New Evidence for a Phonological Stem Domain in Kinande

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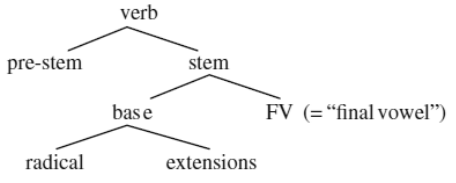
1. Morphological and Phonological Stems in Bantu

The verb in Bantu is a highly complex structure, in which long sequences of morphemes are not at all uncommon. However, as has long been recognized, these morphemes do not all belong to a single monolithic domain. Instead, they divide into two main groups: those that lie within the **verb stem** – i.e. the **root**, the **final vowel**, and any intervening **extension** suffixes – and those that lie outside of it.[1] This division, abstractly schematized in (1), is exemplified with a verb from Kinande in (2).[2]

(1) Simplified representation of the Bantu verb, from Hyman (2009)



(2) mó-tw-a-ná-má-bi-ya-mu-[hum-irír-a]$_{\textbf{Stem}}$
FOCUS-1PS-PAST-AFFIRMATIVE-IMMEDIATE-COMPLETIVE-GO-3SO-[HIT-PURPOSIVE-FV]$_{\text{Stem}}$
'we just now went to hit him on purpose'

The division between stem and pre-stem domains plays a pervasive role in Bantu phonology: disparate processes (e.g. reduplication, vowel harmony, tone assignment, etc.) in many languages care about whether phonological material lies within the stem or not (Myers 1987; Mutaka and Hyman 1990; Mutaka 1994). However, in a few Bantu languages, sensitivity to the stem *vs.* pre-stem divide carries an interesting twist: root-initial vowels which lie at the *beginning* of the stem are treated for phonological purposes as if they lie *outside* of it (Downing 1994, 1998, 1999, 2000).

One example that has been extensively discussed in the literature involves verbal reduplication in Kinande (Mutaka and Hyman 1990; Downing 2000). In this process, a disyllabic reduplicative prefix (RED) is added to the stem in order to convey a sense of repetitive or haphazard action. As is quite common in Bantu, this RED acquires its segmental content by copying material from the verb stem. The exact material that it copies, however, depends on whether the stem begins with a consonant or with a vowel. When the stem begins with a consonant (3a-e), RED copies as much as it can fit within two syllables while also conforming to **a)** a requirement that only contiguous substrings of the stem be copied and **b)** the Morpheme Integrity Constraint (MIC: Mutaka and Hyman 1990), which states that no part of a morpheme can be copied unless all of it is. The result is that RED in forms with consonant-initial stems always contains a full copy of the root, a full copy of whatever suffixes it can fit, and, if necessary, a default vowel *-a*, which appears whenever material copied from the stem is not

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[1] Many Bantu languages, Kinande included, are also sensitive to a "macrostem" domain made up of the verb stem and a preceding object prefix. For reasons of space, however, this domain will not feature in the discussion here.

[2] 1PS = 1st plural subject; 3SO = 3rd singular object; FV = final vowel

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enough to fill two syllables (cf. Downing 2000 for discussion). However, a rather different pattern is observed in forms whose stems begin with a vowel. When these forms reduplicate (3f), copying begins not with the first segment of the stem but with the second (i.e. the first consonant), so that RED contains only a partial copy of the root, in violation of the MIC.[3,4] This result is quite odd, especially since these forms might easily have copied their entire roots into RED: *ery-ombola* (3f), for example, might have reduplicated not as *ery-o[mbola]*$_{RED}$*mbola* but as **ery-[ombol]*$_{RED}$*ombola*. Since the entire root could fit within RED, why is its initial vowel excluded, in violation of the MIC?

(3) Kinande verbal reduplication

a.	eri-[sw-a]$_{Stem}$	'to grind'	eri-[swaswa]swa	full stem copied twice
b.	eri-[sw-er-a]$_{Stem}$	'to grind for'	eri-[swera]swera	full stem copied
c.	eri-[hum-a]$_{Stem}$	'to hit'	eri-[huma]huma	full stem copied
d.	eri-[hum-w-a]$_{Stem}$	'to be hit'	eri-[humwa]humwa	full stem copied
e.	eri-[hum-ir-a]$_{Stem}$	'to hit for'	eri-[huma]humira	full root copied, + *-a*
f.	ery-[ombol-a]$_{Stem}$	'to filch'	ery-o[mbola]mbola	*partial* root copied, + *-a*

Downing (2000) argues that the reason why root-initial vowels fail to copy is that the domain of reduplication in Kinande - i.e. the maximal domain from which material can be copied into RED - is not the morphologically-defined stem (or "MStem") but rather a prosodically-defined "PStem" which systematically excludes MStem-initial vowels; according to this analysis, stem-initial vowels simply do not occur in a context where they can be copied. This approach follows work by Selkirk (1986) and Inkelas (1989) which argues that phonological processes cannot refer directly to morphological domains, but only to prosodic domains which are derived from them. In Downing's OT implementation of this approach, prosodic domains are derived through constraint ranking: faithfulness constraints demanding that prosodic domains be faithful to their corresponding morphological domains are ranked against markedness constraints which impose surface conditions on the prosodic domains themselves. The PStem, therefore, is derived through a ranking like that in (5): Max-MP (4a), which requires that every segment in the MStem have a corresponding segment in the PStem, is dominated by Onset-PStem (4c), which requires the left edge of the PStem to be aligned with a syllable onset.

(4) Markedness and Faithfulness constraints governing MStem-PStem alignment

a. Max-MP	Each MStem-internal segment α must correspond to some PStem-internal segment α′.
b. Dep-MP	Each PStem-internal segment α′ must correspond to some MStem-internal segment α.
c. Align(L, PStem, L, σ) = Onset-PStem	The left edge of the PStem is aligned to a syllable onset.

(5) Derivation of the PStem in Kinande

	eri-[ombola]$_M$	Onset-PStem	Dep-MP	Max-MP
a	ery-[ombola]$_P$	*!		
b	er[y-ombola]$_P$		*!	
c	☞ery-o[mbola]$_P$			*

With the PStem thus defined, it can be incorporated quite directly into phonological analyses by means of constraints which refer to it. My own analysis of why stem-initial vowels fail to reduplicate, for example, is that the high-ranking constraint RED-in-PStem (6b) requires RED, which I assume

[3] This description has one very important exception: forms whose stems consist only of a VC root and a final vowel. These forms are discussed in section 3.2.

[4] Complementing the difference in what RED copies is a difference in where RED is placed: in forms with consonant-initial roots RED surfaces as a prefix to the stem, but in forms with vowel-initial roots it surfaces as an infix sandwiched between the root's first vowel and the root's first consonant. I analyze this latter difference as a secondary effect of the former, and for reasons of space do not discuss it here.

falls within the MStem[5], to fall entirely within the PStem as well. When ranked above the MIC (6a), this constraint ensures that RED will never copy a stem-initial vowel; if it did, it would not fall entirely within the PStem.[6] This is illustrated below in (7).

(6) Two prominent constraints involved in Kinande verbal reduplication

a. MIC	If any segment in a morpheme μ has a correspondent in RED, then all other segments in μ must also have correspondents in RED
b. RED-in-PStem	RED must fall entirely within the PStem.

(7) RED-in-PStem motivates omission of the stem-initial vowels from RED

	eri-[ombola]$_M$ + RED	Red-in-PStem	MIC
a	ery-[o|mbol]$_{RED}$ombola	*!	
b	☞ery-o|[mbola]$_{RED}$mbola		*

To date, the fact that the PStem allows for a straightforward analysis of verbal reduplication has been the most compelling reason for believing that the PStem plays a role in Kinande phonology. That being the case, it is prudent to question whether the PStem is truly a necessary feature of Kinande phonology as a whole, and not simply a convenient means of analyzing reduplication. In this paper, I present new evidence that it is necessary. In section 2, I show that the PStem is relevant to at least three processes other than reduplication, and that deriving its effects separately for each of them is both clumsy and unexplanatory. However, I will also argue (contra Downing, Selkirk, and Inkelas) that the PStem is not the only "stem-level" domain to which the phonology can refer: there are processes that require direct reference to the MStem in Kinande, so we must regard the PStem not as a replacement for the MStem, but rather as an additional domain that exists in parallel with it.

2. Three New Arguments for a Phonological Stem in Kinande

In this section, I discuss three processes in Kinande which, like verbal reduplication, treat stem-initial vowels as if they fall outside of the stem: Intonational Tone Assignment (2.1), Lexical Tone Assignment (2.2), and Purposive Suffix Affixation (2.3). I show that each of these processes may be analyzed in a straightforward manner within OT, provided that the constraints which govern them are permitted to make reference to the PStem.

2.1. Intonational Tone Assignment

Kinande infinitives, like most words in the language, are always assigned two intonational tones in utterance-final position: H% and L$_{//}$ (Hyman 1990). However, the way in which these two tones are realized in infinitives varies according to root shape. Infinitives whose roots are CVC or larger show the **canonical** pattern of intonational tone, in which H% is realized on the penult and L$_{//}$ is realized on the ultima (8). Those with roots smaller than CVC, however, show a **compressed** pattern, in which both H% and L$_{//}$ are realized on the ultima (9).

(8) Canonical Pattern of Intonational Tone: Penultimate H%, Final L$_{//}$

a.	*-hum-*	eri-húmà	'to hit'	(cf. erihuma Kahíndò 'to hit Kahindo')
b.	*-langir-*	eri-langírà	'to see'	(cf. erilangira Kahíndò 'to see Kahindo')

(9) Compressed Pattern of Intonational Tone: Final H%-L$_{//}$ Contour

a.	*-so-*	eri-swâ	'to grind'	(cf. eriswa Kahíndò 'to grind Kahindo')
b.	*-anz-*	ery-anzâ	'to love'	(cf. eryanza Kahíndò 'to love Kahindo')

[5] Downing (2003) proposes that RED is a stem in its own right, which combines with the MStem to form a larger Compound Stem (CStem). If this proposal is correct, then we can maintain the present analysis by deriving the PStem from the CStem instead of the MStem.

[6] For a far more detailed explication of this analysis, see Jones (2009).

In analyzing the canonical pattern, I follow Hyman in assuming that H% and $L_{//}$ are boundary tones that mark the right edges of the Phonological Phrase (PP) and Utterance (U), respectively; within an OT framework, this means they are subject to the constraints Align(H%) and Align($L_{//}$), which seek to align them to the right edges of their respective domains (10ab). In PP-final U-nonfinal position, these constraints do not conflict, and H% systematically appears at the right edge of its PP (11). In U-final position, however, the constraints *do* conflict: since the end of every U is also (by definition) the end of a PP, it is not possible for both H% and $L_{//}$ to be rightmost within their domains. Since $L_{//}$ surfaces rightmost and not H%, we can infer that Align($L_{//}$) dominates Align(H%). Moreover, since H% surfaces on the penult even though it could have remained on the ultima as part of a H%-$L_{//}$ contour, we can infer that a constraint against tonal crowding (10c) dominates Align(H%). The resulting constraint ranking, together with an illustration of its effects, is presented in (12) below.

(10) Alignment constraints for H% and $L_{//}$ boundary tones

a.	Align(H%)	H% is aligned to the right edge of a Phonological Phrase (PP). (One violation if H% is on the ultima, but not rightmost; two violations if H% is on the penult.)
b.	Align($L_{//}$)	$L_{//}$ is aligned to the right edge of an Utterance (U)
c.	*Crowding	No more than one tone per TBU (= vowel or glide)

(11) Rightward alignment of H% in PP-final, U-nonfinal contexts

a. [[erihumá]$_{PP}$ [ryowénè]$_{PP}$]$_{U}$ ‘to hit is good’
b. [[eryanzá]$_{PP}$ [ryowénè]$_{PP}$]$_{U}$ ‘to love is good’

(12) Align($L_{//}$), *Crowding » Align(H%)

	[[eri-huma]$_{PP}$]$_{U}$ H% $L_{//}$	Align($L_{//}$)	*Crowding	Align(H%)
a	erihùmá	*!		
b	erihumâ		*!	*
c	☞erihúmà			**

This analysis correctly derives the canonical pattern of intonational tone in all forms in which it appears. It does not, however, derive the compressed tone pattern observed in (9). As shown in (13), the same ranking of *Crowding above Align(H%) that is necessary in order to rule out ungrammatical **erihumâ* incorrectly rules out *eryanzâ* ‘to love.’

(13) Failure of the ranking in (12) to derive the compressed pattern of intonational tone

	eri-anza H% $L_{//}$	*Crowding	Align(H%)
a	☞eryánzà		**
b	💣eryanzâ	*!	*

Recalling that phonological processes in Bantu frequently distinguish between stem-internal and stem-external material, one might suppose that canonical tone is avoided in verbs with roots smaller than CVC due to a constraint requiring H% to be assigned within the stem. This constraint would correctly bar canonical tone in *eri-swâ* ‘to grind’ (9a), where a penultimate H% (**erí-swà*) would lie oustside of the stem *-swa*. However, the constraint would not bar canonical tone in *eryanzâ* ‘to love’ (9b), for a penultimate H% here (**ery-ánzà*) would occur within the stem, specifically on its first vowel. Since this vowel, though stem-internal, is still not a sufficient host for H%, the correct generalization concerning the assignment of H% is that it must be assigned within the *PStem*. Assuming that the PStem is a phonological domain to which phonological constraints can refer, I formalize this constraint quite directly as Domain(H%) (14). Ranking Domain(H%) above *Crowding correctly derives a final falling tone in *eryanzâ* (15), and more generally predicts the occurrence of compressed tone whenever canonical tone would place H% outside of the PStem.

(14) Domain(H%) H% must be assigned within the PStem

(15) Correct derivation of the compressed pattern of intonational tone

	eri-[anza]$_M$ H% L$_{//}$	Domain(H%)	*Crowding	Align(H%)
a	eryá[nzà]$_P$	*!		**
b	☞erya[nzâ]$_P$		*	*

2.2. Lexical Tone Assignment

Verb roots in Kinande fall into two main classes: tonic roots, which contribute an underlying H tone to the verb stem in which they appear, and non-tonic roots, which do not. Most of the forms we have encountered thus far have had non-tonic roots. In this section, I discuss forms with tonic roots, and how their underlying H tones are realized. The basic data are presented in (16) and (17). There, we see that the underlying H tone of a *consonant-initial* root is realized on the first syllable *before* the root, but that the underlying H tone of a *vowel-initial* root is realized on the first syllable *of* the root.

(16) Realization of lexical H in infinitives with tonic C-initial roots: H on 1st syllable *before* stem

a.	*-túm-*	'send'	erí-tuma mulímì	'to send a farmer'
			eri-yá-tuma mulímì	'to go to send a farmer'
b.	*-tá-*	'bury'	erí-ta mulímì	'to bury a farmer'
			eri-yá-tuma mulímì	'to go to bury a farmer'

(17) Realization of lexical H in infinitives with tonic V-initial roots: H on 1st syllable *of* stem

a.	*-ít-*	'kill'	er-íta mulímì	'to kill a farmer'
			eri-y-íta mulímì	'to go to kill a farmer'
b.	*-ómbol-*	'sneak (s.t.)	ery-ómbola kitsungù	'to sneak a potato'
			eri-y-ómbola kitsungù	'to go to sneak a potato'

Of these two tone patterns, the one seen in infinitives with V-initial roots is less surprising: since the root is the underlying source of H, there is an *a priori* expectation that it should host H on the surface. I formalize this expectation in the constraint Align(H, Root) (18a), which seeks to align H to the root's leftmost vowel. This constraint being established, the question then becomes: why doesn't H surface on the root's first vowel when the root begins with a consonant?

I propose that H fails to surface on the root's first vowel in forms with C-initial roots because in these forms the root's first vowel lies within the PStem, which, though the obligatory domain for H%, is a proscribed domain for H. That is, I propose that Align(H, Root) is dominated by Domain(H) (18b), which explicitly *forbids* H from surfacing PStem-internally. As shown in (19) and (20), this ranking correctly predicts the location of H in all forms. In forms with C-initial roots, where the stem-initial vowel lies within the PStem, Align(H,Root) is violated (minimally) in order to satisfy Domain(H). In forms with V-initial roots, where the stem-initial vowel lies outside of the PStem, Align(H,Root) and Domain(H) are not in conflict, so neither is violated.

(18) Alignment constraints for lexical H tone

a.	Align(H, Root)	H is aligned to the leftmost vowel of the root
b.	Domain(H)	H tone may not surface within the PStem

(19) Realization of H in infinitives with C-initial roots: Misalignment of H is necessary

	eri-[túma]$_M$	Domain(H)	Align(H, Root)
a	☞erí-[tuma]$_P$		*
b	eri-[túma]$_P$	*!	

(20) Realization of H in infinitives with V-initial roots: Misalignment of H is gratuitous

	eri-[ómbola]$_M$	Domain(H)	Align(H, Root)
a	éry-o[mbola]$_P$		*!
b	☞ery-ó[mbola]$_P$		

2.3. Purposive Suffix Affixation

The "purposive" suffix *-irir*, which signals that an action is performed intentionally or "on purpose," is just one of the many stem-internal extension suffixes that can appear in between the root and the inflectional desinence suffix. It stands out, however, as the only suffix that varies in length according to the size of the root: it appears as disyllabic *-irir* after "long" roots that are CVC or longer, but as trisyllabic *-ririr* after "short" roots that are smaller than CVC.

(21) Purposive suffix after root shaped CVC or longer: disyllabic *-irir*

a.	*-hum-*	eri-[húmà]$_{\text{Stem}}$	'to hit'	eri-[hum-**irír**-à]$_{\text{Stem}}$
b.	*-ambal-*	ery-[ambálà]$_{\text{Stem}}$	'to undress'	ery-[ambal-**irír**-à]$_{\text{Stem}}$

(22) Purposive suffix after root shaped shorter than CVC: trisyllabic *-ririr*

a.	*-lu-*	eri-[lwâ]$_{\text{Stem}}$	'to fight'	eri-[lw-**ririr**-à]$_{\text{Stem}}$
b.	*-anz-*	ery-[anzâ]$_{\text{Stem}}$	'to love'	ery-[anz-**ririr**-à]$_{\text{Stem}}$

There are two basic questions that any analysis of the purposive suffix must address. First, why does root length influence the shape of the purposive suffix? Second, why are VC roots considered short when the stems they form contain just as many syllables as stems formed from CVC roots?

Answering both of these questions at once, I propose that root size influences the shape of the purposive suffix because it determines whether or not there is any danger that the suffix might fall within the first syllable of the PStem, in violation of the constraint *Initial (23a). When the root is long, the purposive suffix always falls at least as far right as the PStem's second syllable. However, when the root is short, the purposive suffix will fall within the first syllable of the PStem unless some special measure is taken to prevent this. This special measure, I propose, is the epenthesis of a dummy morpheme *-ir* (whose segmental material is copied from the purposive suffix by constraints which I will not consider in any detail here) to the first syllable of the PStem, in violation of Dep(*morph*) (23b). As shown in (24), placing this dummy syllable into the first syllable of the PStem ensures that the purposive suffix itself, which is always disyllabic, is removed from the PStem's left edge.

(23) Constraints governing the realization of purposive forms

a.	*Initial	The purposive suffix must not be initial in the PStem
b.	Dep(*morph*)	Any output morpheme *morph´* must correspond to some input morpheme *morph*.

(24) Dummy syllable insertion avoids violation of *Initial when the root is smaller than CVC

	eri-[anz-irir-a]$_{\text{M}}$	*Initial	Dep(*morph*)
a	ery-a[nz-irir-a]$_{\text{P}}$	*!	
b	☞ery-a[nz-ir-irir-a]$_{\text{P}}$		*

(25) No insertion is necessary when the root is CVC or longer

	eri-[hum-irir-a]$_{\text{M}}$	*Initial	Dep(*morph*)
a	☞eri-[hum-irir-a]$_{\text{P}}$		
b	eri-[hum-ir-irir-a]$_{\text{P}}$		*!

2.4. Is Reference to the PStem really necessary?

As we have just seen, it is possible to arrive at very straightforward analyses of intonational tone assignment, lexical tone assignment, and purposive suffix affixation so long as the constraints which govern these processes (e.g. Domain(H%), Domain(H), *Initial) are allowed to make direct reference to the PStem. Can we arrive at equally straightforward analyses without such reference? I argue that we cannot. Consider, for example, a PStem-less analysis of intonational tone assignment.

The most attractive analysis of this sort, in my view, runs as follows. The assignment of H% is not explicitly restricted to the PStem, but rather to the morphologically-defined MStem. However,

H% is assigned not to vowels but to syllables, so that the requirement that H% must be assigned within the MStem is satisfied only if the entire syllable to which H% is assigned is MStem-internal. The problem with **eryánzà*, then, is that although H% falls on an MStem-internal vowel, it does *not* fall within an MStem-internal syllable, since the onset lies outside of the stem. Only the final syllable lies entirely within the MStem, so this is where H% must be assigned: *ery-anzâ*.

The problem with this analysis is that it relies upon the assumption, never explicitly stated in the grammar, that only syllables that are *completely* contained within the MStem should be treated as stem-internal. This is not a necessary fact, nor is it a cross-linguistically true fact: it is certainly not the case that all languages with stem-level processes ignore stem-initial vowels. Rather, the fact that only syllables that are completely contained within the MStem are considered stem-internal for phonological purposes is a property specific to Kinande, and must therefore be stated in the grammar.

One way to do this is to define a constituent that includes all and only syllables which are made up entirely of MStem-internal material, and then allow phonological constraints to make reference to it. This is exactly what the PStem-based analysis does. The alternative is to build in reference to syllables consisting solely of MStem-internal material into *each constraint* that appears to ignore stem-initial vowels. Domain(H%), for example, would need to state that H% must be assigned within the MStem, where "within the MStem" means "to a syllable that is fully contained within the MStem." Domain (H) would need to separately state that H must be realized outside of the MStem, where "outside of the MStem" means "not within a syllable that is fully contained within the MStem." *Initial would need to state that the purposive suffix cannot appear within the first syllable of the MStem, where "first syllable of the MStem" means "first syllable fully contained within the MStem." This is not only clumsy, but unexplanatory, for distributing the requirement that stem-level processes make reference only to syllables completely made up of MStem-internal material across all of these different constraints loses sight of the fact that in process after process, we see the *same* systematic divergence between the stem for morphological purposes and the stem for phonological purposes. It is better to codify this mismatch as a central fact in the phonology of Kinande, and give it an actual status in the grammar by means of the PStem.

3. Phonological reference to morphologically-defined domains

I have just presented evidence from three distinct processes (four, counting reduplication) that Kinande phonology makes crucial reference to the PStem. In this section, I discuss evidence that it also makes crucial reference to the MStem. This evidence is problematic for the view that phonology refers only to prosodic domains, and suggests that it can refer to morphological ones as well.

3.1. The MStem and the interaction between intonational and lexical tone

Thus far, though we have seen forms with intonational tone (H%) and forms with lexical tone (H), we have not seen any forms that show both at the same time. Such forms are shown in (26) and (27) below. As seen there, the way in which H interacts with H% varies according to stem shape. When the stem begins with a consonant (26), H always surfaces as a high tone, irrespective of the placement of H%. When the stem begins with a vowel, however, H surfaces as high only if there is at least one syllable between it and H% (27c); if H and H% fall on adjacent syllables, H surfaces as *falling* (27ab).

(26) Interaction of intonational and lexical tone in consonant-initial stems[7]

a.	erí-tâ	'to bury'
b.	erí-téra	'to bury for'
c.	erí-tereréra	'to bury on purpose'

(27) Interaction of intonational and lexical tone in vowel-initial stems

a.	ery-ôtâ	'to bask'
b.	ery-ôtérà	'to bask for'
c.	ery-ótereréràà	'to bask on purpose'

[7] The purposive suffix *-irir* appears with a mid vowel in these forms due to harmony with the root (Mutaka, 1995).

That H should be realized as a falling tone before H% - or, in other words, that a low tone should be epenthesized between H and H% - is not particularly surprising, since processes that prevent OCP-violating H-H sequences are found pervasively throughout Bantu. What is surprising, however, is that low tone epenthesis should take place only in forms with vowel-initial stems. Why should H-H% sequences be repaired in these forms, but not in forms whose stems begin with a consonant?

One promising basis of explanation is that H-H% sequences which *are* repaired (27ab) always lie entirely within the MStem, while H-H% sequences which are *not* repaired (26ab) straddle the MStem's left edge. Building upon this fact, I suggest that the OCP constraint which triggers low tone epenthesis does not penalize *every* H-H sequence, but only H-H sequences that lie within the MStem (28a). So long as the constraint is restricted in this way, it can be ranked above Dep(L) (28b) without creating falling tones in forms with consonant-initial roots. This is shown in (29) and (30).

(28) Constraints governing low tone epenthesis

a.	OCP(MStem)	No adjacent and distinct H tones within the MStem
b.	Dep(L)	Every output L must correspond to some input L

(29) Epenthesis of a low tone into a MStem-internal H-H% sequence

	eri-[ombola]$_{M}$ H% L$_{//}$	OCP(MStem)	Dep(L)
a	ery-[ómbólà]$_{M}$	*!	
b	☞ery-[ômbólà]$_{M}$		*

(30) No low tone epenthesis into H-H% sequence that is not MStem-internal

	eri-[tuma]$_{M}$ H% L$_{//}$	OCP(MStem)	Dep(L)
a	☞erí-[túmà]$_{M}$		
b	erî-[túmà]$_{M}$		!*

By adopting this analysis, we are able to account for the fact that H-H% sequences are subject to low tone epenthesis in forms with vowel-initial roots, but not in forms with consonant-initial roots. For present purposes, what is most important about this fact is that in order to correctly distinguish H-H% sequences which are subject to low tone epenthesis from those which are not, this OCP constraint must refer specifically to the *MStem*. It cannot refer to the PStem, for all H-H% sequences, regardless of whether or not they are subject to low tone epenthesis, relate to the PStem in the same way: they straddle its left edge. Thus, it cannot be the case that the PStem is the only stem-related domain to which the phonology refers.

3.2. Reduplication and the MStem

Further evidence that Kinande phonology must be able to refer to the MStem comes from verbal reduplication. Here, the argument is quite straightforward: the MStem is the maximal domain from which material can be copied into RED.

Given the preliminary discussion of reduplication in section 1, this claim may be somewhat unexpected: since we saw there that stem-initial vowels fail to copy, it seems more appropriate to say that the maximal domain of reduplication is the *PStem*. However, the discussion of reduplication in section 1 did not address a small but important set of forms: those with VCV stems consisting solely of a VC root and the final vowel. When these forms reduplicate, the stem-initial vowel *does* copy; in fact, the entire root copies twice in order to completely fill RED.

(31) Comparing reduplication in **a)** infinitives with VC roots and **b)** infinitives with VCVC roots

a.	ery-ota	'to bask'	ery-[otot]$_{RED}$ota	*ery-o[tata]$_{RED}$ta
b.	ery-ombola	'to filch'	ery-o[mbola]$_{RED}$mbola	*ery-[ombol]$_{RED}$ombola

As argued in Jones (2009), initial vowels of VCV stems copy due to an undominated constraint requiring at least one stem vowel *other* than the final vowel *-a* to be present in RED. What is most important for present purposes, however, is simply the fact that under the right conditions, material

outside the PStem can reduplicate.[8] By contrast, material outside the MStem *never* reduplicates. This is shown dramatically by the fact that when forms with CV and VC roots reduplicate, they fill the two syllables of RED not by copying any material from outside the MStem, but by copying material from within the MStem *twice* (32). If we are to capture the fact that material from outside the MStem is absolutely barred from copying, we must allow reference to the MStem in the phonology.

(32) Material outside of the MStem never copies into RED

a.	eri-mu-swa	'to grind him'	eri-mu-[swaswa]$_{RED}$swa	*eri-[muswa]$_{RED}$muswa
b.	eri-ya-swa	'to go to grind'	eri-ya-[swswa]$_{RED}$swa	*eri-[yaswa]$_{RED}$yaswa
c.	eri-na-swa	'to indeed grind'	eri-ya-[swaswa]$_{RED}$swa	*eri-[yaswa]$_{RED}$yaswa

4. Conclusion

In this paper, I have argued for two main points. First, following Downing, I have argued that Kinande phonology makes crucial reference to the PStem, a prosodic domain which is derived from the morphologically-defined MStem, but which crucially omits any MStem-initial vowel. Though the original motivation for the PStem comes from verbal reduplication, converging evidence for the PStem is found from three additional processes: intonational tone assignment, lexical tone assignment, and purposive suffix affixation. At the same time, however, I have argued that the PStem cannot be viewed as a *replacement* for the MStem in the phonology, for direct reference to the MStem is required both in order to account for the interaction of intonational and lexical tone, and in order to account for verbal reduplication. Kinande phonology, therefore, requires reference to both prosodic and morphological domains. Individual processes appear to be able to choose which type of domain to refer to, and further research is required in order to uncover by what general principles (if any) this choice is made.

References

Beckman, Jill (1999). *Positional faithfulness*: *An Optimality Theoretic Treatment of Phonological Asymmetries*. New York: Garland.

Downing, Laura J. (1994). SiSwati verbal reduplication and the theory of Generalized Alignment. Proceedings of NELS 24. 81-95.

Downing, Laura J. (1998). On the prosodic misalignment of onsetless syllables. *NLLT* **16**. 1-52.

Downing, Laura J. (1999). Prosodic stem ≠ prosodic word in Bantu. In Hall, T. Alan & Ursula Kleinhenz (eds.) *Studies on the phonological word*. Amsterdam: Benjamins. 73-98.

Downing, Laura J. (2000). Morphological and prosodic constraints on Kinande verbal reduplication. *Phonology* **17**. 1-38.

Downing, Laura J. (2003). Compounding and tonal non-transfer in Bantu languages. *Phonology* **20**. 1-42

Herman, Rebecca (1996). Prosodic Structure in SiSwati. *Ohio State University Working Papers in Linguistics* **48**. 31-55.

Hyman, Larry M. (1990). Boundary tonology and the prosodic hierarchy. In *The phonology-syntax connection*, ed. Inkelas, Sharon and Draga Zec, pp. 109-125. Chicago: University of Chicago Press.

Hyman, Larry M. (2009). The natural history of verb-stem reduplication in Bantu. *Morphology* **19**. 177-206

Inkelas, Sharon (1989). *Prosodic constituency in the lexicon*. PhD dissertation, Stanford University.

Jones, Patrick J (2009). The Phonological Stem in Kinande Verbal Phonology. Ms, MIT. [http://web.mit.edu/pjjones/www]

Mutaka, Ngessimo M. (1995). Vowel harmony in Kinande. *Journal of West African Languages* **25**. 41-55.

Mutaka, Ngessimo M. (1994). *The lexical tonology of Kinande*. Munich: LINCOM Europa.

Mutaka, Ngessimo & Larry Hyman (1990). Syllables and morpheme integrity in Kinande reduplication. *Phonology* **7**. 73-119.

Myers, Scott (1987). *Tone and the structure of words in Shona*. PhD dissertation, University of Massachusetts, Amherst.

Selkirk, Elizabeth (1986). On derived domains in sentence phonology. *Phonology Yearbook* **3**. 371-405.

[8] Downing (2000) proposes that the reason why the initial vowels of VCV stems reduplicate is that a condition on PStem minimality expands the PStem so that it includes them. According to this analysis, then, reduplication of VCV stems does not actually involve copying from outside the PStem. The problem with this analysis is that it predicts that the initial vowels of VCV stems should always be PStem-internal; the evidence discussed in section 2 shows clearly that this is not the case.

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