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Cleaning Up the Scraps: A New Look at Kwak'wala *m'u:t* Reduplication*

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1 Introduction

Much has changed in phonology since the advent of Optimality Theory (OT; Prince & Smolensky 1993/2004). But many OT analyses of reduplication processes still rely on an old approach which uses the RED morpheme to derive reduplication. In this paper I follow a different approach, where reduplication is viewed as a repair strategy, which is used in this case to provide a phonological exponent for underlyingly underspecified material. This approach extends the reach of our analysis to include data which were difficult to explain under previous analyses.

The language which I analyze is Kwak'wala (also known as Kwakiutl, Kwakwala, Kwagiutl), a language of the Wakashan family, spoken in the Pacific Northwest. There were 235 total speakers as of 2002 (Ethnologue). Descriptive work on Kwak'wala has been conducted for more than a century, and includes the seminal *Kwakiutl Grammar* (Boas 1947). Theoretical work on the phonology of Kwak'wala has continued sporadically (Bach 1975, Wilson 1986, Zec 1994, Stoham 1994), with new attention on the *m'u:t* suffix in recent years. Using two different models of faithfulness relationships, Struijke (1998) and Struijke (2000) analyze this particular kind of Kwak'wala reduplication which eluded previous attempts at explanation. I show how an underspecification approach (specifically with a floating mora) not only succeeds in explaining the same reduplication pattern, but also explains some related facts about vowel lengthening and avoids some unnecessary stipulations which were required by previous analyses.

Although the phenomena in question are fairly restricted within the phonology of this language, this approach has significant theoretical implications. It calls into question the need for a RED morpheme, and for the associated family of constraints referring to base-reduplicant relationships. Taken to its conclusion, this approach will significantly simplify the machinery of OT, while

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making stronger predictions. Moreover, it does not require the acceptance of any new theoretical or formal assumptions. Rather, I show that these results are the logical outcome of accepting any kind of underspecified input material. I return to this discussion in the conclusion of this paper.

In §2, I present the relevant facts about Kwak’wala prosody, phonotactics and inventory, and the data concerning *m’u:t* suffixation. In §3, I analyze these data with the underspecification approach. In §4, I critique a previous analysis of *m’u:t* suffixation, that of Struijke (1998). In §5 I compare the two approaches and discuss theoretical issues and remaining questions for my analysis.

2 Kwak’wala Phonology and *m’u:t* Data

First let us look at some general facts about Kwak’wala which will become relevant for us when we consider the patterns that emerge with *m’u:t* suffixation.

2.1 Vowel Length and Quality

Vowel length is contrastive in Kwak’wala. However, different inventory restrictions hold for short and long vowels. The only permissible short vowels are *a*, *ə* and *i*. As we will see later, all other vowels (*u e o*) reduce to *a* or *ə* when they surface as short vowels. All vowels except *ə* can surface as long vowels. When *ə* must lengthen, it surfaces as *a*.

The vowels *a* and *ə* alternate in many contexts, but not always in a predictable way. Inconsistencies are apparent within and between the descriptive works on Kwak’wala. Boas (1947) notes that “*ə* must be considered a weakened vowel, in most, if not in all cases derived from *a*. . . . Notwithstanding the close relations between *ə* and *a* they must be distinguished because in certain forms of stem expansion *ə* changes significantly to *a*” (207). Grubb (1977) includes an appendix on the problem of *ə*. He concludes that there probably exist underlying schwas, epenthetic schwas, and schwas reduced from *a*, and that we don’t yet know which is which. The consequence for us is that some of the significant alternations between *ə* and *a* will remain unexplained in this paper.

2.2 Phonotactics

Codas are generally acceptable in Kwak’wala. Consonants at every place of articulation can surface as codas. But one large class of consonants cannot be codas: they are the consonants we can call *laryngeally-marked consonants* (after Lombardi 1991, Lombardi 1995). These are the voiced obstruents and glottalized consonants. When these segments would appear in a coda, an epenthetic vowel is added, causing resyllabification and avoiding the bad coda:¹

- (1) /*a* + *o:dz̥* + *gila*/ → [*ao:dz̥əgila*] ‘not to work right’

These vowels are somewhat special. Boas (1947) notes: “In determining the place of the accent syllables due to the continued voicing of sonants or to glottalized stops [*i.e.* *the epenthetic*

¹Except when otherwise noted, all data and glosses are taken from Boas (1947) and, whenever possible, have been corroborated by Grubb (1977). In attributing data, the following abbreviations are used: primary sources, FB (Boas 1947); DG (Grubb 1977); EB (Bach 1975). Secondary sources, CS (Struijke 2000).

vowels—*JSK*] do not count, so that phonemically the voicing which follows the release of the stop, although acoustically important should be omitted.” (219) This suggests that these vowels are not present phonologically. However, several kinds of evidence (reviewed in the next section) suggest that these vowels are present. We can explain these facts by analyzing the vowels as non-moraic.

Considered segmentally, non-moraic vowels interact normally and therefore will act like normal vowels with regard to the relevant allomorphy. But considered prosodically, these vowels are distinguished by the fact that they link directly to a syllable rather than to a mora, creating a so-called minor syllable (Gafos 1996, Nuger 2006). A universal property of minor syllables is that they never bear stress, accounting for the observation of Boas (1947). We will develop a more formal analysis of this epenthesis in the following section.

Onset clusters are prohibited without exception, as are coda clusters of more than two segments. Two-segment coda clusters, however, are prolific. Generally, any cluster that obeys the Sonority Sequencing Principle (SSP: Sievers 1876, Vogel 1977) is permitted.

2.3 Stress and Syllable Weight

In Kwak’wala words with no heavy syllables, stress falls on the final syllable:

- (2) a. *nə.pá* ‘to throw a round thing’
 b. *m’ə.k^wə.lá* ‘moon’
 c. *gə.tə.x^wá* ‘to tickle’

When heavy syllables do appear, primary stress occurs on the leftmost heavy syllable:²

- (3) a. *p’ə.díə.t’á:* ‘to fly seaward’
 b. *c’ə.má:tu:d* ‘melt away something in ear’ (EB)
 c. *xá:xa.lə.la.k^wə.la* ‘cry out “ho-o-o-o-o” (DG)
 d. *ú:s.gə.mi:* ‘surface’ (EB)

This seems to be a typical default-to-opposite stress pattern. We can use the stress pattern to diagnose syllable weight, and answer the question of whether codas are moraic. If they are, we expect syllables with codas to pattern like syllables with long vowels and attract stress. Superficially, Kwak’wala appears to deliver a split verdict on this question:

- (4) **Codas attract stress**
 a. *x^wəl.dzo:s* ‘Hexagrammus superciliaris’ (CS)
 b. *mən.las* ‘place of getting over-satiated’
- (5) **Codas do not attract stress**
 a. *pəχ.dám* ‘time’ (CS)
 b. *tš’əx.q’á:li.səm* ‘to die of feeling sick’

²Wilson (1986) analyses the stress patterns in Boas (1947) to conclude that secondary stress occurs on every other syllable following the primary stress, ignoring epenthetic vowels. However, comparing Boas (1947) and Grubb (1977), inconsistencies in secondary stress are apparent. Therefore I do not include secondary stress in this paper.

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We can resolve this contradiction by distinguishing two classes of consonants. Only sonorant codas are moraic; all other codas do not contribute to syllable weight. Thus in (4), the coda sonorants *m* and *l* are moraic, causing the syllable to be considered heavy and to attract stress away from the final syllable. In (5), the obstruents χ and *x* cannot bear weight, so the syllables remain light and do not attract stress. (For an OT analysis of the restriction on coda moraicity to sonorants, see Struijke 2000.)

2.4 Syllable Inventory

We can represent the syllable inventory in Kwak’wala as follows (where C is any consonant; V is any vowel; R is any sonorant consonant; and T is any non-sonorant consonant. Except where otherwise noted, examples are taken from a corresponding chart in Struijke 2000):

(6) **Kwak’wala syllable types**

<i>Syllable shape</i>	<i>Example</i>	<i>Gloss</i>
Heavy syllables		
CVV	<u>d</u> z <u>é</u> .daq ^w	‘milky sea eggs’
CVVT	yá:x.k’a	‘to hop on one foot’
CVVTT	t̃s’ə.dá:xs.tə.wə.lə.la	‘woman representative’
CVR	a.tla.n’ə.má:li.sə <u>m</u>	‘to die on account of wolfness’ (FB)
CVRT	t’óls.ta:	‘to eat crabapples’
Light syllables		
CV	má:mə.ʔi.mas	‘fish-life’ (DG)
CVT	gəl’.zú:d	‘crawl onto a flat thing’ (EB)
CVTT	há:l’a:ma <u>xs</u> .ta:	‘to eat quickly’

Our analysis of sonorants as the only mora-bearing coda consonants is confirmed by the absence of any word with a long vowel and sonorant coda in the same syllable or any word with two sonorants in the coda. These gaps result from a prohibition on superheavy syllables (those with more than two moras).

2.5 *m’u:t* Reduplication

There are two suffixes in Kwak’wala which trigger *m’u:t* reduplication.³ They are *m’u:t* ‘refuse, useless’ and *(g)i:sawe:ʔ* ‘left behind; leave behind’. A semantic connection seems to exist between these morphemes, but it should be noted that *aʔjaweʔ* ‘left over’ and *ʔaweʔ* ‘left behind’ do not trigger *m’u:t* reduplication. Therefore, the observed reduplication seems to be related to the suffixes *m’u:t* and *(g)i:sawe:ʔ* themselves. (Everything presented in the analysis of *m’u:t* reduplication is therefore claimed to hold for words with the suffix *(g)i:sawe:ʔ* as well.)

³Boas (1947) uses the designation 6c to refer to *m’u:t* reduplication. Since this paper does not analyze the many other reduplication processes in Kwak’wala, I opt for the more descriptive name.

The pattern of *m'u:t* reduplication is somewhat complicated. The simplest part of the process is the segmental content of the suffix itself, *m'u:t*. This suffix is placed immediately after the root. It has two allomorphs: *m'* after a consonant-final root, and *m* after a vowel-final root. (I do not attempt to analyze this allomorphy. Note also that I have changed some of the forms below to efface this allomorphy, for the sake of clarity.) The effect of this suffix on the root is less straightforward.

The behavior of the root depends on the shape of the final syllable. If the syllable is light and does not have a laryngeally marked coda, then the vowel lengthens. This is shown in the following examples (where V is any vowel; R is any sonorant; T is any voiceless obstruent; D is any voiced obstruent; and C' is any glottalized consonant):

- (7) -VT roots

$\widehat{ts}'\text{əx}$	$\widehat{ts}'a:xm'u:t$	‘hair singed off’
ax^w	$a:x^w m'u:t$	‘waste scum’

If the root has final consonants cluster which cannot be put in the coda (due to SSP or laryngeal markedness), epenthesis to rescue the final consonant occurs in addition to root vowel lengthening:

- (8) -VTT, -VD roots

a.	$k^w\text{əsx}$	$k^w a:sxəm'u:t$	‘left after splashing’
	$\widehat{ts}\text{ət}x$	$\widehat{ts}a:txəm'u:t$	‘left after squirting’
b.	$g^w\text{əd}$	$g^w a:dəm'u:t$	‘left after untying’

Roots of the shape -VC' reduplicate instead of lengthening. Some of these forms inexplicably lengthen and show other changes instead of reduplicating:

- (9) -VC' roots

$\widehat{ts}'\text{əm}'$	$\widehat{ts}'\text{əts}'\text{əm}\text{əm}'u:t$	‘left after melting’
ham'	$ha:ʔam'ut$	‘rest of food’

If the final syllable of the root is heavy, then the root reduplicates. Here again there are several more specific patterns:

- (10) -V:, -VR roots

a.	$de:$	$de:dəm'u:t$	‘refuse of wiping’
	$xo:$	$xo:xəm'u:t$	‘refuse of splitting wood’
b.	$kən$	$kənkəm'u:t$	‘what is left after scooping up’
	$wən$	$wənwəm'u:t$	‘refuse of drilling’
- (11) -V:T roots

$x^w a:tl$	$x^w a:x^w atlm'u:t$	‘remains of fish cutting’
$ju:s$	$ju:jasm'u:t$	‘what is left after eating with spoons’
- (12) -VRT roots

$qəns$	$qənqasm'u:t$	‘chips’
$kəmtl$	$kəmkatlm'u:t$	‘chips made by adzing’
- (13) -V:C', -VRD, -VRC' roots

a.	$q^w 'a:l'$	$q^w 'əq^w 'a:l'əm'u:t$	‘embers’
b.	$məndz$	$məməndzəm'u:t$	‘leavings after cutting kindling wood’
c.	$k^w əml'$	$k^w ək^w əml'əm'u:t$	‘remains of burning’

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Finally, disyllabic roots behave idiosyncratically. They are very rare and they behave as shown in the following example:

- (14) *Disyllabic roots*
ama? ama?m'u:t 'rejected because too small'
ma:məm ma:mamm'u:t 'old leaves'

These roots seem to resist reduplication and lengthening, and they have some other peculiar features, such as the glottalized form of the suffix following a consonant in *ma:mamm'u:t* (violating the rule that *m'u:t* always deglottalizes after consonant-final roots).

2.6 The Facts to be Accounted for

There are several problems posed by these data. We can list them here, with a promise to return to them later (see §4.2):

- (15) a. Why does the *m'u:t* suffix sometimes cause lengthening and sometimes reduplication?
b. Why does one class of light syllables reduplicate (like heavy syllables) instead of lengthening (like all other light syllables)?
c. Why do coda clusters sometimes split, and sometimes remain intact?
d. Why do disyllabic roots resist lengthening and reduplication?

In the next section, I present a new analysis of these data.

3 An Underspecificational Analysis of *m'u:t* Reduplication

The problems posed by the data can only be correctly explained by an analysis that posits the correct underlying representation for the *m'u:t* morpheme. That underlying representation should look something like this: $/-^{\mu}m'u^{\mu}t/$. The segmental content and the two moras inside the suffix are not surprising (since vowel length is contrastive, we know that something like these moras must be included in the input—other analyses, such as one with two underlying vowels, would work just as well). What is more unusual is the inclusion of a floating mora.

The idea of floating phonological elements is not a novel one. Floating tones are routinely used in the analysis of many languages (e.g. Hyman 1987, Myers 1997), and the idea of floating features also has a long history (see discussion in Wolf 2006). All floating elements are properly considered cases of underspecification, an idea which has had currency in autosegmental theories of phonology for decades: e.g. floating palatalization (Mester & Itô 1989) and floating nasal features (Goldsmith 1990). Floating moras and other prosodic structure have also been proposed in the analyses of many phenomena (see the list in Saba Kirchner (forthcoming)). In pre-OT approaches, floating elements could be linked to the correct “anchor” through some version of the Universal Association Convention (Goldsmith 1976). OT versions require that the floating material be realized through a constraint from the MAX family (McCarthy & Prince 1995), and the language-specific ranking of constraints is responsible for finding the correct anchor.

Crucially, in this analysis there is nothing about the *m'ut* which requires reduplication *per se*. *m'ut* is a morpheme like any other, which has no special properties beyond its floating mora. There is no need for any RED morpheme, nor for any constraints which refer to Base-Reduplicant correspondence. Rather than treating reduplication as a process, it emerges as a kind of repair strategy: the least marked way to faithfully realize the floating mora is to reduplicate some of the root.

We can build up the analysis in several steps, looking at small subsets of the data and seeing what constraint interactions we need to account for them. We can begin with the non-reduplicating forms (shown in (7)). In these forms, the short vowel of the root is lengthened in the output. This is diagnostic of the fact that the floating mora of the suffix has anchored onto the vowel of the root. I will make one further assumption to get this analysis off the ground: some moras are specified in the input. It is not necessary that all moras be specified in the input (since DEP_μ-IO is violable), but vowels and moraic coda segments must be attached to moras in the input. The following example shows why:⁴

- (16) **Actual derivation:** $\widehat{ts}'\underline{\partial}^{\mu}x + \underline{\mu}m'u^{\mu\mu}t \rightarrow \widehat{ts}'a^{\mu\mu}\underline{x}m'u^{\mu\mu}t$ ‘hair singed off’
Hypothetical bad derivation: $\widehat{ts}'\underline{\partial}x + \underline{\mu}m'uut \rightarrow * \widehat{ts}'\underline{\partial}^{\mu}\underline{x}m'u^{\mu\mu}t$

In the bad derivation, the floating mora has anchored to the root vowel. The candidate is fully faithful to the root and suffix, so this is an ideal output. But the root vowel would have ended up with a mora anyway in any case, so the floating mora actually has no effect. To avoid this outcome, we must assume that root vowels are underlyingly moraic. This assumption contradicts the idea of Richness of the Base (RotB; Prince & Smolensky 1993), and is therefore immediately suspect. I believe that a successful alternative to this assumption can be constructed using a moraic version of NOVACUOUSDOCKING (Wolf 2006). However, the necessary argumentation is beyond the scope of this paper, so here I make the aforesaid assumption instead. We should also note that since vowel length is contrastive in Kwak'wala, any successful theory of underlying representations in Kwak'wala must capture this distinction, whether through underlying moraification or some other means.⁵

The nonreduplicating forms are the base case for *m'ut* reduplication. The most obvious way to realize an underlyingly floating mora is to anchor it in the output to a vowel which is already present. This is what we see in these words. The following constraints will help us formalize this insight:

- (17) * $\underline{\mu}$ (read “no floating mora”): “Assess one violation for each mora in the output which is not associated with a segment.”⁶

⁴In this and all following examples, correspondence relationships are indicated by matching single and double underlines. Moras immediately following a vowel are anchored to that vowel.

⁵cf. discussion in Struijke (1998), where the issue of RotB is raised. Another way to argue in favor of underlying moraicity without violating RotB could come from the fact that these words are derived from non-suffixed forms. An Output-Output correspondence relationship could also guarantee the needed underlying moras.

⁶The fact that this constraint is violable raises the question of how an unlinked floating mora in the output would be expressed. An alternative to this constraint would be to use MAX- μ , and treating it as violated when an mora is unanchored in the output. (This idea comes from Pater 2003.) However, MAX- μ is also violable, so the possibility

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- (18) MAX-IO : “Assess one violation for each input element with no correspondent in the output.”⁷
- (19) * \mathfrak{a} : “Assess one violation for each long schwa in the output.”
- (20) IDENT-IO : “Assess one violation for each feature mismatch between corresponding input and output elements.”

These constraints are active in choosing the correct output for *m’u:t* suffixation with monomoraic roots. * \mathfrak{a} requires that the underlying unlinked mora be anchored in the output. Familiar MAX-IO will prevent us from simply deleting the mora. * \mathfrak{a} : will require a featural change to turn \mathfrak{a} into *a* when it is linked to two moras. Since it is always satisfied, it must outrank IDENT-IO, which militates against changing feature values. The following tableau shows the right selection:

- (21) $\widehat{ts’axm’u:t}$ ‘hair singed off’

$\widehat{ts’\mathfrak{a}^{\mu}x + ^{\mu}m’u^{\mu\mu}t}$	* \mathfrak{a} MAX-IO * \mathfrak{a} :	IDENT-IO
a. $\widehat{ts’\mathfrak{a}^{\mu}xm’u^{\mu\mu}t}$	*!	
b. $\widehat{ts’\mathfrak{a}^{\mu\mu}xm’u^{\mu\mu}t}$	*!	
c. $\widehat{ts’\mathfrak{a}^{\mu\mu\mu}xm’u^{\mu\mu}t}$	*!	
☞ d. $\widehat{ts’a^{\mu\mu}xm’u^{\mu\mu}t}$		*

In the case of monomoraic roots like $\widehat{ts’ax}$, we see lengthening rather than reduplication. This outcome is entirely straightforward. There is no reason why reduplication would happen. If we considered a candidate with reduplication against those in (21b), the only advantage it could offer would be to satisfy a markedness constraint against long vowels—something which must anyway be very low ranked in Kwak’wala, since vowel length is contrastive. But the candidate would have several violations of INTEGRITY, which is an active constraint in Kwak’wala. The question, then, is why *m’u:t* ever triggers reduplication. To find an answer, we must turn to examine *m’u:t* suffixation with bimoraic roots.

Take the root *de:* ‘wipe’. The most straightforward way to anchor the floating mora would be to link it to the root vowel. This would yield the unattested form *[$de^{\mu\mu\mu}m’u^{\mu\mu}t$]. But this form is impossible because of an unviolated constraint barring superheavy syllables. Since MAX-IO is also unviolated in Kwak’wala, another segment to which the mora can be anchored is needed. A segment can be found by violating INTEGRITY, that is, by reduplicating. By reduplicating rather than epenthesizing a syllable with default segments, a segment to anchor to is provided without violating DEP-IO. The following constraints take us toward a formal version of this insight:

- (22) INTEGRITY : “Assess one violation for each segment in the input with more than one correspondent in the output.” (cf. McCarthy & Prince 1995)

of unlinked moras in phonological outputs remains. In fact, a number of arguments have been made for floating moras sometimes surfacing with visible effects even though remaining unanchored; see Wolf (2006). This is a natural consequence of allowing floating material in underlying representations, and its theoretical and practical consequences deserve further study.

⁷I use the vague term “element” in this definition in order to encompass MAX for both segments and moras. We could split the constraint into MAX_{seg}-IO and MAX _{μ} -IO if necessary.

- (23) DEP-IO : “Assess one violation for each segment in the output with no correspondent in the input.”⁸
- (24) $*\sigma^{\mu\mu\mu}$: “Assess one violation for each syllable which directly dominates three (or more) moras.” (cf. van den Heuvel 2004)
- (25) *HIATUS : “Assess one violation each time this sequence is encountered: V.V .”
- (26) REDUCE : “Assess one violation for any short vowel that is not a, ə or i.”⁹

To motivate reduplication, we need the following ranking: {DEP-IO, $*\sigma^{\mu\mu\mu}$, MAX _{μ} -IO} \gg INTEGRITY. To produce the actual attested forms, we also need this ranking: {*HIATUS, REDUCE} \gg {INTEGRITY, IDENT-IO}. Now we can derive the forms in (10), as shown in the following example:

- (27) *de:dəmu:t* ‘refuse of wiping’

/d <u>e</u> ^{μ} ^{μ} + ^{μ} m’u ^{μ} t/	MAX $*\sigma^{\mu\mu\mu}$ *HIATUS DEP REDUCE	INTEG IDENT
a. d <u>e</u> ^{μ} ^{μ} m’u ^{μ} t	*!	
b. d <u>e</u> ^{μ} ^{μ} ^{μ} m’u ^{μ} t	*!	
c. d <u>e</u> ^{μ} ^{μ} d <u>e</u> ^{μ} m’u ^{μ} t	*!	**
☞ d. d <u>e</u> ^{μ} ^{μ} d <u>ə</u> ^{μ} m’u ^{μ} t		** *
e. d <u>e</u> ^{μ} ^{μ} ə <u>u</u> ^{μ} m’u ^{μ} t	*!	* *
f. d <u>e</u> ^{μ} ^{μ} ? <u>ə</u> ^{μ} m’u ^{μ} t	*!*	

This ranking succeeds equally well in selecting the correct candidates for the -VR roots, as shown in the following tableau:

- (28) *kənkəmu:t* ‘what is left after scooping up’

/k <u>ə</u> ^{μ} ^{μ} <u>n</u> ^{μ} + ^{μ} m’u ^{μ} t/	MAX $*\sigma^{\mu\mu\mu}$ *HIATUS DEP REDUCE	INTEG IDENT
a. k <u>ə</u> ^{μ} ^{μ} <u>n</u> ^{μ} m’u ^{μ} t	*!	
b. k <u>ə</u> ^{μ} ^{μ} <u>n</u> ^{μ} ^{μ} m’u ^{μ} t	*!	*
c. k <u>ə</u> ^{μ} ^{μ} m’u ^{μ} t	*!	*
d. k <u>ə</u> ^{μ} ^{μ} <u>n</u> ^{μ} k <u>ə</u> ^{μ} ^{μ} m’u ^{μ} t		***!
☞ e. k <u>ə</u> ^{μ} ^{μ} <u>n</u> ^{μ} <u>n</u> ^{μ} m’u ^{μ} t		**

But what we have is not yet completely sufficient. We can motivate an output with the CVC root, a CV reduplicant and the *m’u:t* suffix. But we can’t yet select the right order for all these pieces. Consider the following tableau:

- (29) *kənkəmu:t* ‘what is left after scooping up’

/k <u>ə</u> ^{μ} ^{μ} <u>n</u> ^{μ} + ^{μ} m’u ^{μ} t/	MAX $*\sigma^{\mu\mu\mu}$ *HIATUS DEP REDUCE	INTEG IDENT
a. k <u>ə</u> ^{μ} ^{μ} <u>n</u> ^{μ} k <u>ə</u> ^{μ} m’u ^{μ} t		**
b. k <u>ə</u> ^{μ} ^{μ} k <u>ə</u> ^{μ} <u>n</u> ^{μ} m’u ^{μ} t		**

⁸This constraint will later be split into DEP_{seg}-IO and DEP _{μ} -IO

⁹This constraint stands in for a more complex pattern of constraint interactions that conspire to produce this reduction pattern.

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In this theory there is no distinction between “base” and “reduplicant,” so there is no obvious way to stipulate an order for the two syllables derived from the root, even if we wanted to do so. But an insight from Struijke (1998) leads us to the right result. The crucial difference between the two syllables is that *kən* is heavy and *kə* is light. Since both candidates fare equally well with regard to the relevant faithfulness constraints, the choice is left to another constraint: in this case, one that militates for avoiding stress clash. We can call this constraint *CLASH (cf. Kager 1994):

(30) *CLASH : “Assess one violation for any two foot heads adjacent to one another.”

Feet are built from left to right, beginning with the primary stress. By assumption, every heavy syllable heads a foot (whether light syllables affiliate with heavy syllables in iambs or trochees is not relevant). Therefore adjacent heavy syllables will automatically violate *CLASH. We know that INTEGRITY outranks *CLASH because of the lengthening cases, where clash is tolerated instead of being avoided through reduplication. Therefore we can rank it as shown in 31:

(31) *kənkəmut* ‘what is left after scooping up’ (assuming trochaic footing)

<i>/kə^μn^μ + ^μm'u^{μμ}t/</i>	MAX *σ ^{μμμ} REDUCE	INTEG	CLASH *IDENT
⊗ a. (kə^μn^μkə^μ)(m'u^{μμ}t)		**	
b. kə ^μ (kə^μn^μ)(m'u^{μμ}t)		**	*!

Now our grammar is almost equipped to analyze the -V:T roots (shown in (11)). Again we will avoid syllable clash by putting the long vowel in the first syllable. The only difference is that in these words, the coda consonant is non-moraic, and therefore its presence in either syllable will have no effect on syllable weight or stress patterns. In fact, the coda surfaces on the second syllable. To explain this, we can appeal to the idea of aligning root and stem edges, formalized as an alignment constraint (McCarthy & Prince 1993):

(32) ALIGN-R(root,stem) : “Assess one violation for every root unless its right edge is aligned to the right edge of some stem.”

We can see that ALIGN-R(root,stem) is violated in forms like that in 31. Therefore, it must be ranked below *CLASH. The following tableau shows that this ranking does yield the correct result:

(33) *ju:jasmu:t* ‘what is left after eating with spoons’

<i>/ju^{μμ}s + ^μm'u^{μμ}t/</i>	MAX *σ ^{μμμ} REDUCE	*CLASH INTEG	ALIGN-R (root,stem)
a. <u>ju^{μμ}</u> <u>ju^{μμ}</u> sm'u ^{μμ} t	*!	**	
b. ja ^μ <u>ju^{μμ}</u> sm'u ^{μμ} t		*! **	*
c. <u>ju^{μμ}</u> sja ^μ m'u ^{μμ} t		**	*!
⊗ d. ju ^{μμ} <u>ja^μ</u> sm'u ^{μμ} t		**	
e. <u>ju^{μμ}</u> sja ^μ sm'u ^{μμ} t		***!	

Here we should notice a significant difference between the underspecification analysis and the traditional analysis. In the former, reduplication only happens to satisfy an active constraint, and only to the extent required to satisfy that constraint. Since every reduplicated segment incurs

a violation of INTEGRITY, we expect *minimal reduplication*, that is, reduplicants should be as small as possible. On the other hand, in the traditional analysis reduplication is a goal in itself whenever a RED morpheme is involved. A violation of MAX-BR is incurred for each segment which fails to reduplicate. The traditional theory therefore expects *maximal reduplication*. In the underspecification analysis, candidate (e) in the previous tableau fails to be optimal because it has an unnecessary violation of INTEGRITY. Compare this with the traditional analysis. To the constraints shown in 33, we need to add MAX-BR \gg INTEGRITY (since reduplication does happen). But now candidate (e) is superior because it reduplicates more completely (where \times indicates a candidate that is wrongly selected by the tableau, and \odot indicates the losing but actually attested candidate. Irrelevant markedness constraints have been removed from this tableau for clarity):

(34) *ju:jasm'ut* ‘what is left after eating with spoons’ (traditional theory version)

/RED + $\underline{j}u^{\mu\mu}s + m'u^{\mu\mu}t$ /	MAX-BR	INTEGRITY *CLASH	ALIGN-R (root,stem)
\odot d. [_R $\underline{j}u^{\mu\mu}$][_B $\underline{j}a^{\mu}s$]m'u $^{\mu\mu}t$	*!	**	
\times e. [_R $\underline{j}u^{\mu\mu}s$][_B $\underline{j}a^{\mu}s$]m'u $^{\mu\mu}t$		***	

For the traditional analysis, something extra needs to be said to prevent extra copying. But the underspecification analysis avoids this problem completely.

There is one more pattern which we can explain without any trouble. These are the -VRT roots, where the post-vocalic cluster of the root splits up in the output (shown in 12). These are the apparently exotic cases where an input cluster splits into different copies in the output. In the underspecification approach, this is exactly what we expect to happen given these inputs, and the ranking we have established will already select the right candidate here. This is shown in 35:

(35) *kəmkatlm'ut* ‘chips made by adzing’

/ $\underline{k}ə^{\mu}\underline{m}^{\mu}\underline{t}l + m'u^{\mu\mu}t$ /	MAX * $\sigma^{\mu\mu\mu}$ DEP	INTEG *CLASH	ALIGN-R (root,stem)
a. $\underline{k}ə^{\mu}\underline{ka}^{\mu}\underline{m}^{\mu}\underline{t}l m'u^{\mu\mu}t$		** *!	
b. $\underline{k}ə^{\mu}\underline{m}^{\mu}\underline{t}l \underline{ka}^{\mu} m'u^{\mu\mu}t$		**	*!
☞ c. $\underline{k}ə^{\mu}\underline{m}^{\mu}\underline{ka}^{\mu}\underline{t}l m'u^{\mu\mu}t$		**	
d. $\underline{k}ə^{\mu}\underline{m}^{\mu} ? \underline{a}^{\mu}\underline{t}l m'u^{\mu\mu}t$	*!*		

Now we come to a more challenging class of roots. These are the roots with a heavy syllable and a laryngeally marked final segment (shown in (13)). In these roots we see reduplication, with the codas surfacing on the right side of the root. In addition to reduplication, epenthesis occurs after the final root consonant.

Before analyzing the reduplication, let us formalize our analysis of this epenthesis. We classified the epenthetic vowel as nonmoraic, and therefore eligible to head a syllable but ineligible for footing. Examining the evidence that we have seen since that diagnosis confirms our original impression. On the one hand, the status of these epenthetic vowels must be phonological and not

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merely phonetic, since the vowels block stress clash (otherwise we would see **məndzəməm'u:t* instead of *məməndzəm'u:t*). The epenthetic vowels also act like ordinary vowels with regard to the allomorphy of the segmental portion of *m'u:t* (which is not shown in this paper, as stated above). On the other hand, the epenthetic vowels must have a kind of special status since as we noted, they are never eligible to receive stress. We can capture these facts using the following constraints:

- (36) $*\text{Lar}]_{\sigma}$: “Assess one violation for each laryngeally marked segment in coda position.”¹⁰
 (37) $\text{DEP}_{\text{seg}}\text{-IO}$: “Assess one violation for each segment in the output with no correspondent in the input.”
 (38) $\text{DEP}_{\mu}\text{-IO}$: “Assess one violation for each mora in the output with no correspondent in the input.”¹¹
 (39) $*(\text{minor-}\sigma)_{Ft}$: “Assess one violation for a minor syllable that is parsed into a foot.”

Since epenthesis always rescues potential laryngeally marked codas, we know that $*\text{Lar}]_{\sigma}$ is ranked above $\text{DEP}_{\text{seg}}\text{-IO}$. Since epenthetic vowels never receive stress, $*(\text{minor-}\sigma)_{Ft}$ is ranked high enough to be active. The following tableau shows how we derive epenthesis in a word without *m'u:t*:

- (40) *ao:dzəgila* ‘not to work right’

$/a^{\mu} + o^{\mu\mu}\widehat{dz} + gi^{\mu}la^{\mu}/$	$*\text{Lar}]_{\sigma}$	$\text{DEP}_{\mu}\text{-IO}$	$*(\text{minor-}\sigma)_{Ft}$	$\text{DEP}_{\text{seg}}\text{-IO}$
a. $a^{\mu}o^{\mu\mu}\widehat{dz}gi^{\mu}la^{\mu}$	*!	!	!	
b. $a^{\mu}o^{\mu\mu}\widehat{dz}ə^{\mu}gi^{\mu}la^{\mu}$!	*!	
☞ c. $a^{\mu}o^{\mu\mu}\widehat{dz}əgi^{\mu}la^{\mu}$!	!	*

However, when we incorporate these rankings with the hierarchy we have already built for *m'u:t* suffixation, we are forced to select the wrong result. Normally Kwak’wala eschews epenthesis in favor of reduplication. However, in the case of these words we are forced to epenthesize a vowel, and that vowel should be the perfect place to anchor the floating mora in the suffix (and thereby avoid INTEGRITY violations). This bad result is shown in the following tableau:

- (41) *məməndzəm'u:t* ‘leavings after cutting kindling wood’

$/mə^{\mu}n^{\mu}\widehat{dz} + ^{\mu}m'u:t/$	$*\text{Lar}]_{\sigma}$	DEP_{μ}	$*(\text{min-}\sigma)_{Ft}$	DEP_{seg}	$\text{INTEG} \mid * \text{CLASH}$
a. $(mə^{\mu}n^{\mu}\widehat{dz})(m'u:t)$!	*!	*	!
✗ b. $(mə^{\mu}n^{\mu})\widehat{dz}ə^{\mu}(m'u:t)$!	!	*	!
c. $mə^{\mu}(mə^{\mu}n^{\mu}\widehat{dz})(m'u:t)$	*!	!	!		** ! *
d. $mə^{\mu}(mə^{\mu}n^{\mu}\widehat{dz}ə^{\mu})(m'u:t)$!	*!	*	** !
☺ e. $mə^{\mu}(mə^{\mu}n^{\mu})\widehat{dz}ə(m'u:t)$!	!	*	*!*

¹⁰See Rimrott (2003), Um (2001). This constraint could also be defined in terms of constraint conjunction.

¹¹Campos-Astorkiza (2004) presents persuasive arguments against allowing DEP_{μ} in our grammars. However, the alternative which she proposes would be counterproductive here, and therefore I use the traditional constraint instead. A better solution to this problem might also bear on the analysis of the cases here in question, but this remains to be discovered.

The attested output (d) is beaten by the non-reduplicating candidate (b). In fact, (d) is harmonically bounded by (b), so no possible reranking will select it as the correct candidate. Therefore, the only way to save the attested output is to add a constraint outranking the decisive constraints favoring (b) over (d). One such constraint is a positional faithfulness constraint prohibiting epenthetic material within feet. (See Alderete (to appear) on the motivation for avoiding epenthetic material in prominent positions.) We can formalize this insight with the following constraint:

- (42) (DEP-IO)_{Ft} : “Assess one violation for any epenthetic material which is parsed into a foot.”

Ranking this constraint highly will result in epenthesis being allowed only in a non-prominent position (unfooted syllables). The following tableau shows how this ranking selects the attested output:

- (43) *məməndzəm'u:t* ‘leavings after cutting kindling wood’

/mə ^μ n ^μ d̥z + ^μ m'u:t/	(DEP) _{Ft} ! *Lar] _σ ! DEP _μ	*(min-σ) _{Ft}	DEP _{seg}	INTEG
a. (mə ^μ n ^μ d̥zə)(m'u:t)	! !	*!	*	
b. (mə ^μ n ^μ d̥zə ^μ)(m'u:t)	*! !		*	
c. mə ^μ (mə ^μ n ^μ d̥z)(m'u:t)	! *! !			**
d. mə ^μ (mə ^μ n ^μ d̥zə ^μ)(m'u:t)	! ! *!		*	**
e. mə ^μ (mə ^μ n ^μ d̥zə)(m'u:t)	! !		*	**

But this ranking remains vulnerable in another way. What if the vowel neutralizing the problem of the bad coda is not epenthetic, but rather is a copy of the root vowel?¹² In that case the floating mora can dock on the copied vowel, allowing the syllable to be footed, and (DEP-IO)_{Ft} will not penalize its inclusion in a foot because the vowel is non-epenthetic. This candidate will also be assessed fewer INTEGRITY violations than the attested output because it copies once instead of twice. The following tableau compares the two candidates:

- (44) *məməndzəm'u:t* ‘leavings after cutting kindling wood’

/mə ^μ n ^μ d̥z + ^μ m'u:t/	(DEP) _{Ft} ! *Lar] _σ ! DEP _μ ! *(min-σ) _{Ft}	DEP _{seg}	INTEG
⊙ a. mə ^μ (mə ^μ n ^μ d̥zə)(m'u:t)	! ! !	*!	**
✗ b. (mə ^μ n ^μ d̥zə ^μ)(m'u:t)	! ! !		**

Reranking the constraints is out of the question, since the attested candidate is again harmonically bounded. Again, we must introduce a new constraint to produce the attested outcome. The unattested candidate in this case is more harmonic in several ways than the attested winner, but it does create an extra kind of discontinuity by copying instead of epenthesis. We can capture this by using a constraint CONTIGUITY, which is based on but different from the version in McCarthy & Prince (1995). The version we need is defined as follows:

- (45) CONTIGUITY : “For each string *xy* in the output, if there exists an input segment *m* such that *x* \Re *m*, and there exists an input segment *n* such that *y* \Re *n*, then assess one violation unless *mn* is a string in the input.”

¹²Thanks to Lev Blumenfeld for pointing out this possibility.

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McCarthy & Prince (1995) define two constraints, O-CONTIG and I-CONTIG, each of which looks only one direction: from the output to the input, or from the input to the output. Neither of these constraints will distinguish between the candidates in (44). Therefore we use a version which looks at both levels before evaluating, and therefore is vacuously satisfied in the case of adjacent segments where one of the segments is epenthetic. Since it only compares adjacent segments, it assigns the same number of violations to a reduplication of one segment or a reduplication of many segments—as long as the reduplication occurs in the same place. And it crucially assigns only one violation for reduplication at word peripheries, but two violations when reduplication is word-internal (because the reduplicant and its left neighbor earns one violation, and the reduplicant and its right neighbor earns another). This constraint must be ranked below $*(\text{minor-}\sigma)_{Ft}$ and above DEP_{seg} in order to have any effect. (46) shows how its presence selects the correct output:

(46) *məməndzəm'u:t* ‘leavings after cutting kindling wood’

$/m\hat{ə}^{\mu}n^{\mu}dz + ^{\mu}m'u^{\mu}t/$	$(\text{DEP})_{Ft} \mid *(\text{minor-}\sigma)_{Ft}$	CONTIG	DEP_{seg}	INTEG
a. $(m\hat{ə}^{\mu}n^{\mu}dz\hat{ə})(m'u:t)$	∣ *!		*	
b. $(m\hat{ə}^{\mu}n^{\mu})dz\hat{ə}^{\mu}(m'u:t)$	*! ∣		*	
☞ c. $m\hat{ə}^{\mu}(m\hat{ə}^{\mu}n^{\mu})dz\hat{ə}(m'u:t)$	∣	*	*	**
d. $(m\hat{ə}^{\mu}n^{\mu}dz\hat{ə}^{\mu})(m'u:t)$	∣	**!		**

The ranking $\text{CONTIGUITY} \gg \{\text{DEP}_{seg}, \text{INTEGRITY}\}$ appears problematic, since it predicts that neither epenthesis nor reduplication will happen. But the problem is resolved by the ranking of MAX-IO over CONTIGUITY . This requires exponence for all input material, even at the cost of routinely violating CONTIGUITY . In (47), we see that this ranking still allows reduplication in the cases we examined before (cf. (35)):

(47) *kəmkatlm'u:t* ‘chips made by adzing’

$/k\hat{ə}^{\mu}m^{\mu}tl + ^{\mu}m'u^{\mu}t/$	$(\text{Dep})_{Ft} \mid \text{CONT}$	DEP_{seg}	INTEG	*CLASH ∣ ALIGN-R ∣ (root,stem)
a. $k\hat{ə}^{\mu}k\hat{a}^{\mu}m^{\mu}tlm'u^{\mu}t$	∣ *		**	*! ∣
b. $k\hat{ə}^{\mu}m^{\mu}tlk\hat{a}^{\mu}m'u^{\mu}t$	∣ *		**	∣ *!
☞ c. $k\hat{ə}^{\mu}m^{\mu}k\hat{a}^{\mu}tlm'u^{\mu}t$	∣ *		**	∣
d. $k\hat{ə}^{\mu}m^{\mu} ?a^{\mu}tlm'u^{\mu}t$	*! * ∣	**		∣

We don't need to make any changes to account for the roots in (8). These are the monomoraic roots with a laryngeally-marked final segment, which surface with lengthening of the root vowel as well as epenthesis. The floating mora is realized by the lengthening, since the same high ranking constraints prevent it from anchoring on the epenthetic vowel. This is shown in the following tableau:

(48) $g^w a:d\acute{o}mu:t$ ‘left after untying’

	$/g^w \underline{a}^{\mu} d + m' u^{\mu} t/$	$(DEP)_{Ft}$	CONTIG	DEP_{seg}	INTEG ! *CLASH
a.	$(g^w \underline{a}^{\mu} d\acute{o})(m' u^{\mu} t)$	*!		*	!
b.	$g^w \underline{a}^{\mu} (g^w \underline{a}^{\mu} d\acute{o})(m' u^{\mu} t)$	*!	*	*	**!
c.	$(g^w \underline{a}^{\mu} d\acute{o}^{\mu})(m' u^{\mu} t)$		*!*		*!
d.	$(g^w \underline{a}^{\mu} d\acute{o})(m' u^{\mu} t)$			*	!

The remaining roots belong to two categories: monomoraic roots with glottalized final segments (those in (9)), and disyllabic roots. Both of these types of roots are different from all other roots because lexical exceptions are reported in roots of these shapes and no others. In fact, even though generalizations can be made about these roots, their forms after $m'u:t$ reduplication are not predictable. In addition to this problem, there are areas of unclarity in the recording of the data that make any analysis uncertain. For example, consider the form whose root is provided is the word meaning ‘rejected because too small’, which I transcribe here as $ama?mu:t$ (from root $ama?$). The actual transcription given by Boas (1947) for this word is [ämä'ε mut], with root [ämä'ε]. The difficulty is in knowing how to interpret these vowels. If the vowel transcribed as ä is long in both the root and the output then this form is a problem for my analysis: we would expect to see lengthening in the first syllable to accommodate the floating mora. Exactly what, then, is this ä? We look in the introduction to the phonology section of Boas (1947):

“ä and â (ɔ) are evidently secondary phonemes. In almost every case it can be shown that ä is derived from ea or ya, â from aw or wa.” (207)

This suggests that the underlying representation for ä is really ja or aj . If it is the former, we would expect lengthening of one of the vowels to accommodate the floating mora. Given the ranking of *CLASH, we would expect lengthening in the first syllable, and this word remains a problem. In the other case, the rime must be underlying aj' , in which case we expect epenthesis to avoid a bad coda. A further concern is the fact that this word has only one glottalization noted. Given the glottal stop in the root, and the fact that m in $m'u:t$ is always glottalized after a consonant, we would expect either two glottalizations here or none.

The other two disyllabic roots given by Boas (1947) are similarly difficult to interpret, and no clear pattern among them emerges. The $-VC'$ roots also too few in number and too inconsistent to analyze. Given only the data in Boas (1947), it seems that we are unable to give a complete analysis. But the underspecification approach does make predictions which can be tested when better data are adduced to the problem. In the case of disyllabic roots, the floating mora should be able to anchor on either of the stem vowels. In case both vowels are long, we expect reduplication (creating a quadrisyllabic word) which should pattern like the cases we have already analyzed. In the case of $-VC'$ roots, we expect lengthening and epenthesis in a pattern identical to that of $-VD$ roots. The reported data where $-VC'$ roots reduplicate and epenthesize rather than lengthening appear to be troubling counterexamples, and it remains to be seen whether these represent a refutation of the present analysis or are merely lexical exceptions.

4 A Critique of Struijke 1998

In this section I summarize an alternative analysis to the facts presented here, that of Struijke (1998), and critique that analysis. Note that this is not the first critique of Struijke (1998): Caro Struijke herself has critiqued that paper, in her dissertation (Struijke 2000). The present critique focuses on the older paper because the bulk of this section was written before the author obtained a copy of Struijke (2000). However, many of the criticisms here were not made in Struijke (2000), and many of the criticisms also apply to that paper. The interested reader is encouraged to consult Struijke (2000) for a different view of these issues.

Struijke (1998) does not analyze monomoraic roots or disyllabic roots. Exclusion of the monomoraic roots eliminates all the cases that show lengthening rather than reduplication, so Struijke (1998) only provides an analysis of the reduplication patterns. This analysis is developed within what I have called the traditional framework, i.e. one that includes a morpheme RED and a full panoply of faithfulness constraints that militate for identity along the B(ase)-R(eduplicant) direction. However, Struijke (1998) is innovative compared to previous work within the traditional framework, which typically assumed that in cases of reduplication I-O correspondence only holds between the underlying material and the output base, rather than between the underlying material and the reduplicant or simply between the underlying material and the whole output. Against this idea, Struijke (1998) proposes the idea of Broad I-O correspondence, where I-O faithfulness can be satisfied by correspondence between the underlying material and the base or the reduplicant.¹³

The Broad I-O analysis of Struijke (1998) takes the *m'u:t* morpheme to be a circumfix, RED + *m'u:t*, which surrounds the root. As seen above, the reduplication data show reductions that happen sometimes in the first copy and sometimes in the second. For Struijke (1998), the base is always the second copy, but it may be forced to truncate or reduce its vowel to satisfy *CLASH, which is defined as follows:

- (49) *CLASH: Adjacent heads of feet are prohibited.

Crucially, *CLASH outranks $\text{DEP}_{\mu}\text{-BR}$. This yields the correct output for the roots with long vowels (those in (10a)):¹⁴

- (50) *de:dəm'u:t* 'refuse of wiping' - (8) in Struijke (1998)

	/RED- + de: + -m'u:t/	*CLASH	$\text{DEP}_{\mu}\text{-BR}$
a.	(de:)- (de:)- (m'u:t) (H) (H) (H)	**!	
b.	(de:)- (də-m'u:t) (H) (LH)		*

With an additional ranking of *CLASH over $\text{DEP}_{\text{seg}}\text{-BR}$, the Broad I-O analysis achieves the correct outcome for roots with moraic codas (those in 10b):

¹³This framework has similarities to the Existential Faithfulness framework developed in Struijke (2000), but there are interesting differences between the two theories.

¹⁴The tableaux in this section have been altered slightly for consistency of transcription and style, but the content is unchanged.

(51) *wənwəm'u:t* 'refuse of drilling' - (10) in Struijke (1998)

	/RED- + wən + -m'u:t/	*CLASH	DEP _{seg} -BR DEP _μ -BR
a.	(wən)- (wən)- (m'u:t) (H) (H) (H)	**!	
☞ b.	(wən)- (wə-m'u:t) (H) (LH)		* *

To choose the correct candidate for roots with laryngeally-marked final consonants or bad codas, Struijke (1998) ranks *CLASH over MAX_{seg}-BR and MAX_μ-BR, as shown in the following tableau:

(52) *məməndzəm'u:t* 'leavings after cutting kindling wood' - (20) in Struijke (1998)

	/RED- + mən̄dz + -m'u:t/	*CLASH	MAX _{seg} -BR MAX _μ -BR
a.	(mən)- (mən)- (dzə-m'u:t) (H) (H) (LH)	*!	
☞ b.	(mə-mən) (dzə-m'u:t) (LH) (LH)		* *

The -VRT roots, which split up their final clusters when they reduplicate, are the motivating cases for Broad I-O correspondence. In these words, neither the base nor the reduplicant contains all the material of the underlying form, but the complete output always does include all the underlying material. Struijke (1998) shows that these forms cannot be derived using either I-B relations, I-R relations, or a combination of both, and that from a B-R perspective these forms are even worse. There are no tableaux which illustrate this part of the analysis, but they might look something like this:

(53) *qənqasm'u:t* 'chips'

	/RED- + qəns + -m'u:t/	MAX _{seg} -IO	*COMPLEX	*CLASH	MAX _{seg} -BR MAX _μ -BR
☞ a.	qənqasm'u:t				*
b.	qənsqam'u:t		*!		
c.	qəsqanm'u:t			*!	* *
d.	qənqam'u:t	*!			

4.1 Problems with the Analysis

The Broad I-O analysis incorporates important insights about *m'u:t* reduplication, some of which have been used again in subsequent work, including the present paper. It also shows how *m'u:t* reduplication is a strong counterexample to the assumptions of previous theories of reduplication within the traditional framework. However, the Broad I-O account also has significant liabilities which make it an unsatisfactory analysis of the full range of Kwak'wala facts.

First, the analysis is empirically inadequate, and extension of the analysis for the remaining data seems problematic. Struijke (1998) does not analyze the monomoraic roots, which typically lengthen instead of reduplicating. But if RED is part of the *m'u:t* morpheme, then the monomoraic cases should also reduplicate. Nothing should prevent these forms from reduplicating if such were

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their goal. It seems that some stipulation will have to be made, distinguishing forms on the basis of their phonological form for no obvious reason. The analysis also treats the epenthetic vowels following laryngeally-marked final consonants as normal vowels. But as we have seen, these vowels can never receive stress and therefore they should be distinguished in some way.

Second, the form of the morpheme in the Broad I-O analysis is quite curious. All of the ordinary (segmental, non-reduplicating) affixes of Kwak'wala are suffixes. Indeed, Wilson (1986) states that prefixes do not occur anywhere in the Wakashan family. Why should this particular affix be a circumfix, unlike all the other affixes in the language? The claim of such an uncommon prefix type should be supported by strong evidence, but the only apparent motivation for treating *m'u:t* as a circumfix is analysis-internal. Indeed, both the first and second copies sometimes reduce in *m'u:t* reduplication, which goes against the general concept of greater faithfulness to the root, no matter which copy is chosen as the base and which as the reduplicant.

Finally, a full implementation of the Broad I-O analysis will result in a prodigious expansion of CON. In Kwak'wala, it will be necessary to duplicate the entire set of faithfulness constraints not just once (for the B-R direction), but as many times as there are different reduplication patterns. This is suggested in footnote 7 of Struijke (1998), which says: "The present analysis is specific to one type of Kwakwala reduplication only (those involving the morphemes /-mu:t/ or /-(g)i:sawe:ʔ/). If other types of reduplication pattern differently, the BR-constraints used here must be specified for type of reduplicative morpheme." (154) Since Boas (1947) lists fourteen distinct reduplication patterns, the number of new constraints required by this analysis is significant. In addition to the principled argument against language particular constraints, we can make a practical argument against such a Brobdignagian constraint set. This concern becomes particularly salient when we compare this analysis to the one which I argued for in the previous section. An underspecification analysis does not allow any morpheme-specific B-R faithfulness constraints (since it denies the existence of such entities as "base" and "reduplicant"), and limits lexical stipulation to the input material itself.

4.2 Comparison of the Two Analyses

We asked several questions after looking at the *m'u:t* data:

- (54)
- a. Why does the *m'u:t* suffix sometimes cause lengthening and sometimes reduplication?
 - b. Why does one class of light syllables reduplicate (like heavy syllables) instead of lengthening (like all other light syllables)?
 - c. Why do coda clusters sometimes split, and sometimes remain intact?
 - d. Why do disyllabic roots resist lengthening and reduplication?

We can compare the two analyses with regard to their answer for each of these questions.

Why does the m'u:t suffix sometimes cause lengthening and sometimes reduplication? In the underspecification analysis, lengthening is the base case. Reduplication is a repair strategy which is used when a ban on superheavy syllables prevents an underlying floating mora from docking on the root vowel. In the Broad I-O analysis, the difference is unexplained and must be stipulated.

Why does one class of light syllables reduplicate (like heavy syllables) instead of lengthening (like all other light syllables)? Neither analysis answers this question. In the underspecification analysis, this is unexpected. In the Broad I-O analysis, these forms are an exception to the general stipulation of non-reduplication in monomoraic forms.

Why do coda clusters sometimes split, and sometimes remain intact? Both analyses answer this question, but they provide different answers. The underspecification analysis causes clusters to split up in order to simultaneously satisfy *CLASH and ALIGN-R(root,stem). In the Broad I-O analysis, splitting occurs in order to satisfy *COMPLEX, which is inactive except in reduplication cases.

Why do disyllabic roots resist lengthening and reduplication? Neither analysis answers this question. The underspecification analysis does make clear predictions that can be tested against new data. In the Broad I-O analysis, it isn't clear whether disyllabic roots should pattern with the reduplicating roots or the lengthening roots.

5 Conclusion and Implications

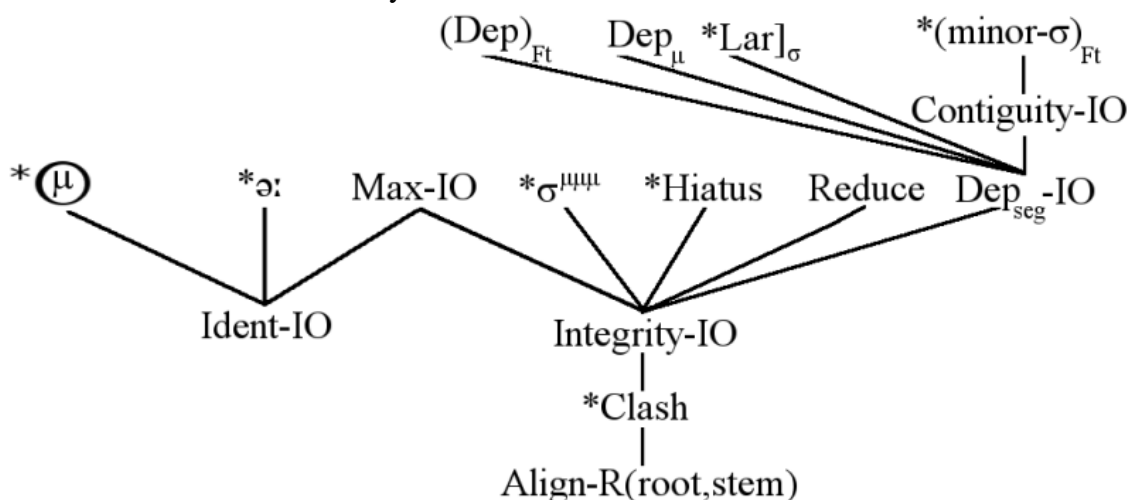
In this paper I presented a new analysis of Kwak'wala *m'u:t* reduplication. In this section, I consider the practical conclusions that I reached about the phonology of Kwak'wala, and then I discuss the larger theoretical implications of this paper and my approach.

5.1 Practical Conclusions

I proposed that in addition to the segmental material in *m'u:t*, there is a floating mora which must anchor somewhere within the word. It is the drive to anchor this mora, even at some significant cost to faithfulness, which results in the observed reduplication and other alternations which are characteristic of this morpheme. All the same should be true of the other suffix that causes *m'u:t* reduplication, *(g)i:sawe:ʔ*—that is, it must also contain a floating mora. I have not worked out whether all of the words which this suffix are well-behaved according to my analysis. This provides a good testing ground to see if the predictions I make are borne out.

I motivated rankings between a number of constraints which were necessary to account for the observed alternations which *m'u:t* induces. These are shown in the following figure:

(55) Kwak'wala constraint hierarchy



My analysis explains almost all of the patterns observed in the data. A few areas of the data remain beyond the reach of my analysis, however. These await a better analysis or a new source of data. There are also some intersecting issues which were not tackled at all in this paper and remain to be analyzed. For example, some of the alternations between *a* and *ə* remain mysterious. The allomorphy of the segmental portion of *m'ut* also remains unexplained.

Some recent work, including other contributions to this volume, question the existence of moras as phonological elements. This analysis depends rather heavily on the phonological reality of the mora, and therefore seems to contradict that line of research. But the analysis is not necessarily incompatible with the abolition of the mora. Any adequate theory of phonological elements will have to account for vocalic length contrasts, gemination, and other phenomena which have been analyzed through the use of moras. Therefore, the potential compatibility of this analysis with an anti-mora framework depends on the precise character of the means employed to account for these phenomena.

5.2 Theoretical Implications

Struijke (1998) has already shown why the Kwak'wala data are problematic for traditional analyses of reduplication within OT. But my analysis suggests a more fundamental challenge to all theories rooted in the idea that reduplication is driven by a RED morpheme and B-R faithfulness constraints. In this paper I showed how it is possible to explain a complex set of reduplication and lengthening data without using RED. In fact, this analysis is more successful than the RED analyses which have been attempted. And it is an analysis which does not require any special theoretical assumptions or technical innovations. The only necessary assumption is that underspecified material may appear in underlying representations—an assumption which already follows from Richness of the Base. Abstracting away from the specific facts about Kwak'wala, what this paper shows is that the possibility of underspecification requires the existence of languages where reduplication is used as a repair strategy. Kwak'wala validates that prediction.

Clearly, an argument against using RED in one specific case of reduplication does not amount

to a refutation of the idea of RED. There is nothing incompatible about an underspecification analysis and the existence of RED. Many phenomena which have been analyzed with RED need to be reanalyzed before such a refutation can be countenanced: these include morphological reduplication (Inkelas & Zoll 2005), templatic reduplication (McCarthy & Prince 1986/1996), fixed segment reduplication (Alderete et al. 1999), and overapplication and underapplication of reduplication (McCarthy & Prince 1995). This amounts to a significant research agenda. But there are compelling reasons to think that its successful conclusion is a worthwhile goal. The RED morpheme is an idea which predates OT and which has never been entirely satisfactory within it, because it is by nature a somewhat procedural morpheme. It is also a morpheme which is nearly unique in having an underlying representation which consists entirely of non-phonological material. The elimination of all B-R faithfulness constraints would also be a welcome diminution of the universal constraint set.

Other issues are raised by treating reduplication as a repair strategy rather than a goal. Although *m'ut* reduplication occurs only in polymorphemic contexts, nothing prevents reduplication being employed in monomorphemic context. The only crucial ranking to see reduplication instead of epenthesis is DEP \gg INTEGRITY. Therefore, for every marked structure which some language resolves with epenthesis, there should be another language which resolves it through reduplication. Some evidence has been adduced which suggests that this prediction is borne out (Yu 2005, Saba Kirchner (forthcoming)), but it remains to be conclusively shown. Whether predictions are made that reduplication should contrast with other kinds of repairs is also an open question. Furthermore, the anti-RED underspecification analysis predicts that languages which employ reduplication, even if only for a single morpheme, will never use epenthesis in the same phonological context. This is a prediction which should be investigated.

More broadly, the potential implications of this analysis go far beyond the issue of reduplication. A radical interpretation of the underspecification analysis would deny the possibility of RED or any other morpheme whose underlying representation includes non-phonological material, and it would affirm the possibility of underlying representations being fully specified, fully underspecified, or anything in between. This analysis would have significant implications for our understanding of phonological representation and of phonological constraints, as well as requiring a revision of much previous work. Some interesting work that seems to point in this direction has been done with regard to the theory of phonological representation has been done (for example, the Direct OT framework: Golston 1996, Golston & Thurgood 1999, Brown 2004), but a more comprehensive attempt remains to be undertaken.

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