Chapter 4

Optimality of Nonconcatenative Allomorphs

4.1 Introduction

In this chapter, I explore multiple nonconcatenative allomorphs. Morphemes often have several different surface realizational forms (i.e., allomorphs). For example, the English plural suffix receives three different realizations depending on the phonological context: [s] after a voiceless non-strident segment, [z] after a voiced non-strident segment, and [əz] after a strident. Given various possibilities of expressing a morpheme by base modification, however, it is naturally expected that similar situations are observed in nonconcatenative morphology. More concretely, we expect that various nonconcatenative operations should be able to be employed to denote a particular morphosyntactic function depending on the phonological shape of the given base, as schematically depicted in (1), where α, β, and γ represent output forms created by performing some base modification rather than by adding an affix to realize morpheme μ.

(1)

$$\begin{tikzcd} & {[\alpha]} \\ \text{/Input/}_{\mu} \arrow[ur] \arrow[r] \arrow[dr] & {[\beta]} \\ & {[\gamma]} \end{tikzcd}$$

This state of affairs is actually attested in natural languages, particularly in the Salishan language family. In (1), the available phonological changes of a stem are mutually exclusive since they are all exponents of the same morpheme. This is a rather trivial fact which follows from the definition of allomorphs. But what makes nonconcatenative allomorphs interesting is the fact that the choice of a particular nonconcatenative allomorph is global. The selection of an allomorph in the English plural formation is quite parochial in the sense that the relevant phonological context is the immediately preceding segment. In nonconcatenative allomorphs investigated here, much more extensive information of the base must be taken into consideration.

It is true that nonconcatenative morphemic alternations are crosslinguistically rare, but the amount of attention paid to those cases has been scarce in the earlier literature. The goal of this chapter is thus to examine some examples and propose a unified account for them within the theoretical context developed in chapter 2. Particularly, I focus on the following two questions: (i) what precisely is the driving force of such nonconcatenative morphemic alternations?, and (ii) how should the driving force be successfully reflected in a formal explanation?

The rest of this chapter is mapped out as follows. In section 4.2, I provide an overall answer to the two questions addressed above. I argue that the reason why a variety of base deformations occur resides in natural languages' desire to achieve phonologically less marked output forms, hence optimality of nonconcatenative allomorphs. This optimization is accomplished through interactions of phonological markedness constraints and various faithfulness constraints, the latter being specific to a given morphosyntactic category. The general proposal outlined in section 4.2 is subsequently tested against actual data. Section 4.3 discusses the continuative formation in Upriver Halkomelem, a Salishan language. In this word formation, four varieties of allomorphs come into the picture: reduplication, *hə*-prefixation, vowel lengthening, and stress shift. Section 4.4 is devoted to a case study of another Salishan language, Saanich. In this language, the actual aspect morpheme is phonologically realized by metathesis, reduplication, or *í*-infixation. In the course of investigating these cases, I critically review some derivational and constraint-based approaches taken in the earlier literature and argue that they are not satisfactory. To this end, I illuminate the significant importance of the role played by RM. In section 4.5, I investigate the incomplete phase formation in Rotuman, a language genetically unrelated to the Salishan languages. The two factors which differentiate this case from the two Salishan language examples are first that the relevant word formation is strictly templatic, and second that, occasionally under duress of undominated constraints, no phonological exponent appears. Finally, section 4.6 summarizes the main results of this chapter.

4.2 Nonconcatenative Allomorphs as Word Optimization

This section outlines the specific issue to be addressed and provides a general proposal to deal with it in a principled way. As discussed and exemplified in chapters 2 and 3, the core constraint ranking to explain various nonconcatenative operations is RM » Faith, the specific Faith determining the particular phonological modification that a base undergoes. Given this basis, simply ranking multiple faithfulness constraints beneath RM is not sufficient to derive various context-sensitive operations, although ranking all relevant Faith-IO below RM is a minimal prerequisite. Suppose that both Max-IO-Seg and Linearity-IO are outranked by RM. But this is not a sufficient condition to derive the effect of multiple nonconcatenative allomorphs. Given the spirit of strict dominance holding among constraints, Max » Linearity or Linearity » Max should hold. In the former ranking, metathesis is more harmonic while it is suboptimal given the latter ranking, modulo everything else being equal. This indicates that any ranking permutation of RM and faithfulness constraints yields at best only one type of nonconcatenative allomorph, the one which violates the lowest ranked faithfulness constraint.

The role of markedness constraints becomes crucial at this point. They are often in conflict with faithfulness constraints, and their interactions play a key role in capturing the distribution of multiple nonconcatenative allomorphs. The gist of the idea is that a violation of a high ranked faithfulness constraint is forced when the violation of a lower ranked constraint leads to a violation of some markedness constraint outranking the higher ranked faithfulness constraint. Otherwise, violating the lower ranked faithfulness constraint is less costly.

To illustrate this idea, consider the following schematic example. In language L, the morphosyntactic category α is phonologically realized either by metathesis or by subtractive morphology. This language is free from any syllable structure restrictions except the inviolable onset requirement. Metathesis is the elsewhere case, so Max_{α} outranks $\text{Linearity}_{\alpha}$. Given this set-up, consider the following two input forms: /CVC/ and /CVCV/. Assuming Onset and RM as undominated constraints, various candidates are evaluated for these two inputs. First, as illustrated in (2), morpheme α is phonologically denoted by metathesis when /CVC/ is the input. Since neither metathesis nor subtractive morphology incurs a violation of Onset, violating low ranked Linearity is the most harmonic. By contrast, metathesis is suboptimal when the input is /CVCV/ because Onset is violated as the result of metathesis. An important observation is that the effect of Onset enters the picture only when metathesis creates an onsetless syllable, and this is the only context where subtractive morphology is chosen as the optimal nonconcatenative allomorph. This accords with the basic tenet of OT that constraints are violable only when it is necessary for the satisfaction of higher constraints (Prince and Smolensky 1993:chapter 3). To take advantage of multiple nonconcatenative allomorphs is therefore an effort of languages to optimize the overall word form by avoiding phonologically marked structures or representations.

(2)

		/CVC/$_{\alpha}$	Onset	RM	Max$_{\alpha}$	Lin$_{\alpha}$
a.		CVC		*!		
b.		CV			*!	
c.	☞	CCV				*

(3)

		/CVCV/$_{\alpha}$	Onset	RM	Max$_{\alpha}$	Lin$_{\alpha}$
a.		CV.CV		*!		
b.	☞	CVC			*	
c.		CV.VC	*!			*

The most significant merit of this constraint-based analysis lies in its explanatory level and strong predictability. First, it is explanatorily satisfactory because the reason why both metathesis and subtractive morphology enter the picture is quite clear. Onsetless syllables are entirely prohibited in L, and the reason why the otherwise cheapest strategy is occasionally blocked directly follows from the normal phonology of L. Second, the strong predictive power is hard-wired into the theoretical architecture. Since various morphemic alternations are explained by a single constraint ranking, all relevant generalizations are packed in the same box. The distribution of various nonconcatenative allomorphs follows from the single ranking, so other cases are predictable. This is a desirable consequence from the perspective of language acquisition since the language learner does not need to be exposed to all individual examples.

The reason why languages exhibit nonconcatenative allomorphs is attributed to the general demand of natural languages to achieve output forms that are as unmarked as possible. This intuition is directly captured by constraint-based OT. Allomorphemic optimization is nothing special to nonconcatenative morphology. A simple example is drawn from the plural suffix in English. The fact that the morpheme surfaces in three different varieties is considered as the effect of markedness constraints requiring voicing assimilation and prohibiting adjacent stridents. This can be seen as an effect motivated by the relevant markedness constraints overriding the relevant faithfulness constraints. Thus, the principle underlying allomorphemic optimization is a general one.

Finally, I discuss a formal aspect of the system deriving nonconcatenative allomorphemic alternations: interactions between markedness and faithfulness constraints. More specifically, I address when a markedness constraint meaningfully interacts with faithfulness constraints. Again, the faithfulness constraints ranked lower than RM are constraints whose violations are allowed for the satisfaction of RM. Given this background, suppose that three faithfulness constraints are outranked by RM, as in (4). M_a-M_d represent slots that a markedness constraint can potentially occupy. A preliminary consideration eliminates uninteresting cases. With respect to M_d, all faithfulness constraints outrank the markedness constraint, so it has no impact on the relevant morphosyntactic formation: it is always violated. In the same way, M_c does not have any surface effect either. Even if the violation of Faith-D entails a violation of the markedness constraint, violating both M_c and Faith-D is still more harmonic than violating only either Faith-B or Faith-C. This suggests that languages do not present any explicit empirical evidence for the distinction between M_c and M_d.

(4) RM » Faith-B » Faith-C » Faith-D

$\uparrow$ M_a $\uparrow$ M_b $\uparrow$ M_c $\uparrow$ M_d

Focusing on M_a and M_b, consider the tableaux in (5) and (6). M_b is active only when the violation of Faith-D results in a violation of M_b (and/or M_a) as well. Despite the fact that Faith-C is ranked over Faith-D, candidate (5b) is the optimal in this case provided that it satisfies M_b. Interactions of M_b with Faith-B have no effect on the selection of the winner. M_a is the unique constraint that gives candidate [AB'CD] the chance to be the winning form. It is crucial that M_a conflict with both Faith-C and Faith-D since (6a) or (6b) would surface otherwise.

(5)

	/ABCD/$_\alpha$	M_a	Faith-B	M_b	Faith-C	Faith-D
a.	ABCD'			*!		*
b. ☞	ABC'D				*	
c.	AB'CD		*!			

(6)

	/ABCD/$_\alpha$	M_a	Faith-B	M_b	Faith-C	Faith-D
a.	ABCD'	*!				*
b.	ABC'D	*!			*	
c. ☞	AB'CD		*			

This consideration highlights the strict dominance of constraints maintained in OT. In essence, a markedness constraint plays an active role only when it blocks all less marked nonconcatenative allomorphs. In derivational terms, the process which violates the lowest ranked faithfulness constraint is the elsewhere case, and the process which incurs a violation of the highest ranked faithfulness constraint has the most severely restricted distribution.

4.3 The Continuative in Upriver Halkomelem

Upriver Halkomelem, a central coast Salishan language, exhibits a complicated pattern of nonconcatenative allomorphy in the continuative formation. The continuative implies that the action denoted by a root continues for a moderate length of time after onset (if a time of onset is implied or stated within the speech event) or before conclusion (if a time of conclusion is implied or stated within the speech event). In the absence of an implication or statement of onset or conclusion, the continuative action is assumed to be continuing indefinitely (Galloway 1993:261). The continuative aspect is opposed to the mutually exclusive and the more unmarked noncontinuative, and is realized in four different ways depending on the context: reduplication, *hə*-prefixation, vowel lengthening, and stress shift, as schematized in (7). As discussed by Urbanczyk (1998), the two prefixal segments are epenthetic.

(7)

{Continuative} → Reduplication
{Continuative} → *hə*-prefixation
{Continuative} → Vowel lengthening
{Continuative} → Stress shift

In this section, I demonstrate the proposal in the previous section with the continuative formation in Upriver Halkomelem. Relevant data are described by Galloway (1980, 1993) and analyzed by Urbanczyk (1998) in OT. However, her analysis is remarkably different from mine, so this example provides a good representative case to highlight my proposal. In section 4.3.1, I offer the basic facts. Section 4.3.2 is devoted my analysis. I also argue that nonconcatenative allomorphs present a serious empirical challenge to anti-faithfulness theory. Finally, section 4.3.3 provides a critical review of Urbanczyk's (1998) OT analysis.

4.3.1 Facts and Descriptive Generalization

Relevant examples excerpted from Galloway (1980, 1993) are provided in (8), where stressed syllables are underlined.

(8) a. Reduplication

Noncontinuative	*Gloss*	*Continuative*	*Gloss*
<u>t'i</u>.ləm	sing	<u>t'i</u>.tə.ləm	singing
<u>wi</u>.qəs	yawn	<u>wi</u>.wə.qəs	yawning
<u>yiq</u>	fall (of snow)	<u>yi</u>.yəq	falling (of snow)
<u>x^{w}a</u>.yəm	sell	<u>x^{w}a</u>.x^{w}ə.yəm	selling
<u>t'i</u>.cəm	swim	<u>t'i</u>.tə.cəm	swimming

b. *hə*-prefixation

Noncontinuative	*Gloss*	*Continuative*	*Gloss*
<u>mə</u>.qət	swallow	<u>həm</u>.q'ət	swallowing
<u>wəq$^{'w}$</u>	drown	<u>həwq$^{'w}$</u>	drowning
<u>məq'</u>	get full	<u>həmq'</u>	getting full

c. Vowel lengthening

Noncontinuative	*Gloss*	*Continuative*	*Gloss*
<u>ʔi</u>.məx	walk	<u>ʔii</u>.məx	walking
<u>hɛ</u>.wə	hunt	<u>hɛɛ</u>.wə	hunting
<u>ha</u>.qwət	smell	<u>haa</u>.qwət	smelling
<u>ʔal</u>.θət	groan	<u>ʔaal</u>.θət	groaning
<u>ʔi</u>.tət	sleep	<u>ʔii</u>.tət	sleeping

d. Stress shift

Noncontinuative	*Gloss*	*Continuative*	*Gloss*
ɬɛl.<u>qi</u>	soak	<u>ɬɛl</u>.qi	soaking
sə.<u>q'ɛt</u>	split	<u>sə</u>.q'ɛt	splitting
ƛ'ə.<u>wəls</u>	bark	<u>ƛ'ə</u>.wəls	barking
caa.<u>lə</u>.x^{w}əm	bleed	<u>caa</u>.lə.x^{w}əm	bleeding
ɬə.<u>x^{w}əɬ</u>.cɛ	spit	<u>ɬə</u>.x^{w}əɬ.cɛ	spitting

Relevant descriptive generalization is divided into two portions, phonological and allomorphemic. Starting with phonological generalization, we need to capture some properties. First, in reduplication, the reduplicant is constantly the initial CV of the base. Furthermore, the initial vowel of the base is reduced to a schwa. Second, in prefixation, a schwa is prefixed and the obligatory onset position is filled by another epenthetic segment [h]. The first vowel of the noncontinuative base is subject to deletion. Urbanczyk (1998) provides evidence that [h] is epenthetic. Galloway (1993) discusses that resultative stems are obtained by adding the *s*- stative prefix to intransitive continuative forms. As /ləcət/→[səlcət] 'fill it/filed' indicates, [h] does not appear in this case. This makes sense if [h] is an epenthetic place holder when underlying segments are insufficient for the satisfaction of the onset requirement. In the resultative, the prefix *s*- is available, so no epenthesis is needed (see Hukari 1978 for the same observation in Cowichan). Furthermore, Galloway (1993:118) remarks that [ʔ] or [h] serves as an epenthetic segment to break up a vowel cluster to prohibit merger of two vowels. Finally, there is nothing special to say on vowel lengthening and stress shift. These generalizations are regarded as emergence of the unmarked (cf. Urbanczyk 1998).

Turning to the distribution of the four nonconcatenative allomorphs, the generalization is as follows. First, reduplication occurs when the noncontinuative base begins with CV (C≠laryngeal, and V≠ə), as shown in (8a). Second, prefixation takes place when the base-initial segments are a sequence of a sonorant and a stressed schwa (8b). Third, vowel lengthening is required if the base begins with a laryngeal consonant (8c), and finally, stress is shifted when the base carries stress on a non-initial syllable of the word (8d). The four processes are in complementary distribution, confirming that they belong to one and the same morpheme. Cases where a base begins with a sequence of an obstruent and a schwa are not considered since they do not conform to a uniform pattern, but this does not impinge on crucial points here. They are not discussed by Urbanczyk (1998) either.

4.3.2 Analysis

In this section, I develop an OT analysis of the distribution of the four nonconcatenative allomorphs involved in the continuative formation in Upriver Halkomelem. Noncontinuative forms are identical to bare stems, and therefore, it does not make any difference whether stems or noncontinuative forms are treated as bases of continuative forms, although bare stems are likely to be bases under the system developed in section 2.3. Given that the two prefixal segments are both epenthetic and that no other allomorphs depend on affixation, the continuative morpheme is entirely contentless. The distribution of the relevant allomorphs is resummarized in (9).

(9) Reduplication: When the base begins with CV (C≠laryngeal, and V≠ə)
hə-prefixation: When the base-initial segments are a sequence of a sonorant and a schwa.
Vowel lengthening: When the base begins with a laryngeal consonant.
Stress shift: When the base-initial syllable is stressless.

As discussed in chapter 2, reduplication and epenthesis violate Integrity and Dep respectively. As the constraint violated by vowel lengthening, I employ Ident-Length which requires that the output length of segments be the same as that of their input correspondents. Furthermore, I assume Align-L(Headσ,PrWd) as the driving force of stress shift. A relevant prosodic faithfulness constraint is violated when stress shift occurs, but it is abstracted away from in the following tableaux. Another essential ingredient is *Stress[ə] militating against a stressed schwa. RM plays an essential role in addition to these constraints.

Beginning with reduplication, a tableau is provided in (10). (10a) violates RM because the continuative morpheme does not receive any phonological realization in the surface representation. RM is satisfied by all other candidates since their phonological deviance from the input can be potentially associated with the continuative morpheme.

(10)

		/wi.qəs/$_{\text{Cont.}}$	Align	RM	Ident-Length	*Stress[ə]	Integ	Dep
a.		wi.qəs		*!				
b.	☞	wi-wə.qəs					**	
c.		həw.qəs				*!		**
d.		wii.qəs			*!			
e.		wi.qəs	*!			*		

(11) delineates a case of epenthetic prefixation. The tableau shows that candidates (11a), (11d), and (11e) lose the competition in the same way as in (10). In the evaluation of the relative wellformedness between (11b) and (11c), the crucial observation is that they both violate *Stress[ə] because the first vowel of the input is a schwa. The decision is passed on to the lower ranked constraints. Given Integrity » Dep, reduplication is suboptimal. Comparing (10) and (11), the general proposal to explain nonconcatenative allomorphs is corroborated. In (11), *Stress[ə] plays no role in eliminating candidates, but in (10), it does. Given the constraint ranking, *hə*-prefixation is the most harmonic modulo no other factor comes into play. This maximal faithfulness is avoided when the violation of the lowest ranked faithfulness

constraint is accompanied by a violation of a high ranked markedness constraint, as in (10).

(11)

/<u>mə</u>.qət/$_{Cont.}$	Align	RM	Ident-Length	*Stress[ə]	Integ	Dep
a. <u>mə</u>.qət		*!		*		
b. <u>mə</u>.mə.qət				*	*!*	
c. ☞ <u>həm</u>.qət				*		**
d. <u>məə</u>.qət			*!	*		
e. mə.<u>qət</u>	*!			*		

The stress shift examples in (8d) are rather trivial given the ranking demonstrated in (10) and (11). As demonstrated in (12), undominated Align-L(Headσ,PrWd) selects the stress shift candidate as the optimal when the noncontinuative base carries stress non-initially. Two remarks are in order. First, the last example in (8d) (i.e., /ɬə.<u>x^{w}əɬ</u>.cɛ/→[<u>ɬə</u>.x^{w}əɬ.cɛ]) motivates the ranking between Align-L(Headσ,PrWd) and *Stress[ə]. Given that the first vowel is a schwa and the third vowel is a full vowel and that stress shifts to the word-initial syllable, the alignment constraint should outrank *Stress[ə]. Second, a prosodic faithfulness constraint which prohibits stress shift must be ranked below Align-L(Headσ,PrWd). The fact that the alignment constraint is not obeyed by noncontinuative forms suggests that their stress assignment is not predictable. It is rather straightforwardly accounted for by postulating lexical stress in noncontinuative forms. The prosodic contrast between the noncontinuative and the continuative is captured by the following ranking: ProsFaith$_{Noncont.}$ » Align-L(Headσ,PrWd) » ProsFaith$_{Cont.}$.

(12)

	/ɬɛl.qi/$_{\text{Cont.}}$	Align	RM	Ident-Length	*Stress[ə]	Integ	Dep
a.	ɬɛl.qi	*!	*				
b.	ɬɛ.lə.qi	*!				**	
c.	hə.ɬɛl.qi	*!					**
d.	ɬɛɛl.qi	*!		*			
e. ☞	ɬɛl.qi						

The analysis developed above is not sufficient for explicating the vowel lengthening cases in (8c). As it stands, the analysis predicts that reduplication is the best allomorph for those cases, contrary to fact. Investigating over two thousand words of Upriver Halkomelem, Urbanczyk (1998) reports that only twenty syllables were found which consist of a sequence of a glottal consonant and a schwa. This is significantly few, and she proposes a constraint which prohibits placeless syllables, where placeless syllables are defined as syllables whose member segments are all placeless. Capitalizing on her insight, I assume *Placelessσ. Placeless segments are laryngeal consonants and a schwa (see Bessell and Czaykowska-Higgins 1991 for arguments that laryngeal is placeless in Salishan languages in general).

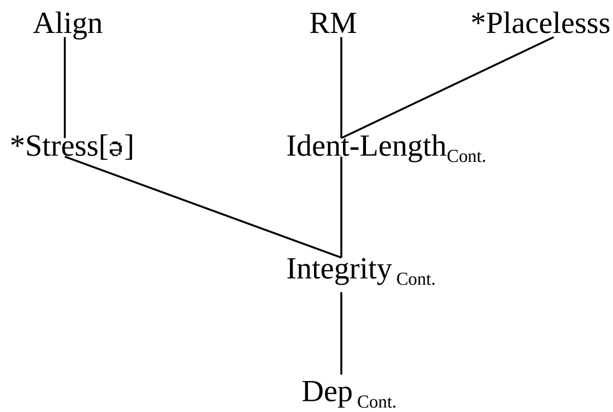
Granting the undominated status to this constraint, consider (13). The crucial observation is that both (13b) (the reduplication allomorph) and (13c) (the *hə*-prefixation allomorph) violate *Placelessσ. As mentioned in section 4.3.1, the base-initial vowel is reduced to a schwa when reduplication occurs. This suggests that *Placelessσ is violated when the noncontinuative base begins with a laryngeal consonant, exactly the context in which vowel lengthening is chosen as the best allomorphs. The *hə*-prefixation candidate also violates *Placelessσ. As stated in section 4.3.1, the initial vowel of the noncontinuative base is subject to elision. Given that the prefixal segments are both placeless, *hə*-prefixation necessarily leads to a violation of *Placelessσ in the context where vowel lengthening takes place. Since Align-L(Headσ,PrWd) and RM are undominated, vowel lengthening is the best allomorph although it violates Ident-Length.

(13)

/ʔi.məx/$_{\text{Cont.}}$	*Plessσ	Align	RM	Ident-Length	*Stress[ə]	Integ
a. ʔi.məx			*!			
b. ʔi.ʔə.məx	*!					**
c. həʔ.məx	*!				*	
d. ☞ ʔii.məx				*		
e. ʔi.məx		*!			*	

Summarizing the analysis, the entire constraint hierarchy is given in (14). This constraint ranking highlights the most important idea in this chapter: multiple nonconcatenative allomorphs are a consequence of the existence of several faithfulness constraints ranked below RM and their interactions with markedness constraints. The allomorph which incurs only the lowest ranked faithfulness constraint violation is the least marked (i.e., *hə*-prefixation), but the least costly option becomes more marked than other allomorphemic realizations when a high ranked markedness constraint is violated. As far as the pertinent faithfulness constraints are concerned, Dep$_{\text{Cont}}$ is ranked the lowest while Ident-Length$_{\text{Cont.}}$ is the highest ranked. This suggests that *hə*-prefixation and vowel lengthening are the least and the most costly strategies to manifest the noncontinuative morpheme in the surface representation. Integrity$_{\text{Cont.}}$ is ranked in-between, and therefore, reduplication has the intermediate markedness value. The overall evaluation of the optimal allomorph involves a large-scale computation compared with concatenative allomorphy because optimization of a whole word needs to be taken into account.

(14)



Allomorphemic alternations in nonconcatenative morphology as attested in Upriver Halkomelem present a serious empirical challenge to anti-faithfulness theory. Under this theory, a morpheme without any phonological substance should be associated with multiple anti-faithfulness constraints and that they are all ranked over the faithfulness counterparts. Thus, for the schematic example discussed in (2) and (3), ¬Max and ¬Linearity outrank Max and Linearity respectively. What is problematic here is that both morphological subtraction and metathesis are required irrespective of the presence or absence of markedness constraints, indicating that their distributional complementarity cannot be captured successfully. This problem arises because anti-faithfulness constraints and the corresponding faithfulness constraints are inherently incompatible with each other regardless of the context. As long as an anti-faithfulness constraint dominates the faithfulness counterpart, an anti-faithfulness effect surfaces on the output representation.

The important fact is that even the introduction of markedness constraints does not rescue the undesirable situation. Suppose that /AB/ is given in the underlying representation, and that ¬Faith-A and ¬Faith-B outrank Faith-A and Faith-B respectively. Given that ¬Faith-A and ¬Faith-B require a faithfulness violation with respect to /A/ and /B/ respectively (i.e., /A/→[A'] and /B/→[B']), the relevant markedness constraints should be *A' and *B'. For these markedness constraints to play an active role, it is essential that they be ranked over anti-faithfulness constraints because otherwise anti-faithfulness constraints are always dominant and therefore the markedness constraints play no deciding role. Given this set-up, however, anti-faithfulness theory has potential to yield undesirable outcomes. First, there is no guarantee that the two markedness constraints are in conflict with the two anti-faithfulness constraints. In such a case, no phonological realization of a morpheme appears on the surface. Second, nothing in anti-faithfulness theory prevents the possibility that the two markedness constraints and the two anti-faithfulness constraints are not in conflict with each other, producing multiple nonconcatenative stem modifications (e.g., subtractive morphology and umlaut) as the phonological exponents of one and the same morpheme. This argument points to the failure of anti-faithfulness theory to capture the complementary distribution of various nonconcatenative allomorphs. Given that those allomorphs do not surface in overlapping environments, what is called here multiple nonconcatenative allomorphs presents an empirical difficulty to anti-faithfulness theory.

By contrast, the RM-based approach does not run into the same problem. RM is a morphological faithfulness constraint which is not inherently antagonistic to phonological faithfulness constraints when a given morpheme does not possess any phonological material. The important implication is that only the violation of one faithfulness constraint is needed to satisfy high ranked RM since additional faithfulness violations are simply gratuitous: multiple nonconcatenative stem changes are always harmonically bounded in the sense of Prince and Smolensky (1993:176-178). Which faithfulness violation must be incurred depends upon the overall well-formedness of the candidates yielded by *Gen*. The significant importance of the same faithfulness violation differs from context to context depending upon the given phonological base since various markedness constraints enter the picture in the well-formedness evaluation. Given that RM and phonological faithfulness constraints are not always antagonistic to each other (see section 2.4), markedness constraints have room to play a role in the computation in RMT. This interaction gives rise to effects of nonconcatenative allomorphy.

4.3.3 Urbanczyk (1998)

Urbanczyk (1998) gives an OT analysis of the continuative formation at issue. I critically review her analysis and clarify my idea along the line of the argument above. I focus attention on the distribution of the four nonconcatenative allomorphs.

Urbanczyk (1998) makes several crucial assumptions in her analysis: (i) the continuative morpheme is essentially reduplicative $\mathrm{RED}_{\mathrm{Cont.}}$ in nature, (ii) $\mathrm{RED}_{\mathrm{Cont.}}$ is imperative in the sense that the morpheme itself demands reduplication, (iii) RM is violated whenever the continuative morpheme is not realized through reduplication, and (iv) there is a constraint called "DistinctStem" which mandates different output forms between noncontinuative and continuative forms. This constraint directly demands two corresponding forms to be phonologically distinct. The role of this constraint becomes clear from the tableau in (15), which is constructed according to her argument. *Struc-Syll militates against any single syllable, restricting the shape of the reduplicant to a monosyllable. The crucial comparison is between (15a) and (15c). According to Urbanczyk, the reason why (15c) is ruled out in favor of (15a) is that DistinctStem is infringed upon by (15c) by virtue of the fact that the continuative form is precisely the same as the noncontinuative base. In the same vein, the perfectly faithful form (16b) is also eliminated.

(15)

		/wi.qəs, RED$_{Cont.}$/	DistinctStem	*Struc-Syll	Max-BR
a.	☞	wi-wə.qəs		***	***
b.		wi.qə-wə.qəs		****!	*
c.		wi.qəs	*!	**	*****

(16)

		/mə.qət, RED$_{Cont.}$/	DistinctStem	Dep
a.	☞	həm.q'ət		**
b.		mə.qət	*!	

Related to the assumption that the continuative morpheme is essentially reduplicative, the reason why DistinctStem is crucial becomes clear. Since RM is violated under Urbanczyk's analysis whenever reduplication fails, both (16a) and (16b) violate RM, as demonstrated in (17). This indicates that no stem modification is expected to be the optimal when reduplication is blocked, contrary to fact. The central claim of Urbanczyk (1998) is that reduplication is the norm to express the continuative morpheme, but when it creates a structure more marked than permissible, some other base modification enters the picture under the pressure of DistinctStem.

(17)	/mə.qət, $RED_{Cont.}$/	RM	Dep
a. ☹	həm.qət	*	*!*
b. ☞	mə.qət	*	

However, this analysis has some serious drawbacks. First, DistinctStem misses the fundamental observation that noncontinuative and continuative forms are phonologically different because they have different morphemes. In other words, DistinctStem is insensitive to the fact that distinct forms are required for noncontinuatives and continuatives for a morphological reason. Although the surface effect of DistinctStem is roughly identical to that of RM, they are sharply distinct at the conceptual level. Thus, DistinctStem is unsatisfactory in the same way as anti-faithfulness theory. By contrast, RM directly captures the idea that distinct forms are required by the presence of a new morpheme. This means that RM is satisfied by (17a) since *hə*-prefixation can be taken to be the specific exponent of the continuative morpheme.

A more serious problem of Urbanczyk's (1998) analysis resides in her assumption that the continuative morpheme is essentially reduplicative. Urbanczyk (1998:656 fn.3) states that "It is hoped that the analysis developed here proves that a reduplicative analysis is possible." This statement is misleading. Even if her reduplicative analysis works, there is no language-internal evidence to support it. One might be led to her assumption by the nature of the morphosyntactic category under consideration. It is true that morphosyntactic functions such as continuatives, progressives, and repetitives are often denoted by reduplication in many languages, but this is not a universal principle. English progressives, which roughly correspond to the continuative morpheme in Upriver Halkomelem, do not take advantage of reduplication. Moreover, reduplication is quite productively and regularly used to express a variety of range of morphosyntactic categories other than those enumerated above. Thus, even this conjecture does not constitute a positive argument for Urbanczyk's assumption. That the continuative morpheme is essentially reduplicative is unmotivated, and thus, the reduplication-oriented analysis is built on stipulative assumptions.

I proposed that the continuative morpheme contains no phonological content, but a specific kind of exponent employed for the satisfaction of RM entirely depends on a constraint ranking. RM is operative as the driving force of the realization of the continuative morpheme. More precisely, RM » $\text{Faith}_{\text{Cont.}}$ forces the continuative form to undergo some phonological modification. RM simply demands the output representation to express the existence of all morphemes in the underlying representation. Importantly, this suggests that RM is sensitive to the input representation, desirably reflecting the intuition that differences between outputs of the continuative and the noncontinuative come from a difference of inputs. Second, the problem arising from Urbanczyk's assumption that the continuative is reduplicative disappears since the morpheme does not require any specific type of phonological exponence.

Again, my proposal has two significant consequences differentiating it from Urbanczyk's. First, RM is satisfied as long as the continuative morpheme receives some phonological exponence, as discussed in section 2.3. This means that (17a) satisfies RM in my system. As a corollary, reduplication is merely a potential but not the essential strategy to satisfy RM in the continuative formation. Urbanczyk's (1998) and my analyses are encapsulated in (18).

(18)

	Urbanczyk (1998)	Proposal here
What is the underlying morphemic representation of continuative?	{Continuative} RED	{Continuative}
Are morphemes process-specific?	YES	NO
What requires different forms in two distinct morphosyntactic categories?	DistinctStem	RM » Faith

4.4 The Actual Aspect in Saanich

As another case study, I examine the actual aspect formation in Saanich in this section. The data and descriptive generalization are based on Montler (1986, 1989). The actual aspect is opposed to the nonactual aspect, and signals that the action, state, or other reference of the predicate is actually occurring at an indicated time, roughly corresponding to the English progressive (Montler 1986:111). Nonactual aspect forms serve as the bases of the corresponding actual aspect forms. In this context, three nonconcatenative allomorphs are relevant: metathesis, reduplication, and ʔ-infixation, as schematically shown in (19).

(19)

{Actual aspect} → Metathesis
{Actual aspect} → Reduplication
{Actual aspect} → ʔ-infixation

The situation looks quite similar to the nonconcatenative allomorphy involved in the continuative formation in Upriver Halkomelem. However, there is a significant difference between the two cases. Unlike *hə*-prefixation in Upriver Halkomelem, the glottal stop is not epenthetic: it is phonological substance of the actual aspect morpheme. This suggests that the actual aspect morpheme is not contentless. In spite of this difference, I argue that the selection of the optimal allomorph in the actual aspect formation in Saanich is captured in exactly the same way as the continuative formation in Upriver Halkomelem. The example studied in this section is subsumed under the rubric of the general schema discussed in section 4.2.

In the rest of this section, I present the data of interest in section 4.4.1, and I present my analysis and discuss some important theoretical consequences in section 4.4.2. Finally, I critically review two earlier studies concerning the present issue (Montler 1989 and Stonham 1994) in section 4.4.3.

4.4.1 Facts and Descriptive Generalization

Concrete examples of metathesis, reduplication, and ƛ-infixation found in the actual aspect formation are given in (20). In the data transcription, an apostrophe denotes that the preceding consonant is glottalized, and [tᶿ] represents a voiceless interdental stop. Furthermore, primarily stressed vowels are underscored.

(20)	*Root*	*Nonactual*	*Actual*	*Gloss*
a. Metathesis	q'p'	q'p'ə̱t	q'ə̱p't	patch
	sq'	sq'ə̱t	sə̱q't	tear
	sx	sxə̱t	sə̱xt	push
	ʃtʃ	ʃtʃə̱t	ʃə̱tʃt	whip
	t's	t'sə̱t	t'ə̱st	break
	tqʷ	tqʷə̱t	tə̱qʷt	tighten
	θk'ʷ	θk'ʷə̱t	θə̱k' ʷt	straighten
	θx	θxə̱t	θə̱xt	shove
	ƛ'k'ʷ	ƛ'k'ʷə̱t	ƛ'ə̱k'ʷt	put out
	t'ᶿɬək	t'ᶿɬə̱k	t'ᶿə̱ɬk	pinch
	ƛ'pəx	ƛ'pə̱x	ƛ'ə̱px	scatter
b. Reduplication	qen'	qe̱n'+(C)	qe̱-qən'	steal
	t'ᶿeʔ	t'ᶿe̱ʔ+(C)	t'ᶿe̱-t'ᶿəʔ	ride
	qʷəl	qʷə̱l+(C)	qʷə̱-qʷəl	say
	kʷul	kʷu̱l+(C)	kʷu̱-kʷəl	school
	ɬik'ʷ	ɬi̱k'ʷ+(C)	ɬi̱-ɬək'ʷ	trip
	qew	qe̱w+(C)	qe̱-qəw	rest
	ɬap'	ɬa̱p'+(C)	ɬa̱-ɬəp'	eat
	yq	tʃə̱k+(C)	tʃə̱-tʃək	get big

c. ʔ-infixation	ʔit'^{θ}	ʔi̲t'^{θ}+V	ʔi̲ʔt'^{θ}	get dressed
	ʔetʃ	ʔe̲tʃ+V	ʔe̲ʔtʃ	wipe
	tʃaq'^{w}	tʃa̲q'^{w}+V	tʃa̲ʔq'^{w}	sweat
	ʔiɬən	ʔi̲.ɬən+V	ʔi̲ʔ.ɬən	eat
	weqəs	we̲.qəs	we̲ʔ.qəs	yawn
	ʔamət	ʔa̲.mət	ʔa̲ʔ.mət	sleep

First, I briefly sketch phonological aspects of relevance. In metathesis, a vowel and the immediately preceding consonant undergo reversal. Second, in reduplication, the initial CV of the nonactual aspect base is uniformly copied, creating a CV reduplicant. The base-initial vowel is concomitantly reduced to a schwa, which is similar to the vowel reduction process observed in reduplication in the continuative formation in Upriver Halkomelem. The reason behind vowel reduction is clear in Saanich. Montler (1986:28, 1989:100) documents that unstressed vowels are all reduced to a schwa. This correlates with the strong pattern in Saanich that all vowels in a word are schwas except the vowel bearing stress. Finally, ʔ-infixation appears right after stressed vowels. I do not discuss these phonological aspects, assuming that independent interactions of constraints not discussed here yield them.

Second, consider the distribution of the three allomorphs, which is the central concern here. The examples in (20) exhibit a seemingly complicated distributional pattern of metathesis, reduplication, and ʔ-infixation, but they indeed receive straightforward descriptive generalization. First, as in (20a), metathesis is taken when a base form is CCVC, where the final VC may be a suffix or part of the root. Second, as in (20b), reduplication is employed when (i) a root is CVC followed by nothing or a C-initial suffix, and (ii) a root is CC, where a schwa is epenthesized between the two root consonants to create the nonactual aspect form. Finally, as in (20c), glottal stop infixation appears elsewhere. The three kinds of phonological exponence are therefore in complementary distribution, supporting the idea that they are allomorphs.

4.4.2 Analysis

The analysis starts by considering the morpheme-internal representation of the actual aspect. Given the discussion in chapter 2, metathesis and reduplication are obtained when RM outranks Linearity and Integrity respectively. Thus, the morpheme needs no phonological material to trigger metathesis and reduplication. The question is whether the glottal stop needs to be explicitly encoded as the phonological substance of the actual aspect morpheme. The answer to this question is positive. Montler (1986:28) reports *h*-epenthesis to break up a cluster of a schwa and a full vowel, but no ʔ-epenthesis is documented, justifying that the glottal stop is not the default epenthetic consonant in Saanich. This suggests that the existence of the ʔ-allomorphy cannot be derived without an underlying specification under the normal assumption that only the default segment serves as the epenthetic element. The morphemic structure of the actual aspect thus looks as in (21). This constitutes a stark contrast with the continuative morpheme in Upriver Halkomelem which is entirely contentless.

(21) {Actual aspect}
|
/ʔ/

Given that metathesis, reduplication, and infixation are relevant, the following three faithfulness constraints come into play: $\text{Linearity}_{\text{Actual}}$, $\text{Integrity}_{\text{Actual}}$, and $\text{Contiguity}_{\text{Actual}}$. These constraints bear the actual aspect morphemic marking. This morphosyntactic specification is important because promiscuous metathesis, reduplication, and ʔ-infixation would take place otherwise regardless of morphosyntactic categories. In the analysis below, I implicitly assume that all other faithfulness constraints are undominated. Crucial markedness constraints are *Complex(onset) and *Complex(coda) (Prince and Smolensky 1993). Besides these constraints, RM is also indispensable.

(22) is the analysis of metathesis cases in (20a) (e.g., /q'p'ət/→[q'əp't]). The crucial observation is that glottal stop infixation does not resolve the offending consonantal sequence violating undominated *Complex(onset). The only way to satisfy the constraint is to employ metathesis. One candidate not included in (22) is [q'əq'.p'ət], where the initial [q'ə] is the reduplicant. The fault of this form is that the reduplicated segments are not contiguous, ruled out by Contiguity-BR. Under the present analysis where the glottal stop is part of the underlying phonological material, Max is clearly violated by the optimal candidate. The question is why [q'ət], for instance, does not surface. From the facts illustrated above, it should be evident that a root segment never undergoes deletion. This observation is captured by Faith-Root » Faith-Affix (or more specifically, Max-Root » Max-Affix), granting faithfulness priority to roots over affixes (McCarthy and Prince 1995; Urbanczyk 1996; Alderete 1999).

(22)

		/q'p'ət, ʔ/$_{Act.}$	RM	*Compl (ons)	*Compl (coda)	Lin	Integ	Contig
a.		q'p'ət	*!	*				
b.		q'p'əʔt		*!	*			*
c.	☞	q'əp't			*	*		
d.		q'ə-q'əp't			*	*	*!*	

Second, (23) is a case of reduplication. Candidate (23a) is ruled out by RM. The optimal form (23e) violates only Integrity$_{Actual}$, but candidates (23b-d) fail to satisfy at least one higher ranked constraint. Candidates (23b) and (24c) violate *Complex(coda), and (23d) violates *Complex(onset). The crucial difference between (20a) and (20b) is what constitutes the initial two segments. In (20a), the initial two segments are CC, but in (20b), they are CV. Thus, base forms in (20a) contain offending consonantal concatenation against *Complex(onset), but those in (20b) do not. This is the reason why metathesis is not chosen in (20b) because it creates a violation of a syllable markedness constraint, either *Complex(onset) or *Complex(coda), as seen from (23c, d). Rather, reduplication is the best because it does not produce any violation of the markedness constraints. The same analysis holds of cases where a CVC root is followed by a consonant-initial suffix. Again, Max is violated by the optimal candidate due to its underparsing of the glottal stop affiliated with the continuative morpheme. Max-Root » Max-Affix is essential here too.

(23)

		/qen', ʔ/$_{Act.}$	RM	*Compl (ons)	*Compl (coda)	Lin	Integ	Contig
a.		qen'	*!					
b.		qeʔn'			*!			*
c.		eqn'			*!	*		
d.		qn'e		*!		*		
e.	☞	qe-qən'					**	

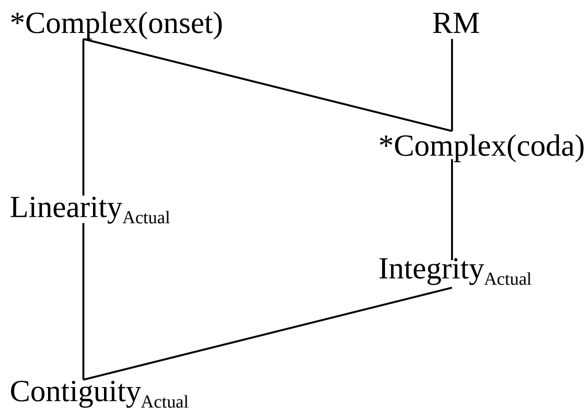
Finally, let us consider cases of glottal stop infixation in (20c). As mentioned above, a glottal stop is infixed when initial CVC is followed by a vowel, whether it is part of a root or the first segment of a suffix. A representative tableau is provided in (24). (24a) is immediately ruled out because of its fatal violation with respect to undominated RM. While desired (24b) violates only Contiguity$_{Actual}$, the lowest ranked constraint, (24c-e) violate at least one higher constraint. Thus, it is clear that (24b) is the winner. Of particular interest here is the comparison between (24b) and (24e). Comparing (20b) and (20c), the crucial difference is the segment that follows the CVC: a consonant in (20b) but a vowel in (20c). Infixation creates a consonant cluster in (20b), but it does not in (20c). Contiguity$_{Actual}$ is crucially dominated by Integrity$_{Actual}$. This means that, everything being equal, infixation costs less than reduplication. This is why glottal stop infixation is the best way of realizing the actual aspect morpheme.

(24)

		/weqəs, ʔ/$_{Act.}$	RM	*Compl (ons)	*Compl (coda)	Lin	Integ	Contig
a.		weqəs	*!					
b.	☞	weʔ.qəs						*
c.		wqe.əs		*!		*		
d.		ew.qəs				*!		
e.		we-wə.qəs					*!*	

Summarizing the analysis above, the relevant constraint ranking is given in (25). This constraint hierarchy shares the essential characteristics of the general proposal in section 4.2 with the continuative formation in Upriver Halkomelem: operations involving a faithfulness constraint that is not ranked the lowest are possible only when some markedness constraint blocks the operation which violates the lowest ranked faithfulness constraint. In other words, various interactions between markedness and faithfulness constraints make the multiple range of nonconcatenative allomorphs possible, supporting the argument in section 4.2. What is remarkable in this constraint ranking is the fact that $\text{Contiguity}_{\text{Actual}}$ is accorded the lowest status because it nicely reflects the observation that ʔ-infixation is the elsewhere case, and therefore, is the default.

(25)



The analysis here has two important theoretical consequences. The most striking one concerns the morphemic representation of the actual aspect. As in (21), this morpheme inherently contains the glottal stop segment, but it fails to surface when metathesis or reduplication is selected. The failure of the surface realization of the underlying phonological substance is nothing surprising given that metathesis, reduplication, and ʔ-infixation are in complementary distribution. The success of the proposed OT analysis is that this is explained naturally. ʔ-infixation is prevented when it creates a highly marked structure. The surface non-realization is a strategy to eschew markedness. Markedness-based systems like OT thus provide a principled reason for this. By contrast, the peculiarity remains a mystery in approaches with no or little markedness consideration. ʔ-infixation should suffice to satisfy RM, so why does Saanich decide to bother to give up using the underlying material and to modify the phonological shape of the base form? To answer this question, syllable structure constraints imposed on phonological representations or some other equivalent would be needed additionally, but this is what the proposed OT analysis implements directly.

A second point has to do with a broader theoretical perspective. I discussed in chapter 2 that there should not be any formal distinction between concatenative and nonconcatenative morphology. The actual aspect formation in Saanich represents a good empirical case for this claim because the three allomorphs are a mixture of concatenative and nonconcatenative morphology. Were the two terminologically distinguished types of morphology independent of each other and governed by completely different linguistic principles, this kind of mixture is completely incomprehensible. Under the view that there exists no formal factor which differentiates them (except the presence or absence of some phonological content associated with the given morpheme), the coexistence of concatenative and nonconcatenative allomorphs is unsurprising.

4.4.3 Montler (1989) and Stonham (1994)

Montler (1989) and Stonham (1994) provide an overall analysis of the actual aspect formation in Saanich. Their analyses are both couched in a derivational framework, but their concrete proposals are radically different from each other. In this section, I critically review both of them, and argue that nether of them is satisfactory.

The central claim of Montler (1989) is that the actual aspect formation is templatic, the template being CVCC. This template is operative only word-initially such that the initial four segments of all actual aspect forms must conform to the templatic restriction. This templatic approach directly accounts for the metathesis and *ʔ*-infixation examples in (20a, c). But this analysis encounters a number of problems, both empirical and conceptual. Empirically, the reduplication examples in (20b) cannot be explained. Recall that the reduplicative allomorph surfaces when the nonactual aspect base is CVC optionally followed by a C-initial suffix. Suppose that a CVC base is followed by such a suffix. The base form is already CVCC in this case and accords with the template. The question is why reduplication takes place. Note that it prevents template satisfaction. By contrast, when no such suffix exists, the base form is CVC, but again, reduplication does not make any contribution to the accomplishment of the CVCC template. In effect, reduplication simply does not make sense in terms of the CVCC templatic approach. Montler (1989:101) states "...if all that is there is CVC, reduplicate the first C...", but this statement is wrong because the reduplicant is constantly CV. The vowel quality of the reduplicant is the same as that of the copied segment, so this point is not refutable.

This analysis has a conceptual difficulty as well. Since McCarthy and Prince (1986), a growing body of arguments has been developed arguing that templates are prosodically defined. In the ʔ-infixation cases, it is obligatory that the base-initial CVC is followed by a vowel, either the continuation of the base or a suffix. This suggests that the second consonant in a nonactual aspect form serves as the onset of a syllable whose nucleus position is occupied by the base-second or suffix-initial vowel, indicating that the CVCC template is separated into two syllables as in [CVC.C]. This is against arguments in favor of the prosody-based view of templates.

These empirical and conceptual problems would not be surmountable. Furthermore, Montler assumes a floating [+constricted glottis] feature as the source of ʔ-infixation, but it remains a mystery why it does not appear as a secondary articulation, glottalizing a base consonant when there is such room (e.g., *[q'əp't'] from [q'əp't]) because Saanich allows for numerous glottalized phonemes. In other words, the floating feature analysis fails to account for the reason why it is not realized in the surface representation when reduplication or metathesis is employed. This is a serious pitfall since this means that the analysis cannot capture the fundamental observation that metathesis, reduplication, and *ʔ*-infixation are in complementary distribution (i.e., allomorphemic). This problem, together with the aforementioned empirical and conceptual difficulties, further weakens the plausibility of the analysis proposed by Montler (1989). I conclude that the templatic analysis must be rejected.

Stonham (1994) develops a prosodic analysis. The essential claim is that the actual aspect morpheme carries a mora, a prosodic unit whose phonological content is not specified. This mora has the effect of augmenting the nonactual aspect form by one mora in the actual aspect formation (see Davis and Ueda 2001 for an OT analysis along this line). Starting with metathesis cases in (21a), he argues that it is in some sense the simplest and most economical from a language-based view since it does not add any new phonemic material (Stonham 1994:175). However, it is not clear why segmental reversal is less costly than epenthesis, for instance. Schwa epenthesis is regularly and productively used in Saanich to break up a consonant cluster in certain environments (Montler 1986:30), so an obvious possibility is to augment the nonactual forms in (21a) by schwa epenthesis between the two offending consonants. In the OT conception, metathesis and epenthesis incur different faithfulness constraint violations, so it is not valid to evaluate the economy of the two distinct processes in terms of the presence or absence of a new segment. Stonham (1994:175) discusses the possibility of vowel lengthening as a way of augmenting nonactual aspect bases.

He denies it because vowel length is not contrastive in Saanich, but phonological contrasts are not a necessary factor in the evaluation of morpheme realization.

Stonham's (1994) analysis crucially departs from Montler's (1989) in that he assumes no concrete phonological substance as the driving force of *ʔ*-infixation. This gives rise to a problem. Given the absence of phonological substance, it is expected that the epenthesized segment is the default segment in the language. As stated in the previous section, Montler (1986:28) reports *h*-epenthesis to break up a cluster of a schwa and a full vowel, but no *ʔ*-epenthesis is documented. This indicates that the default epenthetic consonant is [h].

The various problems discussed above show that Stonham (1994) presupposes the possible range of phonological changes available for the actual aspect formation, putting the cart before the horse. Furthermore, his analysis crucially relies on CV-segregation (McCarthy 1979, 1981), but this theoretical device is not independently motivated language-internally, so this is a stipulation not necessary anywhere else in Saanich phonology and morphology.

The review here suggests that neither Montler (1989) nor Stonham (1994) is satisfactory. Despite the fact that they attempt to reduce the three nonconcatenative allomorphs to a single source, their analyses are undesirable.

4.5 The Incomplete Phase in Rotuman

Following the discussion of the two Salishan languages, I examine Rotuman, a central Oceanic language, which has no genetic relationship with Salishan languages. Of interest here is the incomplete phase formation. Complete phase forms are phonologically the same as stem forms, but there are indications that the complete phase serves as the base of the incomplete phase since some prosodic faithfulness constraints are active in the latter formation. As discussed in section 2.3, bare stems are basically taken to be the bases of word formations, but it does not preclude the possibility that some morphosyntactic category is derived from another (cf. deverbal nouns in Icelandic). I take the incomplete phase as the base of the incomplete phase.

The selection of the appropriate phase in a given context is governed by various principles outside phonology (Churchward 1940:88-89). The phonology involved in this word formation is similar to the two cases studied in the previous sections in that various nonconcatenative base modificational strategies are attested depending on the base form. This phase alternation is comprehensively described by Churchward (1940) and theoretically studied quite extensively in the earlier literature (Haudricourt 1958ab; Biggs 1959, 1965; Milner 1971; Cairns 1976; Saito 1981; van der Hulst 1983; Janda 1984; McCarthy 1986b, 1989, 2000c; Mester 1986; Besnier 1987; Hoeksema and Janda 1988, Odden 1988; Anttila 1989; Weeda 1992; Blevins 1994). All content words exhibit the phase alternation. Numerous nonconcatenative base modifications are observed depending on the base shape, as in (26). An obvious difference from the two previous cases is that the incomplete phase sometimes fails to receive phonological exponence. I argue that no surface realization appears when any effort to satisfy RM results in a violation of some undominated constraint.

(26)

{Incomplete Phase} → Diphthongization
{Incomplete Phase} → Metathesis
{Incomplete Phase} → Fusion/Umlaut
{Incomplete Phase} → Deletion
{Incomplete Phase} → No surface realization

Another significant characteristic which differentiates the incomplete phase formation from the Salishan examples is that it is truly templatic in the sense that various base deformative strategies yield a certain prosodic shape word-finally. This point is especially important for the following discussion since the templatic effect is strictly emergent in my analysis, a by-product of interactions of constraints rather than a requirement forced by a templatic constraint per se. But the incomplete phase formation receives fundamentally the same analysis as the Salishan cases.

This section is mapped out as follows. I present the crucial set of data in section 4.5.1 and provide descriptive generalization. Section 4.5.2 is devoted to presenting my analysis. Finally, in section 4.5.3, I provide a critical review of McCarthy (2000c) among many other earlier works cited above. It attempts to offer a comprehensive OT analysis of the morphology and phonology involved in the incomplete phase formation process. His analysis is quite similar to mine, but the key constraint operative as the driving force of various base modifications is fundamentally different.

4.5.1 Facts and Descriptive Generalization

In this section, I present the basic data to be accounted for. As in (27), five varieties of base modification are relevant, including lack of overt surface realization. They are exemplified in (27). Although these examples seem to be fairly complex in terms of their distribution, they receive reasonably straightforward generalization. First, diphthongization occurs as in (27a) when the complete phase ends in a vowel cluster (heavy or bimoraic diphthongs are denoted by the ligature). This point is discussed in the next section. Unless a vowel sequence is found word-finally, diphthongization is never employed. Metathesis of the final CV takes place when the result is a vowel sequence with rising sonority, where low and high vowels have the highest and the lowest sonority value respectively, mid vowels in-between. This is exemplified in (27b). Third, as in (27c), vowel fusion/umlaut occurs when metathesis is not available because of the sonority requirement mentioned above. When the relevant two vowels are identical, they are simply fused into a single segment, but when their qualities are not the same, the first vowel is umlauted. Since the source of umlaut comes from the front property of a word-final vowel, it is a prerequisite that the final vowel of a complete phase form is front. The simple fusion cases as in [hanuj] have been analyzed as final vowel deletion by many earlier authors (Besnier 1987; Blevins 1994; McCarthy 2000c), but I argue that fusion is correct. Word-final vowel deletion is independently required as in (27d). In (27d), metathesis is not an eligible option because the first vowels are more sonorous than the word-final ones. Furthermore, umlaut is not an option either since the first vowels are already front. Finally, no surface realization appears as in (27e) if the base-final vowel is long.

(27) a. Diphthongization

Complete Phase	*Incomplete Phase*	*Gloss*
ʔea	ʔea	to say
foa	foa	coconut scraper
ʔio	ʔio	to see
kelea	kelea	to look
pupui	pupui	floor
lelei	lelei	good

b. Metathesis

Complete Phase	*Incomplete Phase*	*Gloss*
pure	puer	to rule
rito	riot	to glitter
loŋa	loaŋ	toward the interior of island
ulo	uol	seabird sp.
piko	piok	lazy

c. Fusion/Umlaut

Complete Phase	*Incomplete Phase*	*Gloss*
hanuju	hanuj	tale
toto	tot	blood
nono	non	grip
kamata	kamat	to begin
hose	hös	oar
fuli	fül	deaf
futi	füt	to pull
mose	mös	to sleep

d. Deletion

Complete Phase	*Incomplete Phase*	*Gloss*
lɑʔo	lɑʔ	to go
ɑsu	ɑs	smoke
hɑŋu	hɑŋ	to awake
hɑsu	hɑs	gall bladder
rɑko	rɑk	to imitate

e. No surface realization

Complete Phase	*Incomplete Phase*	*Gloss*
rii	rii	house
ree	ree	to do
sikɑɑ	sikɑɑ	cigar

The descriptive generalization is significant in terms of the harmonic scale of the nonconcatenative allomorphs, as discussed by McCarthy (2000c). Setting aside (27e) where no exponent realizes the incomplete phase, the four processes are hierarchically ranked in the order of preference. The context where diphthongization is a valid process is strictly limited to cases where the word-final portion contains a vowel sequence. A segmentally affected process is demanded in all other environments. The environment of metathesis is next stringently restricted. Fusion/Umlaut is employed when metathesis is blocked by the sonority condition. In the same vein, fusion/umlaut is more preferred to deletion. In effect, deletion is the last resort strategy to achieve an explicit phonological expression of the incomplete phase morpheme. Taking (27e) into account, the five allomorphs receive the harmonic scale in (28) where the order is given in decreasing harmony from left to right. This scale is based on faithfulness considerations. Note that simple fusion is more harmonic than umlaut since the latter incurs additional faithfulness violations. This harmonic scale is a direct and important input to the analysis in the next section.

(28)
No realization → Diphthongization → Metathesis → Fusion → Umlaut → Deletion
(most harmonic) (least harmonic)

4.5.2 Analysis

In this section, I present an analysis along the lines discussed thus far. Since metathesis, fusion, umlaut, and deletion are relevant, Linearity, Uniformity, and Max are the pertinent constraints. Setting various prosodic faithfulness constraints aside, the constraint ranking in (29) is established based on the harmonic hierarchy in (28).

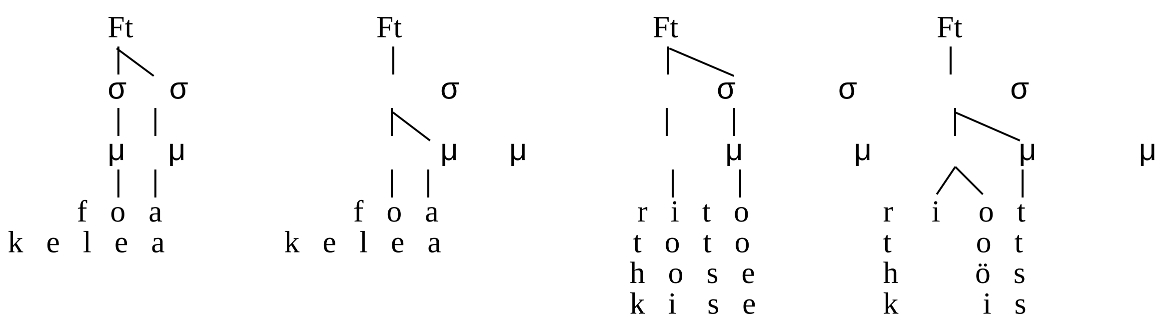
(29) RM » $\text{Max}_{\text{Incomplete}}$ » $\text{Linearity}_{\text{Incomplete}}$, $\text{Uniformity}_{\text{Incomplete}}$ » *Heavy-Diphthong

Since final vowel deletion is the least preferred, the faithfulness constraint prohibiting segmental deletion (i.e., Max) is ranked the highest among the relevant faithfulness constraints. Metathesis violates only Linearity while umlaut violates both Linearity and Uniformity because umlaut is a consequence of fusion of the last two vowels, involving segmental reversal of the word-final vowel and the preceding vowel. In other words, metathesis incurs only a subset of violations of Umlaut. Thus, the relative harmony between metathesis and umlaut can be accounted for without manipulating a crucial ranking between Linearity and Uniformity. RM is the driving force of nonconcatenative base changes, so it must be ranked over all the relevant faithfulness constraints. Considering diphthongization which involves no segmental changes, I assume *Heavy-Diphthong. It may be more plausibly substituted by a prosodic faithfulness constraint, but it suffices for our purposes. I omit the morphosyntactic marking on the faithfulness constraints subsequently.

Two more pieces of background information are necessary. A first one concerns the prosodic structure of the complete and the incomplete phases, in particular, in order to motivate diphthongization in (27a). The following discussion regarding this issue owes a debt to McCarthy (2000c). It is argued at length that the various nonconcatenative base modifications involve the prosodic changes in word-final position, as schematically shown in (30). He justifies the prosodic structures mainly based on stress assignment facts. The crucial distinction between these two phases is that the complete phase ends in a disyllabic foot whereas the word-final foot is constantly a bimoraic monosyllable in the incomplete phase.

(30) Diphthongization
Metathesis/Fusion/Umlaut/Deletion

Complete *Incomplete* *Complete* *Incomplete*

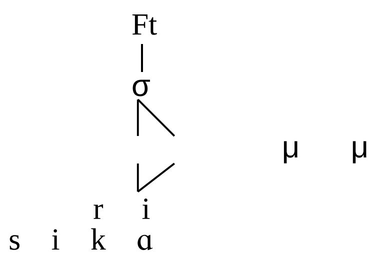


The only exception to the word-final disyllabic foot generalization is cases where the word-final vowel is long. The complete phase contains a heavy syllable word-finally in such cases, as represented in (31). This conforms to the moraic theory in which long vowels are invariably bimoraic (Hyman 1985; McCarthy and Prince

1986; Hayes 1989). The important consequence is that no phonological distinction is made between the two phases in such cases. Otherwise, the complete phase always has a word-final foot consisting of two light syllables. This observation is significant because it motivates the diphthongization process in (27a).

(31) No surface realization

Complete=Incomplete



As a final background before presenting my analysis, I introduce several additional constraints to facilitate the subsequent argument. The relevant constraints are provided in (32).

(32) a. Light-Diphthong:
The sonority value must rise for a light (or monomoraic) diphthong.

b. $*\sigma_{\mu\mu\mu}$:
Trimoraic syllables are prohibited.

c. RHType=Trochaic:
Feet are trochaic.

d. Align-R(Ft,PrWd):
Feet are aligned to the right edge of a prosodic word.

e. Head-Match:
If α is the prosodic head of the word and α β, then β is the prosodic head of the word.

f. Weight-Ident:
If α β, and if α is monomoraic, then β is monomoraic, and if α is bimoraic, then β is bimoraic.

A brief explanation of each of these constraints is in order. Light-Diphthong dictates that tautosyllabic light diphthongs must have a sequence of vowels such that the second one is more sonorous than the first one (Rosenthall 1994). This is never violated in Rotuman, so Light-Diphthong is undominated. Next, $*\sigma_{\mu\mu\mu}$ literally bans trimoraic syllables, which is also faithfully obeyed with no exception. Third, the rhythmic type constraint (Prince and Smolensky 1993) and the foot alignment constraint (McCarthy and Prince 1993a) together derive the effect of the moraic trochee in Rotuman. Permissible foot structures consist either of two light syllables (where the first syllable carries stress) or of a single heavy syllable. (32c) and (32d) together require that a moraic trochee is aligned at the right edge of a prosodic word. The property of a moraic trochee holds of both the complete and the incomplete phases. Head-Match requires head correspondence between the two phases. Thus, it is an output-output correspondence constraint comparing the two phases because prosodic information is reliably present only in output forms given the conception of richness of the base (Prince and Smolensky 1993; Smolensky 1996; Kurisu 2000c). Since the head or the stressed vowel in the complete phase is carried over to the incomplete phase, this constraint can be considered to be undominated for the present purposes. But it must be dominated by the rhythmic type and alignment constraints, as discussed by McCarthy, when we consider stress assignment in the context of the richness of the base hypothesis. Finally, Weight-Ident in (32f) is a faithfulness constraint militating against vowel lengthening and shortening. This constraint needs to be ranked fairly low to ensure the strict obedience to the bimoraic word minimality requirement in connection with the richness of the base hypothesis (see also Blevins 1994). We are dealing with the phase alternation involving only surface-to-surface correspondence relations, so we can safely assume that Weight-Ident is undominated too for our purposes. In effect, all the constraints in (32) can be assumed inviolable so that many potential candidates can be removed from the following analysis.

Given the background above, I consider the examples in (27) in the order presented there. Beginning with diphthongization, a tableau is given in (33). There is not much worth remarking here since *Heavy-Diphthong is ranked the lowest. Other conceivable processes such as metathesis, umlaut, and deletion are suboptimal because they incur one or more higher ranked violation. A potential candidate not included in (33) is [pu.pui], syllabifying the last three segments tautosyllabically as a light diphthong. But this candidate fatally violates Light-Diphthong. Since *Heavy-Diphthong is ranked the lowest and therefore does not exhibit any interesting interactions with other constraints, I leave it out in the subsequent tableaux.

(33)

		/pu.pu.i/$_{\text{Incompl.}}$	RM	Max	Lin	Unif	*Heavy-Diphthong
a.		pu.pu.i	*!				
b.	☞	pu.pui					*
c.		pu.pi.u			*!		
d.		pu.pü			*!	*	
e.		pu.pu		*!			

Second, consider metathesis in (27b). It is strictly regulated by Light-Diphthong, but the examples in (27b) satisfy the requirement. As demonstrated in (34), no morphemic realization (34a) and deletion (34d) violate a constraint ranked over Linearity violated by the optimal form, and umlaut (34c) incurs a gratuitous violation of Uniformity. Two more plausible candidates exist: [pu.er] and [puer]. In [pu.er], the stress should fall on the last vowel as in [pu.ér] under duress of the rhythmic type constraint in (32c) and the foot alignment constraint in (32d). However, it infringes on undominated Head-Match in (32e). By contrast, [puer] is ruled out by the constraint against trimoraic syllables in (32b). The constraints in (32) are all ranked over RM, so by transitivity, over Linearity. This shows that the two additional candidates are eliminated for independent reasons. The reason why diphthongizaion is eligible only when the complete phase form ends in a vowel cluster becomes clear now. Since coda consonants are consistently a weight bearing unit, diphthongization in other contexts necessarily results in a violation of $*\sigma_{\mu\mu\mu}$.

(34)

		/pu.re/$_{\text{Incompl.}}$	RM	Max	Lin	Unif
a.		pu.re	*!			
b.	☞	puer			*	
c.		pür			*	*!
d.		pur		*!		

Third, let us turn to simple fusion cases, a subset of (27c). Simple fusion occurs when the last two vowels are exactly identical. Thus, potentially conceivable candidates can be quite narrowed down from the beginning. For instance, umlaut is not a plausible option, and diphthongization is untenable for the reason stated above. However, as illustrated in (35), simple fusion cases are interesting since final vowel deletion is another possible interpretation of those examples, as actually done by Besnier (1987), Blevins (1994), and McCarthy (2000c). Comparing (35b) and (35c), the fusion candidate turns out to be more harmonic than the deletion candidate. As discussed above and exemplified shortly below, Max » Linearity and Max »

Uniformity are independently needed to explain the umlaut examples, the remaining subset of (27c). This justifies to group the cases I call simple fusion with umlaut rather than with deletion.

(35)

		/ha.nu$_1$.ju$_2$/$_{\text{Incompl.}}$	RM	Max	Lin	Unif
a.		ha.nu$_1$.ju$_2$	*!			
b.	☞	ha.nu$_{1,2}$j			*	*
c.		ha.nu$_1$j		*!		

In order to motivate Max » Linearity and Max » Uniformity, consider the umlaut examples. As shown in (36), Max outranks both Linearity and Uniformity to obtain umlaut because it is never expected to appear otherwise. Three candidates are omitted in (36): [moes], [moes], and [mo.es]. Light-Diphthong, *$\sigma_{\mu\mu\mu}$, and Head-Match rule them out respectively.

(36)

		/mo$_1$.se$_2$/$_{\text{Incompl.}}$	RM	Max	Lin	Unif
a.		mo.se	*!			
b.	☞	mö$_{1,2}$s			*	*
c.		mo$_1$s		*!		

The umlaut process certainly violates Linearity and Uniformity in Rotuman, but they are not the only constraint violations of relevance. Mainly two vocalic feature identity constraints are involved additionally: vowel height and vowel backness. The relevant feature identity constraints should be ranked beneath Max to keep [mös] as the winner in (36). One may bring up the input-output correspondence as depicted in (37), where umlaut still comes from the final vowel but the final vowel remains without undergoing fusion. Since this form violates neither Linearity nor Uniformity, it is a serious competitor. My claim is that this candidate is ruled out by Integrity, another faithfulness constraint never violated in the incomplete phase formation. A new aspect is that the domain where Integrity is active is not restricted to segments but is expanded to the featural level.

(37)

```
/m   o   s   e/
             |
        [-back]
         ____|
[m   ö   s   e]
```

Considering final vowel deletion in (27d), a tableau is given in (38), where some constraints in (32) and stress information are included since they are of direct relevance. Stressed syllables are underscored. As (38) shows, any attempt to satisfy RM in a way other than vowel deletion infringes on some undominated constraint, suggesting that subtraction is a highly expensive strategy: subtraction is the best only when all other options result in a violation of some undominated constraint.

(38)

	/rɑ.ko/$_{\text{Incompl.}}$	*Heavy-Diphthong	*$\sigma_{\mu\mu\mu}$	Head-Match	RM	Max
a.	rɑ.ko				*!	
b.	rɑok	*!				
c.	rɑok		*!			
d.	rɑ.ok			*!		
e. ☞	rɑk					*

But the incomplete phase formation occasionally pays more, reaching the maximal extreme. The relevant examples are in (27e). When a complete phase form ends in a long vowel, no overt exponent of the incomplete phase surfaces. (39) represents some potential candidates for the input /si.kɑɑ/. As the tableau indicates, no stem modification can avoid the violation of some kind of undominated constraint ranked over RM. The upshot is to give up on any overt phonological expression of the incomplete phase morpheme in cases as in (27e).

(39)

		$/\text{si.k}ɑɑ/_{\text{Incompl.}}$	Weight-Ident	$*\sigma_{\mu\mu\mu}$	Head-Match	RM
a.	☞	si.(kɑɑ)				*
b.		(si.kɑ)	*!			
c.		si.(ɑɑk)		*!		
d.		(sɑɑ).ki			*!	

Under the present analysis where RM plays a prominent role as the driving force of nonconcatenative base modifications, the reason why the examples in (27e) do not undergo any changes is due to the pressure of the undominated constraints. This accords with the observation made in the nominative formation in Lardil that an explicit morphemic realization is prevented when any attempt results in a violation of some phonological constraint ranked higher than RM.

4.5.3 McCarthy (2000c)

The main concern of McCarthy (2000c) is to expand the domain of faithfulness constraints to prosodic information, so it does not share the same principal interest as the goal of this chapter. Despite this, it provides a comprehensive OT analysis of the phase alternation at issue. The distinction of prosodic structure between the two phases discussed in the preceding section plays a direct role in McCarthy's (2000c) analysis. He claims that the incomplete phase formation is a phonological effect, which makes the word-final portion be occupied by a stressed bimoraic monosyllable, paying attention to the invariance of the word-final prosodic structure of the incomplete phase. Various nonconcatenative allomorphs are needed to achieve this goal (although "allomorphs" is not an appropriate terminology in the context of his analysis). McCarthy (2000c:160) directly captures the prosodic contrast through the phonological markedness constraint in (40).

(40) Align-Head-σ: Align(H'(PrWd),R,PrWd,R)
The main-stressed syllable is final in every word.

The only possible syllables are (C)V in Rotuman generally except in the word-final position of the incomplete phase or in words with long vowels, which are also found only word-finally. According to McCarthy, the reason why the incomplete phase deviates from the very rigid syllable structure constraint is that Align-Head-σ outranks Syll=μ (a constellation of constraints responsible for deriving only (C)V syllables). Under McCarthy's analysis, the examples in (27e) are unremarkable. Since the complete phase forms already satisfy Align-Head-σ, no ado is required for the incomplete phase formation. Any attempt to satisfy the constraint by adding some modification to the complete phase base results in meaningless faithfulness violations, so complete faithfulness is the most harmonic. The central constraint ranking posited by McCarthy (2000c) is given in (41).

(41) Align-Head-σ » Max » Linearity, Uniformity

This is quite similar to the ranking proposed in (29), the only difference being which constraint operates as the driving force of base modifications. He does not discuss the diphthongization process in (27a) in detail, but it can be safely assumed that the constraint militating against it is ranked below Linearity and Uniformity. Given this constraint ranking, deletion still has the most severely restricted distribution while diphthongization is the least expensive stem modification among the range of nonconcatenative allomorphs employed in the incomplete phase formation. The more stringently restricted, the higher markedness constraints must be satisfied.

The significant difference between the two analyses lies in the driving force of the various stem modifications in the incomplete phase. While my analysis employs morphology-oriented RM, a phonological markedness constraint is used in McCarthy's analysis. His basis of the phonological analysis comes from the argument developed by Hale and Kissock (1998). Examining Churchward's (1940) descriptive documentation, they claim that the phase alternation is phonological rather than syntactic or semantic. They observe that the two phases are associated with complementary suffixes and clitics. Crucially, complete phase forms are linked only to monomoraic suffixes and clitics whereas the incomplete phase occurs when a suffix is bimoraic or larger or when no suffixal element follows a stem, as shown in (42) (Hale and Kissock 1998:120).

(42) The complete phase / The incomplete phase

The complete phase		The incomplete phase	
-ŋa	'nominalizer'	-ʔia	'ingressive'
-me	'hither'	-tia	'completive aspect'
-(a)fu	'away (towards listner)'	-ʔaki	'causative'
-(a)ŋe	'away (towards third person)'	-kia	'transitive'
-a	'completive aspect'	-ʔian	'ingressive'
-a	'transitive'	-taʔa	'that'
-e	'locative anaphor'	-tei	'vocative particle'
-t	'indefinite singular article'	-tema	'each'
-s	'interrogative'	-teʔisi	'this'
-Ø	'definite plural/locative'	-ta	'definite singular article'

In (42), there are five apparent exceptions to the generalization above: *-t* (indefinite singular article), *-s* (interrogative), two instances of *-Ø* (definite plural/locative) and *-ta* (definite singular article). The first four are unexpected since they are submoraic despite the fact that they are employed in the complete phase. The final one is not expected because it is monomoraic although it is used in the incomplete phase. Hale and Kissock argue that they are actually not exceptional. For the present purposes, I review their discussion of the indefinite singular article *-t* and the definite singular article *-ta*.

They crucially assume that an indefinite article and the lexeme meaning *one* have a close connection. They claim that the lexeme meaning *one* in Rotuman is *ta* (although this is factually wrong) and that the indefinite singular article is /*-ta*/ in the underlying representation (e.g., /vaka-ta/ 'the canoes'). The immediate question is then how to distinguish the indefinite and the definite singular articles since they both exhibit the same form *-ta* (e.g., /vaka-ta/ 'the canoes/a canoe') at the underlying level. The proposed answer to this puzzle is to decompose the definite singular morpheme into two distinct morphemes: definite and singular morphemes where the definite morpheme contains a phonetically unpronounced mora (e.g., /vaka-$\text{ta}_{\text{Singular}}$-$\text{Ø}_{\text{definite}}$/). In McCarthy's (2000c:162) terms who fully adopts Hale and Kissock (1998), the definite article consists of a floating mora. Given this, the definite singular morpheme in (42) is bimoraic, and therefore, the surface *-ta* conforms to the descriptive generalization that all suffixes and clitics used in the incomplete phase are more than monomoraic, effectively distinguishing the definite and the indefinite singular morphemes. Furthermore, the indefinite singular morpheme is reanalyzed as a monomoraic morpheme, again obeying Hale and Kissock's generalization. In effect, Hale and Kissock argue that the five exceptions are simply superficial since they all receive a similar line of reanalysis. Indeed, Churchward (1940:14) states that there are no suffixes which can be attached indiscriminately to either phase. Moreover, the syntactico-semantic environments where the two phases are used are admittedly unclear. Therefore, Hale and Kissock's idea to explain the phase alternation in phonological terms is interesting.

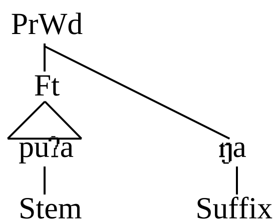
Based on Hale and Kissock's claim, McCarthy claims that the alignment constraint in (40) captures the complete-incomplete phase distinction. He assumes that suffixes larger than a mora have a foot status and stand as prosodic words on their own independently of the preceding stem, as illustrated in (43) (McCarthy 2000c:163). Given this representation, a prosodic word boundary coincides with the right edge of the stem, and therefore, /…CVCV/ undergoes some stem modification such as metathesis and fusion to create […CVC]. The final CVC syllable carries the main stress and is properly aligned to the right edge of the prosodic word dominating the stem. This explains why various stem modifications take place in the incomplete phase because the second last syllable of the stem would carry main stress otherwise due to RHType=Trochaic.

(43)

PrWd	PrWd
|	|
Ft	Ft
△	△
sun	ʔia
|	|
Stem	Suffix

By contrast, monomoraic suffixes do not constitute a foot, and therefore, they do not stand as independent prosodic words. As a consequence, they are prosodically dependent on the prosodic word dominating a stem, as shown in (44). This is a reconstructed underlying representation on the basis of McCarthy's textual explanation since the structure of the complete phase given by McCarthy (2000c:163) is inconsistent with his discussion. In this structure, a stem is not a free-standing prosodic word since the following suffix is also part of the same prosodic word. The alignment constraint in (40) is irrelevant to determining the stem form itself since it is not coextensive with the prosodic word. Since the alignment constraint is sensitive to the prosodic word, the entire form including the suffix attached to the stem must obey the alignment restriction. As in [fere-aŋ] 'flying' (Churchward 1940:22), therefore, the suffix undergoes some phonological modification in the complete phase.

(44)



Although McCarthy's analysis is consistent with the phonological generalization made by Hale and Kissock (1998), their argument, on which McCarthy's analysis is based, has a number of problems. First of all, their initial assumption is not supported. Churchward (1940:15 fn.4) explicitly mentions that "this [the definite singular article] -*ta* must not be confused with *taa*, meaning *one*, in which the *a* is long..." (see also Churchward 1940:36). Long vowels are clearly distinguished from short vowels by attaching a macron over long vowels in Churchward's documentation. This indicates that the indefinite singular morpheme and the lexeme representing *one* are clearly distinguished phonologically, so Hale and Kissock's morphological reanalysis is dubious from the beginning. Even if their morphological reanalysis is adopted, the result should be -*taa* rather than -*ta*. But given this reanalysis of the indefinite singular morpheme, the motivation to decompose the definite singular morpheme into two components is lost since the definite and the indefinite singular morphemes are phonologically distinguishable. This suggests the invalidity of the reanalysis implemented by Hale and Kissock. This in turn shows that the indefinite singular morpheme is not an apparent but real exception to their phonological distinction of the two phases.

Second, it is not clear why the vowel of /-ta/ is lost in the indefinite singular morpheme when realized in the surface representation if their reanalysis were on the right track. Rotuman is basically a CV language. Therefore, there is no phonological reason to prohibit a word-final vowel. This suspicion is natural especially because the indefinite singular article is used in the complete phase, and as discussed in section 4.5.2, the complete phase admits only (C)V syllables modulo long vowels in the word-final position is the only exception. Hale and Kissock do not provide any explanation for this question, but it should be morphologically governed. Whatever the reasoning is, however, the vowel must be always subject to deletion. The obvious question is why a morpheme contains a vowel which never surfaces. Since the vowel presence and absence never exhibit an alternation, the analysis stipulates a phonologically unmotivated abstract vowel. Furthermore, it is also unclear why the floating mora of the definite article posited in the reanalysis is not realized in the form of lengthening of a vowel affiliated with the singular morpheme, for instance (e.g., [vaka-taa] where the suffix *-taa* is the simultaneous exponent of the definite and the singular morphemes). The argument here shows that neither the vowel in the indefinite singular morpheme nor the floating mora posited as a result of Hale and Kissock's morphological reanalysis receives strong phonological underpinning. In other words, they posit several unmotivated abstract phonological units. These points cast a doubt that the phonological explanation for the phase alternation is a castle in the air. This is problematic for McCarthy's (2000c) phonological analysis as well. Given that the alignment constraint in (40) is a pure markedness constraint, it is insensitive to the underlying representation. Unless any of the abstract vowels posited by Hale and Kissock surfaces, the stem followed by the definite singular article /-ta/ would be expected to take a complete phase form, contrary to fact.

Third, Churchward (1940:15) provides several minimal pairs where only different stem forms denote different functions, as cited in (45). In each pair, the first one is the complete phase, the second one being the incomplete phase. The words exhibiting the stem alternation are underscored. Since no suffix or clitics is involved in these examples, a purely phonological analysis of the phase alternation has no explanation for the fact that the complete and incomplete phases take different stem shapes. Churchward (1940:15) states that the definite-indefinite distinction is often made explicit by attaching /-ta/ or /-t/, but crucially, these suffixes are not obligatory. This shows that Hale and Kissock's generalization that only the incomplete phase is employed when a stem is not followed by any suffix or clitics is falsified.

(45)	a.	famori ʔea	'The people say.'
		famör ʔea	'Some people say.'
	b.	ʔepa la hoaʔ	'The mats will be taken.'
		ʔeap la hoaʔ	'Some mats will be taken.'
	c.	ʔäe la ʔoaf se mori	'Would you like the oranges?'
		ʔäe la ʔoaf se mör	'Would you like some oranges?'
	d.	gou hoʔam ʔeu kalofi	'I have brought your eggs (the eggs belonging to, or intended for, you).'
		gou hoʔam ʔeu kalöf	'I have brought you some eggs.'

The review above strongly shows that a purely phonological analysis of the phase alternation cannot be maintained. Hale and Kissock (1998) correctly point out that the precise syntactic-semantic contexts for each phase are not clearly understood. But examples as in (45) are never expected under a phonological explanation of the complete-incomplete phase distinction. McCarthy's (2000c) phonological analysis crucially relies on Hale and Kissock (1998) and does not give any independent argument for a phonological analysis. The alignment constraint in (40) is a pure phonological markedness constraint, and therefore, no morphological factor is taken into account for the evaluation of its satisfaction or violation. Given that it is the only constraint in McCarthy's analysis which drives the incomplete phase formation, I conclude that his analysis is not supported.

One might point out as a potential problem of my analysis that the modified portion does not follow from any constraints. Word-final portions are always affected, but how can we explain this restriction without (40)? Many cases are indeed dealt with by the generalization and analysis presented above without any further ado. For example, the reason why the word-initial CV cannot be metathesized can be reduced to the undominated constraints in (32). Consider /pu.re/ as the input and an output candidate [up.re]. The rhythmic type constraint and the alignment constraint in (32) requires stress to fall on the initial syllable in the output, but in [up.re], stress assignment on the same syllable violates the alignment constraint. If the final syllable carries stress, Head-Match is violated. In the same vein, many other potential possibilities are successfully eliminated by the analysis presented above.

To ensure that only the word-final part of the complete phase is altered, however, we can posit a positional faithfulness constraint such as Faith-IO-σ1

(Beckman 1995, 1997). Comparing the word-internal and word-final positions, affecting the word-medial part incurs more massive violations of Contiguity than changing the word-final portion. Given that these two constraints are presumably needed for independent reasons, the absolute generalization that only the word-final portion is affected in the phase alternation follows without specifying the prosodic shape of the incomplete phase. The fact that the incomplete phase formation creates an otherwise entirely impermissible syllable structure is captured by ranking Syll=μ below RM such that Rotuman allows for more room to realize the incomplete phase morpheme.

4.6 Summary

In this chapter, I investigated how nonconcatenative allomorphs can be explained in a principled manner. It is clear from the brief review of various earlier studies that nonconcatenative allomorphs have not received a unified understanding so far. I claimed that the reason why various base modifications are employed to express a single morpheme is to optimize the word form as much as possible, achieving phonologically less marked structures. In this sense, nonconcatenative allomorphs are nothing different from concatenative allomorphs such as the allomorphy displayed in the alternation of the plural suffix *-s* in English. This is not surprising given the claim that concatenative morphology and nonconcatenative morphology should be understood in a unified way despite the terminological distinction established in the discipline. The actual aspect formation in Saanich provides particularly strong evidence for this integration since both types of morphology coexist as allomorphs of the actual aspect morpheme. No theory to tease them apart would succeed in providing a satisfactory account of such cases. RM plays a role as the key constraint, and interactions of various constraints ranked below it determine what kind of base change is the most harmonic. Although violating the faithfulness constraint ranked the lowest is the cheapest strategy to realize a morpheme, some other nonconcatenative allomorph surfaces when the violation of the lowest faithfulness constraint results in a concomitant violation of a high ranked markedness constraint.

Several attempts have been made to account for multiple nonconcatenative allomorphs, but I argued that RMT overcomes various problems encountered by them. Moreover, the empirical issues discussed in this chapter clearly distinguish RMT and anti-faithfulness theory. As argued in section 4.3.2, anti-faithfulness theory cannot deal with multiple nonconcatenative allomorphs essentially because nothing in the theory guarantees that multiple anti-faithfulness constraints are not in conflict with crucial markedness constraints or that anti-faithfulness constraints ranked over faithfulness counterparts are all in conflict with markedness constraints. Thus, complementary distribution of nonconcatenative allomorphs presents a serious challenge to anti-faithfulness theory. Empirical data covered in this chapter are also in favor of RMT over anti-faithfulness theory.