PATTERNS IN KIRUNDI REDUPLICATION[*]

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This paper offers a detailed analysis of reduplicative patterns in Kirundi. In it, I show that what looks like simple OCP effects preventing the reduplicant and the base from being identical are due to the interaction of markedness and faithfulness constraints giving rise to what McCarthy and Prince (1994) call the emergence of the unmarked (TETU). Moreover, in accounting for the non-identity of the base and reduplicant, I show that a ranking paradox occurs when applying McCarthy and Prince's (1995) Full Model of reduplication to Kirundi reduplicated words. I show that models with a broad Input-Output correspondence, like those advocated by Spaelti (1997) and Struijke (1998), easily account for Kirundi reduplicated words.

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1 Introduction

The Obligatory Contour Principle (OCP) (Leben 1973, Goldsmith 1976) has played an important role in phonological theory ever since its initial introduction into the field as a generalization that languages tend to disallow two adjacent identically-toned syllables. From this original formulation for tone, the OCP has been expanded into a fundamental constraint on autosegmental representations banning adjacent identical elements, where elements may refer to a host of phonological units from tone, to features, to syllables.

(1)   *Obligatory Contour Principle* (McCarthy 1986)
        Adjacent identical elements are prohibited.

For example, the OCP would deem illicit a representation like the one in (2), in which two high tones are adjacent. A representation like the one in (3), in which there is a single multiply-linked high tone, is licit with respect to the OCP.

(2)   OCP violation   (3) No OCP violation

        *H   H   H
         | | / \
         σ   σ   σ   σ

Prior to the advent of Optimality Theory (OT), the OCP was taken to be an inviolable principle (although see Odden (1986) for counterarguments). There has been considerable evidence illustrating that a phonological rule is blocked if it were to create an OCP violation (McCarthy 1986). It has also been shown that operations like Meeusen's Rule, which deletes the second of two morphologically or syntactically juxtaposed high tones, are triggered by the OCP precisely because they repair underlying OCP violations.

(4)   *Meeusen's Rule*
    a. $H \rightarrow L / H \#$ ___

    Shona (Odden 1980)
    b. hóvé   'fish'   né#hove   'with a fish'
        badzá 'hoe'   né#badzá 'with a hoe'

    c. ne#hove   ne#badza   ne#hove   ne#badza
        | |╱ | | | Meeusen's Rule $\rightarrow$ | |╱ | | |
        H **H**   H   L   H   H **L**   H   L   H

A basic tenet of OT is that all constraints are violable and it is the ranking of these constraints that derives surface forms. Myers (1997) has shown that the OCP is in fact violable. He illustrates this with tonal interactions in Kishamba. In this language, two morphologically juxtaposed high tones remain distinct. By considering the OCP as just another constraint within Kishamba's grammar, it must be the case that faithfulness to underlying tone dominates the OCP and thus two adjacent high tones are allowed to surface. In a language like Shona, which employs Meeusen's Rule, the OCP dominates the constraint requiring faithfulness to underlying tone and therefore deletion of that tone is permitted in order to satisfy the OCP.

Yip (1995) extends the OCP to morphological units. Much like Leben (1976) did for tone, Yip observes that languages tend to disallow adjacent identical morphemes. Working within OT, she captures this generalization with the constraint *REPEAT, given in (5). *REPEAT prohibits identical morphemes from appearing together.

(5)   ***REPEAT** (Yip 1995)
       Output must not contain identical morphemes

Yip uses the haplology of the English plural and possessive morphemes to illustrate her point.

(6) | **Singular** | **Plural** | **Possessive Sg.** | **Possessive Pl.** |
       | --- | --- | --- | --- |
       | ox | oxen | ox's | oxen's |
       | cat | cats | cat's | *cats's |
       | Katz | Katzes | Katz's | *Katzes's |

The English plural morpheme and the possessive suffixes can co-occur on the same word as seen with *oxen's* in which the plural morpheme is /-en/ and the possessive morpheme

is /-s/. However, when the plural morpheme is also /-s/ as with *cats*, the two suffixes cannot co-occur and thus a form like **cats's* is ruled out. Yip shows that *REPEAT is indeed the deciding constraint by contrasting the illicit **cats's* with the homophonous but licit *Katzes*/*Katz's*. *Katzes* and *Katz's* are perfectly fine precisely because there is only one morpheme in either case, thus no violation of *REPEAT occurs.

Reduplicative patterns in Kirundi suggest that *REPEAT may be at work because it is generally the case that the base and reduplicant are not identical, but differ minimally.

(7)   a. /mi-bíi/   →   mibíi+mibí   *mibíi+mibíi
        b. /ma-gúfi/ →   magúfi+mágufi   *magúfi+magúfi

For example, in (7a), the long vowel in the left-hand copy is shortened in the right-hand copy, creating a situation in which the two halves of the reduplicated form are not identical. In (7b), the high-tone in the right-hand-copy shifts one mora to the left. This shift also prevents the reduplicant and the base from being perfectly identical. The OCP/*REPEAT appears to be the constraint responsible for the non-identity. Nevertheless, I show that what appears to be OCP effects are in fact due to the interaction of markedness and faithfulness constraints giving rise to what McCarthy and Prince (1994) call the emergence of the unmarked (TETU). Furthermore, the location of marked elements is shown to be a product of alignment constraints on long vowels and tone working in conjunction with TETU. In accounting for the non-identity of the base and reduplicant, I also show that a ranking paradox occurs when applying McCarthy and Prince's (1995) Full Model of reduplication to Kirundi reduplicated words.

The paper is laid out as follows: in section 2, I give some background on Kirundi. The data is presented in section 3 and in section 4, I discuss and compare two leading models of reduplication. In section 5 I revisit Yip's *REPEAT and show how it cannot account for surface forms that resolve the non-identity issue in different ways. Thus such an analysis would have to rely on other constraints to capture the internal workings of Kirundi reduplicative patterns. The size of the base is analyzed in section 6 and in sections 7 and 8, long vowels and high tone are discussed, respectively. In section 9, I show that the distribution of tone in reduplicated nouns and adjectives is an instantiation of general tone interaction in Kirundi. In section 10, I show how my account is superior to an OCP-based account and in section 11, I conclude my findings.

2   Background

Kirundi is a Bantu language spoken in the areas south of Lake Victoria. It is the major language of Burundi and is spoken by 5 million speakers[1] (Grimes 1996). Guthrie classifies it as a D62 Bantu language. Kirundi is closely related to the much-studied Kinyarwanda (see Kimenyi 1978, Kimenyi 1979, Bateranzigo 1984) which Guthrie also classifies as a D62 language.

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[1] Kirundi is spoken by 4.6 million speakers in Burundi, 100,000 speakers in Uganda and 101,000 speakers in Tanzania.

Kirundi has contrastive vowel length as evidenced by (8). Data are drawn from Ntihirageza (1999, 2000, 2001).

(8) Contrastive Vowel Length
  a. -s**a**ba   'ask'
  b. -s**aa**ba   'shatter'
  c. -fuung**u**ra   'eat'
  d. -fuung**uu**ra   'open'

Along with distinguishing between vowel length, Kirundi contrasts five possible tonal melodies: H and L on short vowels and HH, HL, and LL on long vowels (low tone is not indicated) as illustrated in (9). There is at most one tone per tone bearing unit (TBU)[2] and there is no LH tonal melody in Kirundi.

(9) Contrastive Tonal Melodies
  a. korora   'drop'
  b. kórora   'cough'
  c. *kôrora

  d. intoore   'garden eggs'
  e. intóore   'small piece of dough'
  f. *intoóre

  g. aháaga   'that s/he get full'
  h. aháága   'that (place) which is narrow'

Like all other Bantu languages, Kirundi uses a number of prefixes and suffixes in order to express grammatical relations or discourse information. For instance, nouns are divided into different classes, with each class being associated with a prefix (and pre-prefix vowel). An adjective takes the class marker prefix of the noun it modifes. Verbs have a number of different prefixes and suffixes. For my purposes here, I will only be concerned with the infinitival prefix /ku-/ and semantically empty final vowel suffix /-a/.

3 Data
3.1 Adjectives
In the reduplication of adjectives, which marks emphasis, the entire stem is copied. By stem, I mean the root plus affixal material. Ntihirageza (1999) notes that the number of adjectives is quite small in Kirundi as is true for all Bantu languages. This fact may be justification for why some constraints that affect nouns and verbs do not apply to adjectives. In the table below, roots are given in bold. Class affiliation, which is represented by a standard numbering system, is given in parentheses.

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[2] In general, vowels are the tone bearing units in Kirundi. A nasal may bear tone but only in certain verb conjugations (Ntahokaja 1994).

(10)		**Base**	**Reduplicated Form**	**Gloss**
		a. /mi-**bíi**/	mibíi+mibí	'bad (4)'
CVV Roots		b. /ga-**kée**/	gakée+gaké	'little by little (12)'
		c. /ba-**tóo**/	batóo+bató	'small (2)'
		d. /ma-**gúfi**/	magúfi+mágufi	'short (6)'
CVCV Roots		e. /bi-**níni**/	biníni+bínini	'big (8)'
		f. /ma-**kúru**/	makúru+mákuru	'important (6)'
VVCV Root		g. /ba-**íiza**/	béza+béeza[3]	'beautiful (2)'

The forms seen in (10a-c) have CVV roots. In the reduplicated forms, long vowels appear only in the left-hand copy. In the right-hand copy, long vowels are shortened. Due to this shortening, the base and the reduplicant are rendered dissimilar. The forms in (10d-f) have CVCV roots. When the adjective is reduplicated, the high tone in the left-hand copy is on the second TBU, but in the right-hand copy, high tone appears on the first TBU. Like the shortening of long vowels seen in (10a-c), tone-shift ensures that the two halves are not identical. The form shown in (10g), which has a VVCV root, is another instance of vowel shortening in reduplication. However, unlike the long vowels of the CVV roots which appear in the left-hand copy, the long vowel of *béza-béeza* appears in the right-hand copy and is short in the left-hand copy.

In the examples in (10), non-identity of the base and the reduplicant is achieved through either shortening of long vowels (10a-c,g) or tone-shift, but never both. Similar phenomena are also apparent in reduplicated nouns and verbs. I show in section 9 that the lack of tone-shift is simply another instance of a larger process in Kirundi that disallows two syllable-adjacent high tones.

3.2 Nouns

The reduplication of nouns is a more productive process than the reduplication of adjectives. However, unlike the adjectives, reduplication of nouns does not have a fixed meaning. Also, unlike the adjectives, reduplicated nouns only incorporate affixal material when the root is monosyllabic. When the root is polysyllabic, only the root reduplicates.

Sometimes, a reduplicated noun has a different class marker than its non-reduplicated counterpart. Only polysyllabic roots may shift class markers (11e,g); monosyllabic roots never exhibit a shift in noun class (11a-d). In section 6, this is shown to fall out from a bisyllabicity constraint. In the table below, roots are presented in bold and class affiliation is given in parentheses.

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[3] Kirundi employs vowel coalescence, fusing /a/ + /ii/ to [ee]. I do not deal with this phenomenon. For an OT account of vowel coalescence in Runyankore, another Bantu language, see Poletto (1998).

(11)	Base	Gloss	Reduplicated form	Gloss
	a. /i-mi-**zii**/	'roots'	i-mizii+mizi	'very thin (4)'
CVV Roots	b. /u-bu-**zii**/	'jobs'	u-buzii+buzi	'small jobs (14)'
	c. /u-bu-**sáa**/	'nothing'	u-busáa+busa	'nothingness (14)'
	d. /a-ma-**bwáa**/	'shit'	a-mabwáa+mabwa	'shit! (6)'
	e. /u-mu-**biri**/	'body (1)'	i-ki-biri+biri	'material body (7)'
CVCV Roots	f. /i-n-**kóni**/	'stick'	i-n-kóni+kóni	'of a stick kind (9)'
	g. /u-mu-**tíma**/	'heart (1)'	i-n-tíma+tíma	'of the center (9)'
	j. /a-ma-**béere**/	'breast'	a-ma-bére-béere	'breastmilk (6)'
CVVCV Roots	i. /i-gi-**tooki**/	'banana'	i-gi-toki-tooki	'field of bananas (8)'
	h. /u-ru-**seenge**/	'chimney (11)	u-mu-senge+seenge[4]	'soot (3)'

In (11a-d), in which the root is CVV, two things occur: the CV noun class prefix is incorporated and, like the adjectives, the long vowel in the left-hand copy is shortened in the right-hand copy. However, unlike the adjectives, tone is not copied when CVV root nouns reduplicate. In (11e-j), the roots are bisyllabic and we encounter another difference between the nouns and the adjectives. Adjectives always incorporate the prefix when reduplicated, regardless of the size of the root. The whole stem acts as the base for reduplication. Nouns on the other hand, incorporate the prefix only when doing so results in a bisyllabic reduplicant. The root is the base for reduplication except when the root is deemed too small, in which case the prefix is incorporated.

When a CVVCV root reduplicates as with (11h-j), the long vowel is preserved in the right-hand copy but is shortened in the left. The shortening of long vowels (both word final as well as root internal) is another mechanism with which non-identity of the base and reduplicant is ensured. And lastly, in (11f-g, i), we see that tone may be copied in reduplicated forms contrary to what examples (11a-d) may have led us to believe. This is in stark contrast to the verbs in which tone is never copied. All these facts, I show, fall out from the interactions of the same constraints. I now turn to the verbs.

3.3 Verbs
Reduplication of verbs, which means 'to do V repeatedly', is a productive process. The reduplicant is maximally bisyllabic. All roots in the reduplicative paradigm are C-final roots, either CV(V)C or CV(V)CV(V)C. Monosyllabic C-final roots incorporate the final vowel (FV) suffix /-a/ in order to satisfy the bisyllabicity requirement on reduplicants. Monosyllabic V-final roots cannot be reduplicated. In that case, the reduplication meaning 'to do V repeatedly' is expressed with other suffixes or verbs, creating a serial verb construction (Ntihirageza pc). In section 6, an explanation for this gap is provided. I illustrate that the same constraint ranking that explains the incorporation of prefixes of monosyllabic root nouns also explains why CVV root verbs do not reduplicate.

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[4] In Bantu, it has been shown that vowels are long before an NC cluster. I follow Ntihirageza's (1999) transcription in which the long vowel in a -VVNC- sequence is shortened to -VNC- in the left-hand copy of reduplicated forms. The precise quality of these vowels under reduplication have yet to be phonetically measured.

(12)

	Base	Reduplicated form	Gloss
	a. /ku-**sek**-a/	gu-seka+seka[5]	'to smile'
CVC Roots	b. /ku-**pfuny**-a/	gu-pfunya+pfunya	'to compress'
	c. /ku-**díg**-a/	ku-díga+diga	'to tickle'
	d. /ku-**nyíg**-a/	ku-nyíga+nyiga	'to be loose'
	e. /ku-**kaand**-a/	gu-kanda+kaanda	'to massage'
CVVC Roots	f. /ku-**cuuc**-a/	ku-cuca+cuucaa	'to knock'
	g. /ku-**téer**-a/	gu-téra+teera	'to throw'
	h. /ku-**hóoy**-a/	gu-hóya+hooya	'to bring to calm'

In (12e-h), the roots have long vowels. In the reduplicated forms, long vowels appear only in the right-hand copy and are shortened in the left-hand copy. This is the same phenomenon previously encountered with the adjectives and nouns. The forms in (12c-d,g-h) illustrate that tone is never copied in reduplicated forms. This fact about Kirundi verbs is addressed in section 7. The interaction of tone and long vowels as exemplified by (12g-h), in which one half has high tone and the other a long vowel, is shown to fall out from the interaction of markedness and faithfulness constraints. It is this interaction that renders the two halves non-identical.

Below is a table summarizing the treatment of long vowels and tone under reduplication. If there is a change, it occurs in one half of the reduplicative construction.

(13)

	ADJECTIVES	NOUNS	VERBS
copy tone	always	sometimes	never
copy long vowels	never	never	never
shorten root-internal long vowels	always	always	always
shorten word-final long vowels	always	always	N/A
shift tone	sometimes	never	N/A
shift tone & shorten long vowels	never	never	N/A

In the next section, I introduce the model of reduplication I use in the analysis of the data.

4 Reduplication
4.1 Models of Reduplication

Reduplication in OT examines the relationship between a phonologically-unspecified morpheme RED and a phonologically-specified base to which RED is attached. This

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[5] There is a voicing alternation exhibited by the Kirundi infinitival marker /ku-/: the voicing of the velar stop is the opposite value of the initial consonant of the verb root. This is known as Dahl's Law and is found in other Bantu languages such as Kikuyu and Kinyarwanda.

relationship between RED and the base is not a simple copying-of-the-base function first argued for by Marantz (1982), but rather it is a correspondence between the two. This correspondence relation are governed by a set of correspondence constraints which expresses the dependency of the elements in RED on those in the base. It is precisely this correspondence between RED and the base that marks a morpheme as reduplicative.

There are two leading models of reduplication: McCarthy and Prince's (1995) Full Model (FM) and the Spaelti (1997) and Struijke (1998, 2000) models (henceforth SS). Both models are analyzed because an issue apparent in the Kirundi data is the nature of the correspondence relationship, namely Input-Output correspondence (I-O Faithfulness) and Base-Reduplicant correspondence (B-R Faithfulness).

Within the Full Model, I-O Faithfulness is defined as a set of constraints that bears on the correspondence relationship between the input and the base (I-B Faithfulness). B-R Faithfulness is a family of constraints that governs the relationship between the base and the reduplicant. There is also a relationship between the input and the reduplicant (I-R Faithfulness)[6].

(14)   Full Model of Correspondence
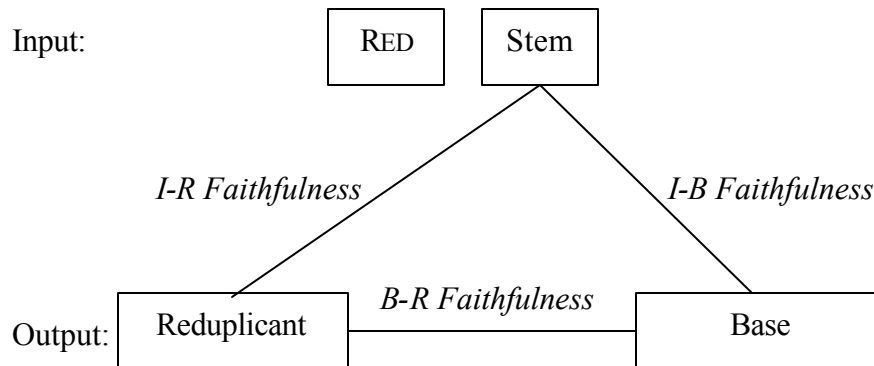
Inherent in the FM model is the notion that one can and must identify one half of a reduplicated word as the base and the other half as the reduplicant. This is in stark contrast to the Spaelti (1997) and Struijke (1998, 2000) models.

A ramification of the SS models is that one does not have to truly know which half is the reduplicant and which is the base in order to assess IO correspondence. [7] This is because both Spaelti and Struijke argue for a model of reduplication in which the Input-Output correspondence relation evaluates the relationship between the input and the entire output (i.e. base and reduplicant as a whole).

In the SS models, constraints that govern the correspondence between the Input and Output are satisfied if an element in the input has a correspondent in the base, the

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[6] McCarthy & Prince (1994, 1995) have also proposed a model of reduplication that has no I-R correspondence which they call the Basic Model. In this model, as well as the Full Model, one must identify which half is the reduplicative form and which is the base.

[7] Struijke (1998, 2000) uses a Root Faithfulness constraint that "shares important similarities with the Input-Base relation of the Full Model but should not be equated with the broader Input-Output relation (2)". Root Faithfulness ensures that the reduplicant alternates rather than the base. She also argues that Root Faith is irrelevant in reduplicative patterns like the ones in Kirundi that show change in the one member of a base-reduplicant pair. See footnote 17 in section 7.3 in which I address the ranking of Root Faithfulness in relation to I-O and B-R Faithfulness constraints.

reduplicant or both. Input-Base and Input-Reduplicant are united into a single Input-Output correspondence relation . This results in a more streamlined grammar because the number of correspondence relations to be evaluated are now two instead of three.

(15)   SS Model of Correspondence

Input: [RED] [Stem]

I-O Faithfulness

Output: [Reduplicant —— *B-R Faithfulness* —— Base]
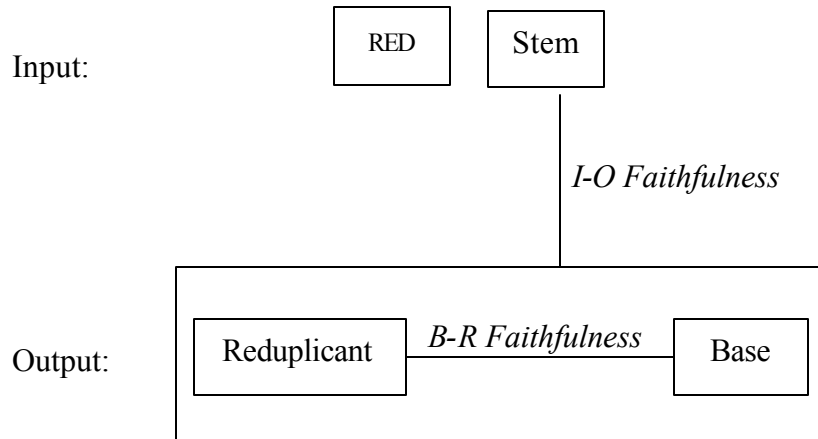
   In what follows, I present theoretical arguments against the FM and in favor of the SS. In section 7.3, I make explicit my empirical arguments against the FM, specifically I show that it exhibits a ranking paradox when confronted with Kirundi reduplicated words.

4.2 Theoretical arguments: SS vs FM

Reduplicated Kirundi verbs present a furtile testing ground for the theoretical implications of the FM and SS models of reduplication. In Kirundi verbs, neither the right-hand copy nor the left-hand copy is more faithful to the input than is its counterpart. This is illustrated by forms such as (12g) repeated here as (16).

(16)   /ku-téer-a/ → gu-téra+teera   'to throw repeatedly'

 In (16), the left-hand copy parses the high tone present in the input but fails to copy the long vowel while the exact opposite is true of the right-hand copy which parses the long vowel but fails to copy high tone. Neither half is more faithful to the input than the other. As noted, the FM requires one to know which half is the reduplicant and which is the base. Thus if we were to use such a model we would have to make an unwarranted assumption about the nature of the language. The SS model does not force a decision one way or the other; the output is considered in total when assessing its relationship to the input. In this regard, it is superior to the FM because it requires fewer theoretical or ad hoc assumptions on the part of the researcher.

   Also, because the SS model collapses the Input-Base and Input-Reduplicant correspondence relations into a single Input-Output correspondence relation, fewer constraints are needed. For example, looking again at (16), we see that, under the SS model, constraints that govern the I-O correspondence relation are satisfied because every element present in the input (specifically high tone and a long vowel) is present in the

output (left-hand copy and right-hand copies respectively). In models that demand a base and reduplicant be identifed, such as the FM, one must decide which half is the reduplicant and which is the base and explain why the reduplicant is more faithful to the input with respect to one phenomenon, such as copying of tone, while the base is more faithful to the input with respect to another phenomenon, such as parsing of long vowels. In the SS model, there is no need to explain why the base or reduplicant is more faithful to the input with respect to a certain phenomenon than is its counterpart because the correspondence is between the input and the base *and* reduplicant. Explanations as to why certain phenomena occur in one side as opposed to the other will be needed, but this can be accomplished, as I show, with various alignment constraints, therefore rendering moot the need to explain why something happens in the base versus the reduplicant.

While the Kirundi forms present interesting theoretical problems for the Full Model, they more importantly provide empirical arguments against it. I show in section 7.3 that a ranking paradox occurs when using the Full Model to account for Kirundi reduplication. This will be shown to result from the need to identify which half is the base and which is the reduplicant.

In what follows, I use RED to represent the phonologically-underspecified reduplicative morpheme and am consistent with other researchers in placing it to the left of a base. It should be noted that if I were to place the reduplicative affix to the right of a base, the same optimal candidates would be chosen.

The faithfulness constraints that I use are given in (16) through (19). I follow Walsh (1992) in analyzing high tone as a segment-like element and not as a feature.

(16)   **MAX IO**[8]
>   Every element in the input has a correspondent in the output.

(17)   **MAX IO (A)**
>   Every tonal-association in the input has a correspondent in the output.

The constraint in (17) takes as its argument the association of high tone to tone-bearer. I follow Myers (1997) in defining an association as a binary relation between two elements. There is no question of tone association if either the tone or the tone bearer are missing[9].

(18)   **MAX BR** (after Myers 1997)
>   Every element in the base has a correspondent in the reduplicant.

(19)   **MAX BR (A)** (after Myers 1997)
>   Every tonal-association in the base has a correspondent in the reduplicant.

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[8] The MAX IO constraint used here is actually a family of constraints which contain MAX IO (Mora), MAX IO (Segment) and MAX IO (Tone).

[9] Myers describes the application of MAX IO (A) as a constraint that requires the preservation of underlying associations:

> [W]e assume that MAX IO (A) is only violated when (a) an input tone *T* has an output correspondent *T'*, (b) an input syllable *S* has an output correspondent *S'*, and (c) *T* is associated with *S* but *T'* is not associated with *S'*. Thus if tone is deleted, that violates MAX IO (T) but not MAX IO (A). Only delinking violates MAX IO (A) (Myers 1997:865).

In the next section, I return to Yip's (1995) *REPEAT and more closely examine its explanatory and predictive powers with regards to Kirundi reduplication.

5   *REPEAT

As noted in the introduction, Myers (1997) illustrates that the OCP, which is a prohibition on adjacent identical elements, is but another violable constraint within an optimality theoretic framework. Yip (1995) extends the OCP into morphology. She does this with the constraint *REPEAT.

(20)   ***REPEAT** (Yip 1995)
       Output must not contain identical morphemes.

*REPEAT can be instantiated with a number of different arguments from *REPEAT (AFFIX) to *REPEAT (STEM).

Because it is generally the case that the base and reduplicant are not identical, it appears that *REPEAT is at work in Kirundi reduplication. However, an account using *REPEAT is unable to predict an optimal form between two candidates that resolve the non-identity issue in different ways. Observe tableaux (21) and (22).

(21)

RED+mi-bíi	*REPEAT$_{STEM}$
☞ 1. mibíi+mibí	
☞ 2. mibí+mibíi	
3. mibíi+mibíi	*!

(22)

RED+ma-gúfi	*REPEAT$_{STEM}$
☞ 1. magúfi+mágufi	
☞ 2. mágufi+magúfi	
3. magúfi+magúfi	*!

In (21), both candidates 1 and 2 satisfy *REPEAT by having non-identical halves. Candidate 1, which is in reality the form that surfaces, shortens the long vowel in the right-hand copy while candidate 2 satisfies *REPEAT by shortening the long vowel in the left hand copy.

A similar situation is observed in (22). Again, both candidates 1 and 2 satisfy *REPEAT because the base and reduplicant are not identical. Candidate 1, the surface form, avoids total identity by associating high tone on the second TBU of the left-hand copy and on the first TBU of the right-hand copy. Candidate 2 does the exact opposite and associates high tone on the first TBU of the left-hand copy and on the second TBU of the right-hand copy. In both tableaux, candidate 3 fails because the two halves are identical. *REPEAT is not sufficient to choose the correct candidate. Additional constraints are required.

I show that the non-identity of the base and reduplicant fall out from the interaction of faithfulness, markedness and alignment constraints. In so doing, it turns out that an OCP-based account such as one using *REPEAT is unnecessary and will in fact make incorrect predictions.

6   The Base

Kirundi reduplicants are minimally bisyllabic. All monosyllabic roots incorporate affixal material in order to make a bisyllabic base. With the exception of adjectives, roots that are bisyllabic never incorporate affixal material under reduplication. In this section I address the constraint that will account for the incorporation/non-incorporation of affixal material in reduplicative forms. Consider the forms represented in (23) and (24). Roots are presented in bold.

Nouns

(23)	**Base**	**Gloss**	**Reduplicated form**	**Gloss**
	a. i-mi-**zii**	'roots'	i-mizii+mizi	'very thin'
	b. u-bu-**zii**	'jobs'	u-buzii+buzi	'small jobs'
	e. u-mu-**biri**	'body'	i-ki-biri+biri	'material body'
	f. i-n-**kóni**	'stick'	i-n-kóni+kóni	'of a stick kind'

Verbs

(24)	**Base**	**Reduplicated form**	**Gloss**	**Impossible form**
	a. /ku-**sek**-a/	gu-seka+seka	'smile repeatedly'	*gusek+gusek-a
	b. /ku-**cuuc**-a/	gu-cuca+cuuca	'knock repeatedly'	*gucuc+gucuuc-a
	Base	**Reduplicated form**	**Gloss**	**Impossible form**
	c. /ku-**fuungur**-a/	gu-fungu+fuungur-a	'eat repeatedly'	*gufu+gufuungur-a
	d. /ku-**gaban**-a/	ku-gaba-gaban-a[10]	'share repeatedly'	*kuga+kugaban-a

As seen in section 2, reduplication of adjectives always incorporates the prefix regardless of the size of the base (the stem is reduplicated) whereas the nouns and verbs only incorporate affixal material into the base when the root is monosyllabic as seen in (23a-b) and (24a-b). Forms such as *u-bu-zii+zi* or *gu-sek+sek-a* never surface. It appears then that the reduplicant must be minimally bisyllabic (Ntihirageza 1999). Bisyllabicity of reduplicants has been claimed for other Bantu languages as well, such as Ndebele (Hyman et al. 1999), IsiXhosa (Downing 1998), Runyankore (Poletto 1996) and Kikerewe (Odden 1996).

In reduplicated forms, such as *i-mizii+mizi* and *gu-seka+seka*, affixal material is incorporated in order for there to be a well-formed base for reduplication. Contrast those with bisyllabic roots, (23c-d) and (24c-d), which do not incorporate affixal material. Unlike the adjectives, noun reduplication isn't simple reduplication of the stem, nor is it simply reduplication of the root. How then does one reconcile the fact that monosyllabic roots incorporate prefixal material while bisyllabic roots do not? In other words, what is the base for these forms?

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[10] It has been well documented that Bantu forbids closed syllables, preferring CV or CVV syllables. Thus a constraint like NoCoda which prohibits closed syllables is undominated in most Bantu languages. This explains the suboptimality of a form like *ku-gaban+gaban-a*. Kirundi sacrifices a violation of MAX BR in order to satisfy the higher ranked NoCoda. I do not discuss NoCoda, as it is not central to the current analysis.

Downing (1998) provides a solution[11]. She argues for a notion of the base that is independent of any morphological notion of the root. This phonological notion of the base is usually, but not always, coterminous with the root. According to Downing, one must abandon the idea that the base is strictly a morphological entity and accept the fact that it is precisely a phonological conceptualization of the base that is needed in order to account for the facts encountered in Bantu languages such as Kihehe and Kirundi. Thus, if a reduplicant must be bisyllabic and the root is monosyllabic, well-formedness and alignment constraints conspire to create a base that is no longer identical to the root (thus no longer strictly a morphological unit) in order to satisfy the higher ranked bisyllabicity constraint.

Odden (1996) in analyzing Kikerewe, incorporates Downing's insights. Kikerewe, like Kirundi, incorporates prefixal material when reduplicating monosyllabic roots in order to satisfy a high ranking constraint that requires the reduplicant to be bigger than a syllable.

(25) *Kikerewe*

Base	Gloss	Reduplicated form	Gloss
a. bá-bí	'bad (2)'	babíí+bábi	'kind of bad'
b. bí-hyá	'new (8)'	bihyáá+bíhya	'kind of new'
c. mu-kokolo	'old (1)'	mu-kokoló+kókolo	'kind of old'
d. ki-leehi	'tall (7)	ki-leehí+léehi	'kind of tall

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[11] Hyman et al. (1999) analyze Bantu verbal reduplication as being driven by morphological factors. They argue that the reduplicant is a copy of the base's morphosyntactic structure. Specifically, the reduplicant does not correspond to a stem, it *is* a stem "which is in morphosyntactic agreement with the following 'normal' stem that it appears to reduplicate (5)". The reduplicant stem is a full copy of the base stem if there are no prosodic size constraints placed on the reduplicant stem (i.e. RED=ss). They schematize their proposal with the tree given below in (i).

(i) Reduplication as stem juxtaposition
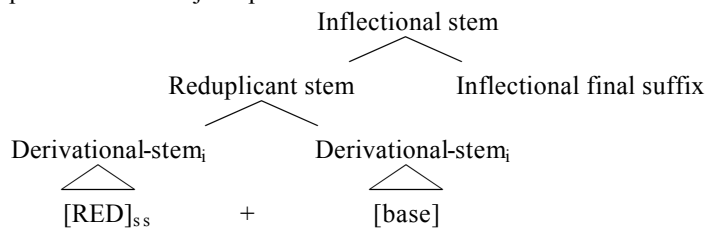
While such an analysis correctly predicts the facts for verbs, it is unclear how it can be extended to reduplicated nouns and adjectives. For instance, nouns incorporate prefixal material only when the root is monosyllabic (see examples (10a-d)). When the root is polysyllabic, no prefixal material is incorporated and only the root reduplicates. It is unclear then at what level (D-stem or I-stem) nouns reduplicate. Assuming prefixes attach at D-stem level, and this is the level of reduplication, what prevents a polysyllabic root from incorporating the prefix? It cannot be a size constraint such as RED=ss, because there are three syllable roots that reduplicate: *i-gi-harage+harage* 'bean field after harvest'. We encounter the same problem if the I-stem level is the level of reduplication and prefix-attachment. If we assume prefixes attach at the I-stem level and reduplication takes place at the D-stem level, then we cannot have a unified account of noun reduplication: monosyllabic roots would necessarily have to be reduplicated at the I-stem level in order to have a prefix to incorporate; polysyllabic roots would reduplicate at the D-stem level to avoid incorporating a prefix.

Odden offers the following constraints which prove useful in analyzing the Kirundi data.

(26) **Base-to Root Alignment** (ALIGNBRT)
ALIGN (Base,R;Root;R)
Align the right-edge of the base with the right-edge of the root.

ALIGN (Base,L;Root,L)
Align the left-edge of the base with the left-edge of the root.

These constraints capture the generalization that bases and roots tend to be identical. However, because all constraints are violable, a base does not necessarily have to be identical to a root. To put it another way, bases don't have to be morphological constructs. Odden follows Downing in assuming that the placement of the reduplicant relative to the base is governed by prosodic alignment constraints. This constraint is given below.

(27) **Reduplicant-to-Base Alignment** (ALIGN RB)
ALIGN (RED,R;Base;L)
Align the right-edge of the reduplicant with the left-edge of the base.

ALIGN RB, when combined with (RED=σσ) and (RED≥σσ), constraints which require reduplicants to be bisyllabic (verbs) and minimally bisyllabic (nouns), ensure that with monosyllabic roots, the edges of the base must be adjusted to incorporate affixal material. In order for this to happen, ALIGN RB and RED=σσ/RED=σσ must dominate ALIGN BRT. This is illustrated in (28), applied to Kirundi. Below, the base is in bold and the reduplicant is underlined. This choice is completely arbitrary.

(28)

i-mi-RED+zii	RED≥σσ	ALIGN RB	ALIGN BRT
☞1. i-mizii+**mizi**			mi
2. i-m**i**-izii+**zi**		i!	i
3. i-**m**-mizii+**izi**		m!	mi
4. i-**mi**-mizii+**zi**		m!i	mi
5. i-mi-zii+**zi**	*!		

Candidate 1 sacrifices violations of ALIGN RB by incorporating the prefix /mi-/ into the base (thus misaligning the left-edge of the base from the left-edge of the root by two segments) in order to satisfy the higher-ranked RED≥σσ and ALIGN RB. Candidate 2 minimizes violations of ALIGN BRT by incorporating only the /i/ of the prefix, but in doing so, it violates ALIGN RB. Candidates 3 and 4 are suboptimal because the edges of the reduplicant and base are misaligned. Candidate 5 fails because it violates the constraint that demands reduplicants be bisyllabic.

MAX IO, which evaluates the correspondence relation between the input and the *entire* output accounts for the suboptimality of forms like **i-mizi-mizi* in which the base and the

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reduplicant are identical at the expense of faithfulness to underlying vowel length. Candidate 1 does not violate MAX IO because the long vowel present in the input is also present in at least part of the output (in this case, it is present in the reduplicant).

(29)

i-mi-RED+zii	MAX IO
☞1. i-<u>mizii</u>+**mizi**	
2. i-<u>mizi</u>+**mizi**	*!

The suboptimality of a form like **i-mizi+mizii* in which the long vowel is shortened in the left-hand copy and realized in the right-hand copy is explained in the next section in which I show that long vowels are prohibited word-finally.

The tableau shown in (30) illustrates that when there is a bisyllabic root, the candidate that simply copies the root is the best candidate. Doing anything else always violates a constraint that the optimal candidate does not violate.

(30) base in bold, reduplicant underlined (choice is arbitrary)

i-n-RED+kóni	MAX IO	RED$\geq$σσ	ALIGN RB	ALIGN BRT
☞ 1. i-n-<u>kóni</u>+**kóni**				
2. <u>inkóni</u>+**inkóni**				i!n
3. <u>inkó</u>+**i-n-kó**ni				i!nni
4. i-<u>kóni</u>-n-**kóni**			n!	
5. <u>kóni</u>+i-n-**kóni**			i!n	
6. i-n-<u>kó</u>+**kóni**		*!		
7. i-n-<u>kón</u>+**kóni**		*!		
8. i-n-<u>koni</u>+**koni**	*!			

We are now at a point to account for the fact that monosyllabic roots never change noun class when reduplicating. Recall the forms in (11) repeated as (31).

(31)

	Base	**Gloss**	**Reduplicated form**	**Gloss**
	a. i-mi-**zii**	'roots'	i-mizii+mizi	'very thin (things)(4)'
CVV Roots	b. u-bu-**zii**	'jobs'	u-buzii+buzi	'small jobs (14)'
	c. u-mu-**biri**	'body (1)'	i-ki-biri+biri	'material body (7)'
CVCV Roots	d. u-mu-**tíma**	'heart (1)'	i-n-tíma+tíma	'of the center (9)'

Noun class affiliation is a product of the root's semantics so the class marker is dependent upon the root. This implies it it dependent on all aspects of the root including its structure/shape. If we assume that the assignment of class markers is not cyclic then it is clear why only polysyllabic roots exhibit class-shift. Monosyllabic roots, as we have just seen, must incorporate prefixal material in order to reduplicate. Polysyllabic roots cannot incorporate prefixal material. It appears that class markers are assigned to the entire reduplicant-base complex (32a). If a class maker is inside that complex, as with monosyllabic roots, then it cannot be altered (32b).

(32)   **Licit Structure**   **Illicit Structure**

a. CM-[σσ$_{RED}$+σσ$_{BASE}$]   b. *CM$_1$-[(CM$_2$-σ)$_{RED}$+(CM$_2$-σ)$_{BASE}$]

Let's now look at the verbs. The data show that C-final monosyllabic roots incorporate the FV into the base in order to satisfy the bisyllabicity constraint on reduplicants. The question at hand is why the verbs don't follow the nouns in incorporating prefixal material. Our current constraint ranking provides the solution.

(33) base in bold, reduplicant underlined (choice is arbitrary)

gu-RED-sek-a	RED=σσ	ALIGN RB	ALIGN BRT
☞ 1. gu-<u>seka</u>+**seka**			a
2. <u>gusek</u>+**gusek**-a			gu!
3. <u>guse</u>+**guse**k-a			gu!k
4. g**u**-<u>usek</u>+**sek**-a		u!	
5. **gu**+<u>gusek</u>+**sek**-a		g!u	gu
6. gu-<u>sek</u>+**sek**-a	*!		

Candidate 1 surfaces because it violates ALIGN BRT by one segment in order to satisfy the higher ranked RED=σσ. Candidates 2 and 3 incur more than one violation of ALIGN BRT by incorporating the prefix. Candidate 4 violates ALIGN RB because the left-edge of the root (-*sek*-) is not aligned with the left-edge of the base (-*usek*-), likewise for candidate 5. And as candidate 6 illustrates, a faithful copy of the root and only the root results in a fatal violation of RED=σσ.

We are now able to speculate to why only C-final verb roots reduplicate and why monosyllabic vowel-final roots never reduplicate (Ntihirageza pc). The present analysis predicts that a CVV root would have to incorporate prefixal material when reduplicating in order to satisfy the bisyllabicity constraint on reduplicants. However, all prefixal material in Kirundi verbs are grammatical or discourse markers such as object markers or focus markers. I suggest that CVV roots do not reduplicate due to semantic blocking. If say, an object marker were to be realized twice, once in the reduplicant and once in the base, interpretation of such a clause may be difficult. Kirundi avoids reduplication of CVV verb roots by using a suffix that means 'do V repeatedly' or by the root with other verbs, thus creating a serial verb construction.

In this section, we've seen that having a broader notion of what constitutes a base allows us to capture the fact that Kirundi monosyllabic roots must incorporate affixal material in order to satisfy the bisyllabicity constraint placed on reduplicants. The use of alignment constraints explained why nouns incorporate prefixes while verbs incorporate the semantically empty final vowel /a/. The two types of constraints combined explain the class-marker shift of polysyllabic noun roots and the paradigmatic gap encountered in verb reduplication.

Adjectives on the other hand, always incorporate prefixal material, regardless of the size of the root. For the adjective, there is no size constraint but rather a constraint that requires the reduplicant be equal to the stem. Recall from section 2 that the stem is defined as the root plus affixal material. The interaction of markedness and

correspondence constraints will then explain any deviation the reduplicant has from the base.

In the next section I explore the distribution of long vowels in reduplicated forms.

7 Long vowels

Like other Bantu languages, Kirundi forbids long vowels word-finally. This can be seen in the infinitive and passive forms of Kirundi verbs.

(34) *Infinitive vs. Passive*

	Root	**Infinitive**	**Passive**	**Gloss**
a.	/-táa/	gutá	gutáabwa	'throw away'
b.	/-nyóo/	kunywá[12]	kunywóobwa	'drink'
c.	/-háa/	guhá	guháabwa	'give'

Poletto (1998) analyzes the same phenomena for Runyankore, a Bantu language Guthrie classifies as J13. In this language, vowels are always long after glides[13], as shown in (35a). However, if the glide-vowel sequence is in word-final position, the vowel is never long as (35b) illustrates.

(35)

	GV word-internal			**GV word-final**	
a.	okubyaama	'to sleep'	b.	okúrya	'to eat'
	okucweera	'to spit'		okugwa	'to fall'
	okumyoora	'to twist'		okucebwa	'to be mashed'
	okurwaana	'to fight'		okureebya	'to betray'

We can formalize this observation with the constraint given in (36). The constraint will assign a mark to any long vowel that is word-final.

(36)   ***VV]**
        No long vowels at the right-edge of a word

*VV] must dominate MAX IO as seen in (37). Surface forms sacrifice faithfulness to the input in order to satisfy the higher ranked *VV]. This ranking is precisely why no words in Kirundi or Kinyarwanda (as well as other Bantu languages[14]) end in long vowels.

(37)

u-bu-zii	*VV]	MAX IO
☞ 1.ubuzi		*
2. ubuzii	*!	

---

[12] Kirundi employs glide formation, a process which resolves hiatus by turning the first vowel into a glide. For instance /o/ + /a/ becomes [w]. I do not deal with glide formation. For an OT account of the same phenomena in Runyankore see Poletto (1998).
[13] For details on compensatory lengthening of vowels after glides in Runyankore, see Poletto (1996, 1998:175-178).
[14] For similar effects in Kinyarwanda see Kimenyi (1979); for Kikerewe see Odden (1996).

7.1 Word-final long vowels and reduplication

We have already observed that in CVV root reduplication, underlying length is preserved in the left-hand copy but not the right-hand copy. This is precisely because in the right-hand copy, the long vowel is in word-final position. This fact falls out from the interaction of IO faithfulness constraints, BR faithfulness constraints and the positional markedness constraint *VV]. Witness tableau (38).

(38)

RED+mi-bíi	*VV]	MAX IO	MAX BR
☞1. mibíi+mibí			*
2. mibí+mibí		*!	
3. mibíi+mibíi	*!		
4. mibí+mibíi	*!		*

In order to avoid a violation of *VV], candidate 1 sacrifices perfect correspondence between the base and the reduplicant by having a long vowel in the left-hand copy but a shortened vowel in the right-hand copy. Both candidates 2 and 3 achieve perfect correspondence between the base and reduplicant but at the expense of violating higher ranked constraints. Candidate 2 doesn't parse a long vowel in either half of the reduplicated form. In doing so, MAX IO is violated because nowhere in the output is there a correspondent to the input's long vowel. Candidate 3, which has no MAX BR or MAX IO violations, is ruled out because it has a long vowel word-finally. The same constraint rules out candidate 4. It is this constraint ranking that ensures that the two halves of the reduplicated form are not identical. This holds for all word classes.

7.2 Root-internal long vowels and reduplication

In the previous section, it was shown that the positional markedness constraint *VV] captured the generalization that word-final long vowels are disallowed in Kirundi. I turn now to root internal long vowels and their realization and distribution in reduplication. Observe the data in (39), (40), and (41).

Nouns

(39)	**Base**	**Gloss**	**Reduplicated form**	**Gloss**
	a. /i-gi-tooki/	'banana'	i-gi-toki+tooki	'field of bananas (7)'
	b. /u-ru-seenge/	'chimney (11)'	u-mu-senge+seenge	'soot (3)'
	c. /a-ma-béere/	'breast'	a-ma-bére+béere	'breastmilk (6)'

Verbs

(40)	**Base**	**Reduplicated form**	**Gloss**
	a. /ku-cuuc-a/	gu-cuca+cuuca	'to knock'
	b. /ku-saab-a/	gu-saba+saaba	'to shatter'
	c. /ku-fyoond-a/	gu-fyonda+fyoonda	'to squeeze'

Adjective

(41)	**Base**	**Reduplicated form**	**Gloss**
	a. /ba-íiza/	béza-béeza	'beautiful (2)'

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As illustrated by the forms shown above, the long vowel of the input is preserved only in the right-hand copy. In the left-hand copy, the vowel is shortened. This fact considered with the previous observation that long vowels are disallowed word-finally suggests that Kirundi disfavors long vowels in general. It is well-documented that long vowels are cross linguistically marked (Rosenthall 1994). That long vowels are marked can be formalized into the constraint given in (42).

(42)   ***VV**
         Avoid long vowels.

This constraint penalizes any form that surfaces with long vowels. For every occurrence of a long vowel, a violation is incurred.

   *VV must be dominated by MAX IO because long vowels do surface as evidenced by such forms as -*saaba* 'shatter'. Word-internal long vowels are only shortened in reduplicative forms, which suggests this is an instance of what McCarthy and Prince (1994) call the emergence of the unmarked (TETU) occurring with respect to long vowels.

   McCarthy and Prince notice that in reduplicative patterns, there tends to be an alternation of marked elements (such as voiced segment) and unmarked elements (voiceless segments). The marked element is contained in the base and the unmarked element in the reduplicant. They term this phenomenon TETU. They go on to illustrate that TETU utilizes the following constraint ranking of markedness, IO faithfulness and BR faithfulness constraints[15].

(43)   *The Emergence of the Unmarked*
         IO Faith>>Markedness>>BR Faith

The constraint ranking in (43) ensures that the marked element contained in the input will surface in one half of a reduplicated form because IO Faith dominates the constraint that marks that element. However, because markedness dominates BR Faith, the unmarked element surfaces in order to avoid a violation of the markedness constraint, thus total correspondence between the base and reduplicant is sacrificed. Note that the same ranking works for the SS model[16].

   The Kirundi facts are a clear example of TETU and the correct ranking for Kirundi, with respect to long vowels is given in (44).

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[15] They also show that if Markedness>>IO Faith, no marked elements would surface in the language. If BR Faith>>Markedness, marked elements would always surface.

[16] Struijke (1998, 2000) gives two ranking for TETU within her model:
    (i)   I-O Faith>>Markedness>>B-R Faith
    (ii) Root Faith>>Markedness>>B-R Faith
High ranking I-O Faith constraints in ranking (i) force unreduplicated words and one member of the reduplicative complex to surface faithfully. This is the pattern in Kirundi She states that the ranking of Root Faith is irrelevant. In ranking (ii), it is the I-O Faith ranking that is irrelevant. This is because high ranking Root Faith constraints act like I-O/B constrains in the full model and force unreduplicated words and bases to surface faithfully. Change occurs only in the reduplicant. The analysis of Kirundi given in section 7.3 illustrates that the ranking of Root Faith is not irrelevant but is necessarily below BR Faith.

(44)   MAX IO>>*VV>>MAX BR

This ranking ensures that in non-reduplicated forms, longs vowels in the input will be preserved in the output. Because *VV dominates MAX BR, a long vowel will not be parsed in one of the copies. The fact that a long vowel will surface at all in a reduplicated form is guaranteed because MAX IO dominates *VV. This is illustrated below.

(45)

i-gi-RED+tooki	MAX IO	*VV	MAX BR
☞1. i-gi-toki+tooki		*	*
2. i-gi-tooki+tooki		**!	
3. i-gi-toki+toki	*!		

The question then arises as to why it is the right-hand copy that preserves the long-vowel. A constraint that aligns all long vowels to the right-edge of the word can account for the distributional facts observed. A more explanatory possibility is that the position of the long vowel in the penultimate syllable reflects the prosodic prominence of that position in being the bearer of stress. Downing (to appear) shows that penultimate stress is the overwhelming pattern in Bantu languages for which stress-accent has been reported, and that prominence is conveyed via vowel length. The constraint STRESS-TO-WEIGHT requiring that stressed syllables be heavy could be substituted here for ALIGN (VV, R; Wd, R). However, without direct evidence for penultimate stress in Kirundi, the ALIGN constraint will suffice.

(46)   ALIGN (VV,R;Wd,R) (=ALIGN (VV))
          Align the right edge of every VV with the right-edge of a word[17].

This constraint is gradient; for every long vowel that is not at the right-edge of a word, a violation is incurred for the number of syllables that separate the long vowel form the word's right-edge. The higher ranked *VV] will prevent this constraint from ever fully being satisfied. In the next section, it will be shown that there is a parallel phenomenon and constraint ranking for high tone.
     The following tableau will illustrate the interaction of ALIGN (VV) with the other constraints.

(47)

gu-RED+saab-a	MAX IO	*VV	ALIGN (VV)	MAX BR
☞1. gu-saba+saaba		*	*	*
2. gu-saaba+saba		*	**!*	*
3. gu-saaba+saaba		**!	* ***	
4. gu-saba+saba	*!			

---

[17] This constraint is similar in spirit to McCarthy and Prince's (1993) alignment constraints that aligns the Ilokano affixes /ag/ and /um/ to the left of a stem.

In (47), the optimal candidate sacrifices a violation of MAX BR in order to minimize its violations of *VV, however, it must violate it at least once in order to satisfy MAX IO. By placing the long vowel only one syllable away from the word's right-edge, the optimal candidate minimizes its violations of the alignment constraint. Compare this with candidate 2, which fails because it has more egregious violations of the alignment constraint by parsing the long vowel in the left-hand copy. Candidate 3 has perfect correspondence between the base and reduplicant. This faithfulness, however, makes it violate the higher-ranked *VV one more time than does the optimal form. And lastly, candidate 4 avoids violating *VV by having no long vowels; in so doing, it fatally violates MAX IO and is rendered suboptimal.

I have shown that it is the interaction of *VV and ALIGN (VV) along with MAX IO and MAX BR that places the locus of change in the left-hand copy of reduplicated forms. I have also shown that the positional markedness constraint *VV], may place the locus of change in the right-hand copy. The current ranking is given below and is valid for adjective nouns and verbs.

(48)   *Current Constraint Ranking*
        *VV]>>MAX IO>>*VV, ALIGN (VV)>>MAX BR

I am now able to illustrate the ranking paradox exhibited by the Full Model.

7.3 Paradox and the Full Model
Recall that the Full Model uses three correspondence relations: Input-Base (a.k.a. Input-Output) correspondence, Input-Reduplicant correspondence and Base-Reduplicant correspondence. Inherent in this model is the requirement that a reduplicant be identified. I show that this requirement leads to a ranking paradox when the FM is applied to Kirundi reduplication.

Under the Full Model, bases and unreduplicated words admit greater contrasts than do reduplicants (i.e. change is apparent only in the reduplicant). This is because IB faithfulness constraints (IO for unreduplicated words) outrank BR faithfulness constraints.

In the previous section I illustrated that the correct ranking with regards to long vowels is *VV]>>MAX IO>>*VV>>MAX BR[18]. If we were to assume that the right-hand copy were the reduplicant, the correct result would be obtained for roots that have word-final long vowels such as *i-mi-zii*.

(49) RED is underlined

i-mi-zii+RED	*VV]	MAX IO	*VV	MAX BR
☞1. i-mizii+<u>mizi</u>			*	*
2. i-mizi+<u>mizi</u>		*!		
3. i-mizi+<u>mizii</u>	*!	*	*	*
4. i-mizii+<u>mizii</u>	*!		**	

---

[18] Within the Full Model (McCarthy and Prince 1995), IB (IO) Faith>>Markedness>>BR Faith, IR Faith is the correct TETU ranking. Because IR Faith is unranked with respect to BR Faith, it does not play a crucial role and thus I leave it out of the above tableaux.

In (49), candidate 1 wins because the change occurs in the reduplicant (the right-hand copy). Compare this with candidate 3 which loses because it violates MAX IO by placing the change in the base (left-hand copy). This ranking however predicts the wrong result for roots that have root-internal long vowels such as *i-gi-tooki*, predicting optimal **i-gi-tooki+toki.*

(50) RED is underlined

i‑gi‑tooki+RED	*VV]	MAX IO	*VV	MAX BR
1. i‑gi‑toki+<u>tooki</u>		*!	*	*
☹2. i‑gi‑tooki+<u>toki</u>			*	*
3. i‑gi‑tooki+<u>tooki</u>			**!	
4. i‑gi‑toki+<u>toki</u>		*!		

Candidate 1, which is the actual surface form, fails under the FM precisely because the long vowel is shortened in the base, thus violating MAX IO. Candidate 2 is incorrectly chosen optimal because it avoids a violation of MAX IO by shortening the long-vowel in the reduplicant (right-hand copy).

If we were to reverse our assumption and place RED to the left of the base, we would fail to predict the optimality of *i-mizii+mizi* (predicting **i-mizi+mizi*) but would succeed for *i-gi-toki+tooki*. The paradox becomes apparent. Observe (51) and (52).

(51) RED is underlined

i-mi-RED+zii	*VV]	MAX IO	*VV	MAX BR
1. i‑<u>mizii</u>+mizi		*	*!	*
☹2. i‑<u>mizi</u>+mizi		*		
3. i‑<u>mizi</u>+mizii	*!		*	*
4. i‑<u>mizii</u>+mizii	*!		**	

In (51) candidate 2 wins because it sacrifice MAX IO in order to satisfy *VV]. Candidate 1 fails because it parses a long vowel in the reduplicant (left-hand copy) and violates *VV and MAX BR. Candidates 3 and 4 are suboptimal because, being faithful to the input by parsing the long vowel in the base, they violate the undominated *VV].

(52) RED is underlined

i‑gi‑RED+tooki	*VV]	MAX IO	*VV	MAX BR
☞1. i‑gi‑<u>toki</u>+tooki			*	*
2. i‑gi‑<u>tooki</u>+toki		*!	*	*
3. i‑gi‑<u>tooki</u>+tooki			**!	
4. i‑gi‑<u>toki</u>+toki		*!		

In (52) candidate 1 wins precisely because it avoids a violation of MAX IO by shortening the long vowel in the reduplicant. This can be contrasted with candidate 2 which violates MAX IO by shortening the long vowel in the base.

The ALIGN (VV) constraint, which I've already shown to outrank MAX BR but which is in turn dominated by MAX IO, cannot solve the ranking paradox because: (i) if RED were

to the left of the base, **i-mizi+mizi* is still optimal because it vacuously satisfies ALIGN (VV) (ii) if RED were to the right of the base, **i-gi-tooki+toki* would be chosen as optimal because MAX IO dominates ALIGN (VV).

(53) RED is to the left, underlined - ALIGN (VV) vacuously satisfied

i-mi-RED+zii	*VV]	MAX IO	*VV	ALIGN (VV)	MAX BR
1. i-mizii+mizi		*	*!	**	*
☹2. i-mizi+mizi		*			
3. i-mizi+mizii	*!		*		*
4. i-mizii+mizii	*!		**	**	

(54) RED is to the right, underlined - ALIGN (VV) fails to predict correct result

i-gi-tooki+RED	*VV]	MAX IO	*VV	ALIGN (VV)	MAX BR
1. i-gi-toki+tooki		*!	*	*	*
☹2. i-gi-tooki+toki			*	**	*
3. i-gi-tooki+tooki			**!	* ***	
4. i-gi-toki+toki		*!			

In this section I have given empirical evidence that a ranking paradox emerges when applying the Full Model to Kirundi reduplicated words. This was shown to be a result of the Full Model's requirement that a reduplicant and base be identified. Furthermore, I have shown that within the SS models, the locus of change is a product of the interaction *VV, *VV] and ALIGN (VV) along with MAX IO and MAX BR. It is the markedness constraints *VV and *VV] in conjunction with the faithfulness constraints that render the base and reduplicant non-identical. An appeal to the OCP to account for the non-identity of the base and reduplicant would result in a stalemate between two forms that resolve the non-identity issue in different ways.

(55)

u-bu-RED+zii	*REPEAT
☞ 1. u-buzii+buzi	
☞ 2. u-buzi+buzii	
3. u-buzii+buzii	*!

(56)

i-gi-RED+tooki	*REPEAT
☞ 1. i-gi-toki+tooki	
☞ 2. i-gi-tooki+toki	
3. i-gi-tooki+tooki	*!

I have also shown that the location of change is either due to independently motivated positional markedness constraints that apply to the entire language (as with *VV]) or due to the interaction of alignment constraints and TETU for reduplicated forms. An OCP-based account would necessarily involve stipulation as to which half of a reduplicated form changes. It would also have to specifically address why the left-hand copy is more faithful to the input when CVV roots reduplicate but it is the right-hand copy that is more faithful to the input when CVVCV roots reduplicate. Under my account, the need to address which half is more faithful is rendered unnecessary. The locus of change is simply a product of constraint interactions.

We turn now to the distribution of high tone in reduplicated forms.

8   High tone

In this section, high tone in reduplicative patterns are analyzed. A review of the data is given below.

(57)   *Verbs*

Base	Reduplicated form	Gloss
a. /ku-díg-a/	ku-díga+diga	'to tickle'
b. /ku-nyíg-a/	ku-nyíga+nyiga	'to be loose'
c. /ku-hóoy-a/	gu-hóya+hooya	'to bring to calm'
d. /ku-téer-a/	ku-téra+teera	'to throw'

Tone is never copied in verb reduplication. Tone is always in the left-hand copy.

(58)   *Adjectives*

Base	Reduplicated form	Gloss
a. /mi-bíi/	mibíi+mibí	'bad'
b. /ga-kée/	gakée+gaké	'little by little'
c. /ba-íiza/	béza+béeza	'beautiful'
d. /ma-gúfi/	magúfi+mágufi	'short'
e. /ma-kúru/	makúru+mákuru	'important'
f. /bi-níni/	biníni+bínini	'big'

Tone is always copied in the adjectives. Roots containing long vowels (58a-c) do not exhibit tone-shift. Tone shift occurs only in roots containing short vowels (58d-f).

(59)   *Nouns*

Base	Gloss	Reduplicated form	Gloss
a. /u-bu-sáa/	'nothing'	u-busáa-busa	'nothingness'
b. /a-ma-bwáa/	'shit'	a-mabwáa-mabwa	'dog feces'
c. /i-n-kóni/	'stick'	i-n-kóni+kóni	'of a stick kind'
d. /u-mu-tíma/	'heart'	i-n-tíma+tíma	'of the center'
e. /a-ma-béere/	'breast'	a-ma-bére-béere	'breastmilk'
f. /u-bu-úuzi/	'little water'	u-búzi-búuzi	'little water'

Tone is generally copied in nouns. Tone fails to copy when the root is CVV as illustrated by (59a-b). Input tone has a correspondent in the left-hand copy. Tone never shifts.

8.1 High tone and verb reduplication

In the previous section, I used the interaction of markedness and alignment constraints to account for the fact that long vowels appear only in the left-hand copy of reduplicated forms. The distribution of tone is explained by appealing to the same type of constraint interactions. Regard the forms in (60).

(60) **Base**   **Reduplicated form**   **Gloss**

      a. /ku-díg-a/   ku-díga+diga   'to tickle'

      b. /ku-nyíg-a/   ku-nyíga+nyiga   'to be loose'

      c. /ku-rég-a/   ku-réga+rega   'to be unstable'

      d. /ku-hóoy-a/   gu-hóya+hooya   'to bring to calm'

      e. /ku-téer-a/   ku-téra+teera   'to throw'

      f. /ku-twáar-a/   gu-twára+twáara   'to carry'

It has been well documented that high-tone is not transferred in verb reduplication in Kirundi (Meeusen 1959, Rodegam, 1967, Bigangara, 1982). Nor is tone copied in Bantu verb reduplication in general, the exception to this being Chichewa (Hyman et al. 1999, Myers and Carleton 1996). In Bantu verb reduplication, if there is a high tone, it is realized in the left-hand copy. Hyman et al. (1999) write, "Where one can tell, the tonal opposition (H/Ø) on verb roots is realized only in D-stem₁, i.e. the reduplicant. H tones presumably come in at the I-stem level. It may thus be necessary to restrict H tone from being (independently) realized in D-stem₂ (1999:7)"[19]. There are two phenomena they describe: (i) high tone is not copied in reduplication and (ii) the high tone appears as far to the left-edge of the word as possible. This is a mirror image of the phenomena encountered with root-internal long vowels. In reduplication, long vowels are not copied and appear as far the the right-edge of the word as possible. As I did with long vowels, I show that (i) is another example of TETU and that (ii) is a product of the combinatory effects of an alignment constraint and TETU.

First the markedness constraint:

(61) ***H**

     Avoid high tones.

This constraint will mark every occurrence of a high tone.

It is illustrated in (62) that there is an emergence of the unmarked with respect to high tone in reduplicated verbs.

(62)

ku-RED+díg-a	MAX IO	*H	MAX BR
☞1. ku-díga+diga		*	*
2. ku-díga+díga		**!	
3. ku-diga+diga	*!		

Candidate 1 allows a violation of *H because it must parse a tone in the output in order to satisfy MAX IO. It sacrifices a MAX BR violation in order to keep its violations of *H to a minimum. By copying tone, the base and reduplicant are identical in candidate 2 thus satisfying MAX BR. However this results in two violations of *H and it is therefore ruled

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[19] Hyman et al. (1999) abbreviate derivational stem as D-stem and inflectional stem as I-stem. See footnote 12 for details.

out. Candidate 3 satisfies *H because there are no high tones, but avoiding tones causes it to fatally violate MAX IO.

Using *H with an alignment constraint that aligns every high tone with the left-edge of a word, an OT version of the left-to-right tonal association conventions, will explain why it is always the left-hand copy that parses input tone.

(63)   ALIGN (H,L;Wd,L) (=ALIGN (H))
       Align the left-edge of every high tone with the left-edge of a word.

Tableau (64) illustrates the relevant rankings.

(64)[20]

ku-RED+díg-a	MAX IO (A)	*H	MAX BR	ALIGN (H)
☞ 1. ku-díga+diga		*	*	*
2. ku-diga+díga		*	*	**!*
3. kú-diga+diga	*!	*		

In (64), candidate 1 surfaces because it minimizes violations of *H, MAX BR and ALIGN (H) by placing the tone that it must copy on the first TBU of the left-hand copy. Compare this with candidate 2 which places its high tone on the first TBU of the right-hand copy. It is ruled out because doing so causes it to misalign the tone from the word's left edge by three TBUs. And finally, fully satisfying the alignment constraint results in a MAX IO (A) violation because input association is not respected in the output.

Tone is generally copied in Kirundi reduplication and it is only with the verbs that there is a general ban on multiple high tones. This was shown to be the result of a TETU ranking with respect to high tone. However, this is not true of adjectives and nouns. For these word classes, MAX BR dominates *H because tone *is* generally copied. This is addressed in section 9.2.

8.2 Tone shifting

We come now to cases in which tone is not only copied, but a shift to the left occurs as well. This can be seen in the following adjectives in which tone is associated with the second TBU of the left-hand copy and with the first TBU of the right-hand copy. In other words, tone shifts to the left in the right-hand copy.

(65)   **Base**   **Reduplicated form**   **Gloss**
       a. /ma-gúfi/   magúfi+mágufi   'short'
       b. /ma-kúru/   makúru+mákuru   'important'
       c. /bi-níni/   biníni+bínini   'big'

I show that this shifting results from the ALIGN (H) constraint previously used to account for the high tone in the left-hand copy of reduplicated verbs. I've already illustrated that MAX IO (A) dominates ALIGN (H). With our current constraints I demonstrate that ALIGN (H) must dominate MAX BR (A) as shown in (66).

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[20] The argument for MAX BR>>ALIGN (H) is given in tableau (67)

(66)

RED+ma-gúfi	ALIGN (H)	MAX BR (A)
☞1. magúfi+mágufi	* ***	*
2. magúfi+magúfi	* ****!	
3. magúfi+magufǐ	* ****!*	*

By shifting tone one TBU to the left in the right-hand copy, candidate 1 minimizes its violations of ALIGN (H). Doing so, it allows a violation of the lower ranked MAX BR. Compare this with candidate 2 which fatally incurs one more violation of ALIGN (H) in order to have perfect correspondence between the two halves.

Shifting tone is preferable to tone only being realized in one half. This shows that MAX BR dominates ALIGN (H) as I illustrate below.

(67)

RED-ma-gúfi	MAX BR	ALIGN (H)	MAX BR (A)
☞1. magúfi+mágufi		* ***	*
2. magúfi+magufi	*!	*	
3. mágúfi+magufi	*!*	*	

Candidates 2 and 3 violate MAX BR because they both contain at least one tone in the left-hand copy that does not have a correspondent in the right hand copy. Candidate 1 wins because it crucially does not violate MAX BR. Recall that MAX BR governs the relationship between elements in the base and reduplicant. MAX BR is not violated by candidate 1 because there is a high tone in the left-hand copy which *does* have a corresponding high tone in the right-hand copy. Candidate 1 violates the lower ranked MAX BR (A) because the association of tone to TBU is not in correspondence; high tone is associated with the second TBU in the left-hand copy but with the first TBU in the right-hand copy.

Under our current ranking we would predict the surface candidate to be in free-variation with a form like **mágufi+magúfi*[21]. This form violates ALIGN (H) the same number of times as does the surface form (they both incur four violations). The constraint that rules out this form is given in (68).

(68)   ***[H**
        Avoid high tone word-initially.

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[21] **mágufi+mágufi* is ruled out by max io (a) because the tonal association in the input does not have a correspondent anywhere in the output.

*[H is the tonal counterpart to our other positional markedness constraint *VV]. However, unlike *VV], *[H must be ranked below MAX IO (A) because Kirundi does allow word-initial high tones. This is shown in (69).

(69)

kórora	MAX IO	MAX IO (A)	*[H
☞1. kórora			*
2. koróra		*!	
3. korora	*!		

As shown below, *[H dominates MAX BR (A) and thus its effects surface only in reduplication. In (70), both candidates violate ALIGN (H) and MAX BR (A) the same number of times, but candidate 1 wins because it crucially does not violate *[H. It achieves this by shifting tone in the right half instead of in the left.

(70)

RED+ma-gúfi	*[H	ALIGN (H)	MAX BR (A)
☞1. magúfi+mágufi		* ***	*
2. mágufi+magúfi	*!	****	*

To conclude this section, I've shown that it is the interaction of *[H, ALIGN (H) and the faithfulness constraints that ensure that the base and reduplicant are not identical. Specifically, the constraints conspire to place the locus of change in the right-hand copy. This is parallel to the analysis given to root-internal long vowels for which I showed that it was the interaction of *VV], ALIGN (VV) and the faithfulness constraints that place its change in the left-hand copy. It appears that Kirundi has created symmetrical constraint rankings between its marked elements and its alignment constraints, resulting in a system in which high tones are driven to the left-edge of words and long vowels to the right-edge. I schematize this in (71).

(71)   *Symmetrical Constraint ranking of Marked Element*
      MAX IO (A)>>*[H, ALIGN (H)>>MAX BR (A)

      MAX IO>>*VV[22], ALIGN (VV)>>MAX BR

This analysis is superior to one that appeals to the OCP for explanations involving the non-identity of the base and reduplicant because an OCP-based analysis would have to stipulate that it is the right-hand copy of reduplicated verbs and adjectives that exhibit change (cf. tableaux 21 and 22). But, as I've illustrated, such stipulations are unnecessary. Under my analysis, there is no need to refer specifically to one copy or the other as the location of change. The realization of tone in the left half of reduplicated

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[22] This constraint can also be formulated as a positional markedness constraint *VV] without affecting the selection of the surface form as optimal. This will result in a ranking that is truly symmetrical in its treatment of marked elements.

verbs and the shifting of tone in the right half of reduplicated adjectives falls out from the same alignment constraint. This generalization would be lost in an OCP-based account of the data.

In the next section I address apparent problems with the current analysis. I show that what appears to be problems can be solved by considering adjacency parameters on the OCP applied to high tones (Odden 1994).

9   Syllable-adjacent high tones
9.1 The *mibíi* forms
Our current ranking for the adjectives and nouns is given below in (72).

(72)   *Current Ranking*
    *VV>>IO Faith>>*VV, ALIGN (VV)>>MAX BR>>*[H, ALIGN (H)>>MAX BR (A)

This ranking unfortunately predicts as optimal a form like **mibíi-míbi*, in which a long vowel is shortened and tone in the right-hand copy is shifted one TBU to the left. The actual form is *mibíi+mibí*.

(73)

RED+mi-bíi	*[H	ALIGN (H)	MAX BR (A)
1. mibíi+mibí		* ****!	
☹ 2. mibii+mibi		* ***	*
3. míbii+míbi	*!	***	

Candidate 1, which is the actual surface form, is deemed suboptimal because it violates ALIGN (H) five times. Candidate 2 which has two adjacent phonologically-distinct high tones is deemed optimal because it has fewer violations of ALIGN (H). The actual surface form loses because nothing we have seen thus far rules out tone-shift from occurring in these froms. I provide a constraint that accounts for this in section 9.4 but first I turn to forms in which tone is deleted rather than shifted.

9.2 The *ubusáa* forms
Recall that tone is not copied when CVV noun roots reduplicate. This is evidenced by forms such as *u-busáa+busa* and *a-mabwáa+mabwa*. Under our current constraints and ranking, we would expect these forms to behave much like their adjectival counterparts and copy the tone on the final TBU of the right-hand copy (cf. *mibíi+mibí*). How then do we account for such forms?

We have already observed that the marked elements, long vowels and high tone, have symmetrical constraints as well as ranking. We may draw further from this symmetry to notice that high tone is acting much like root internal long vowels in that long vowels are only realized in the right-hand copy of reduplicated forms (74(c-d). High tone is realized on the left-hand copy of reduplicated CVV root nouns (74(a-b). Observe the forms in (74).

(74)	**Base**	**Gloss**	**Reduplicated form**	**Gloss**
CVV Roots	a. /u-bu-sáa/	'nothing'	u-busáa+busa	'nothingness'
	b. /a-ma-bwáa/	'shit'	a-mabwáa+mabwa	'shit!'
CVVCV Roots	c. /i-gi-tooki-/	'banana'	i-gi-toki+tooki	'field of bananas'
	d. /u-ru-seenge/	'ceiling'	u-mu-senge+seenge	'soot'

The distribution of the long vowels was analyzed as an emergence of the unmarked (TETU), a product of the interactions of IO and BR faithfulness constraints, the markedness constraint *VV and the alignment constraint ALIGN (VV) (align long vowels to the right-edge of the word).

It was also shown that the distribution of high tones in reduplicated verbs was an instance of TETU.

(75)   *The Emergence of the Unmarked: high tones*
        MAX IO>>*H>>MAX BR

This ranking is illustrated in (76).

(76)

u-bu-RED+sáa	MAX IO	*H	MAX BR
☞1. u-busáa+busa		*	**
2. u-busáa+busá		**!	*
3. u-busá+busa	*!	*	**
4. u-busaa+busaa[23]	*!		

Candidate 1 incurs a violation of *H so it may have a faithful parse of input tone. However, it reduces its violations of *H by allowing multiple violations of MAX BR. It incurs one violation for shortening the long vowel (this is done to satisfy the undominated *VV]). It incurs the second violation because it doesn't copy tone. In order to have a closer correspondence between the base and reduplicant, candidate 2 copies tone. This faithfulness to correspondence however, results in it fatally violating *H one more time than does the optimal candidate. Candidate 3 and 4 both violate MAX IO. Candidate 3 is ruled out because it fails to have a long vowel in either copy. Candidate 4 manages to satisfy *H but at the expense of incurring a much more egregious violation of MAX IO; it is thus deemed subpar.

However, this ranking would incorrectly rule out forms like *i-n-tíma+tíma* from surfacing, predicting the surface form to be **i-n-tíma+tima*.

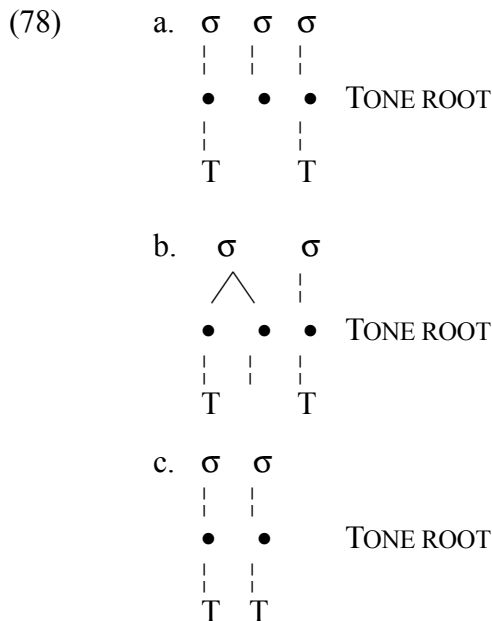[23] This form would be ruled out by *VV] as well.

(77)

i-n-RED+tíma	MAX IO	*H	MAX BR
☹1. i-n-tíma+tíma		**!	
☞2. i-n-tíma+tima		*	*
3. i-n-tima+tima	*!		
4. í-n-tima+tima	*!		

It must be the case that for nouns (as well as adjectives) *H is ranked lower than MAX BR and some other mechanism is responsible for forms like *u-busáa+busa*. In the next section I show that the distribution of tone in the adjectives and nouns are but another instantiation of general tone interaction in Kirundi.

9.4 *śś

As previoulsy discussed, the OCP prohibits adjacent identical elements. Within rule-based phonolgy, McCarthy (1986) has shown that the OCP can be a rule-blocker as well as a rule-trigger. It's a blocker if application of some rule would result in an OCP violation. It is a trigger of rules like Meeusen's rule which remedy OCP violations. Myers (1997) shows that the OCP as both rule-blocker and rule-trigger falls out from various constraint interactions. I show just this with the Kirundi forms. A constraint that prohibits syllable-adjacent high tones (*óó) will act as trigger in unreduplicated words and a blocker in reduplicated words due to the interplay of markedness and faithfulness constraints.

Odden (1994), in analyzing the different instantiations of Meeusen's Rule in Bantu languages, shows that the notion of adjacency may take different forms. He considers tone configurations of the following type: (78a) has two toned syllables separated by a toneless syllable; (78b) has two adjacent syllables, with tones separated by an empty tone node; and (78c) has two tones on adjacent tone nodes.

(78) a. σ σ σ

        • • • TONE ROOT

        T   T

      b. σ   σ

        • • • TONE ROOT

        T   T

      c. σ σ

        • • TONE ROOT

        T T

Odden argues that languages parameterize adjacency. If a language allows tone interaction in configurations such as 78(a-c) then no adjacency parameter is needed. If a language only allows interaction between configurations like the ones in 78(b-c) then syllable adjacency is invoked. And if a language allows tone interaction only for configurations like 78(c), then root node adjacency is the necessary parameter. I follow Myers' (1997) assumption that tone contrasts in Bantu languages is a privative one between the presence of high tone and its absence.

With this assumption and given the above configurations, the forms below[24] in conjunction with the reduplicated forms suggest that syllable adjacency is crucial for tone interaction in Kirundi[25]. Kirundi does not employ Meeusen's Rule to remedy OCP violations, but rather it employs tone-shift.[26] Regard the forms in (79)

(79)   a. nooné abaantu   'or les gens'   b. nóone báabaantu   'or ces gens'

In 79(a) *nooné* has a high tone on the last syllable. When it's followed by a word that has a high tone on the first syllable, as in 79(b), the tone is retracted to the left. However, tone is not retracted to the first TBU to the left, but rather to the first vowel of a long vowel. Recall that Kirundi disallows LH melody (*LH)[27] and thus retracting the tone only one TBU to the left is ruled out. We are able to account for the tone-shift seen in 79(b) with or current constraints supplemented with an additional constraint that penalizes two high tones on adjacent syllables.

(80)   ***śś**   Avoid phonologically distinct high tones that are syllable-adjacent

That * óó is ranked above the IO faithfulness constraints is shown in (81). These forms also provide evidence that MAX IO dominates MAX IO (A) which mirrors the ranking of their BR counterparts.

(81)

nooné báabaantu	*LH	*óó	MAX IO	MAX IO (A)	ALIGN (H)	*[H
☞1. nóone báabaantu				*		**
2. nooné baabáantu				*	*!* **	
3. noone báabaantu			*!			*
4. nooné baabaantu			*!		**	
5. noone baabaantu			*!*			
6. nooné báabaantu		*!			* *	*
7. noóne báabaantu	*!			*	*	*

---

[24] Examples taken from Meeusen (1959:19-20).
[25] The parameter must be minimally syllable-adjacency because if there were no adjacency parameter (structure (78a)), the form in (79b) would still be in violation.
[26] This is a common strategy Bantu languages employ to remedy OCP violations (cf. Shona (Myers 1997))
[27] Another approach would be to crucially rank ALIGN (H) above *[H which will provide the same result that *LH provides.

In (81), candidates 1 and 3 illustrate that it is preferable to shift tone (a MAX IO (A) violation) than it is to delete it(a MAX IO violation). Candidate 1 sacrifices a violation of MAX IO (A) in order to satisfy the higher ranked MAX IO whereas candidate 3 opts to delete tone in order to avoid a MAX IO (A) violation. Candidate 2 shows that ALIGN (H) is active in nonreduplicated words because retracting the second high tone to the right creates multiple ALIGN (H) violations. Candidate 5 remains faithful to the input, but in so doing, it violates *όσ by allowing two high tone syllables to be adjacent. Candidate 6 avoids a violation of *όσ by shifting the tone one TBU to the left. However, it is ruled out by *LH.

We are now able to account for the suboptimality of forms like *mibíi+míbi, in which tone-shift occurs resulting in two syllable-adjacent high tones. These forms are given again in (82).

(82)
	Base	**Reduplicated form**	**Gloss**
a.	/mi-bíi/	mibíi+mibí	'bad'
b.	/ba-tóo/	batóo+bató	'small'
c.	/ga-kée/	gakée+gaké	'little by little'

Tone-shift fails to occur because doing so would create a structure in which two phonologically distinct high tones are syllable-adjacent.

(83)

RED+mi-bíi	*όσ	MAX BR	ALIGN (H)	MAX BR (A)
☞1. mibíi+mibí		*	* ****	
2. mibíi+míbi	*!	*	* ***	*

Both candidates 1 and 2 violate MAX BR once because there is a long vowel in the left half but not in the right (this is done to appease the undominated *VV]). Candidate 1 satisfies MAX BR (A) by keeping the base and reduplicant tonal associations in correspondence, even though doing so results in one more violation of ALIGN (H). It satisfies the lower ranked MAX BR (A) in order to avoid a *όσ violation. Candidate 2, wanting fewer violations of ALIGN (H), shifts tone in the right-hand copy, resulting in syllable-adjacent high tones. It is then ruled out by the undominated *όσ. This ranking correctly predicts that tone shift occurs in forms like magúfi+mágufi because the tones are note syllable adjacent.

Tableau (84) illustrates that *όσ is not the same as *REPEAT and if we were to substitute *REPEAT for *όσ the wrong candidate would be chosen as optimal.

(84)

RED+mi-bíi	*REPEAT	MAX BR	ALIGN (H)	MAX BR (A)
1. mibíi+mibí		*	* ****!	
☹2. mibíi+míbi		*	* ***	*
3. mibíi+mibíi	*!		* ****	

Our current ranking for nouns and adjectives is given in (85). In the next subsection I explore the ramifications of *óó and how it accounts for other forms we have not yet analyzed.

(85) Current Rankings for Nouns and Adjectives

*óó, *VV]
|
MAX IO
|
MAX IO (A)
|
*VV, ALIGN (VV)
|
MAX BR
|
*[H, ALIGN (H)
|
MAX BR (A)
|
*H
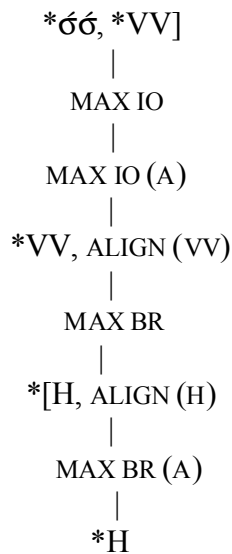
9.5 *śś and the *u-busáa+busa* forms

In section 9.2 it was shown that with our current constraints, the *u-busaá+busa* forms present a problem because we are unable to account for the lack of tone in the right-hand copy. Specifically, we expect the form to act like the adjectives and realize a high tone on the last TBU, *u-busáa+busá*. I demonstrated that appealing to the markedness constraint *H in a TETU pattern predicts the correct results for these forms but it also predicts the wrong results for instances in which tone is copied (*i-n-tíma+tima* vs. *i-n-tíma+tíma*).

The problem is not the high tone, but where that tone is. As we saw in section 8.2, the positional markedness constraint *[H was used to account for forms like *magúfi+mágufi* in which tone shifts one TBU to the left in the right-hand copy. Fitting that its mirror image will be a factor in explaining why tone fails to shift in the *u-busáa+busa* forms.

(86)   ***H]**   Avoid high tones word-finally.

For the nouns, ranking *H] above MAX BR will rule out forms like *ubusáa+busá. For the adjectives MAX BR must dominate *H] because of forms like *mibii+mibí*[28].

There are two justifications for this constraint: (i) related languages such as Runyambo, prohibit word-final high tones completely (ii) evidence from my consultants suggest that this constraint may be in the process of 'moving past' IO faithfulness. When asked for forms that end in a high tone, they varied between a form that was faithful to the input and a form that would sacrifice IO faithfulness in order to avoid a high tone on the last TBU. For instance, the consultants told me that both *gutá* and *gúta* ('to throw away') were possible realizations of /ku-táa/[29].

Of course a solution to avoid violating *H] would be to shift tone. However this too will be ruled out by the interaction of *H] and *óó. This interaction illustrates that it is better to delete an element rather than shift it[30].

(87)

u-bu-RED+sáa	*óó	*H]	MAX BR	ALIGN (H)	MAX BR (A)
☞1. u-busáa+busa			**	**	
2. u-busáa+busá		*!	*	** *****	
3. u-busáa+búsa	*!		*	** ****	*

This ranking predicts that high tone will be deleted in the reduplication of CVCV noun roots in which the last V is marked with high tone. The prediction is proven true by forms such as the ones given in (88).

(88) **Root** **Reduplicated form** **Gloss**
a. gozí   i-ki-gozí+gozi   'vine'
b. sagú   a-ka-sagú+sagu   'chin'
c. bigí   a-ma-bigí+bigi   'jaw'

Incorporating Odden's (1994) analysis of adjacency parameters, I've shown that a constraint that bans two phonolgically distinct high tones in adjacent syllables accounts for the different tone interactions present in Kirundi. Specifically I showed that tone shifts in non-reduplicated words in order to avoid having two syllable-adjacent high tones. This was shown to be a product of the combinatory effects *óó, IO faithfulness
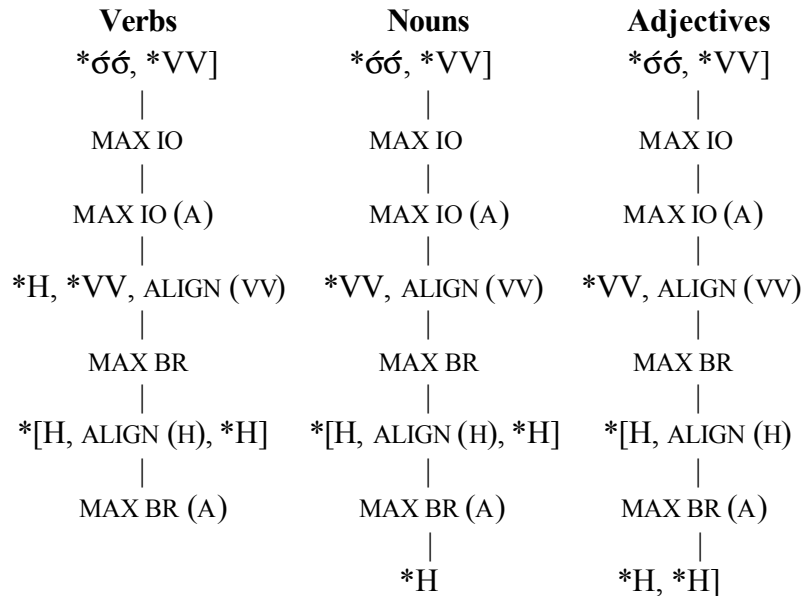
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[28] As noted in section 3, the class of adjectives is quite small and the class of adjectives that reduplicate is even smaller, it is therefore possible for this class to have a slightly different ranking simply because the number of forms to which is applies is relatively small.

[29] If *H] were to dominate IO faithfulness, it would not create a problem for *[H because *[H is only active in reduplicative form. This is due to the TETU rankings which have it ranked in between IO Faith and BR Faith.

[30] Recall that in non-reduplicative forms it was better to shift a tone. This contrast is due to MAX IO. In non-reduplicative forms, there is only one chance for lexically specified elements to be realized, thus deletion of any element violates MAX IO. However, in reduplicative forms, there are (potentially) two output elements corresponding to input elements. Deletion of one of these elements does not violate the correspondence relation because there is another to satisfy it.

constraints, and the alignment constraint. In reduplicated words, tone-shift was blocked in order to avoid adjacent high toned syllables. The different strategies taken by the reduplicated adjectives and nouns falls out from the fact that the positional markedness constraint *H] is ranked below MAX BR (A) for the adjectives but above MAX BR (A) for the nouns.

(89) *Final constraint ranking*

Verbs	**Nouns**	**Adjectives**
*óó, *VV]	*óó, *VV]	*óó, *VV]
|	|	|
MAX IO	MAX IO	MAX IO
|	|	|
MAX IO (A)	MAX IO (A)	MAX IO (A)
|	|	|
*H, *VV, ALIGN (VV)	*VV, ALIGN (VV)	*VV, ALIGN (VV)
|	|	|
MAX BR	MAX BR	MAX BR
|	|	|
*[H, ALIGN (H), *H]	*[H, ALIGN (H), *H]	*[H, ALIGN (H)
|	|	|
MAX BR (A)	MAX BR (A)	MAX BR (A)
	|	|
	*H	*H, *H]

In the next section, I show that an OCP based account of Kirundi reduplication makes false predictions and like the Full Model, exhibits a ranking paradox.

10 Predictions

The analysis I have presented relies upon the interplay of markedness, faithfulness and alignment constraints to account for the non-identity of the base and reduplicant. It also predicts that if there are no marked elements or if the marked elements are properly aligned, the reduplicant and base will be identical. This prediction is born out as the forms in (90) show.

(90)

Base	**Gloss**	**Reduplicated form**	**Gloss**
u-mu-biri	'body'	i-ki-biri+biri	'material body'
i-gi-harage	'bean'	i-gi-harage+harage	'bean field after harvest'
i-n-kóni	'stick'	i-n-kóni+kóni	'of a stick kind'
u-bu-dógiri	'peaceful departure'	i-dógiri+dógiri	'slow walk'
gu-seka	'to smile'	gu-seka+seka	'to smile repeatedly'
gu-pfunya	'to compress'	gu-pfunya+pfunya	'to compress repeatedly'
ku-rima	'to cultivate'	ku-rima+rima	'to cultivate repeatedly'
gu-soma	'to read'	gu-soma+soma	'to read repeatedly'

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An analysis that uses *REPEAT or any other formulation of the OCP to explain the non-identity of the base and reduplicant would predict the examples in (84) to never surface precisely because they rely upon the avoidance of identical adjacent morphemes.

More importantly, an analysis that uses the OCP as the reason for non-identity between the base and the reduplicant creates a paradox when confronted with forms like *i-n-tíma+tíma* and *i-mizii+mizi*.

(91) correct candidate chosen

i-mi-red+zii	MAX IO	*REPEAT	MAX BR
☞ 1. i-mizii+mizi			*
2. i-mizii+mizii		*!	
3. i-mizi+mizi	*!		

In (91), candidate 1 sacrifices a violation of MAX BR in order to satisfy the higher ranked *REPEAT. Candidate 2 loses because the base and reduplicant are identical and candidate 3 is ruled out because the input's long vowel is not realized in either copy and thus violating MAX IO. However, this same ranking is unable to predict the optimality of a form like *i-n-tíma+tíma*.

(92) wrong candidate chosen

i-n-RED+tíma	MAX IO	*REPEAT	MAX BR
1. i-n-tíma+tíma		*!	
☹2. i-n-tíma+tima			*
3. i-n-tima+tima	*!	*	

As illustrated in (92), the optimal candidate violates *REPEAT and is barred from surfacing. In order to remedy this we would have to rank *REPEAT below MAX BR (93). This new ranking though, would predict *i-mizii+mizii to be optimal (94). Thus a ranking paradox becomes apparent in an OCP-based account of the data.

(93) correct candidate chosen

i-n-RED+tíma	MAX IO	MAX BR	*REPEAT
☞1. i-n-tíma+tíma			*
2. i-n-tíma+tima		*!	
3. i-n-tima+tima	*!		*

(94) wrong candidate chosen

i-mi-red+zii	MAX IO	MAX BR	*REPEAT
1. i-mizii+mizi		*!	
☹2. i-mizii+mizii			*
3. i-mizi+mizi	*!		*

I have shown in this section that my analysis is superior to one that uses the OCP to explain the non-identity of the base and reduplicant. Non-identity is simply an epiphenomenon resulting from the interaction of markedness, faithfulness and alignment

constraints. Because non-identity is due to constraint interaction and is not in and of itself a constraint, my analysis correctly predicts that forms that have no marked elements or elements that are properly aligned will indeed surface.

Furthermore, I have shown that an OCP-based analysis makes incorrect predictions and results in a ranking paradox. What appeared to be OCP-effects on reduplicated forms was reduced to the interplay of TETU and alignment constraints.

11 Conclusion

The shape of Kirundi reduplicated nouns, adjectives and verbs appear, at first glance, to be the result of the OCP acting upon adjacent morphological units. Yip (1995) provides a method with which one could analyze the Kirundi data along these lines. However, I've shown that appeals to the OCP are not needed and if used create an ordering paradox. I've illustrated that apparent OCP-effects are in fact due to the interactions of markedness, faithfulness and alignment constraints. Specifically, non-identity of the base and reduplicant was shown to be the result of the emergence of the unmarked with respect to vowel length and tone and the locus of change was analyzed as the combinatory effects of the TETU ranking of markedness and faithfulness constraints, and alignment constraints.

Furthermore, I have given empirical arguments that show McCarthy and Prince's (1995) Full Model of reduplication exhibits a ranking paradox when applied to Kirundi reduplicative patterns. The paradox is a product of the requirement that one must identify the reduplicative morpheme in reduplicative structures. The Spaelti (1997) and Strujike (1998) models of reduplication were shown to be superior both theoretically and empirically because in their models, one does not have to identify a base in order to evaluate Input-Output correspondence.

REFERENCES

Alderete, John (1996). Dissimilation as Local Conjunction. *NELS* 27:17-32

Bateranzigo, Gédéon (1984). *Les Systemes Verbaux du Kirundi et du Kinyarwanda*. Ruhengeri: Université nationale du Rwanda, Faculte de Lettres

Bigangara, Jean-Baptiste (1982). *Eléments de Linguistique Burundaise*. Bujumbura, Burundi: Faculté de Philosophie et Lettres

Downing, Laura (1998). Prosodic misalignment and reduplication. In G. Booij and J. van Maarle (eds.) *Yearbook of Morphology 1997. K*luwer Academic Publishers. 83-120.

Downing, Laura. to appear. Accent in African Languages. In R.W.N. Goedemans & H.G. van der Hulst (eds), *Stress Patterns of the World: Data.* Amsterdam: John Benjamins.

Goldsmith, John (1976). *Autosegmental Phonology*. PhD Dissertation, MIT. Distributed by Indiana University Linguistics Club.

Goldsmith, John & Firmard Sabimana (1989). The Kirundi Verb. In F. Jouannet (ed.) *Mòdeles en tonologie*. Paris: Centre National de la Richerche Scientifique, 19-62.

Grimes, Barbara F. ed. (1996). *Ethnologue* 13th Edition. Arlington, TX: SIL

Leben, Will (1973). *Suprasegmental Phonology*. PhD Dissertation, MIT. New York: Garland Press.

Kimenyi, Alexandre (1978). *A Relational Grammar of Kinyarwanda*. Berkeley: University of California Press

Kimenyi, Alexandre. (1979). *Studies in Kinyarwanda and Bantu Phonology*. Carbondale, Illinois: Linguistic Research

Kirchner, Robert (1996). Synchronic Chain Shifts in Optimality Theory. *Linguistic Inquiry* 27:341-350.

Marantz, Alec (1982). Re-reduplication. *Linguistic Inquiry* 13:435-482.

Meeusen, A. E. (1959). *Essai de Grammaire Rundi.* Tervuren, Belgium: Annales du Musée Royal du Congo Belge.

McCarthy, John (1986). OCP Effects: Gemination and Antigemination. *Linguistic Inquiry* 17:207-264.

McCarthy, John & Alan Prince (1993). Generalized Alignment. Ms, UMass Amherst and Rutgers Univeristy

McCarthy, John & Alan Prince (1994). The emergence of the unmarked. Optimality in Prosodic Morphology. *Proceeding of NELS* 24:291-306

McCarthy, John & Alan Prince (1995). Faithfulness and Reduplicative Identity. In Jill N. Beckman, Laura Walsh Dickey and Suzanne Urbanczyk (eds.) *Papers in Optimality Theory*. UMass, Amherst: GLSA, 249-384.

Myers, Scott (1997). OCP Effects in Optimality Theory. *Natural Language and Linguistic Theory* 15:847-892

Myers, Scott & Troi Carleton (1996). Tonal Transfer in Chichewa. *Phonology* 13: 39-72.

Ntahokaja, Jean-Baptiste (1994). *Grammaire Structurale du Kirundi*. Bujumbura, Burundi: Faculté de Philosophie et Lettres

Ntihirageza, Jeanine (1999). Vowel Length in Kirundi Suffixation and Reduplication: The Bisyllabicity Constraint. *Papers from the Regional Meetings, Chicago Linguistic Society* 35(1): 249-264.

Ntihirageza, Jeanine (2000). Quantity Sensitivity in Kirundi: Interaction between Vowel Length and Tone. Paper presented at the *Annual Conference on African Linguistics* 31, Boston University.

Ntihirageza, Jeanine (2001). *Quantity Sensitivity in Bantu Languages*. PhD Dissertation, University of Chicago.

Odden, David (1980). Associative Tone in Shona. *Journal of Linguistic Research* 1.2: 37-51.

Odden, David (1994). Adjacency Parameters in Phonology. *Language* 70:289-330

Odden, David (1996). Patterns of Reduplication in Kikerewe. *OSU Working Papers in Linguistics* 111-148.

Poletto, Robert (1996). Base-Identity Effects in Runyankore Reduplication. *OSU Working Papers in Linguistics* 183-210

Poletto, Robert (1998). *Topics in Runyankore Phonology*. PhD Dissertation, The Ohio State University.

Rodegam, F.M. (1967). *Précis de Grammaire Rundi.* Bujumbura, Burundi: Faculté de Philosophie et Lettres

Rodegam, F.M. (1988). *Dictionaire Rundi-Francais*. Musée Royal de L'Afrique Centrale. Tervuren, Belgium

Rosenthall, Samuel (1994). *Vowel Glide Alternation in a Theory of Constraint Interaction*. PhD Dissertation, Univeristy of Massachusettes, Amherst

Smolensky, Paul (1993). Harmony, Markedness, and Phonological Activity. Handout to talk presented at the Rutgers Optimality Workshop 1. New Brunswick, NJ

Spaelti, Philip (1997). *Dimensions of Variation in Multi-Pattern Reduplication*. PhD Dissertation, University of California, Santa Cruz

Struijke, Caro (1998). Broad IO-Correspondence and Faithfulness to Roots in Kwakwala Reduplication. manuscript, University of Maryland, College Park

Struijke, Caro (2000). *Existential Faithfulness: A study of Reduplicative TETU, Feature Movement, and Dissimilation*. PhD Dissertation, University of Maryland.

Suzuki, Keiichiro (1998). *A Typological Investigation of Dissimilation*. PhD Dissertation, Univeristy of Arizona

Walsh, Laura (1992). Tone in Reduplication. *Papers from the Regional Meetings, Chicago Linguistic Society* 28: 543-553

Yip, Moira (1988). The Obligatory Contour Principle and Phonological Rules: A loss of Identity. *Linguistic Inquiry* 19

Yip, Moira (1995). Repetition and its Avoidance: The Case of Javanese. Available as ROA-83-0000 from the Rutgers Optimality Archive.

Yip, Moira (1998). Identity avoidance in Phonology and Morphology. In S. Lapointe, D. Brentari & P. Farrell. *Morphology and its relation to syntax and phonology*. Stanford, CA: CSLI Publications, 216-246.

Zoll, Cheryl (1998). *Parsing Below the Segment in a Constraint-Based Framework*. Stanford, CA: CSLI Publications

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