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The emergence of the unmarked reaffirmed

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Abstract
In a number of languages, the reduplicant tends to be unmarked or less marked than the base which it copies although the language in question may have marked prosodic and segmental structures outside reduplication. Traditional rule-based derivational approach failed to account for the cross-linguistic emergence of the unmarked phonological structures because of ordering paradoxes while templatic approach equally failed to explain the variation in their 'templates'. Currently, this is explained in terms of the 'The emergence of the Unmarked' (hereafter, TETU) in Optimality Theory (OT). This paper argues that the emergence of the unmarked phonological structures is best captured in terms of constraints, which though dominated, may emerge to favour structures that are unmarked over those which are marked. Based on Lubukusu (Bantu, Kenya) reduplication, it is shown that constraints against onsetless syllables and monosyllabic stems (though dominated in the constraint hierarchy of the language), are responsible for the unmarked CV syllables and bisyllabic prosodic words. At the segmental level, it is shown that the unmarked and preferred epenthetic segments are coronals while the Bantu verb final vowel [a] is considered unmarked in this position. This is done through constraint interaction without stipulating any derivational rules or templatic specifications. The study proposes that the universal TETU ranking is sufficient in accounting for this phenomenon across languages.

Keywords: TETU, constraint, optimal, unmarked, reduplicant

1. Introduction

Reduplication, as a phonological process, involves some phonological identity between the reduplicant and the base. This is the view embodied in the Correspondence Theory (McCarthy & Prince, 1994, 1999, 2004; McCarthy, 2002) [1, 2, 3, 4] within the larger framework of Optimality Theory (OT, Prince & Smolensky, 1993/04). Correspondence Theory (CT) accounts for reduplication through correspondence relations in which faithfulness constraints enforce identity such that identity is the expected norm in reduplication processes. However, in the study of reduplication, it was long observed that that the reduplicant (hereafter RED) tends to be less marked than the base from which it copies its material (Wilbur, 1973; Maratz, 1982; Broselow & McCarthy, 1983; McCarthy & Prince, 1986; Steriade, 1988, among others) [6, 8, 9, 10]. Significantly, while the general grammar of a language may have phonological structures that are considered marked, the reduplicant is invariably unmarked in the output form across languages.

In this respect, the phonologically unmarked structure, one that obeys some Phono-Constraint, emerges in the reduplicated form although it is not a requirement in the grammar of the language in question. The RED obeys a constraint that is freely violated in the language because it is low ranked in the language's constraint hierarchy (CON) from an OT perspective. The constraint obeyed may be violated in the base of the very same reduplicant. Typically, the Phono-Constraint may not compel inexact correspondence between the stem and the base which in Correspondence Model (McCarthy & Prince 1994:81) [1] results in no application. However, the reduplicant satisfies the requirements of this constraint even when it results in inexactness of identity between the base and RED. This phenomenon has been referred to as 'The Emergence of the Unmarked' (TETU) by McCarthy and Prince (1994, 1999, & 2004) [1, 2, 3] and McCarthy (2002) [4].

Theoretically, TETU provides support for the view in OT that constraint are ranked but not parameterized because the later would require an 'all-or-nothing' requirement from the Phono-Constraint ruling out the emergence of the unmarked. The gist of the argument is that in OT, dominated markedness constraints may emerge and in so doing determine the optimal outputs of the grammar. This is the expected situation when the high-ranked constraints are indecisive or when in comparative evaluation, they fail in to produce one optimal candidate. The concept of (TETU) is true when the emerging constraints emanate from the markedness family, hence the term 'the emergence of the unmarked' (McCarthy, 2002:129-31) [4]. In OT, one of the basic premises is that a constraint may be crucially dominated but this does not imply inactivity on the part of the constraint as is the case in Principles and Parameters approach (Culicover, 1997) [11].

In Lubukusu, studies have shown that 'the emergence of the unmarked' is observed at both the segmental and supra-segment (prosodic) levels of its phonology. Specifically, at the segmental level the coronal palatal glide [j] seems to be the unmarked epenthetic segment which is often used to provide an onset to vowel initial words or in resolving vowel hiatus (Nandelenga, 2013) [12]. On the other hand, the low open vowel [a] has been shown to be the canonical and probably the unmarked verb stem final vowel. At the prosodic level, the language exhibits two cases of TETU. First, at the syllable level, it is observed that in reduplication, no RED may be optimal if it does not have onsets in all its syllables (Mutonyi, 2000; Nandelenga, 2014) [13]. Cross-linguistically, the CV syllable is reported to be the unmarked syllable structure mainly because it has an onset. Secondly, at the prosodic word level, there is a requirement that the RED which is the

equivalent a prosodic word (PrWd) can only be optimal if it is minimally bisyllabic. Morphological stems are universally parsed as prosodic words, a process that may be based on the Stem-Prosodic Word homology. The minimal word assumed to be bisyllabic, is said to be the unmarked word in terms of prosodic criteria (McCarthy & Prince 1994:3; Downing, 2006a, b) [15].

In Lubukusu language, there is a minimal-word reduplicative pattern which restricts the copying of inflectional suffixes once the RED-size requirement is met (Nandelenga, 2013, 2014) [12]. In reduplication, only the unmarked REDs emerge under specific ranking of universal constraints. These cases of TETU are examined within the TETU ranking (McCarthy & Prince, 1994; McCarthy, 2002) [1, 4]. The paper is organized as follows; section 2 examines the unmarked CV syllables in REDs focusing on the constraint that motivate the overcopying of prefixes to provide an onset in section 2.1. Onset-motivated infixation of RED is examined in 2.2, followed by onset-driven consonant epenthesis in 2.3 and finally, onset-driven null parse in 3.4. Section 3 surveys the unmarked prosodic word focusing on RED-size driven prefix overcopying in 3.1, followed by RED-size driven suffix copying in 3.2 and RED-size driven null-parse in 3.3. Section 4 looks at the unmarked segmental type: the epenthetic palatal glide [j] in 4.1 and the verb final vowel [a] in 4.2. The summary and conclusion are highlighted in 5.

2. The Unmarked CV Syllable REDs

In the Lubukusu language, both total and partial reduplication processes are pervasive involving nouns, adjectives, verbs, adverbs and even functional words such as numerals (Mutonyi, 2000) [13]. In these patterns of reduplication, it is apparent that the REDs that emerge in the process are of the unmarked CV type of syllables (Nandelenga, 2013) [12]. In the following data on total reduplication, only CV syllables are the optimal outputs in the RED. The Reds are underlined.

(1) Total Reduplication (Nandelenga, 2014) [12]

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED
i	/o-mu-βeji/	[omu βeji]	'a liar'	[omu-βejiiβeji]	*[omuβe βeji]
ii	/βa-kololofu/	[βakololofu]	'upright men'	[βa-kololofukololofu]	*[βakolokololofu]
iii	/o-mu-iᵐbi/	[omwiːᵐbi]	'a short man'	[omwiːᵐbi mwiːᵐbi]	*[o muiːᵐbi iᵐbi]
iv	/βa-kaβula/	[βakaβula]	'they divided'	[kaβula kaβula]	*[βakaβukaβula]

In the data, there is total reduplication of the base, typically the root which is thus fully identical to the RED. The root/stem reduplicates entirely resulting in the RED and base that are completely identical. This is only possible if the stem has onsets hence CV base. In (i), the adjective [βeji] 'liar' is the root base that reduplicates. Similarly in (ii) the root [kololofu] 'upright' reduplicates fully. The same pattern is apparent in (iii) and (iv) in which all base materials are copied in the RED excluding the prefix except in (iii) where the prefix is copied to provide an onset. Faithfulness constraints (MAX-BR) demand maximum copying of the base material in the reduplicant thus enforcing total reduplication. However, partial reduplication is also attested in the language and typically involves CV syllable structure in the RED. The phrase 'each other' is shortened to e.o. in these examples. REDs mean 'done repeatedly/haphazardly'.

(2) Partial reduplication

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED
i	/xu-lim-ila/	[xulimila]	dig with	[xu-lima limila]	*[xulimila limila]
ii	/xu-kaβ-ana/	[xukaβana]	we share	[xu- kaβa kaβana]	*[xukaβana kaβana]
iii	/lil-il-ana/	[lililana]	cry for e.o	[lila lililana]	*[lililana lililana]
iv	/βa-xal-isja/	[βaxalisja]	they waylay	[βa-xala xalisja]	*[βaxalisja βaxalisja]

In partial reduplication, the root reduplicates without the inflectional suffixes, if it is bisyllabic. In addition, the prefix is not reduplicated as this leads to misalignment between the base and the RED. The RED is a prefix (located to the left edge of the base) similar to what occurs in other Bantu languages (Downing, 1999) [4]. Mutonyi (2000) [13] and Downing (2004) argue that the basic form of reduplication in Lubukusu is that of prefixation; the RED is to the left edge of the base. The evidence is derived from partial reduplication in which the RED copies the root without the following suffixes, implying the RED is word initial in the compounded prosodic word. Partial reduplication is normally accounted for via a word size restriction constraint which has the effect of inducing root reduplication alone minus the suffix if the root is bisyllabic.

The following data show that onsetless syllables must be repaired before reduplication can take place. The repair mechanisms are basically three; prefix overcopying (i & ii), RED infixation (iii & iv) and consonantal epenthesis to provide an onset in (v & vi).

(3) Onsetless repair mechanisms

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED
i	/βa-βa-iri/	[βaβeːri]	killers	[βa-βeːri βeːri]	*[βaβa-iri iri]
ii	/xu-ira/	[xwiːra]	we kill	[xwiːra xwiːra]	*[xu ira ira]
iii	/ikula/	[ikula]	open (v)	[i-kula kula]	*[ikula ikula]
iv	/e-N- tiŋa/	[eⁿdiŋa]	I sieve	[e ⁿdiŋa tiŋa]	*[en.tiŋa tiŋa]
v	/xu-ixa/	[xwiːxa]	we descend	[xwiːxa jixa]	*[xu ixa ixa]
vi	/xu-iŋga/	[xujiŋga]	we tighten	[xujiŋga jiŋga]	*[xu iŋga iŋga]

The emergence of the CV prosodic structures is of theoretical interest largely because in the general phonology of the language, syllables without onsets are a norm. This phenomenon has been dubbed 'The Emergence of the Unmarked' (TETU) in prosodic structures. In Lubukusu, stems without onsets do not reduplicate unless they are supplied with an appropriate onset consonant as shown in the data above. The demand for an onset may lead to prefix overcopying, consonant epenthesis or infixation; otherwise, there is a null parse (no output from the given input). In the section that follows, we examine onset-driven prefix overcopying, constraints responsible and appropriate ranking for the same to account for the observed RED outputs.

2.1 Onset-driven Prefix Overcopying

According to Mutonyi (2000) [13] and Nandelenga (2013, 2014) [12], prefix copying is prohibited and any copying of the same is considered a form of 'overcopying' (Mutaka & Hyman, 1990) [19]. The prefix is considered not part of the canonical stem (Hyman, 2003; Mutonyi, 2000; Marlo 2008) [13, 20, 21]. The stem is made up of the root with or without inflectional suffixes, an argument supported by Lubowicz (2009) [22] who reports that infixes/suffixes are in fact part of the root morpheme in the output form via morpheme absorption but prefixes are outside the root domain. The macrostem is made up of the stem plus the object prefix. Copying of the prefix must therefore be motivated by some constraints such as those demanding a syllable onset. Below is the structure of the canonical Bantu stem/macrostem illustrated by Lubukusu reciprocal verbal extension; /fuk-il-an-a/ → [fukilana] 'cook for each other'.

(4) Canonical shape of Bantu Stem/Macrostem

Subj – Tns/Asp {Obj [Root – Infl - FV] Stem} Macrostem.
βa - xa - {βa [Fuk - il – an - a] Stem} Macrostem.

The need for an onset compliant syllable may justify overcopying of the prefix in vowel initial stems. The data below show prefix consonants being absorbed into the base to provide an onset.

(5) Onset-driven prefix overcopying

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED
i	/βa-βa-iri/	[βaβe:ri]	killers	[βa-βe:ri βe:ri]	*[βaβa-iri iri]
ii	/βa-βa-ene/	[βa-βe:ne]	themselves	[βa-βe:ne βe:ne]	*[βa-βa ene ene]
iii	/o-mu-iri/	[omwi:ri]	a killer person	[o mwi:ri mwi:ri]	*[o mu iri iri]
iv	/o-mu-aji/	[omwa:ji]	a herder	[o mwa:ji mwa:ji]	*[omu aji aji]

In the data, the prefix is recruited into the RED to provide an onset in vowel initial syllables. This is due to TETU; only unmarked CV syllable types occur in reduplication. Overcopying is driven by markedness demands for a well-formed CV syllable which leads to onset attracting overcopying. The constraint ONSET, conflicts with ALIGN-R, resulting in the violation of the latter. Below, the input /o-mu-aji/, reduplicates [o mwa:ji mwaji]. In an OT grammar, tableaux are used to assess the optimal candidate, one that is the attested form in the language as follows.

(6a) /o-mu-RED -aji/ → [o mwa:ji mwa:ji] 'kind of a herdsman'

	/o-mu-RED -aji/	ONSET	ALIGN-R
a	☞[o mwa:ji mwa:ji]		*
b	[o mu.a.ji a.ji]	*!*	

The tableau shows that the identity of the prefix is not just copied to include the [-mu-]; this creates vowel hiatus of the form V_i # V_j (dissimilar hetero-syllabic/morphemic vowels), instead [-mu-] undergoes gliding into [-mw-] yielding [omwa:ji] rather than [o.mu.a.ji]. The repair of V_i # V_j is due to prohibition of the heterosyllabic sequence of dissimilar vowels (Ngunga, 2000; Wasike, 2004) [24]. The constraint ONSET resolves both the onset requirement and markedness of vowel hiatus through prefix absorption. Tableau (6b), shows that the constraint *HIATUS which bans vowel hiatus, yields the same result.

(6b) /o-mu-RED -aji/ → [o mwa:ji mwa:ji] 'kind of a herdsman'

	/o-mu-RED -aji/	*HIATUS	ALIGN-R
a	☞[o mwa:ji mwa:ji]		*
b	[o mu.a.ji mu.a.ji]	*!	

It can be assumed that the provision of an onset and removal of hiatus can be attained through deletion of one of the vowels in the input. However, there is no justifiable context; deletion of base material (candidate (c)) is penalized by MAX-BR and CONTRAST constraints as follows;

(6c) /o-mu-RED -aji/ → [o mwa:ji mwa:ji] 'kind of a herdsman'

	/o-mu-RED -aji/	Contrast	Onset	Align-R	Max-Br
a	☞[o mwa:ji mwa:ji]			*	
b	[o mu.a.ji mu.a.ji]	*!	**		
c	[o maji maji]			*	*!

Besides MAX-BR, candidate (b) is suboptimal in Lubukusu because of violating the universal constraint against contrast neutralization. CONTRAST as a constraint is undominated in the language; deletion that neutralizes contrast cannot be allowed. Furthermore, in /o-mu-aji/ → [o mwa:ji mwa:ji], the prefix vowel [-u] is not deleted but is changed into a glide. According to some studies (Casali, 1996; Tanner, 2007) [25, 26], formation of a glide from a vowel changes the moraic features of the remaining vowel. The non-moraic glide replaces the

moraic vowel hence the V_1 mora is transferred to the adjacent vowel (V_2). In Lubukusu, glides are phonologically consonantal providing syllable onsets. In OT, glide formation is in violation of IDENT-IO (μ) and IDENT-IO$_{SYLLABIC}$. Glides are non-syllabic segments in the language. The initial vowel delinks from its associated mora and attaches to V_2 thus maintaining its attachment to the root node preserving the articulatory features of the vowel. The V_2 will emerge as a long vowel in compensatory lengthening, a violating of IDENT-IO (μ) due to mora shift from V_1 to V_2.

(6d) /o-mu$_1$-RED –a$_2$nji/ → [o mwa:$_{12}$ji mwa:$_{12}$ji] 'kind of a herdsman'

	/o-mu$_1$-RED –a$_2$ji/	ONSET	ALIGN-R	MAX-BR	IDENT-IO(μ)
a	☞[o mwa:$_{12}$ji mwa:$_{12}$ji]		*		*
b	[o mu$_1$a$_2$ji mu$_1$a$_2$ji]	*!*	*		
c	[o ma$_2$ji ma$_2$ji]		*	*!	

Note the significance of MAX-BR dominating IDENT-IO (μ), in avoiding candidate (a) and (c) tying in violation marks which could imply free variation that is unattested. On the other hand, height coalescence takes place in prefixes copying into the RED. This leads to violations of the anti-coalescence constraint UNIFORMITY-IO which prohibits single outputs that have multiple correspondents in the input. This constraint is low ranking in the hierarchy as shown below.

(7) /βa- βa$_1$-RED-i$_2$ra/ → [βa-βe:$_{12}$ra βe:$_{12}$ra] 'kind of killers'

	/βa-βa$_1$-RED-i$_2$frai/	ONSET	ALIGN-R	MAX-BR	IDENT-IO(μ)	UNIFOR-BR
a	☞[βa-βe:$_{12}$raβe:$_{12}$ra]		*		*	*
b	[βa- βa$_1$i$_2$ra i$_2$ra]	*!*				
c	[βa- βa$_1$ra βa$_1$ra]		*	*!		

The optimal candidate is the same after addition of the UNIFORMITY-BR constraint. ONSET triggers the overcopying of prefix leading to the violations of ALIGN-R, IDENT-IO (μ) and UNIFORMITY-BR by the optimal candidate, but being low-ranked, are less costly violations. Finally, prefix overcopying to provide an onset may compel deletion of vowels that could potentially create hiatus or other marked syllable types i.e. diphthongs.

(8)	/βa-βa-one/	[βa-βo:ne]	'they saw'	[βa-βo:ne βo:ne]	*[βa-βa one one]
	/βa-βa-eji/	[βa-βe:ji]	'liars'	[βa-βe:ji βe:ji]	*[βa-βa eji eji]

The data reveal that the need for an onset leads to prefix overcopying, which may unfortunately, create vowel hiatus. This must be repaired through deletion of the V_1 due to positional faithfulness of V_2 which protects it from deletion. We adopt Pater (2007), who argues that morpheme-specific phonology is analyzed in terms of lexically indexed markedness and faithfulness constraints. Consequently, faithfulness to the root is indexed to show the deletion exceptionality of such positions. Root-specific faithfulness constraint protects V_2, hence a faithfulness constraint relevant in reduplication is proposed; MAX-BR$_{ROOT}$. This constraint dominates the general vowel faithfulness constraint MAX-BR to protect the root vowel from deletion as follows; (MAX-BR$_{ROOT,}$ ONSET≫ MAX-BR$_{VOWEL}$). The result of this ranking is the deletion of the V_1 of the prefix and compensatory lengthening of the root vowel (V_2).

(9) /βa-βa$_1$-RED-o$_2$ne/ → [βa-βo:$_{12}$ne βo:$_{12}$ne] 'they sort of saw'

	/βa-βa$_1$-RED-o$_2$ne/	MAX-BR$_{ROOT}$	ONSET	MAX-BR(V)	IDENT-BR(μ)
a	a.☞[βa-βo:$_{12}$ne βo:$_{12}$ne]			*	*
b	b. [βa-βa$_1$o$_2$ne o$_2$ne]		*!*		
c	c. [βa-βa$_1$ne βa$_1$ne]	*!		*	

By deleting the prefix vowel, candidate (a) only violates the two low-ranking constraints. In all cases of onset-driven prefix overcopying, the provision of an onset is not sufficient; the resultant syllables must meet other relevant markedness constraints. This is because in reduplication, only unmarked syllable types are allowed; vowel hiatus must be repaired before reduplication.

2.2 Onset-driven Infixation

Infixation of the RED is another process of ensuring that REDs have onsets. ONSET requirements on the RED may induce vowel initial trisyllabic/polysyllabic stems to undergo infixation. The fact that infixation is invoked is evidence that there is a general tendency to avoid prefix copying. Basically, if the stem is long enough to meet the requirement that the RED is bisyllabic (due to RED=PRWD constraint), the RED is simply infixed after the base initial vowel, precluding the vowel that is the cause of markedness. Consider these examples.

(10). Onset-driven infixation

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED FORMS
i	/xu-axil-isja/	[xuaxilisja]	paint often	[xua-xila xilisja]	*[xu axilisja axilisja]
ii	/βa-anusilja/	[βaanusilja]	drop with	[βaa-nusja nusilja]	*[βa anusilja anusilja]
iii	/ikula/	[ikula]	open (v)	[i-kula kula]	*[ikula ikula]t
iv	/elesja/	[elesja]	give	[e-lesja lesja]	*[elesja elesja]

Infixation is driven by ONSET constraint resulting in avoidance of the copying of the initial base vowel. It can be inferred from the data as to why prefix overcopying is not an option in the provision of an onset. First, prefixes in (i) and (ii) are the canonical CV-syllables. Therefore, incorporating them into RED would result in either vowel hiatus (i) because the stem begins with vowels following the prefix final vowel or create a long vowel in (ii), neutralizing contrast. In addition, the resultant vowel hiatus in (i) cannot be resolved through the mechanism available in the language; coalescence, deletion and glide formation due to contrast preservation principle. The form [xuaxilisja] 'to paint repeatedly' contrasts with [xwaxilisja] 'we have surpassed' that results from glide formation. Therefore, resolving hiatus in this manner is not available.

In addition, deletion of the prefix vowel (V_1 [-u]) results in [xaxilisja]; a diminutive singular form of [xwaxilisja]. Deletion of the V_2 leads to contrast violation because [xuxilisja] 'to surpass them' exists independently in the language. Finally, coalescence of [u] and [a] vowels results in [xe] from [xua] yielding the causative form [xexilisja] 'I am making (somebody/something surpass' a totally unrelated form/meaning. In essence, these cases favour infixation. The outcome is that the reduplicative prefix becomes an infix due to the higher ranked ONSET, but it sits as close as possible to the left edge of the stem; ALIGN-RED-L (ALIGN-L) which demands that the left edge of the RED is aligned with the left edge of the PrWd.

The foregoing argument is in accord with (Lubowicz, 2009) [22] who argues that most infixes are prefixes or suffixes that are displaced from their edge-most positions for prosodic or phonotactic reasons. This observation appears to be the case in Lubukusu; the RED is a prefix displaced from the edge for phonotactic reasons of alignment. The RED must be located immediately after the initial vowel to avoid the offending onsetless syllable. Infixation is due to; ONSET, ALIGN-R and ALIGN-L in which ONSET dominate the latter two. We include a constraint against neutralizing contrast among members of a paradigm; PARCONTRAST.

(11) /xu-RED-axil-isja/ → [xu-a-xila xilisja] 'we paint repeatedly'

	/xu-RED-axil-isja/	PARCONT	ONSET	ALL-σ- LEFT	ALIGN-R	ALIGN-L
a	a. ☞[xua xila xilisja]			10		*
b	b. [xu axila axilisja]		*!*	21		*
c	c. [xwaxilisja jilisja]	*!		21	*	
d	d. [xu xilisja xilisja]	*!		15		
e	e. [xexila xilisja]	*!		10		*

The optimal candidate is an infixed RED that is as close as possible to the left edge of the base. The constraint responsible for maintaining contrast among surface forms is crucial in declaring candidate (e) sub-optimal: without PARCONT, the two candidates would tie in harmony (a & e).

2.3 Onset-driven Consonant Epenthesis

There might be situations when there are no appropriate prefixes with onsets to supply a syllable onset. Similarly, there might be prefixes with onsets but such onsets may not be copied by the RED due to some markedness reasons. Finally, infixation can only be invoked if the bases are long enough (at least three syllables) due to bisyllabicity requirement. In such cases, epenthesis of the coronal glide is done to provide the syllable onsets. Epenthesis is preferred in bisyllabic verb stems with initial vowels. Below are examples of onset-driven consonant epenthesis.

(12) Onset motivated epenthesis

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED FORMS
i	/-ixa/	[ixa]	'descend'	[jixa jixa]	*[ixa ixa]
ii	/-ima/	[ima]	'stand up'	[jima jima]	*[ima ima]
iii	/-iŋga/	[iŋga]	'tighten'	[jiŋga jiŋga]	*[iŋga iŋga]
iv	/-e:ɲa/	[e:ɲa]	'want'	[je:ɲa je:ɲa]	*[e:ɲa e:ɲa]
v	/-ora/	[ora]	'bask'	[jora jora]	*[ora ora]

In the above data, the palatal glide seems to be the preferred epenthetic segment which is inserted in all stems lacking an onset. The ONSET constraint is responsible for insertion of the glide and it must dominate the anti-deletion constraint DEP-BR as shown below.

(13a) /-RED-ora/→ [jora jora] 'bask frequently/haphazardly'

	/-RED-ora/	MAX-BR$_{ROOT}$	ONSET	DEP-BR
a	☞ [jora jora]			*
b	[ora ora]		*!*	

The optimal candidate (a) has the coronal palatal glide to provide an onset, although epenthesis leads to violation of DEP-BR, this constraint is ranked low. Note that there are many options in avoiding the offending syllable that lacks an onset: deletion of the initial vowel or insertion of any consonant. However, as we shall see in section 3 and 4, deleting the vowel violates the RED-size constraint and the MAX-BR_{ROOT}. The insertion of any consonant may violate CONTRAST or violate markedness constraints against non-coronal epenthesis (see §4.1). This is depicted in the following tableau in which non-coronal consonants cannot be used as epenthetic segments.

(13b) /-RED-ora/→ [jora jora] 'bask frequently/haphazardly'

	/-RED-ora/	CONTRAST	MAX-BR_{ROOT}	ONSET	*DOR/LAB	DEP-BR
a	☞[jora jora]					*
b	[ora ora]			*!*		
c	[βora ora]	*!			*	*
d	[xora xora]	*!			*	*
e	[ra ora]		*!	*		

2.4 Onset-driven Null Parse

In Lubukusu, the three processes mentioned above (cf. §2.1, 2.2 & 2.3) could be triggered to repair the suboptimal bases that begin with vowels to allow for the normal reduplication processes. However, if these processes cannot be utilized for whatever reasons, then reduplication fails, leading to a null parse or simply a null output. The absence of a prefix or presence of an inappropriate prefix may rule out prefix overcopying. Similarly, shorter bases cannot allow infixation while contrast preservation may block consonant epenthesis. Generally, bisyllabic bases beginning with vowels cannot reduplicate if they cannot be repaired.

(14) Onset-driven null parse

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED
i	/a.na/	[a.na]	give	[⊙]	*[jana jana]
ii	/o.na/	[o.na]	heal	[⊙]	*[jona jona]
iii	/e-ca/	[e.ca]	he comes	[⊙]	*[eca eca]
iv	/ula/	[u.la]	overcome	[⊙]	*[u-la la]

In data (a) above, there is no reduplication because the base begins with a vowel contrary to markedness constraints that require the RED to begin with an onset (the left edge of the RED must be aligned with a C (consonant); (ALIGN-L, RED, C). CONTRAST constraint prevents insertion of the glide to yield [ja.na] 'scream' and similarly in (ii); [jola] 'gather'. In (iii), the same [jeca] and in (iv) [jula] violate CONTRAST. All forms begin with vowel prefixes ineligible for copying while infixation results in monosyllabic base contrary to [CV.CV] form required.

Whenever an input lacks an output, it violates faithfulness constraints requiring input morphemes to be realized on the surface in some phonological form; MORPHEME PARSE (M-PARSE, Prince & Smolensky, 1993). In the following, the null output is optimal for /ula/ 'overcome'.

(15a) /ula/ → [⊙]

	/ula/	CONTRAST	ONSET	MAX-BR	DEP-BR	M-PARSE
a	☞ [⊙]					*
b	[ula ula]		*!*			
c	[la la]			*!		

The tableau reveals that the null candidate vacuously satisfies all the constraints except the lowest-ranked M-PARSE. Candidate (b) violates the undominated constraint against contrast neutralization; CONTRAST. [ula] 'overcome' and [jula] 'grab' contrast in Lubukusu. Furthermore, this candidate would be ruled out by the anti-epenthesis constraint DEP-BR which is ranked above M-PARSE. Candidate (c) is sub-optimal although it is a faithful mapping of the input, it lacks an onset. Note that ONSET is itself dominated by other constraints in the language. This is clear case of TETU; ONSET is a dominated constraint, but because the high ranking CONTRAST is irrelevant in ruling out candidate (c), ONSET emerges and declares it suboptimal for lack of an onset. On the other hand, candidate (d) is sub-optimal, though typically CV, because MAX-BR dominates M-PARSE, its violation is fatal. In tableau (15b), the alignment constraint demanding that the left edge of the RED begins with an onset (ALIGN-L, RED, C) may be the inverse of the ONSET and the null output remains the most harmonic.

(15b) /ula/ → [⊙]

	/ula/	CONTRAST	ALIGN, L, RED, C	MAX-BR	DEP-BR	M-PARSE
a	☞ [⊙]					*
b	[jula jula]	*!			*	
c	[ula ula]		*!			
d	[la la]			*!		

The tableau (15b), confirms the result from tableau (15a) above. A null output is preferred to a RED without an onset. The alignment constraint rules out candidate (c); the left edge of the RED is not aligned with an onset consonant (C). The emergence of CV syllables is instantiated by our ranking in which faithfulness constraints, CONTRAST, among others, is high ranked dominating ONSET (the markedness/phono-constraint) dominating base-reduplicant specific constraints; MAX-BR, IDENT-BR etc.

3 The Unmarked Bisyllabic Prosodic Word

The unmarked prosodic word of Lubukusu, similar to other languages (Downing, 2006a, 2006b) [15, 16], is bisyllabic. This is a form of TETU because the language has many words that are either monosyllabic or polysyllabic. However, in reduplication, it is the unmarked bisyllabic forms that emerge as output REDs based on the universal TETU ranking. In Lubukusu generally, there can be no reduplication of sub-minimal (monosyllabic) stems and the constraint against prefix copying may be violated to augment the RED-size. In the reduplication of verbs, the RED does not copy all the suffixes but the bare minimum to satisfy the minimal word-size constraint of bisyllabicity. This is what is observed in the partial reduplication and infixation process mentioned earlier (section 2). In partial reduplication, only a bisyllabic root may be reduplicated. If it is monosyllabic, the RED will include just one syllable to meet the RED-size requirement of bisyllabicity. The following data show that there is no reduplication for monosyllabic stems because they do not meet the RED-size requirement of the reduplication process (16i & ii). The sub minimal stem can be augmented through prefix overcopying (16iii & iv) and suffix copying (16v & vi) but this is only available to verbs. If the two repair mechanisms are not tenable, there is no reduplication; resulting in a null parse. Note; e.o. = each other

(16) Lubukusu subminimal base repairs and null parse

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED
i	/ca/	[ca]	'go'	[⊙]	*[ca ca]
ii	/fwa/	[fwa]	'die'	[⊙]	*fwa fwa]
iii	/βa-xwe/	[βaxwe]	'in-laws'	[βaxwe βaxwe]	*[βa xwe xwe]
iv	/βa-ɲwi/	[βa-ɲwi]	'drunkards'	[βaɲwi βaɲwi]	*[βa ɲwi ɲwi]
v	/c-il-ila/	[cilila]	'go for'	[cila cilila]	*[ci cilila]
vi	/fw-il-ana/	[fwilana]	'die for e.o.	[fwila fwilana]	*[fwi fwilana]

The data reveals that unless the stem base is bisyllabic, there is no reduplication. REDs as prosodic words require stems to be bisyllabic for reduplication to take place. The language though has monosyllabic words/stems implying that the bisyllabicity constraint RED=PRWD is not an undominated constraint in the language. In an OT analysis pursued here, it means that it only emerges and selects the unmarked prosodic words which are bisyllabic when the high-ranked constraints fail to do so or are simply irrelevant. It is proposed that the RED=PRWD constraint, just like ONSET, is dominated by certain faithfulness constraints such as CONTRAST and MAX-BR_{ROOT}. However, RED=PRWD should dominate other constraints such as ALIGN-R to engender prefix copying and M-PARSE-BR to allow for the emergence of the null parse as the optimal. Below, we examine RED-size motivated prefix copying.

3.1 RED-size Driven Prefix Overcopying

It was mentioned earlier (see §2) that the copying of the prefix is prohibited because it is not part of the canonical stem that forms the base for reduplication. However, because OT constraints are violable, the prefixes may be copied if well motivated by high ranked constraints. In the case under discussion, the need for a bisyllabic base may induce prefix overcopying to augment the stem size. Under such conditions, the prefix (subject to other markedness constraints), may be copied into the base which is subsequently copied in the RED to meet the RED-size constraint. However, only adjectives use this strategy in meeting RED-size requirement. The verbs typically augment the stem size through verbal inflections (Mutonyi, 2000; Nandelenga, 2013, 2014) [12, 13].

(17) Prefix overcopying to meet RED-size requirement

	INPUT	OUTPUT	GLOSS	REDs	UNATTESTED
i	/βa-ri/	[βari]	cowards	[βari βari]	*[βa ri ri]
ii	/li-lja/	[lilja]	form of eating	[lilja lilja]	*[li lja lja]
iii	/o-mu-fu/	[omufu]	a dead (person)	[o mufu mufu]	*[omu fu fu]
iv	/o-mu-ja/	[omuja]	a new one	[o muja muja]	*[omu ja ja]

In the data, whenever the stem is monosyllabic, the RED includes the prefix to satisfy RED-size condition of bisyllabicity. If this is not possible, there is no reduplication; the unattested forms above have monosyllabic stems. In (i) reduplication includes the prefix [βa-] in the base so that the RED can copy it. There is prefix overcopying of [li-] in (ii) while in (iii) and (iv), both of them copy the prefix [-mu-] but not the pre-prefix [o-].

Urbanczyk (2006) and Downing (1999, 2000, 2006a) [4, 15], reveal that the canonical prosodic word across languages is bisyllabic. In building a prosodic hierarchy of a language, the unmarked prosodic word tends to be bisyllabic/moraic. The stem, a morphological structure, must be bisyllabic to meet the size requirement of its phonological equivalent; the prosodic word (the RED after reduplication). It is proposed that the RED-size requirement is due to the constraint demanding that the RED is identical to the prosodic word and, by transitivity, bisyllabic. The constraint; RED=PRWD (McCarthy & Prince, 1994; Downing, 2004) [1, 3, 18] demands that the RED is a prosodic word; it is minimally bisyllabic. In data above, this constraint is responsible for prefix copying violating the alignment constraint; RED=PRWD ≫ALIGN-R.

(18) /o-RED-mufu/ → [o-mufu mufu] 'a dead (person)'

	/o-RED-mufu/	RED=PRWD	ALIGN-R
a	☞[o-mufu mufu]		**
b	[o-mu-fu fu]	*!	

The sub-optimal candidate (b) reduplicates a monosyllabic stem contravening the RED-size requirement. Inclusion of the prefix in the RED leads to the fusion of the prefix and the RED and due to the effect of B-R identity the base back-copies from the reduplicant (retrograde overcopying). However, MORPH-DIS (Morphemic Disjointness) prohibits cases of haplology in which two morphemes share overlapping contents (McCarthy & Prince, 1995) [30]. However, this being is a low-ranked constraint is of little effect in the assessment of candidate harmony.

(19) /o-RED-mufu/ → [o-mufu mufu] 'a dead (person)'

	/o-RED-mufu/	MAX-BR$_{ROOT}$	RED=PRWD	ALIGN-R	MORPH-DIS
a	☞[o-mufu mufu]			**	*
b	[o-mu-fu fu]	*!	*		

3.2 RED-size Driven Suffix Copying

Verbs may also increase their stem size through verbal extensions to meet RED-size requirement. Generally, inflectional suffixes indicating the applicative, perfective, causative, reciprocal, and benefactive aspect, among others, can be added to the base. Such suffixes are considered part of the canonical Bantu stem. In the following examples, the applicative suffix [-ila] is added to the roots [kwa-] 'fall' and [lja-] 'eat' and the base can reduplicate accordingly. Note that prefix copying is ruled out if there are suffixes to augment the stem base.

(20) Verbal extensions (Root + Applicative suffix [-ila/ela]

	Root	Applicative	Gloss	Reduplication	Unattested
i	/xu:-sj-a/	[xu:sjela]	'to grind with'	[xu:-sjela sjela]	*[xu:sja sja]
ii	/xu:-lj-a/	[xu:lila]	'to eat with'	[xu:-lila lila]	*[xu:lja xu:lja]

In the data, the verb stems can reduplicate when bisyllabic and the RED does not include the prefix materials due to the alignment constraint. To ensure that the RED has just the canonical size for reduplication, the constraint ALL-σ- LEFT demands that no more than the bisyllabic base is copied. It is proposed that RED=PRWD is responsible for suffix copying while MAX-BR$_{ROOT}$ requires that the base must include the root whenever suffixes are incorporated into the RED. These two are ranked higher followed by ALL-σ- LEFT, MAX-BR and ALIGN-R.

(21a) /xu:-RED-sj-el-a/ → [xu:-sjela sjela] 'to grind with, repeatedly'

	/xu:-RED-sj-el-a/	MAX-BR$_{RT}$	RED=PRWD	ALL-σ-LEFT	MAX-BR	ALIGN-R
a	☞[xu:-sjela sjela]			6		
b	[xu:sjela xu:sjela]			15!		**
c	[xu:-sja sjela]		*!	3	**	

Candidate (a) is the most harmonic because it meets RED-size requirement constraint without prefixes copying. It harmonically bounds candidate (b); it has a subset of (b)'s violations. Candidate (c) has a fatal violation of top-ranked RED=PRWD because in /sjel-a/, candidate (c) violates the constraint against skipping base materials in reduplication. Note that even without the RED=PRWD constraint, candidate (c) is suboptimal in tableau (21b) in which RED=PRWD is replaced by CONTIG-BR requiring the RED to copy contiguous materials of the base.

(21b) /xu:-RED-sj-el-a/ → [xu:-sjela sjela] 'to grind with, repeatedly'

	/xu:-RED-sj-el-a/	CONTIG-BR	MAX-BR$_{ROOT}$	ALL-σ-LEFT	MAX-BR	ALIGN-R
a	☞[:xu- sjela sjela]			6		
b	[xu:sjela xu:sjela]			15!		**
c	[xu:-sja sjela]	*!		3	**	

Similar results can be obtained from an input that has the perfective suffix [-il-e] or [-el-e]. Note that in reduplication, the stem final [-e] is dropped for the canonical Bantu stem final vowel [a] because of the constraint demanding that verbal stems end in vowel final [a].

(22) Verbal extensions (Root + Perfective suffix [-e/il-e]

	ROOT	PERFECTIVE	GLOSS	REDUPLICATION	UNATTESTED
a	/xu-sj-a/	[xusjele]	'we have ground'	[xu-sjela sjele]	*[xusjela xusjele]
b	/xu-lj-a/	[xulile]	'we have eaten'	[xu-lila lile]	*[xulila xulile]

The data reflects similar behaviour as shown in the applicative form. The same constraints are used in determining the optimal candidate in the following tableau.

(23) /xu-RED-sj-el-a/ → [xu-sjela sjele] 'have ground repeatedly'

	/xu-RED-sj-el-e/	MAX-BR$_{ROOT}$	RED =PRWD	SFV$_{[a]}$	ALL-σ-LEFT	MAX-BR	ALIGN-R
a	☞[xu sjela sjele]				6		
b	[xusjele sjele]			*!	6		
c	[xusjela sjele]				15!		**
d	[xu sja sjele]		*!		3	**	

The optimal candidate (a) satisfies the top ranked constraints. Candidate (b) lacks the canonical verb final [a] while (c) overcopies the prefix. The copying of the prefix also leads to unmotivated violation of alignment constraint (ALIGN-R). Candidate (d) copies the monosyllabic root without the following suffix violating the RED=PRWD. The same result is obtained for [xu-lja] 'to eat' which is realized in the perfective as [xulile] 'we have eaten'.

(24) /xu-RED-lil-e/ → [xu lila lile] 'have eaten repeatedly'

	/xu-RED-lil-e/	MAX-BR$_{ROOT}$	RED=PRWD	ALL-σ-LEFT	MAX-BR	ALIGN-R
a	☞[xu lila lile]			6		
b	[xulile xulile]			15!		**
c	[xulila xulile]			15!		**
d	[xu lja lile]		*!	3	**	

For the reciprocal extension, the optimal candidate also copies just one extra syllable to meet RED-size requirement without overcopying the suffixes. (Note, e.o.→ each other).

(25) Verbal extensions (Root + Applicative + Reciprocal [-ana]

	INPUT	RECIPROCAL	GLOSS	REDUPLICATION	UNATTESTED
i	/xu-sj-a/	[xusjelana]	'we grind for e.o'	[xu-sjela sjelana]	*[xusja xusja]
ii	/xu-lj-a/	[xulilana]	'we eat for e.o'	[βa-lila lilana]	*[xulja xulja]
iii	/xu-ɲw-a/	[xuɲwelana]	'we drink foe e.o'	[xuɲwela ɲwelana]	*[xuɲwa xuɲwa]

The RED copies just one more syllable from the inflectional suffix to meet RED-size requirement and does not include prefix materials in the reduplicant. Tableau (26) confirms what was reported in the preceding two tableaux (23 & 24).

(26). /xu-RED-lil-an-a/→[xu-lila lilana] 'we eat for each other repeatedly'

	/xu-RED-lil-an-a/	MAX-BR$_{ROOT}$	RED=PRWD	ALL-σ-LEFT	MAX-BR	ALIGN-R
a	☞[xu-lila lilana]			10	**	
b	[xulila lilana]			15!	**	*
c	[xu-li lilana]		*!	6	***	
d	[xu-la lilana]		*!	6	***	

In the tableau, the optimal candidate is (a) which harmonically bounds candidate (b) in having just a subset of (b)'s violations in spite of sharing the MAX-BR violations. Candidate (b) includes the prefix material that is not part of the stem base violating ALL-σ-LEFT and ALIGN-R, while candidates (c) and (d) fail to meet the RED-size constraint.

3 RED-size Motivated Null-Parse

Generally, nouns cannot augment RED-size either through prefix overcopying or suffix copying. Similarly, bare monosyllabic verbs cannot be augmented because there are neither prefixes nor suffixes to be copied. Consequently, such subminimal stems simply fail to reduplicate leading to a null parse. The concept of a null parse or a null output (Prince & Smolensky, [1993]) refers to cases in which the input lacks an output. This is premised on the concept of 'absolute ill-formedness': if a form is likely to result in absolute 'ungrammaticality', then the grammar of the language will block it from appearing on the surface during input-output mapping. The following monosyllabic verb and nouns stems fail to reduplicate, consequently, the inputs have no outputs, resulting in a null parse. Note: /xu-infinitive 'to', /ci-/ class 10, /li-/ class 5 noun prefix.

(27) Null-parse of sub-minimal noun and verb stems

	INPUT	OUTPUT	GLOSS	EXPECTED	UNATTESTED FORMS
i	/xu:-sj-a/	[xu:sja]	'to grind'	*[xu:sja xusja]	*[xu: sja sja]
ii	/xu:-lj-a/	[xu:lja]	'to eat'	*[xu:lja xulja]	*[xu: lja lja]
iii	/ci-xu/	[cixu]	'firewood'	*[cixu cixu]	*[ci xu xu]
iv	/li-ru/	[liru]	'an ear'	*[liru liru]	*[li ru ru]

The foregoing data reveal that there is no copying of the prefix even when the stems are sub-minimal in size (are monosyllabic), they simply fail to reduplicate because they are in violation of RED=PRWD. Furthermore, the semantics of the resultant RED forms must have clear meaning in the grammar of the Lubukusu language. However, in these data neither the monosyllabic noun stem nor the bisyllabic noun stem has any known tenable meaning in Lubukusu when reduplicated. This is one aspect of the concept of 'absolute ill-formedness'.

In an OT analysis, it is assumed that any input must have an output in whatever form as demanded by the input-output constraint, MAX-IO. The constraint proposed by Prince and Smolensky (1993) is MORPHEME PARSE (M-PARSE) which requires that every morpheme in the input is parsed or has a correspondent in the output which has been dubbed 'the structural realization of morphological properties'. This constraint also demands that every morpheme in the base has a correspondent in the reduplicant. The M-PARSE is low ranked in the hierarchy below RED=PRWD and ALIGN-R because the prefix is not incorporated into the stem to add an extra syllable as shown in the following tableau.

(28a) /li-RED-ru/ → [liru] → *[liru liru]

	/li-RED-ru/	MAX-BR$_{ROOT}$	RED=PRWD	ALIGN-R	M-PARSE
a	☜[liru liru]			*	
b	[ru ru]	*!	*		

Tableau (28a) fails to yield any attested optimal form in Lubukusu because candidate (a), as was seen in the data on null parse, is not optimal nor is candidate (b). The true optimal candidate is the absent null output candidate represented as [⊙] in McCarthy and Wolf (2005) [31]. The null output is the candidate that violates the low ranking constraint which requires the parsing of the stem morpheme while satisfying all other constraints; the M-PARSE.

According to Prince and Smolensky (1993) and McCarthy and Wolf (2005) [31], the null output is ideally a member of every candidate set represented as the null parse that consisted of a segmental string without prosodic structure. On this interpretation, the null output; ([⊙]) is always among the candidates emitted by GEN based on freedom of analysis encoded in the Richness of the Base (ROTB). The null output is unmarked because it vacuously satisfies every markedness constraint in any constraint set. However, in terms of faithfulness, it is unfaithful for not parsing the input materials violating M-PARSE constraint as shown in the following tableau.

(28b) /li-RED-ru/ → [liru] → [⊙]

	/li-RED-ru/	MAX-BR$_{ROOT}$	RED=PRWD	ALIGN-R	M-PARSE
a	☞[⊙]				*
b	[liru liru]			*!*	
c	[ru ru]	*!	*		

Candidate (a), the null output, is optimal although it doesn't parse the morpheme as required by M-PARSE. However, this is the preferable output due to the 'absolute ungrammaticality' that may result if it is parsed. Similarly, in verbs, subminimal stems cannot reduplicate leading to a null parse. In other words, when nothing can be done to increase RED-size, ineffability results; the grammar of a language blocks underlying representations such as the grammar blocking insertion (Smith, 2012) [32]. Phonologically-conditioned ineffability (PCI) may surface when phonological constraints

block affixation such as reduplicative affixation. The ineffable candidate lacks an underlying representation and so satisfies the faithfulness constraints, vacuously thus satisfying some phonological markedness (*PHON) trivially by having gaps.
The verbal data below also shows that regardless of the syllables in the stem base, the RED is invariably bisyllabic as if the RED has to fit into some predetermined reduplicative template (Downing, 2000; Zuraw, 2003; Urbanczyk, 2004) [33, 34].

(29) Bisyllabic canonical REDs

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED
i	/tim-il-a/	[timila]	run with	[tima timila]	*[timila timila]
ii	/lom-el-an-a	[lomelana]	speak for e.o	[loma lomelana]	*[lomela lomelana]
iii	/inul-a/	[inula]	lift up	[i nula nula]	*[inula inula]
iv	/uj-isj-an-a/	[ujisjana]	move e.o.	[u jisja jisjana]	*[ujisjana ujisjana]

In (i), the root is [tim-a] and the RED is a complete copy of the base. In (ii), the root is also bisyllabic, [lom-a]. However, in (iii), the root word is trisyllabic but because REDs require onsets, there is infixation of RED in [i.nu.la] but in (iv), the root is also bisyllabic [uja]. In Lubukusu, the concept of shape invariance seems to be the case and the invariant RED shape, according to Downing, may be explained by two complementary constraints; RED=FOOT (RED=FT) and FOOT-BINARY (FT-BIN), the latter constraint subsumes two others; FOOT-MINIMALITY (FT-MIN) and FOOT-MAXIMALITY (FT-MAX). RED=FOOT (RED=FT) as a constraint, requires that the RED string is coextensive with a foot (the RED string is associated with the weight bearing elements of a foot).

On the other hand, FOOT-BINARY (FT-BIN) requires that the feet are minimally and maximally bisyllabic (Downing, 2000, 2006a, 2006b; Kager, 1999) [15, 16]. The notion of a foot is based on the categories that build up the prosodic hierarchy with the syllable/ mora at the base, followed by the foot which is made up of one to two syllables. Because of variation in foot length (or weight), the inclusion of binarity is essential in ensuring that the RED is actually a bisyllabic or bimoraic word form. The prosodic word is assumed to be minimally bisyllabic but the upper limit is language specific. Ranked above the MAX-BR, the effect of the FT-BIN plus ONSET requirement is that the RED will be minimally bisyllabic regardless of the base.

(30) /i-RED-nul-a/→ [i nula nula], /RED-lom-el-an-a/ → [loma lomelana]

	/i-RED-nul-a/	CODA	FT-BIN	ONSET	MAX-BR	ALIGN-L
a	☞[i nula nula]				*	*
b	[inula inula]			*!		
c	[i nu nula]		*!		**	*
	/RED-lom-el-an-a/					
a	☞[loma lomelana]				*	
b	[lomelana lomelana]			*!		
c	[lom lomelana]	*!	*		***	

The requirement of FT-BIN in conjunction with MAX-BR (μ) ensures that monosyllabic candidates such as (c) are ruled out. In addition, candidate (c) of [lom] has gratuitous violations of the undominated *CODA in not copying enough of the base materials. The FT-BIN ensures that the resultant RED is minimally and maximally bisyllabic. However, polysyllabic roots reduplicate fully contrary a bisyllabic reduplicative templatic argument.

The RED in Lubukusu emerges in the form that is assumed to be unmarked: the bisyllabic canonical prosodic word. However, because in OT constraints are violable, the bisyllabicity requirement can be violated minimally if well-motivated. This explains why in the analysis so far, the shape invariance for the RED has been RED=PRWD rather than RED=FT or FT-BIN both of which may rule out trisyllabic or polysyllabic REDs resulting from of long roots.

(31) Reduplication in trisyllabic and polysyllabic roots

	INPUT	OUTPUT	GLOSS	REDUPLICATION	*UNATTESTED
i	/kaβ-ana/	[kaβana]	share(v)	[kaβa kaβ-ana]	*[kaβana kaβ-ana]
ii	/kaβula/	[kaβula]	divide	[kaβula kaβula]	*[kaβa kaβula]
iii	/βukula/	[βukula]	take	[βukula βukula]	*[βuka βukula]
iv	/koloŋgola/	[koloŋgola]	remove all	[koloŋgolakoloŋgola]	*[kola koloŋgola]

The above data show that the RED may be bisyllabic if the root is bisyllabic but not so if the root is trisyllabic or polysyllabic CV shape. The entire root must be reduplicated if it meets markedness constraints such as ONSET and other faithfulness constraints such as MIC, MAX-BR_{ROOT}, RED=PRWD. MIC requires that reduplication is by morphemes (no splitting of morphemes). MAX-B_{ROOT} requires that the entire root in the base is reduplicated but may be violated if the root begins with a vowel due to ONSET. RED=PRWD requires that the RED is co-indexed with a prosodic word; the root is a prosodic word if minimally bisyllabic.
It follows from the above observations that the constraint RED=PRWD demands that minimally the RED is bisyllabic but maximally, it may be longer if constrained by constraints such as MIC. Due to the MIC constraint, the RED must copy

the entire root however long but without including any suffix materials. The final ranking for the emergence of the unmarked prosodic word is as follows: CONTRAST, MIC, CONTIG-BR,*CODA ≫MAX-BR$_{ROOT}$, ≫RED=PRWD, FT-BIN, ONSET ≫ MAX-BR, ALIGN-L.

The constraints relevant for the current input /kaβula/ 'divide' are shown as in tableau (33). ONSET is left out of the tableau because the input has well-formed onsets. MIC, *CODA and MAX-BR$_{ROOT}$ are excluded for now because they have the same effects as RED=PRWD in ensuring that the root morpheme is not split to satisfy FT-BIN.

(32) /RED-kaβula/ → [kaβula kaβula] 'divide'

	/RED-kaβula/	CONTRAST	CONTIG	RED= PRWD	FT-BIN	MAX-BR	ALIGN-L
a	☞[kaβula kaβula]				*		
b	[kaβa kaβula]	*!		*		*	
c	[kala kaβula]		*!	*		*	
d	[la kaβula]			*!	*	**	*

The optimal candidate (a) violates only one constraint: FT-BIN, but satisfies all the high-ranked constraints especially the RED=PRWDs. Candidate (b) fails because it copies just the first two syllables to meet FT-BIN a violation of RED=PRWD, and also contrast neutralization in [kaβa] 'give out' a violation of CONTRAST. Candidate (c) skips some material in the base violating the undominated CONTIG-BR requiring REDs to consist of contiguous substring of the base. Finally, candidate (d) undercopies the base leading to multiple violations of four constraints. In summary, we evaluate the efficacy of our analysis in the light of the TETU ranking schema.

At this juncture, it is necessary to determine how these constraints are in accord with the proposed TETU ranking schema (McCarthy & Prince, 1994, 1999, 2004) [1, 2, 3] as follows;

(33) Skeletal Ranking for the Emergency of the Unmarked (McCarthy & Prince 1994,, 1999) [1]

Schema:	I-O Faithfulness	≫ Phono-Constraint	≫ BR Identity.
Instantiation:	CONTRAST	≫ ONSET	≫ MAX-BR (for CV syllables).
Instantiation:	CONTRAST, MIC	≫ RED=PRWD, FT-BIN	≫ MAX-BR (for [CV.CV] Prwd).

This ranking of constraints in Lubukusu mirrors the universal TETU ranking. It appears the emergence of the bisyllabic RED is due to RED=PRWD, FT-BIN 'emerging' as the decisive constraint for the unmarked prosodic word, so long as the undominated CONTRAST and MIC constraints are not at risk of violation (no partial copying of a polysyllabic stem or contrast neutralization). In so doing, there may be violation of the low ranking constraints such as MAX-BR by not copying the inflectional suffixes once the RED is bisyllabic, or misaligning the RED and base to avoid a vowel initial stem (given a trisyllabic base). The schema fully accounts for the emergence of the unmarked prosodic [CV] syllables and [(C) CV. (C) CV] prosodic words.

4 The Unmarked Segmental Types

In a number of languages, only the unmarked segments may be used as epenthetic sounds and during neutralization processes, only the unmarked segments seem to emerge (de Lacy 2002) [35]. Generally, it has been reported that in terms of place of articulation markedness, the coronals are less marked than either the labials or the dorsals (Prince and Smolensky 1993; de Lacy 2002, 2004, 2006) [5, 35]. For example, de Lacy (2006) argues that epenthetic segments across languages have either the coronal or glottal place of articulation and are rarely dorsals ([k, ɡ, x, ŋ]) or labials ([p, b, m]). The glottal sound is argued to be the most unmarked; for example, in English, it is frequently epenthesized in place of other consonants and it emerges in neutralization. In Lubukusu therefore, the use of the palatal glide in epenthesis receives some credence from the place of articulation markedness perspective. Lombardi (1998, 2002) [38, 40], Prince (1999) [2] and de Lacy (2006) propose a universal markedness hierarchy for the major place of articulation as follows;

(34) Major place of articulation markedness hierarchy (Lombardi 1998; de Lacy 2006) [38]

Dorsal — Labial — Coronal — Glottal

Most marked — Least marked

From the markedness scale, it could be deduced that in Lubukusu, the glide is the epenthetic consonant because the language has no glottal sound and, as such, the coronal glide should be the preferred epenthetic segment. Studies of multiple languages by de Lacy (2006) indicate that there are conflicting markedness hierarchies such that there is nothing like the 'least marked consonant'. Rather, there is a range of 'least marked consonants' dependent on the language's constraint ranking. The 'least' marked sounds are [ʔ, h, t, r, ɹ, j, w] in epenthesis via interaction between place of articulation and sonority hierarchies on one hand, and assimilation on the other.

Features that favour epenthesis may also favour neutralization; default epenthesis produces glottals and coronals while place of articulation assimilation tend to neutralize to the glottal or coronal place. Based on place of articulation markedness scale, some constraints have been proposed (Prince, 1999 and de Lacy 2006) [2] which are output markedness constraints for the major place of articulation. These are; *DORSAL (*DOR), *LABIAL (*LAB), *CORONAL (*COR) and

*GLOTTAL (*GLO). Conversely, the faithfulness constraints for the major place of articulation are: IDENT-IO (DOR), IDENT-IO (LAB), IDENT–IO (COR) IDENT-IO(GLO). In terms of markedness, *DOR *LAB outranks *COR ruling out these two as epenthetic segments.

In the data on onset-driven epenthesis, it was reported that a glide may be inserted in the stem to provide an onset to the stem for reduplication to take place. This phenomenon is pervasive cross linguistically. Alderete *et al.* (1999) [47], among others, have identified specific epenthetic segments. In Bantu languages, the [a] is said to be the unmarked canonical verb final vowel (Mutaka & Hyman 1990; Odden 1996 [46]; Downing 1999, 2000; Mutonyi 2000; Wasike 2004; Marlo 2007) [13, 19, 24, 43] and markedness explanations have been invoked. In verb stems of more than two syllables, the RED ends in the canonical verb final vowel [a] regardless of the analogous vowel in the stem base.

4.1. The Unmarked Epenthetic Consonant [j]

In Lubukusu, only the palatal glide is used as epenthetic consonant to provide an onset to the base to allow for reduplication to take place. The following data depicts this process.

(35) Onset motivated epenthesis of the glide [j]

	INPUT	OUTPUT	GLOSS	REDUPLICATION	UNATTESTED FORMS
i	/-ixa/	[ixa]	descent	[jixa jixa]	*[ixa ixa]
ii	/-ima/	[ima]	stand up	[jima jima]	*[ima ima]
iii	/-ora/	[ora]	bask	[jora jora]	*[ora ora]
iv	/-iŋga/	[iŋga]	tighten	[jiŋga jiŋga]	*[iŋga iŋga]

In the data, the epenthetic glide [j] is inserted before the stem initial vowel to provide an onset to the initial vowel base to support reduplication. In the previous analysis (§2), two conflicting constraints were particularly relevant for the repair mechanism to avoid the vowel initial stem, these are ONSET and DEP-BR. The former demand an onset in both the RED and base stem while the latter prohibit epenthesizing of segments not present in the input. This conflict results in glide epenthesis based on the ranking ONSET ≫ DEP-BR. Also, a markedness constraint favouring the epenthesis of a coronal is added in the table to rule out the use of non-coronals; *DOR *LAB *COR in the following tableau leaving out *GLO which is unattested in Lubukusu.

(36) /RED-ora/ → [jora jora] 'bask repeatedly'

	/RED-ora/	CONTRAST	ONSET	*DOR	*LAB	*COR	DEP-BR
i	☞[jora jora]					*	*
ii	[ora ora]		*!				
iii	[kora kora]	*!		*			*
iv	[βora βora]	*!			*		*

There are other constraints involved such as CONTIG-BR, MIC, PARCONT and MORPH-DIS relevant in the evaluation of the optimal candidate. However, not all these constraints may be relevant for every input. In the discussion of the concept of TETU, there is an assumption that the responsible constraint is not actually top ranked in the language. The implication of this assumption is that ONSET and *COR are in fact dominated constraint. The general phonology of Lubukusu has stems without onsets but in reduplication such stems are considered marked because ONSET 'emerges' and selects as optimal candidate form with an onset. The fact that onsetless syllables are licit in the general grammar means that some faithfulness constraints such as CONTRAST, MAX-IO among others dominate ONSET. Cases that defy ONSET requirements and those that defy epenthesis indicate the context when ONSET is dominated in reduplication but still emerge to determine the optimal candidate as in the following data.

(37) Failure of [j] epenthesis/Optimal onsetless syllables

	INPUT	OUTPUT	GLOSS	REDUPLICATION	EXPECTED
i	/o:ja/	[o:ja]	seduce	[o:ja o:ja]	*[jo:ja jo:ja]
ii	/e:sja/	[e:sja]	be pregnant	[e:sja e:sja]	*[je:sja je:sja]
iii	/a:ja/	[a:ja]	hunt	[a:ja a:ja]	*[ja:ja ja:ja]
iv	/u:ja/	[u:ja]	migrate	[u:ja u:ja]	*[ju:ja ju:ja]

These examples show that if epenthesis is not possible, the stems may be reduplicated without an onset but this is occurs in very limited context to preserve contrast between short and long vowels. Note that long vowels are in fact bimoraic. The expected but ill-formed outputs in the data are cases that could potentially neutralize meanings contrast in the language. In (ii), the form [je:sja] 'to bend something' is in contrast with the input form which means 'to become pregnant'. In (iii), the form [ja:ja] 'grab greedily' is in contrast with the input [a:ja] 'hunt' and finally in (iv), the form [ju:ja] 'hurry up' contrasts with [u:ja] 'migrate'. The insertion of the glide [j] must be blocked to maintain the underlying contrast in the outputs as shown below.

(38) /RED-u:ja/ → [u:ja u:ja] 'migrate repeatedly/frequently'

	/RED-ora/	CONTRAST	ONSET	*DOR	*LAB	*COR	DEP-BR
a	☞ [u:ja u:ja]		*				
b	[ju:ja ju:ja	*!				*	*
c	[ku:ja ku:ja]	*!		*			*
d	[βu:ja βu:ja]	*!			*		*

However, whether the above REDs are indeed without an onset is a matter of debate. Some linguists (Mutonyi 2000; Wasike 2004; Marlo 2007) [24, 43] have argued that the reduplicants which seem to lack onsets have 'ghost' consonants based on comparative studies of Bantu syllable typology. Therefore, if reduplication cannot take place with onsetless syllables, it is assumed that the cases in (39) have ghost segments so they can reduplicate. This remains an outstanding issue.

It can be deduced from the examination of the data on presumed failure of epenthesis in data (39) is that the specific faithfulness constraint prohibiting consonant epenthesis is CONTRAST which dominates ONSET. ONSET constraint emerges only in cases where contrast is not at stake or both optimal and competing candidate satisfy it. The final ranking of the three constraints mirror the TETU ranking schema instantiated as follows; CONTRAST ≫ ONSET ≫ DEP-BR. In this analysis, the palatal glide is argued to be the unmarked epenthetic segment of Lubukusu from the place of articulation markedness scale because it is used in both reduplication (to provide an onset) and in hiatus resolution (to break hiatus involving initial front high vowel, Wasike, 2004) [24].

4.2 The Unmarked Verb Final Vowel [-a]

Besides the palatal glide as the unmarked epenthetic segment, all reduplicants invariably end in the canonical stem final vowel [-a] regardless of the vowel in the base. From the data on the applicative, perfective, causative and the reciprocal verbal inflections, the second syllable may not necessarily be the [a] in the base stem.

(39) Verbal Inflections with [a] in RED but not base

	INPUT	OUTPUT	GLOSS	REDUPLICATION	EXPECTED RED
i	/xu-cile/	[xucile]	we went	[xucila cile]	*[xucile cile]
ii	/kendela/	[kendela]	walk with	[kenda kendela]	*[kende kendela]
iii	/kwilisja/	[kwilisja]	cause to fall	[kwila kwilisja]	*[kwili kwilisja]
iv	/fukilana/	[fukilana]	cook for e.o.	[fuka fukilana]	*[fuki fukilana]

The RED invariably ends in a low vowel [a]. Among Bantu languages, it has been proposed that the unmarked verb final vowel is the [a] (Mutaka and Hyman 1990; Downing 2000; Mutonyi 2000; Marlo 2007) [13, 19, 29, 43]. In OT, the requirement is recast into a markedness constraint that ensure stems end in the low open vowel [a] except for the subjunctive. Mutonyi (2000) [13] refers to this constraint as Canonical Final Vowel [-a] while Downing (2000) [29] calls it Inflectional Final Suffix (IFS) [-a] based on Bantu roots which are assumed to be [CVC] when bisyllabic and the [-a] is added during the derivation by default rule to [CVC-V] → [βal-a] 'count', (to use the rule-based analogy). It is also referred to as stem final [-a] in Bantu inflectional morphology studies. As a constraint, it demands that every verbal reduplicant ends in a stem final vowel [-a].

(40) /xu-RED-kwile/ → [xukwila kwile] 'we fell repeatedly'

	/xu-RED-kwile/	RED=PRWD	MAX-BR$_{ROOT}$	ALL-σ-LEFT	MAX-BR	ALIGN-R
a	☞[xukwila kwile]			6		
b	☞[xukwile kwile]			6		
c	[xukwile xukwile]			15!		**
d	[xukwila xukwile]			15!		**
e	[xu kwa kwa]	*!		1	**	

It is apparent that in tableau, candidates (a) and (b) tie in violations yet the form that is the actual optimal candidate is (a). The constraint STEMF[a] is required and must be ranked at least higher than the IDENT-BR but because this is a TETU constraint (which is low-ranked but emerges to determine the winner that is unmarked), it must not be undominated. Secondly, because the subjunctive verb stems end in mid vowel [e], STEMF[a] is dominated by faithfulness constraint.

Finally, because alignment constraints are not violated if features in segments are altered or changed, ranking STEMF[a] together with alignment should be optimal so long as it is above IDENT-BR hence the ranking should be as follows; RED=PRWD ≫ ALL-σ-LEFT, STEMF[a] ≫ MAX-BR, ALIGN-R, ≫ IDENT-BR. In the following tableau, MAX-BR$_{ROOT}$ which is not violated by any candidate in the preceding tableau is omitted for purposes of space.

(41) /xu-RED-kwile/ → [xukwila kwile] 'we fell repeatedly'

	/xu-RED-kwile/	CONT	RED=PRWD	ALL-σ-LEFT	STEMF[a]	MAX-BR	ALIGN-R	IDENT-BR
a	☞[xukwila kwile]			6				*
b	[xukwile kwile]			6	*!			
c	[xukwile xukwile]			15!			**	
d	[xukwila xukwile]			15!			**	
e	[xu kwa kwa]		*!	1		**		

In tableau, the constraint STEM-FINAL[a] is crucial in determining the optimal candidate between candidates (a) and (b). However, besides invoking the concept of TETU, what phonological reasons or phonetic grounding that make the [a] a canonical verb final vowel?

Clements and Hume (1995) [41] argue that vowels and consonant should share place nodes or place of articulation feature values in feature geometry, then a low vowel [a] would be considered a pharyngeal. It is therefore an unmarked segment in terms of place of articulations because pharyngeals and glottals are considered the least marked in terms of place of articulation (Lombardi 2002; de Lacy 2006) [40]. Yet studies of other Bantu languages also show the front high vowel [i] to be the preferred epenthetic vowel. This has been observed in diverse Bantu languages such as SiSwati (Kiyomi and Davis 1992) [44], Shona (Beckman 1997) and Kikerewe (Odden 1996) [46]. If [a] is not phonologically a default vowel, then other factors should explain its fixed occurrence in reduplication. Mutaka and Hyman (1990) [19] postulate that morphological factors condition the occurrence of the fixed [a] in the RED.

Due to the interaction of morphology and phonology, Downing (2000) [29] also proposes that to account fully for the fixed stem final [a], one has to define the RED as a morphological constituent; the canonical stem which invariably ends in [a] vowel. Assuming that reduplication takes place by morphemes, MIC constraints would require that morphemes are not split. Based on the MIC argument, all the examples in the data should end in the canonical [a]. This is because all the different vowels in the base actually belong to a separate morpheme. For example [-i-] and [-e-] in [rum-il-a] 'send with' and [kend-el-a] 'walk with' belongs to the applicative suffix after the root morpheme. Therefore, copying these vowels would inevitably violate MIC.

Viewed from this perspective, the [a] might not necessarily be the unmarked vowel phonologically, but morphologically its occurrence is understandable if the RED is defined as a morphological verb stem as proposed by Hyman *et al*. (1999) [48] and Downing (2000) [29]. This view is lent weight by proposals in Yip (1998) [49] who posit that unmarked morphemes may be forced to appear in outputs when some constraints require a certain morphological category (e.g. suffix [a]), to have a particular phonological realization (the phonological features inherent in [a]).

Finally, how do the proposed constraints for both the unmarked epenthetic consonant (coronal palatal glide [j]) and Stem Final Vowel [a] mirror the universal TETU ranking schema?

(42) Skeletal Ranking for the Emergency of the Unmarked (McCarthy & Prince 1994, 1999) [1]

Schema:	I-O Faithfulness	≫ Phono-Constraint	≫ BR Identity.
Instantiation:	CONTRAST	≫ ONSET, *COR	≫ DEP-BR (for [j] epenthesis).
Instantiation:	CONTRAST	≫ ONSET, STEMF[a]	≫ DEP-BR (for verb final [a]).

5. Summary and Conclusion

Lubukusu reduplication confirms the OT concept of the emergence of the unmarked (TETU) in which the RED is clearly unmarked or less marked than the base which it copies. This is explained in terms of a low ranking markedness constraint that 'emerges' and selects the output that is the least marked as optimal. ONSET though dominated selects the RED that have onsets while FT-BIN alongside RED=PRWD selects the unmarked RED that qualifies as a prosodic word. No reduplication may take place if the base is monosyllabic or the resultant RED has no onset. To avoid onsetless syllables, the grammar may overcopy the prefix, use infixation or epenthesis to derive optimal CV REDs. In subminimal stems, the base may be augmented through prefix overcopying or incorporation of inflectional suffixes. The study has revealed that the prosodic word may be bisyllabic, but if the root is long enough, the entire root-base must be copied Similarly, the use of the coronal glide and stem final vowel as the default unmarked epenthetic and verb final segments respectively can be accounted for in the universal TETU ranking in an OT grammar. Any emergent markedness constraint characterizes the default distribution, in this case, CV syllables and bisyllabic prosodic words of Lubukusu may be said to be the default. The universal TETU ranking of constraints in Lubukusu is able to yield unmarked prosodic structures. However, there are few outstanding issues that remain indeterminate and warrant further research. It is not absolutely certain that the verb final [a] is unmarked; it may simply be a case of fixed segmentism. The use of [i] for epenthesis in many languages makes this argument plausible. Similarly in other studies (Mutonyi, 2000) [13], the dorsal [k] has been used as epenthetic consonant outside reduplication casting doubt on the coronal unmarkedness status of [j]. Future studies should focus on unravelling the basis for these counter examples.

6. References

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