs              | poking through (e.g., working on a mat) |

Constructivist approaches start with a base, making it necessary to determine what the correct form of the root is. Given the range of allomorphy exhibited above, one is faced with three choices: /čəq̣<sup>w</sup>/, /čq̣<sup>w</sup>/, or /čq̣<sup>w</sup>a/. The most common assumption among Salishanists is that schwa is predictable, and hence absent underlyingly, making these vowelless roots; so /čq̣<sup>w</sup>/ would be a standard approach. Schwa insertion would be one of the phonological processes to apply.

Having established that the choice of exponent is based not on the root, let us now turn to systematic exceptions to this: cases in which the root determines the correct form of *imperfective*. There are a set of affixes that trigger a reduction of the root vowel to schwa. In these cases, the *imperfective* is based on the root, not the *perfective* stem.

- (11) Root = ‘look at’
- |    |                         |                               |
|----|-------------------------|-------------------------------|
| a. | le mət                  | look at                       |
|    | le ləmət                | looking at; looking after     |
| b. | x <sup>w</sup> ləmqət   | look down someone's throat    |
|    | x <sup>w</sup> leləmqət | looking down someone's throat |

- c.  $l\acute{o}mn\acute{o}x^w$  see  
 $le\acute{l}o\acute{m}n\acute{o}x^w$  seeing it.

In these words, the addition of a CVC-shaped suffix seems to trigger reduction of the root vowel to schwa in the *perfective*. Seemingly unexpectedly, the *imperfective* is CV-reduplication; this is not expected, because the stem begins with a sonorant-stressed schwa sequence.

In order to account for this in a constructive approach, one would need to order the realization of *imperfective*, prior to the application of the vowel reduction process. In order to illustrate this ordering, let us assume first that there is some function in the morphological component that is able to determine the correct allomorph, based on the properties of the base to which the operation applies.

- (12) Imperfective Function:  $f_{IMP}$   
 $f_{IMP}$  is a function that selects the exponent of IMPERFECTIVE, depending on phonological features of its base.

In order to derive words like (11a) and (11c), the following order of phonological and morphological operations would need to occur. In the derivation below, RED = morphophonemic vowel reduction process and SCHWA = regular process of unstressed vowel reduction.

(13)

	<i>perfective</i>		<i>imperfective</i>	
root	lem	lem	lem	lem
affix	lem -ət	lem -nəx <sup>w</sup>	lem -ət	lem -nəx <sup>w</sup>
$f_{IMP}$	–	–	le <sup>l</sup> le <sup>m</sup> ət	le <sup>l</sup> le <sup>m</sup> nəx <sup>w</sup>
RED	–	ləmnəx <sup>w</sup>	–	le <sup>l</sup> ə <sup>m</sup> nəx <sup>w</sup>
SCHWA	–	–	le <sup>l</sup> ə <sup>m</sup> ət	–

Notice that both reduction processes need to apply after  $f_{IMP}$ , in order to be sure that there are no schwas before  $f_{IMP}$  and so that full vowels are reduced after reduplication has applied.

Related to this systematic exception, a challenge occurs for all constructive approaches when certain derivational affixes are added to the stem. There are two basic patterns. The most common is that the choice of *imperfective* is based on the word-form, most closely related to it semantically and morphologically, i.e. the *perfective* word-form. The other pattern is that where the choice of *imperfective* exponent is related to the underlying root of the word (Urbanczyk 2005).

- (14) Root = ‘sew’  
a.  $\acute{p}\acute{e}t^{\acute{o}}\acute{a}t$  ‘sew it’  
 $\acute{p}\acute{e}\acute{p}\acute{a}t^{\acute{o}}\acute{a}t$  ‘sewing it’

- b. p̄l̄éls                    ‘sew’  
     p̄é̄p̄á̄l̄é̄ls            ‘sewing’

Observe that in both *imperfective* forms above, CV- reduplication is utilized. This is unexpected in (b) because the *perfective* begins with a cluster. One might suggest that it is always the root that determines the form of *imperfective*, but we have already seen that it is the stem. Furthermore, the following data set illustrates that not every derivational suffix functions this way, as one can see with the lexical suffix associated with the meaning of ‘eyelet’. In (15b) below, the *perfective* begins with a cluster and *imperfective* is formed by schwa insertion.

- (15) lexical suffix ‘stitch, eyelet’ /-aləs/  
 a. f̄ic̄ə̄t                    ‘sliced it’  
     f̄if̄ə̄c̄ə̄t                ‘slicing it’  
 b. f̄ə̄c̄əl̄ə̄st               ‘slice out a piece of weaving’  
     f̄ə̄c̄ə̄l̄ə̄st              ‘slicing out a piece of weaving’

In addition to these examples, forms have also been found in which a root can take both types of affixes, as illustrated below.

- (16) Root = ‘punch, hit with jabbing motion’ (Hukari and Peter 1995)  
 a. ī<sup>θ</sup>īq̄<sup>w</sup>ə̄t                punch, hit with fist, [...]  
     ī<sup>θ</sup>ī<sup>θ</sup>ə̄q̄<sup>w</sup>ə̄t            punching, hitting with fist, stabbing  
 b. ī<sup>θ</sup>q̄<sup>w</sup>ēl̄s                punch, stab  
     ī<sup>θ</sup>ī<sup>θ</sup>ə̄q̄<sup>w</sup>ə̄l̄s            punching  
 c. x<sup>w</sup>ī<sup>θ</sup>q̄<sup>w</sup>ə̄l̄ə̄st            punch someone in the eye  
     x<sup>w</sup>ī<sup>θ</sup>ə̄q̄<sup>w</sup>ə̄l̄ə̄st        punching someone in the eye

This pattern poses several problems for constructive approaches. The basic problem is how to order the phonological processes that produce the clusters with the addition of various morphemes. To make this discussion explicit, I will outline what a classic stratal approach would need to assume. In stratal morphological approaches, such as Lexical Phonology (Kiparsky 1982), morphological operations are interleaved with phonological operations. Multiple strata are proposed to account for the pattern whereby some phonological operations might apply at a specific stage in the derivation of a word, such as stem vs. word-level (Borowsky 1991). The usual type of morphology-phonology interaction is such that an affix is added at some strata and this triggers a phonological operation. However, this approach cannot be applied to the patterns discussed and exemplified in (15-16) above. In the



Given the rest of the word-forms in the word-family, one can readily see that with /-els/, the root-form is relevant and with /-aləst/ the word-form is relevant.

The complexities of how to determine the correct form become more of a challenge to constructivist theories, once one acknowledges that there is variation in how speakers form words with more than one affix. For example, there are several forms in the *Cowichan Dictionary*, in which the root or word is taken as the basis for determining the *imperfective* allomorph.

- (20) Root = ‘dig’ + /-ənəp/ ‘bottom’
- a. weqət                    dig it (a hole)
  - b. wəqənəp              dig the soil
  - həwqəhəp            digging the soil
  - c. wəqənəpt             dig it
  - həwqəhəpt           digging the soil
  - wewəqəhəpt         digging it

Notice that in (20c) two different forms are provided for the *imperfective* of ‘dig it’. In this case, there are two different suffixes added: the lexical suffix meaning ‘bottom’ and the ‘control transitive’ /-t/. For the constructivist to get the variation, they would need to change the order in which  $f_{IMP}$  applies. In the first case, it would apply after vowel reduction, in the second, it would apply before vowel reduction. There wouldn’t be any particular explanation for why the reordering occurs. The problem arises, because there is no variation in (20b), but there is in (20c). Let’s look at some derivations. The first goes over the case where  $f_{IMP}$  applies at the end.

(21)	<i>perfective</i>		<i>imperfective</i>	
affix	weq-ənəp	weq-ənəp-t	weq-ənəp	weq-ənəp-t
SCHWA	wəqənəp	wəqənəpt	wəqənəp	wəqənəpt
$f_{IMP}$	–	–	həwqəhəp	həwqəhəpt

In order to get the reduplicative allomorph,  $f_{IMP}$  needs to apply before vowel reduction. This is illustrated below.

(22)	<i>perfective</i>		<i>imperfective</i>	
affix	weq-ənəp	weq-ənəp-t	weq-ənəp	weq-ənəp-t
$f_{IMP}$	–	–	–	wewəqəhəpt
SCHWA	wəqənəp	wəqənəpt	wəqənəp	wewəqənəpt
$f_{IMP}$	–	–	həwqəhəp	–

The variation only occurs with the form that has the /-t/ suffix. This implies that the suffix must be attached after the lexical affix, but *prior* to the application of

$f_{IMP}$ . Without the transitive suffix,  $f_{IMP}$  applies after schwa reduction. This is simply a complication that the rules must capture in the ordering.

With the relational approach, there seems to be an explanation for why there is variation, that relates to the fact that there are two suffixes. Speakers may not be sure which word to choose as the base for the proportional analogy, because there are two suffixes.

The final pattern to discuss, involves returning to the examples of triconsonantal roots with the suffix /-m/. Recall that there was an unexpected ablaut vowel associated with the *perfective* form of the verb. The following examples are repeated from above.

- (23) Schwa deletion (Hukari 1978)
- |    |                       |  |
|----|-----------------------|--|
| a. | čátəq <sup>w</sup> əm | fall apart (from cooking)                  |
|    | čátq <sup>w</sup> əm  | falling apart (from cooking)               |
| b. | łépəχəm               | fall (leaves)                              |
|    | łépχəm                | falling (leaves)                           |
| c. | łátəq <sup>w</sup> əm | snore                                      |
|    | łátq <sup>w</sup> əm  | snoring                                    |
| d. | čək <sup>w</sup> əχəm | sizzling sound (e.g., grease in a hot pan) |
|    | čək <sup>w</sup> χəm  | sizzling sound (e.g., grease in a hot pan) |

We have already discussed the issues raised by these forms. However, there is a further complication to bring forward by words that have lexical suffixes preceding the suffix /-m/. Notice that in the words below, the *perfective* does not have the ablaut vowel.

- (24) Complex triconsonantal forms
- |    |  |                                    |
|----|--|------------------------------------|
| a. | /-as/  | ‘face’                             |
|    | χəmχ <sup>w</sup> əsəm                               | haircut; have a haircut            |
|    | χamχ <sup>w</sup> əsəm                               | haircut; having hair cut           |
| b. | /=əw <sup>w</sup> tx <sup>w</sup> /                  | ‘building’                         |
|    | səw <sup>w</sup> qəw <sup>w</sup> tx <sup>w</sup> əm | look for a house                   |
|    | sew <sup>w</sup> qəw <sup>w</sup> tx <sup>w</sup> əm | looking for a house (for yourself) |

In order to derive words like those in (23) and (24), the rule for ablaut (let us call it ABL) must be specific enough to apply to words with only the /-m/ suffix, but not any other suffix. For a constructivist approach, the rule must be stated to include a negative condition. The conditions for the rule include a combination of phonological and morphological conditions: triconsonantal root, /-m/ suffix,

and NOT any other suffix. A derivation of the various forms will illustrate how this rule applies to some forms, but not others. Following standard approaches, we will assume that there are no schwas in the input and that there are rules for epenthesis that need to apply first. The rule of *perfective* ablaut (ABL) will be ordered after schwa epenthesis (EP), though as can be seen below, this is not a crucial assumption.

	<i>perfective</i>		<i>imperfective</i>	
affix	č̣ṭq̣ <sup>w</sup> -m	ṣẉq̣-e <sup>w</sup> ṭx <sup>w</sup> -m	č̣ṭq̣ <sup>w</sup> -m	ṣẉq̣-e <sup>w</sup> ṭx <sup>w</sup> -m
EP	č̣ə̣ṭə̣q̣ <sup>w</sup> ə̣m	ṣə̣ẉq̣e <sup>w</sup> ṭx <sup>w</sup> ə̣m	č̣ə̣ṭə̣q̣ <sup>w</sup> ə̣m	ṣə̣ẉq̣e <sup>w</sup> ṭx <sup>w</sup> ə̣m
ABL	č̣əṭə̣q̣ <sup>w</sup> ə̣m	–	–	–
$f_{IMP}$	–	–	č̣əṭq̣ <sup>w</sup> ə̣m	ṣə̣ẉq̣e <sup>w</sup> ṭx <sup>w</sup> ə̣m
SCHWA	–	ṣə̣ẉq̣ə̣ẉṭx <sup>w</sup> ə̣m	–	ṣə̣ẉq̣ə̣ẉṭx <sup>w</sup> ə̣m

The complication associated with specifying the application of ablaut to forms without specific suffixes is not needed with the relational approach.

## 5 Summary and discussion

Having illustrated the problems that Halkomelem *imperfective* allomorphy poses to both traditional notions of the morpheme as well as realizational models of word formation, it is useful to now summarize the specific evidence from Hul'q'umi'num' for a word-based relational approach, and to provide a more general discussion of why such an approach would be preferred to standard constructivist models.

First, it is not impossible for constructivist approaches to derive Hul'q'umi'num' *imperfective* verbs. Rather, this paper's aim is to illustrate the issues that arise in doing so. The previous discussion has shown several areas where the fundamental nature of constructivist approaches – sequential building up of word structure – poses several problems. Probably the most significant of these is that whatever mechanism is used to create *imperfective* words must be either a stem-level or word-level operation, depending on what the other affixes are in the word. This is a kind of ordering paradox that illustrates the hazards of ordering in general. Other issues relate to word-formation occurring in isolation. While it is possible to create the words, an understanding of why the patterns may be as they are is not possible. On the other hand, a relational approach can offer some level of understanding as to why some processes apply and others do not, and has a simple approach to accounting for the patterns. While realizational approaches are more successful at accounting for the patterns, there are some cases in which morpheme-based approaches simply cannot account for some of the exponents of the *imperfective*.

As Chomsky (1986, et seq.) has often pointed out, linguistics can be understood as a branch of cognitive science, with the goal to model a speaker's internal universal knowledge of language systems. In terms of word-formation, it is commonly understood that we store full words in our mental lexicon, as

evidenced by theories relying on this, such as exemplar dynamic theory. There is also evidence to suggest that speakers have knowledge of morphemes. Both viewpoints are compatible with various approaches to morphology, including relational abstractive approaches. The questions one must ask are: whether there is evidence that words are linked to each other and whether there is evidence for analogical reasoning. As a quick answer to these questions, one need look no further than the basic design of psycholinguistic studies, which rely on repetition priming to have evidence for the former: faster responses to words heard previously can only be accomplished if there is some link between what was heard prior to what was presented. And as Blevins and Blevins (2009: 1) note, analogy is “the core of human cognition”. It would seem that there is ample evidence to support a relational analogical approach to word-formation over a constructivist approach in which words are created in isolation from other words.

This paper also represents a first small step to articulating a theory of *Grounded Morphology* (after Archangeli and Pulleyblank’s (1994) *Grounded Phonology*), in which formal properties of a model of morphology are grounded in what is known about the mental lexicon. A growing body of research supports a view that morphological structure is emergent and gradient (Bybee 1985, et seq.; Hay 1991 et seq.; Hay and Baayen 2005). Furthermore, there is a formal mechanism within Optimality Theory (Prince and Smolensky 1993) in which words are related to each other: in particular McCarthy and Prince’s (1995, 1999) Correspondence Theory.

In summary, Halkomelem *imperfective* word-formation poses a challenge to constructivist approaches to morphology in which words are concretely built up incrementally from roots or from stems in isolation. An alternative approach has been outlined which is abstractive and relational, based on a fundamental assumption regarding the structure of the lexicon – that speakers and hearers store full words rather than the individual bits of words or complex rule interactions.

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