

VOWEL HARMONY IN KINANDE

Ngessimo M. Mutaka
University of Yaoundé 1

This article discusses the vowel harmony processes in Kinande: height harmony, coalescence, and ATR harmony. It is shown that height harmony in the verb stem together with coalescence in nouns are a stem level phenomenon, whereas coalescence in verbs that occurs with the tense marker *-jre* as in *mɔ́twáswere* /mɔ́-tu-a-sɔ́-jre/ 'we ground', *mɔ́twásángere* /mɔ́-tu-a-sangal-jre/ 'we were surprised', *mɔ́twahangéne* /mɔ́-tu-a-hangan-jre/ 'we stood up' is word level. ATR harmony is also extensively described and shown to occur both at the word level and the phrasal level.

Dans cet article l'auteur discute l'harmonie de hauteur, la coalescence et l'harmonie ATR comme processus d'harmonie vocalique en kinande. Il propose que l'harmonie vocalique de hauteur dans le thème verbal ainsi que la coalescence dans les noms sont des processus qui s'opèrent au niveau du thème et que la coalescence dans le verbe, provoquée par la finale *-jre* dans des exemples tels que *mɔ́twáswere* /mɔ́-tu-a-sɔ́-jre/ 'nous avons moulu', *mɔ́twásángere* /mɔ́-tu-a-sangal-jre/ 'nous étions surpris', *mɔ́twahangéne* /mɔ́-tu-a-hangan-jre/ 'nous nous sommes levés', s'opère au niveau du mot. Cet article décrit également l'harmonie ATR qui s'applique aussi bien au niveau du mot qu'au niveau postlexical.

0. INTRODUCTION

A general assumption in the analysis of the Bantu verb form is that it consists of at least two levels: a stem level and a word level. The stem level usually comprises the phonological processes that take place in the stem and these processes are assumed to apply before the word level. One nagging problem about the stem level is that the stem structure in certain tenses contains tense markers, usually the reflexes of the Proto-Bantu perfective **-id-e* or the final *-e*. Since tense markers which in a Bantu verb usually precede the stem and are derived at the word level, the question is whether these tense markers in the stem level should be derived at the stem level or the word level. Ingenuous solutions have sometimes been proposed in order to bypass this problem. One glaring example is the treatment of the so-called 'imbrication phenomenon' addressed in Bastin (1983) and Hyman (1991) which in fact consists of a number of morphological and phonological processes caused by the **-id-e* tense marker ending. To account for this imbrication phenomenon, Hyman proposes that, in a stem like *-sakat-il-e* 'seize', where *-sakat-* is the root, *-ile* is the Cibemba **-ide* reflex, the final consonant of the root *t* undergoes prosodic circumscription, i.e., it is made invisible during the affixation of *-il-*. Upon the morphological affixation of the final vowel *-e*, it loses its invisibility. That is why, the stem is able to become *-saka-il-t-e* → *saka-i-t-e* → *sakeete* after a number of phonological processes triggered by imbrication. One question about this derivation is: why is the root consonant made invisible and why does it lose its invisibility soon after the final vowel *-e* is affixed? A deeper exploration of the stratal organization of the Bantu verb will provide more satisfactory answers to this type of problems. Unfortunately, very little work has been systematically done on the stratal organization of the Bantu verb (Goldsmith and Sabimana (ms), Mutaka (1990)). The general assumption that all the material in the stem domain can be derived at the stem level is wrong. Mutaka (1990) shows, for example, that a suffixal high tone that is associated with the tense markers which are part of the word level (i.e., pre-macrostem material) links to Tone Bearing Units in the stem domain during the word level stratum.

This article, which explores vowel harmony in Kinande,¹ is meant to show further evidence of the need to recognize that stem material does not necessarily consist solely of stem level phonological processes. Height harmony will be shown as a stem level phenomenon, ATR harmony shown to occur both at the word level and phrasal level, and coalescence in nouns shown as stem level whereas coalescence in verbs is word level. In §1 the structure of the verb and noun in Kinande will be given along with the underlying seven vowel phonemes. In §§2 and 3 data on height harmony and coalescence is discussed and it is argued that height harmony with the applicative *-ir-*, causative *-is-*, stative *-ik-* and vowel coalescence in nouns fit within the stem level domain. However, the phonological processes of imbrication related to the tense marker *-ir-e* in the stem and which comprise vowel coalescence in verbs will be proposed to fit within the word level domain. In §4 ATR harmony in Kinande is discussed, and in §5 some alternative solutions are given that do not assume a stratal approach.

1. PRELIMINARIES

Kinande has nine phonetic vowels among which seven are phonemic. These seven vowels appear in the root of a verbal unit as in (1).²

(1)	SUBJECT MARKER	TENSE MARKER	OBJECT MARKER	ROOT	EXTENSIONS	FINAL VOWEL
	u	nému	ki	hum	ir/ul	a
	a	ka	ka	βiβ	ir/ul	
	ki	limu		hɨmb	ir/ul	ire
			mu	hɨk	ir/ul	
				kenz	er/ul	e
				hɔm	er/ɔl	
				samb	ir/ul	

This table illustrates the different formatives of a verb unit. The underlying seven vowels *i i e a ɔ u y* appear in the root. The vowels marked with a cedilla are [+ATR]. The vowels *e* and *o* are not phonemic. They receive their ATR feature through spreading (see also Clements (1991), Archangeli and Pulleyblank (1994)). There is also a variant of the vowel *a* that appears in the word *o-mú-kalɨ* /*ɔ-mu-kalɨ* 'woman'.³

As illustrated in *o-mú-kalɨ*, a noun typically consists of an initial vowel (*o*), a class prefix (*mɨ*) and a stem (*kalɨ*). Each noun has a lexically assigned prefix for the singular and plural. However, a derived prefix indicating the diminutive (e.g., *ka-*, *hi-*, *tu-*) or the augmentative (e.g., *ki-*, *lu-*) can take the position of the lexically assigned prefix to convey an added meaning. Thus, *o-lú-kalɨ* is 'a big despised woman', *e-kú-kalɨ* is 'a big woman', *a-ká-kalɨ* is 'a small (beautiful) woman'.

¹ The original manuscript was written in 1986. This revised version of the manuscript has benefited from extensive comments from Larry Hyman, Doug Pulleyblank, Robert Hedinger, and an anonymous phonology reviewer to whom I address my sincere thanks. Any remaining weakness is my responsibility.

² The high tone is represented by an acute accent, the low tone is unmarked, the phrasal H is also unmarked when it appears on the penultimate vowel. A falling tone on the final vowel is marked by a caret. Such a falling tone is the result of a phrasal H on the penultimate vowel and a default L tone on the final vowel as in *tu-ká-hum-á-a* [tukáhumâ] 'we are hitting'. Also, a low tone is marked with a grave accent in words whose penultimate vowel does not surface with a phrasal H as in *mɔ́-twáswerè* 'we ground'. The phonetic forms are represented between square brackets unless otherwise specified in the text.

³ I am indebted to Larry Hyman (personal communication) for pointing out this sound to me. This sound can be considered as the [+ATR] equivalent of *a*. However, in addition to appearing in the environment of [+ATR] vowels, it must surface with a low tone to sound with an ATR resonance. Compare: [o-mú-ka:lɨ] 'woman', [o-mó-ká:tɨ] 'in the interior', [ɔ-mú-ká:lɨ] 'strong person', and [ɔmú-ka:ma] 'chief'. The *a* of [omó-ká:tɨ], has an intermediary resonance between the *a* of [omúka:lɨ] and the *a* of [ɔmúká:lɨ] or [ɔmúka:ma] which is wide open. For a discussion of the status of [a] with respect to ATR harmony, see Archangeli and Pulleyblank (1994:210-12).

2. HEIGHT HARMONY

There are two types of height harmony. One type of height harmony appears when the vowel of the stem is [-lo, -hi]. It applies to the suffixes -ir (APPLICATIVE), -ik (STATIVE), -irir (PURPOSIVE), and -is (CAUSATIVE). This is illustrated in (2) where ϵ /e = augment, ri/rj = infinitive marker, a = final vowel, and j = causative.

(2) a.	erí-tum-a	to send	erí-tum-ir-a	to send for
			erí-tum-ik-a	to be sendable
			erí-tum-irir-a	to send anyway
	eri-hat-a	to peel	erj-tum-js-j-a	to make someone send
			eri-hat-ir-a	to peel for
			eri-hat-ik-a	to be peelable
	eri-lim-a	to work	eri-hat-irir-a	to peel anyway
			erj-hat-js-j-a	to make someone peel
			eri-lim-ir-a	to work for
b.	eri-hek-a	to carry	eri-lim-ik-a	to be workable
			eri-lim-irir-a	to work anyway
			erj-lim-js-j-a	to make someone work
	eri-log-a	to bewitch	eri-hek-er-a	to carry for
			eri-hek-ek-a	to be carryable
			eri-hek-erer-a	to carry anyway
			erj-hek-es-j-a	to make someone carry
			eri-log-er-a	to bewitch for
			eri-log-ek-a	to be bewitchable
			eri-log-erer-a	to bewitch anyway
			erj-log-es-j-a	to make someone bewitch

As shown in these infinitive forms, when the vowel of the stem is / ϵ ɔ/ the vowel /i/ of the extension changes into [ϵ].

A second type of height harmony occurs when the vowel of the extension is u and the stem vowel is o as shown in (3).

(3) a.	eri-seng-a	to pack	eri-seng-ul-a	to unpack
			eri-seng-ukal-a	to unpack by itself
			eri-seng-ukal-ir-a	to unpack by itself for
	eri-lung-a	to join	eri-lung-ul-a	to straighten
			eri-lung-ukal-a	to become straight
			eri-mat-ul-a	to ungrab
	erí-mat-a	to grab	erí-mat-ukal-a	to ungrab by itself
			erí-βiβ-ul-a	to unsow
			erí-βiβ-ukal-a	to unsow by itself
b.	erí-βɔh-a	to tie	erí-βɔh-ɔl-a	to untie
			erí-βɔh-ɔkal-a	to untie by itself
			erí-βɔh-ɔkal-ir-a	to untie by itself for someone

Example (4) gives a tentative formulation of the height harmony rule.

(4)	[+hi]	→	[-hi]	/	[-hi -lo]	_____
	< +rd > a				< +rd > b	
	V				V	
	(Condition: if a, then b)					

LATER POSTLEXICAL STRATA:

mɔ-tw-a-satira

mɔ-tw-a-swere

(e.g., gliding)

OUTPUT:

[mɔ́twásátirà]

[ɛríhekɛra]

[ɛríhɔmɔla]

[mɔ́twáswerè]

3. VOWEL COALESCENCE

There are two types of vowel coalescence: vowel coalescence in nouns and vowel coalescence in verbs. The vowel coalescence in nouns is illustrated in (8).

- | | | | |
|------------|-----------|-------------------------------|----------------------|
| (8) áma-ɲɔ | teeth | ɔ́ri-ɲɔ [érɪ:ɲɔ] | tooth |
| [ámɔ́:ɲɔ] | | áka-ɲɔ [ákɪ́:ɲɔ] | small tooth |
| | | ɔ́tu-ɲɔ [ótɰɪ́:ɲɔ] | small teeth |
| áma-ɲa | names | ɔ́ri-ɲa [érɪ́:na] | name |
| [ámɔ́:na] | | áka-ɲa [ákɪ́:na] or [áké:na] | small name |
| | | ɔ́tu-ɲa [ótɰɪ́:na] | small names |
| áma-ɲkɔ | fireplace | éri-ɲkɔ [érɪ́:kɔ] | cooking stone |
| [ámé:kɔ] | | áka-ɲkɔ [ákɪ́:kɔ] or [áké:kɔ] | small cooking stone |
| | | ɔ́tu-ɲkɔ [ótɰɪ́:kɔ] | small cooking stones |
| | | éhi-ɲkɔ [éhɪ́:kɔ] | small fireplaces |

As shown in these forms, vowel coalescence obtains between *a* and *ɪ* to form [ɛ]. (Length that is indicated on the penultimate vowel with a colon is postlexical and should be ignored here.)

Vowel coalescence in verbs occurs between the vowel *ɪ* of *-ɪre* and a preceding vowel. This is illustrated in (9).

- (9) mɔ́-tu-á-[sɔ́-ɪrɛ] [mɔ́twáswe:re] we ground
 mɔ́-tu-a-[há-ɪrɛ] [mɔ́twahé:re] we gave

As shown in these examples, *ɔ* + *ɪ* becomes *ɛ* and it is preceded by a glide *w* whereas *a* + *ɪ* becomes *ɛ*. Vowel coalescence in verbs also occurs in forms where a liquid precedes *-ɪre* and that liquid is preceded by at least two vowels in the stem. This is illustrated in (10).

- (10) a. mɔ́-tu-a-[ndaɣál-ɪrɛ] → -ndaɣa-ɪrɛ → mɔ́-tu-a-ndaɣére [mɔ́twandaɣé:re]
 we went down
- mɔ́-tu-á-[súβal-ɪrɛ] → -suβa-ɪrɛ → mɔ́-tw-á-súβerɛ [mɔ́twásúβe:re]
 we urinated
- mɔ́-tu-a-[kɔ́hɔ́l-ɪrɛ] → -kɔ́hɔ́-ɪrɛ → mɔ́-tu-a-kɔ́hwére [mɔ́twakɔ́hwé:re]
 we coughed
- mɔ́-tu-á-[sénzer-ɪrɛ] → -senze-ɪrɛ → mɔ́twásénzerɛ [mɔ́twásénze:re]
 we slipped
- mɔ́-tu-a-[tsakúr-ɪrɛ] → -tsaku-ɪrɛ → mɔ́-tw-a-tsakú-ɪrɛ [mɔ́twatsakwɪ́:re]
 we voted
- mɔ́-tu-á-[sángat-ɪrɛ] → -sanga-ɪrɛ → mɔ́-tw-á-sángerɛ [mɔ́twásánge:re]
 we got astonished

One crucial observation is that vowel coalescence in nouns obtains with the plural prefix **ma-** whereas it is optional with the diminutive **ka-**. There are phonological processes that are associated with the noun stems when they occur with their lexically assigned prefixes, i.e., **ma-** as the plural prefix of class 6 nouns and **ri-** as the singular prefix of class 5 nouns. To capture the dichotomy between the lexically assigned prefixes and the derived prefixes (like the diminutive **ka-** or the augmentative **ki-**), it is proposed here that the phonological processes associated with the lexically assigned prefixes take place at stratum 1, i.e., at the stem level. By this reasoning, vowel coalescence in nouns thus takes place at stratum 1.¹⁰

(13) mɔ́-tu-a-[kɔ́hól-í-a → [mótwakohó:lyâ]
 *koho-í-a [*motwakohwja] or [*motwakohwea]
 mɔ́-tu-a-[sɔ́ngokál-í-a → [mótwasongoká:lyâ]
 *songoka-í-a [*motwasongokya]

The illustrative derivations in (14) conclude this section on vowel coalescence.

- Stem cycle:**

ino

3

(vowel coalescence)

a-ka-inə

 $\emptyset$

(liquid deletion)

உ

(vowel coalescence and ATR harmony)

akino¹¹

(e.g. gliding, vowel deletion i.e., $a \rightarrow \emptyset / ___ V$)

¹⁰ In Mutaka (1990), it was proposed that noun roots do not constitute a cyclic domain. The affixation of the lexically assigned prefixes to the noun roots would then constitute a cyclic domain. This domain might correspond to the macrostem domain in verbs, that is, the stem domain augmented with the OM, which, in Kinande, is also derived at stratum 1.

¹¹ The derivation of *ákéno* 'small tooth' from *á-ka-jno*, i.e., with the diminutive prefix *ka-* can be considered an exceptional case and that it is so marked to undergo vowel coalescence at stratum 1.

On the basis of the data presented above, Schlindwein (1987) claimed that Kinande ATR harmony can be accounted for without any underlying ATR vowels. A floating [+ATR] feature associated with the root morpheme would first dock onto the rightmost high vowel and then spread leftward (see also Archangeli and Pulleyblank 1994:202). This proposal nicely accounts for the form in (17) where, under the proposal of having underlying ATR vowels, spreading would be bidirectional.

- To account for the contrast in (17a), the root in *-hum-* would bear the floating [+ATR] feature which would dock on the rightest high vowel before spreading. That this analysis is wrong is shown in (18).

- If the ATR feature linked to the rightmost high vowel, we would expect the high vowels in the extension in these forms to surface with [+ATR]. Because of this, we must maintain the proposal that there are underlying [+ATR] vowels. To account for the bidirectional spreading in (17), I propose that this is due to the fact that, underlyingly, or at its initial docking as will be proposed in (21), the [+ATR] feature is dependent on the [+hi] vowels à la Mester (1986) and that, in this case, the high vowels are linked to a single [+hi] feature because of OCP. This is illustrated in (19).

- | | | | | | |
|------|----|----------------|------------------|--------------|-------------|
| (20) | a. | [ɛri-langir-a] | to see | [ɛri-gend-a] | to go |
| | | [ɛri-súngu] | rat | [ɛrí-Bumbà] | clay |
| | | [ɛri-rinda] | seven | [ɛri-tsúku] | frost |
| | | [ɛri-sunzu] | male's hairstyle | [ɔ́ri-eru] | ripe banana |
| | | [ɛrí-sesa] | to feel itchy | | |
| | b. | [erí-takɔ] | buttock | | |
| | | [erí-βere] | breast | | |
| | | [erí-hembè] | horn | | |
| | | [erí-sambà] | eagle | | |
| | | [erí-lɔlɔ] | sin | | |

[erí-téma]	cheek				
[erí-sê]	a rat's dung				
[erí-sesa]	thatch				
c. [ehí-takɔ]	small buttocks			[ɔtú-takɔ]	small buttocks
[ehí-βere]	small breasts			[ɔlú-βere]	a big breast
[ehí-hembè]	small horns			[ɔtú-hembè]	small horns
[ehí-sambà]	small eagles			[ɔtu-sambà]	small eagles
[ehí-lɔlɔ]	small sins			[ɔtu-lɔlɔ]	small sins
[ehítema]	small cheeks			[ɔlú-téma]	a big cheek
[ehí-sê]	small rat's dungs			[ɔtú-sê]	small rat's dungs
[ehí-sesa]	small thatch			[ɔtú-sésa]	small thatch
d. [esí-sekè]	reeds	vs.		[ɔlu-seke]	big reed
				[ehí-sekè]	small reeds
				[ɔtú-sésa]	small thatch
[esí-sakɔ]	tattoos	vs.		[ɔlú-sakɔ]	tattoo
				[eβí-sakɔ]	big tatoos

In these forms, *ri* is a class 5 nominal prefix and it is also the verbal prefix marker for the infinitive. As shown in (20a), its *i* is not underlyingly [+ATR]. It has been observed up till now that [+ATR] harmony can only originate from a [+hi] vowel in the stem. Since the nouns in (20b) do not have any high vowel and nevertheless surface with a [+ATR] prefix, I propose that these noun stems have an underlying floating [+ATR] feature and that this feature docks on the lexically assigned class prefix. The forms in (20c,d) suggest that the [+ATR] feature dock onto the front high vowels only at stratum 1, that is, when the lexically assigned nominal prefix is affixed to the root as was proposed earlier with vowel coalescence. Notice that the lexically assigned prefix in the singular form in (20d) is a high back vowel and remains [-ATR]. That is why, it is crucial to have the feature [-back] in the ATR docking rule which is formulated in (21).

- (21)
$$\begin{array}{c} \boxed{\begin{array}{c} -bk \\ +hi \end{array}} \\ \downarrow \\ \text{V} \\ | \\ [+ATR] \end{array} \quad \text{Condition: stratum 1}$$

This rule says: A floating [+ATR] feature docks onto a high front vowel at stratum 1. Consider also the following forms.

- (22) a. mɔ́-tu-á-[sɔ́-jrè] [mɔ́twáswe:re]
 b. mɔ́-tu-a-[tsáng-jre] [mɔ́twatsángj:re]

The form in (22a) shows that coalescence bleeds ATR harmony. That is why the TM *mɔ* does not surface with the [+ATR] feature. It also suggests that ATR spreading applies after vowel coalescence. Since it was suggested that vowel coalescence occurs at stratum 1 in nouns and stratum 2 in verbs, ATR spreading could then occur either at stratum 2 or postlexically. While it will be argued later that there is an ATR spreading at the phrasal level, I propose that ATR spreading at the word level occurs at stratum 2 because of the following forms.

assumption is not crucial for accounting for ATR harmony once we assume that [+ATR] spreads within a word as long as it originates from a [+hi] vowel. That the vowel **a** exhibits gradient ATR properties would be a matter of phonetic implementation.

On the basis of the data presented above, Schlindwein (1987) claimed that Kinande ATR harmony can be accounted for without any underlying ATR vowels. A floating [+ATR] feature associated with the root morpheme would first dock onto the rightmost high vowel and then spread leftward (see also Archangeli and Pulleyblank 1994:202). This proposal nicely accounts for the form in (17) where, under the proposal of having underlying ATR vowels, spreading would be bidirectional.

- (17) a. *erí-hum-irir-a* [erʃhʉmɪrɪːra] to move anyway (from *-hum-*)
 erí-hʉk-irir-a [erʃhʉkɪrɪːra] to cook anyway (from *-hʉk-*)
 erí-sɪm-ir-a [erʃsɪmɪːra] to thank for (from *-sɪm-*)
 b. *erí-hum-irir-a* [erʃhʉmɪrɪːra] to roar anyway (from *-hum-*)

To account for the contrast in (17a), the root in **-hum-** would bear the floating [+ATR] feature which would dock on the rightest high vowel before spreading. That this analysis is wrong is shown in (18).

- (18) ϵ -rí-liBatangan-irir-a [eríliBatanganirí:ra] to behave confusedly anyway
 ϵ -rí-liBatangan-a [erí-liBatanga:n-a] to behave in a confused way
 ϵ -ri-liBan-ir-a [erí-liBan-í:r-a] to disappear for someone
 (from ϵ -ri-liBan-a [erí-liBá:na])

If the ATR feature linked to the rightmost high vowel, we would expect the high vowels in the extension in these forms to surface with [+ATR]. Because of this, we must maintain the proposal that there are underlying [+ATR] vowels. To account for the bidirectional spreading in (17), I propose that this is due to the fact that, underlyingly, or at its initial docking as will be proposed in (21), the [+ATR] feature is dependent on the [+hi] vowels à la Mester (1986) and that, in this case, the high vowels are linked to a single [+hi] feature because of OCP. This is illustrated in (19).

- (19) **eri-huk-irir-a**
 |
 [+hi]
 |
 [+ATR]

Consider also the forms in (20). Penultimate length and the phrasal H are ignored in the phonetic forms in (20).

- | | | | | | |
|------|----|----------------|------------------|--------------|-------------|
| (20) | a. | [ɛri-langir-a] | to see | [ɛri-gend-a] | to go |
| | | [ɛri-súngu] | rat | [ɛrí-Bumbà] | clay |
| | | [ɛri-rinda] | seven | [ɛri-tsúku] | frost |
| | | [ɛri-sunzu] | male's hairstyle | [óri-eru] | ripe banana |
| | | [ɛrí-sesa] | to feel itchy | | |
| | b. | [erǐ-takɔ] | buttock | | |
| | | [erǐ-βerɛ] | breast | | |
| | | [erǐ-hembè] | horn | | |
| | | [erǐ-sambà] | eagle | | |
| | | [erǐ-lɔlɔ] | sin | | |

[erí-tema]	cheek				
[erí-sê]	a rat's dung				
[erí-sesa]	thatch				
c. [ehí-takɔ]	small buttocks			[ɔtú-takɔ]	small buttocks
[ehí-βere]	small breasts			[ɔlú-βere]	a big breast
[ehí-hembè]	small horns			[ɔtú-hembè]	small horns
[ehi-sambà]	small eagles			[ɔtu-sambà]	small eagles
[ehi-lɔlɔ]	small sins			[ɔtu-lɔlɔ]	small sins
[ehítema]	small cheeks			[ɔlú-tema]	a big cheek
[ehí-sê]	small rat's dungs			[ɔtú-sê]	small rat's dungs
[ehí-sesa]	small thatch			[ɔtú-sésa]	small thatch
d. [esí-sekè]	reeds	vs.		[ɔlu-seke]	big reed
				[ehí-sekè]	small reeds
				[ɔtú-sésa]	small thatch
[esí-sakɔ]	tattoos	vs.		[ɔlú-sakɔ]	tattoo
				[eβí-sakɔ]	big tatoos

In these forms, *ri* is a class 5 nominal prefix and it is also the verbal prefix marker for the infinitive. As shown in (20a), its *i* is not underlyingly [+ATR]. It has been observed up till now that [+ATR] harmony can only originate from a [+hi] vowel in the stem. Since the nouns in (20b) do not have any high vowel and nevertheless surface with a [+ATR] prefix, I propose that these noun stems have an underlying floating [+ATR] feature and that this feature docks on the lexically assigned class prefix. The forms in (20c,d) suggest that the [+ATR] feature dock onto the front high vowels only at stratum 1, that is, when the lexically assigned nominal prefix is affixed to the root as was proposed earlier with vowel coalescence. Notice that the lexically assigned prefix in the singular form in (20d) is a high back vowel and remains [-ATR]. That is why, it is crucial to have the feature [-back] in the ATR docking rule which is formulated in (21).

- (21)
$$\begin{array}{c} \boxed{\begin{array}{c} -bk \\ +hi \end{array}} \\ \vee \\ | \\ [+ATR] \end{array} \quad \text{Condition: stratum 1}$$

This rule says: A floating [+ATR] feature docks onto a high front vowel at stratum 1. Consider also the following forms.

- (22) a. mɔ́-tu-á-[sɔ́-jrè] [mótwáswe:re]
 b. mɔ́-tu-a-[tsáng-jre] [mótwatsángj:re]

The form in (22a) shows that coalescence bleeds ATR harmony. That is why the TM *mɔ* does not surface with the [+ATR] feature. It also suggests that ATR spreading applies after vowel coalescence. Since it was suggested that vowel coalescence occurs at stratum 1 in nouns and stratum 2 in verbs, ATR spreading could then occur either at stratum 2 or postlexically. While it will be argued later that there is an ATR spreading at the phrasal level, I propose that ATR spreading at the word level occurs at stratum 2 because of the following forms.

- mó-tu-á-[séng-és-í-a [mótwáséngé:syâ]** we caused someone to pack

To sum up the main proposals that govern ATR harmony at the word level, ATR spreading originates from a [+ATR] vowel¹⁴ and it spreads leftward in the entire word; in nominal forms, there is a floating [+ATR] that docks on a front high vowel at stratum 1 and ATR spreading occurs at stratum 2. These proposals are illustrated in the derivations in (24).¹⁵

- takə**
[+ATR]

[+ATR]

ɛhi-takɔ

[+ATR]

[+ATR]
(ATR spreading)

ɛhi-takɔ

[túkásengesayâ]

[erítá:kɔ]

[ehíta:kɔ]

In the previous section, it was observed that ATR spreading applies within a word. In this section, it will be shown that ATR spreading also applies across words in a more limited way. Consider first the forms in (25). (The examples that will be given in the remaining part of the article will be written as they appear in their phonetic forms, ignoring penultimate length and the phrasal H.)

¹⁵ In general, the first vowel in a word may be extrametrical with respect to ATR spreading: e.g., o-bú-tuku or o-bú-tuku 'day', mótwásjirè or m5-twásjirè 'we came'.

- (25) a. *emi-hámhá mǐ-kǔhǐ* short knives
 emí-tweró mǐ-kǔhǐ short nails
 ebí-seké bí-kǔhǐ short sugar canes
- b. *emítí mǐkǔhǐ* short trees from *emí-tí* trees
 emítí mǐkǔhǐ short trees *mǐ-kǔhǐ* short
 emítí mǐkǔhǐ short trees
 emítí mǐkǔhǐ short trees
 εbitsungú βǐkǔhǐ short potatoes from *εβi-tsungù* potatoes
 εbitsungú βǐkǔhǐ short potatoes *βǐ-kǔhǐ* short
 εbitsungú βǐkǔhǐ short potatoes
 εβitsungú βǐkǔhǐ short potatoes

As shown in these forms, ATR spreading applies across the words when the last P-bearing unit of the first word is [+hi]. However, as shown in (25b), this ATR spreading is 'gradient' and it depends upon the rate of speech. In a very careful speech, the first word may be entirely [-ATR]. Following Pulleyblank's explanation (personal communication, July 19, 1994), gradient spreading, when applied to Kinande, should be understood in two senses. The first sense is that the left edge of the harmonic domain may optionally extend one, two, three, etc. vowels away from the source. The second sense is in the degree of advancement; that is the source of phrasal harmony becomes fully advanced, with vowels getting gradually less and less advanced, in a non discrete fashion, as a vowel gets further and further from the source of harmony. Consider also the noun plus adjective with initial vowel forms in (26).

- (26) *emítty emǐkǔhǐ* trees that are short cf. *emí-tí, emǐ-kǔhǐ*
 ɔlútty olúkǔhǐ a big tree that is short cf. *ɔlú-tí, olúkǔhǐ*
- emihámhá emǐkǔhǐ* knives that are short cf. *emi-hámhá, emǐ-kǔhǐ*
 ɔlɔhámhá olúkǔhǐ a big knife that is short cf. *ɔlu-hámhá, olúkǔhǐ*
- emítwerw emǐkǔhǐ* nails that are short cf. *emí-tweró, emǐ-kǔhǐ*
 ɔmútwerw omúkǔhǐ a nail that is short cf. *ɔmú-tweró, omúkǔhǐ*
- ebǐseky ebǐkǔhǐ* reeds that are short cf. *ebí-seké, ebǐ-kǔhǐ*
 ɔlúseky olúkǔhǐ a reed that is short cf. *ɔlú-seké, olúkǔhǐ*

These forms show that gliding or vowel deletion that occurs at the end of the first word and causes a syllabification of the resulting consonant with the vowel of the following word creates the environment for ATR spreading. In other words, this gliding or vowel deletion destroys the morphological boundary between the two words (I am indebted to John McCarthy for this suggestion.). The same ATR spreading process occurs when the second word is a numeral starting with *i*, or with the demonstrative starting with a vowel. This is illustrated with nouns and demonstratives in (27) and nouns and numerals in (28).

- (27) *ekihindi* log *ekì* this *ε/ekǐhǐndy ekì*
 emítí trees *eyì* these *ε/emítty eyì*
 ɔmútí tree *oyù* this *ɔ/omútty oyù*
 émbeñè goat *eyì* this *é/émbeñy eyì*
 embása axe *eyì* this *ε/embás eyì*
 ɔmumbesa girl *oyù* this *ɔ/omumbes oyù*

	esyómbása	axes	esì	these	ε/esyómbás esì
	ɔlúhenè	goat	olù	this	ɔ/olúheny olù
	éngókè	chicken	eyì	this	é/éngokw eyì
	ɔlúkəkè	chicken	olù	this	ɔ/olúkəkəw olù
(28)	emíti	trees	ìβìrì	two	ε/emít ìβìrì
	esyómbenè	goats	ìβìrì	two	ε/esyómben ìβìrì
	aβambesa	girls	íkumì	ten	aβambes íkumì
	esyómbundu	rifles	ínì	four	ε/esyómbundw ínì
	esyóngókò	chickens	ìsatu	three	ε/esyóngokw ìsatu

As suggested in the phrasal phonology data presented above, ATR spreading is leftward. Recall that, at the word level, it was observed that if the adjacent vowels to a [+ATR] underlying vowel were [+hi], these vowels also acquire the [+ATR] feature. Across words, this spreading does not occur as shown in (29).

(29)	ε/ekí-kalì	woman	kí-ri	tall	ε/ekíkalì kíri
	ε/e-nyunyù	bird	nyí-ri	long	ε/enyunyù nyíri
	ɔ/omú-kalì	woman	mú-li-mú-li	tall	ɔ/omúkalì múlimúli
	ε/ekí-síkì	log	ki-βuya	pretty	ε/ekísíkì kibuya

This data also suggests that OCP never applies across word juncture unlike the way it applies word internally as in *erìhúkùlìra* in (19).

A number of particles like the linker *kyo*, the complementizer *i-* and the relative pronoun *yu* in (30) are procliticized to the following word and undergo ATR spreading.

- (30) a. **nyí-ri-á-h-a** **ekí-séké** **kyo-Síríkì**
 I-TM-TM-give-FV sugarcane LK-Siriki
 I gave the sugar-cane to Siriki.
- nyí-ri-á-h-a** **ekí-síkì** **kyo-Kámbalè**
 I-TM-TM-give-FV log LK-Kambale
 I gave the log to Kambale.
- b. **Yoséfù** **yú-kandi-yend-a**
 REL-TM-go-FV
 It is Joseph who will go.
- Yoséfù** **yú-kandí-kw-â / yú-kandí-kw-â**
 REL-TM-die-FV REL-TM-die-FV
 It is Joseph who will die.
- c. **u-kándí-By-á** **w-á-Buy-á** **í-w-a-yend-a**
 SM-TM-be-FV SM-TM-finish-FV CP-SM-TM-go-FV
 When you finish, you leave.
- ú-kándí-By-á** **w-á-Buy-á** **í-w-uwam-à**
 SM-TM-be-FV SM-TM-finish-FV CP-SM-shelter-FV
 When you finish, you shelter yourself.
- ú-kándí-By-á** **w-á-Buy-á** **í-mó-w-a-yend-a**
 SM-TM-be-FV SM-TM-finish-FV CP-TM-SM-TM-go-FV
 When you finish, then you leave.

ú-kándí-By-á w-á-Buy-á í-mó-w-uwam-à
 SM-TM-be-FV SM-TM-finish-FV CP-TM-SM-shelter-FV
 When you finish, then you take a shelter.

These particles together with the nouns to which they procliticize form clitic groups.

The data that have been presented so far have consisted of a noun + adjective, noun + numeral, noun + demonstrative, particle + word where it has been observed that [+ATR] can spread. In the following data, verb + noun in (31a) and noun + verb in (31b), ATR does not spread at all.

- (31) a. ú-húm-e hit ekí-síkj log → úhúmy ε/ekísíkj hit the log
 ú-m-be give me ekí-síkj log → úmby ε/ekísíkj give me the log
 eri-her-a to plant ekí-síkj log → eriher ε/ekísíkj to plant the log
- b. eki-tsungù kj-némündj-hük-y-a
 potato it will be cooked
- eki-tsungu kj-némündj-hük-w-â
 The potato will be cooked.

Following Hyman (1990), a Kinande noun that precedes a verb constitutes a separate phonological phrase but a verb followed by a noun as in (31a) forms a single phonological phrase. The failure of ATR spreading in these data suggests that its application in a phonological phrase is severely restricted. We have seen that its application depends upon the rate of speech, that it obtains in environments where phonological processes like gliding and vowel deletion have destroyed the morphological boundary between two words, that it does not apply between a verb followed by a noun and that it strictly applies from right to left. Assuming the prosodic hierarchy on phrasal phonology, (Selkirk (1984), Hayes (1989), Hyman (1987), Nespor and Vogel (1982)), ATR spreading in Kinande applies in the phonological word and the clitic group and, in a more restricted way, in the phonological phrase.

5. ALTERNATIVE SOLUTIONS NOT ASSUMING A STRATAL APPROACH

The facts discussed above could of course be analysed without necessarily assuming the notion of stratum. However, such an analysis would be fraught with a number of stipulations as will be shown in the present section.

First, a non cyclic approach which assumes that all phonological rules take place after all the morphological processes would not be able to account satisfactorily for the height harmony and the coalescence data illustrated in (32).

- (32) a. tu-a-ne-ndi-sek-irir-a → tu -a -né-ndi-sek-erer-a Kámbale
 SM TM TM TM RT EXT FV we laugh Kambale
 We could have laughed at Kambale.
- b. mɔ-tu-a -jman-jr-e → mo-tu-a-jma-jn-e [mótwjme:ne]
 TM SM TM RT jre we stand
 We stood up.

Height harmony in (32a) is limited to the stem. A stratal approach easily captures this by assuming that stratum 1 which consists of the stem domain is cyclic. A non cyclic approach would wrongly predict that the high vowel of *ndi* in the TM would undergo height harmony. Similarly, vowel coalescence of *a + j* resulting in /ε/ is a stem level phenomenon. A non cyclic approach would

wrongly predict that this vowel coalescence could obtain with the vowel *a* of TM and the root initial vowel *i*. A more intractable problem for the non cyclic approach would arise for the analysis of height harmony in a word such as *erǰ-takɔ* 'buttock' and *ɛhǐ-takɔ* 'small buttocks' discussed earlier. In a stratal approach, this difference is captured by the fact that ATR docking on a high vowel takes place at stratum 1 and that, since the diminutive class prefix *-hi-* in *ɛhǐtakɔ* is joined to the stem at stratum 2, its high vowel does not undergo ATR docking. Such an explanation is unavailable in a non cyclic approach.

A cyclic approach not assuming the notion of stratum would certainly fare better as long as it recognizes that the stem domain is cyclic. However, it would face the same problems as the non cyclic approach with respect to the interpretation of *erǰ-takɔ* and *ɛhǐ-takɔ* ATR docking. This approach could assume my interpretation in Mutaka (1990) that, the root in the Kinande nouns does not constitute a cyclic domain and that the cyclic rules apply when the class prefix is joined to the stem. This would explain why ATR docking applies in *erǰ-takɔ* when the prefix *-ri* joins the stem *-takɔ*. However, the failure of this ATR docking on the diminutive prefix *-hi-* (e.g., in *ɛ-hǐ-takɔ* 'small buttocks') would remain a mystery.

6. CONCLUSION

Given the problems that a non cyclic or a cyclic approach would face in the analysis of ATR harmony, height harmony, and coalescence in the stem of the Kinande word, this article advocates the adoption of a stratal approach for the analysis of the word in Kinande, and in Bantu languages in general. It has been argued that height harmony, vowel coalescence in nouns and ATR docking in nouns apply at stratum 1; that vowel coalescence in verbs and ATR spreading applies at stratum 2 and that, postlexically, its application is more restricted and is limited to the phonological word, the clitic group and the phonological phrase.

REFERENCES

- Archangeli, Diana and Douglas Pulleyblank. 1994. *Grounded phonology*. Cambridge, Massachusetts: MIT Press.
- Bastin, Yvonne. 1983. La finale *-ide* et l'imbrication en Bantou. Musée Royale de l'Afrique Centrale, Tervuren Série In-8, Sciences Humaines, 114.
- Clements, George N. 1991. Vowel height assimilation in Bantu languages. ms. Cornell University.
- Goldsmith, John and Firmard Sabimana. 1985. The Kirundi verb. ms. University of Chicago.
- Hayes, Bruce. 1989. The prosodic hierarchy in meter. In Paul Kiparsky and G. Youmans (eds.), *Rhythm and Meter*. Orlando: Academic Press.
- Hyman, Larry M. 1987. Prosodic domains in Kukuya. *Natural Language and Linguistic Theory*, 5:311-33.
- . 1990. Advanced tongue root in Kinande. ms. University of California, Berkeley.
- . 1991. Cyclic phonology and morphology in Cibemba. ms. University of California, Berkeley.
- Mester, Armin. 1986. Studies in tier structure. Ph.D. dissertation, University of Massachusetts, Amherst.
- Mutaka, M. Ngessimo. 1989. The status of the liquid in Kinande. *Current Approaches to African Linguistics*, 6:83-89. Dordrecht: Foris.
- . 1990. The lexical tonology of Kinande. Ph.D. dissertation, University of Southern California, Los Angeles. [Published by Lincom Europa, Munich, 1994].
- . 1991. The tense marker *-ire* in the Kinande verbal stem: Evidence for a stratally organized phonology. In F. Katamba (ed.), *Lacustrine Bantu Phonology*. *Afrikanistische Arbeitspapiere* 25:157-73.
- and Larry M. Hyman 1990. Syllables and morpheme integrity in Kinande reduplication. *Phonology* 7:73-119.
- Nespor, Marina and Irene Vogel. 1982. Prosodic domains of external sandhi rules. In Harry van der Hulst and Neil Smith (eds.), *Advances in Non-linear Phonology*. Dordrecht: Foris.
- Schindwein, Deborah. 1987. P-bearing units: A study in Kinande vowel harmony. *Proceedings of NELS* 17:551-67.
- Selkirk, Elisabeth. 1984. *Phonology and syntax: The relation between sound and structure*. Cambridge, Mass.: MIT Press.