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# TYPOLOGIE DES LANGUES D'AFRIQUE & UNIVERSAUX DE LA GRAMMAIRE

*Volume I*

**Approches transversales**
**Domaine Bantou**

2003

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# "Abstract" Vowel Harmony in Kàlɔŋ :

## A System-Driven Account

Larry M. Hyman

Few linguists would disagree that African languages have played a major role in linguistic theory. Within phonology, the unique contributions of African tone systems would probably be cited as having had the greatest impact, followed by the study of so-called advanced tongue root (ATR) vowel harmony systems. Both tone and ATR harmony are widespread and reach a unique level of complexity and variation on the African continent. In each case, linguists have applied findings from African languages far beyond the Sahara—e.g. African-style tonal analysis to English intonation (Pierrehumbert 1980) and Japanese "pitch-accent" (Pierrehumbert & Beckman 1988) and African-style ATR harmony to languages as diverse as Nez Perce (Hall & Hall 1980) and dialectal Italian "metaphony" (Calabrese 1998), to mention just a few cases. This impact is quite the more remarkable as so few of Africa's 1500-2000 languages have actually been submitted to theoretical scrutiny. Instead, much of the importance of "our" languages for general linguistics has been made possible because of the strong description tradition that has characterized African linguistics almost from its inception.

As just stated, who could deny the value of description? At least in principle. In practice, however, even linguists who have general or theoretical interests work quite differently from one another. It seems to me that there are two equally valid approaches to the interface of linguistic theory and the study of (African) languages. First, in a universalist "top down" approach, linguistic theory is informed by the study of languages. On the other hand, in a universalist "bottom up" approach, the study of languages is informed by theory. As just defined, both can be concerned with general or "universal" properties of language, i.e. both can lead to insights on the relation between

theory and data. (Perlmutter 2001 makes the same point in the syntax area.) Both, however, are subject to limitations. First, a top-down approach may underestimate linguistic particularities : one may overapply linguistic theory as a "mold" into which languages must be fit, thereby missing important system-specific properties. On the other hand, a bottom-up approach may result in an underestimation of linguistic theory : one may overapply language particularities in such a way as to miss important system-independent properties.

In this paper, I propose to conduct a kind of experiment to determine just how far one can go with a strictly bottom-up approach. In the following sections I present an analysis of Kàlɔŋ vowel harmony that is "system-driven", i.e. where analytical decisions are dictated exclusively by the phonologically active properties of the language itself. Thus, to the fullest extent possible, I shall resist a top-down application of theoretical aprioris which either other linguists or I have expressed in our general linguistic work. I will, for example, not assume that phonology should be derivational vs. non-derivational, nor whether it should be input- and/or output-driven. Thus, I will not assume any of the pre-existing vowel feature systems, but rather will let Kàlɔŋ guide us as to the exact vowel features that *need* to be posited. After conducting this exercise in bottom-up analysis, we will take a look at where it has led us and decide whether we like it. The result, I believe, is that we will. Specifically, we shall see that the harmony processes in the Kàlɔŋ language unambiguously lead to a unique representation of the vowel system and its "abstract" properties. I shall suggest that the result can be extended to other phonological systems, particularly ones with simpler vowel inventories.

The paper is organized as follows. In §1 I present the general outlines of the system-driven account of Kàlɔŋ vowel harmony system. In §2 I show that two more "abstract" underlying vowels are naturally incorporated into the analysis. This is followed by discussion in §3 and further implications in §4. A brief summary is provided in §5.

## 1 Kàlɔŋ vowel harmony

The Kàlɔŋ language [nù-kàlɔŋè], also known as Yàŋbèn and designated as Bantu A.62d by Guthrie (1967-71), is spoken in three villages (Yangben, Omendé and Batanga) in the Mbam Division of the



Center Province in southern Cameroon. According to Boone et al (1992), there were 5,296 speakers in a 1977 census. The data and descriptive analysis are based on Paulian (1986ab, 2001).[1]

As schematized in (1a), Kàlɔŋ has a surface seven-vowel system. Representative CVC verb roots illustrate these vowels in (1b).[2]

(1) Surface vowel system (´ = High tone ; ` = Low tone)

| a. | | | b. | | | | |
|---|---|---|---|---|---|---|---|
| i | u | | -tím | 'creuser' | -fùk | 'fermer' |
| e | o | | -fén | 'dédaigner' | -pós | 'aboyer' |
| ɛ | ɔ | | -sél | 'éplucher' | -kɔ̀k | 'tirer' |
| a | | | | -yàn | 'jouer' | |

As summarized in (2), Kàlɔŋ shows three vowel harmony processes which will be discussed in turn : ATR harmony, Front harmony, and Round harmony.

(2) Three bidirectional vowel harmonies in the language

| | Feature | Target | Environment |
|---|---|---|---|
| a. | ATR | All vowels | before/after ATR vowel |
| b. | Front | /a/ | before/after /e, ɛ/ |
| c. | Round | /a/ | before/after /o, ɔ/ |

The first of these, ATR harmony, is illustrated in the examples in (3), which consist of the infinitive prefix kù- followed by a verb stem :

[1]An earlier version of this paper was first presented at the 9th Manchester Phonology Meeting, May 24, 2001, while I had a summer appointment as a chercheur associé in the Laboratoire ERSS (UMR 5610, CNRS & Université de Toulouse-Le Mirail), which I acknowledge with great thanks. I also have benefited from input received at subsequent presentations at UC Berkeley, UCLA and USC. For her helpful comments and examples, including her 3000-entry lexical database (Paulian 2001), I am especially endebted to Christiane Paulian of the Laboratoire LACITO (UMR 7107, CNRS & Université de Paris III), whose insights were critical to the present study.

[2]Kàlɔŋ is one of a subset of zone A languages where verb stems do not require an inflectional final vowel (FV) morpheme as in more familiar central, eastern and southern Bantu languages. As we shall see below, verbs may appear with a meaningful aspectual suffix -a.

(3) ATR harmony : conditioned by the causative suffix *-i*

a. vowels that are underlyingly ATR

| | | | | |
|---|---|---|---|---|
| kù-ɲîm | 'se perdre, disparaître' | → | kù-ɲím-ì | 'perdre qqch.' |
| kù-énèp | 'noicir (intr.)' | → | kù-énèp-ì | 'noircir (tr.)' |
| kù-sûk | 'manquer' | → | kù-súk-ì | 'faire échouer' |
| kù-wòk | 'refroidir (intr.)' | → | kù-wòk-ì | 'refroidir (tr.)' |

b. vowels that are not underlyingly ATR

| | | | | |
|---|---|---|---|---|
| kù-êy | 'se changer en' | → | kù-éy-ì | 'changer qqn.' |
| kù-sôt | 'vivre' | → | kù-sót-ì | 'sauver' |
| kù-sâk | 's'évaporer, tarir' | → | kù-sék-ì | 'assécher, vider' |

As to the right of the arrows in (3a), the causative is marked by the suffix -i. Since the vowels /i, e, u, o/ are already [+ATR], no changes take place. In (3b), however, the vowels /ɛ, ɔ/ become [e, o] by ATR harmony, as in (4a). While /a/ is also realized as [e], (4b) indicates that ATR harmony first converts /a/ to a [+ATR] central vowel, here symbolized as a schwa. While some speakers pronounce schwa, others convert it to [e], as shown. We shall therefore consider that the fronting of /a/ under ATR harmony is a secondary development, the primary one being to lower its F1.[3]

(4) Vowel changes under ATR harmony

a. /ɛ, ɔ/ → [e, o] b. /a/ → ə → [e]

Turning to the other two harmonies, the forms in (5) demonstrate the realization of the aspectual suffix /-a/ after each of the seven root vowels :

(5) ATR, Front and Round harmonies affecting the aspectual suffix /-a/

a. root has high ATR vowel

| | | | | |
|---|---|---|---|---|
| kù-tím-à | → | kù-tím-è | 'creuser' | a → ə → e / i |
| kù-fùk-à | → | kù-fùk-è | 'fermer' | a → ə → e / u |

[3] I use the term ATR as a convenience, as I do not have knowledge of the physiological mechanisms involved in making the "ATR" contrast. I could alternatively have used Tense/Lax as a cover feature.



b. root has mid Front vowel

| | | | | |
|---|---|---|---|---|
| kù-fén-à | → | kù-fén-è | 'dédaigner' | a → e / e |
| kù-sél-à | → | kù-sél-è | 'éplucher' | a → ɛ / ɛ |

c. root has mid Round vowel

| | | | | |
|---|---|---|---|---|
| kù-pós-à | → | kù-pós-ò | 'aboyer' | a → o / o |
| kù-kɔ̀k-à | → | kù-kɔ̀k-ɔ̀ | 'tirer' | a → ɔ / ɔ |

d. root has low vowel

| | | | | |
|---|---|---|---|---|
| kù-yàn-à | → | kù-yàn-à | 'to play' | |

In (5a), /-a/ becomes schwa, and ultimately [e], after /i/ and /u/. In (5b) /-a/ assimilates to a preceding /e/ or /ɛ/ by Front (and ATR) harmony, while in (5c), /-a/ assimilates to a preceding /o/ or /ɔ/ by Round (and ATR) harmony. There is no change in (5d), where the root vowel is /a/.

While the preceding examples show harmony from the root onto a suffix, as seen in (6), all three harmonies also apply from the root onto a prefix :

(6) All three harmonies are bidirectional, applying also between a root and prefix, e.g. cl. 6a /ma-/

a. Root has high ATR vowel

| | | | | |
|---|---|---|---|---|
| mà-pín | → | mè-pín | 'danse (n.)' | a → ə → e / i |
| mà-kùt | → | mè-kùt | 'nourriture' | a → ə → e / u |

b. root has Front mid vowel

| | | | | |
|---|---|---|---|---|
| mà-pě | → | mè-pě | 'machination' | a → e / e |
| mà-pénè | → | mè-pénè | 'lait' | a → ɛ / ɛ |

c. root has Round mid vowel

| | | | | |
|---|---|---|---|---|
| mà-yòyó | → | mò-yòyó | 'safoutiers' | a → o / o |
| mà-yɔ̀yɔ̀ | → | mɔ̀-yɔ̀yɔ̀ | 'bave' | a → ɔ / ɔ |

d. root has low vowel

| | | | |
|---|---|---|---|
| mà-yàn | → | mà-yàn | 'jeux' |

In (6a) the /a/ of the class 6a /ma-/ prefix becomes schwa, ultimately [e], when followed by root /i/ or /u/. In (6b) prefixal /a/ assimilates to a following /e/ or /ɛ/, while in (6c), prefixal /a/ assimilates to a following /o/ or /ɔ/. In (6d) there is no change, since the root vowel is /a/. As seen in the summary of the realization of affixal /a/ in (7), all three harmonies are bidirectional in Kàlɔŋ :

(7) Summary of realization of affixal /a/ (thus far)

| | Prefix /a-/ | Root Vowel | | Suffix /-a/ | |
|---|---|---|---|---|---|
| a. | e- | i | u | -e | [e] < ə |
| b. | e-, o- | e | o | -e, -o | |
| c. | ɛ-, ɔ- | ɛ | ɔ | -ɛ, -ɔ | |
| d. | a- | a | | -a | |

At this point we turn to the analysis. Recalling that the goal is not to impose a feature system from without, but rather to posit for Kàlɔ̀ŋ only that for which the language provides direct evidence. That is, we ask the question in (8): What features are needed for Kàlɔ̀ŋ, based exclusively on what is phonologically "active" in the vowel system ?

(8) What features are needed, based exclusively on what is "active" in the vowel system?

a. a feature ATR which spreads in ATR harmony
b. a feature Front which spreads in Front harmony
c. a feature Round which spreads in Round harmony
d. a feature Open on which Front and Round harmonies are parasitic

As seen, we need three features to describe vowel harmony: A feature ATR which spreads in ATR harmony, a feature Front which spreads in Front harmony, and a feature Round which spreads in Round harmony. In addition, since /i/ and /u/ do not condition Front or Round harmony, we need a feature Open on which these harmonies are "parasitic".

Since the goal of this paper is to postulate only what Kàlɔ̀ŋ provides direct evidence for, and since there is no evidence for the opposite features, retracted tongue root (RTR), Back, Unround, and Close, I will treat the features in (8) as privative. If not identical, they are at least similar in spirit to the "elements" proposed in particle-, dependency-, government-, and (some) autosegmental phonology, e.g. Schane (1984); Anderson & Ewen (1987); Goldsmith (1985), van der Hulst & Smith (1985), van der Hulst (1988), Kaye, Lowenstamm & Vergnaud (1985), Harris (1990, 1999), Harris & Lindsay (1995), Goad (1993), Rennison (1987), among others. For this purpose, I abbreviate the four features as A, F, R and O, and specify the seven Kàlɔ̀ŋ vowels as in (9).



(9) Specification of the seven Kàlɔ̀ŋ vowels

| | i | u | e | o | ɛ | ɔ | a | ə [e] |
|---|---|---|---|---|---|---|---|---|
| A | x | x | x | x | | | | x |
| F | x | | x | | x | | | |
| R | | x | | x | | x | | |
| O | | | x | x | x | x | x | x |

As indicated, these are exactly the feature specifications needed to express the vowel harmony processes we have examined. Again, they are privative, because Kàlɔ̀ŋ gives us no evidence that the minus value is ever referenced in its phonology. The elements A, F, R, O are unlike any features I have used before in my own work. (I have generally used High and Low.) However, as we can see, once we accept ATR, Front, Round and Open, which are clearly needed, there ceases to be any evidence for three vowel heights: /e, ɛ, o, ɔ, a/ are Open, while /i/ and /u/ are not. As some of the above authors have noticed, there is no need for the equivalent of the feature Low, since we have the ATR feature. Note also in (9) that no vowel has only F or R as its specification. We shall see in the next section that this is a good result.

## 2 Two "abstract" vowels in Kàlɔ̀ŋ

Up to now we have assumed seven underlying and seven surface vowels. In fact, as Paulian (1986a) amply documents, there are two more underlying vowels in Kàlɔ̀ŋ, which she designates as /i*/ and /u*/. These have the realizations summarized in (10).[4]

(10) There are two more underlying vowels, designated as /I/ and /U/, which :

a. are realized [i, u] in open syllables
b. are realized [ɛ,ɔ] in closed syllables
c. are realized [i, u] when undergoing ATR harmony (even in closed syllables)
d. do not condition ATR, Front or Round harmony

[4]Paulian actually states that her /i*, u*/ are realized [ɛ, ɔ] "quand elles sont en finale" and [i, u] "quand elles ne le sont pas". By "en finale", Paulian apparently has in mind final- vs. non-final syllable. However, given the syllabic structure of the language, a close examination reveals that this corresponds to the more natural distinction between closed vs. open syllables, especially in verb forms. Noun stems allow more possibilities, e.g. nì-tílé 'larme' should be analyzed as /nì-tílé/, not */nì-tílí/.

In order to show the distinctness of the two additional vowels, /I/ and /U/, consider the alternations that occur in (11a).

(11) */I, U/* show alternations of *[i~ɛ]* and *[u~ɔ]* in the roots */-lIk/* and */-lUk/*

a. kù-lɛ̂k kù-lík-à 'désirer' b. kù-lɛ̂k kù-lék-è 'lécher' /-lék/
kù-lɔ̀k kù-lùk-à 'nommer' kù-lɔ̀k kù-lɔ̀k-ɔ̀ 'abîmer' /-lɔ̀k/

As seen in (11a), /I, U/ are realized [ɛ,ɔ] in closed syllables, but [i, u] in open syllables. Crucially, the forms with the aspectual suffix /-a/ are not realized *ku-lík-è or *kù-lùk-è, i.e. the final -a does not undergo ATR harmony. In (11b), on the other hand, underlying /ɛ, ɔ/ remain in open syllables, and final -a assimilates to them.

In (12) we see that related noun-verb pairs show the same ɛ/i and ɔ/u alternations :

(12) Noun-verb pairs show the same alternations

a. ni-lèmb 'sorcellerie' b. kù-limb-à 'ensorceler' (not *kù-limb-ɛ̀)
kù-yɔ̀k 'aller' nì-yŭk-én '(bonne) route' (not *yŭkɛ́n)

As indicated in (12b), the phonetic root vowels [i, u] fail to condition ATR harmony on affixes.

Just as [i, u] realizations of /I, U/ do not condition ATR harmony, the [ɛ, ɔ] realizations fail to condition Front or Round harmony :

(13) [ɛ, ɔ] realizations of /I, U/ do not condition Front or Round harmony

a. /mà-kÎp/ → mà-kɛ̂p 'vin de palme' (not *mɛ̀-kɛ̂p)
b. /mà-sÙk/ → mà-sɔ̀k 'sel' (not *mɔ̀-sɔ̀k)

Thus, class 6a /ma-/ is realized [ma-] in both examples.

The above results are quite general, as seen in the realization of the recent past prefix /sà-/ before all nine root vowels :



(14) The recent past prefix */sà-/* realized before all 9 root-initial vowels

a. root has one of the high ATR vowels /i, u/
ù-sà-tínìt → ù-sè-tínìt 'il a couru' a → ə → e / i
ù-sà-tûm → ù-sè-tûm 'il a commencé' a → ə → e / u

b. root has one of the Front mid vowels /e, ɛ/
ù-sà-télèmìt → ù-sè-télèmìt 'il s'est levé' a → e / e
ù-sà-néŋɛ̀ → ù-sè-néŋɛ̀ 'il a nagé' a → ɛ / ɛ

c. root has one of the Round mid vowels /o, ɔ/
ù-sà-yòsòn → ù-sò-yòsòn 'il a regardé' a → o / o
ù-sà-tɔ́ŋɔ̀ → ù-sɔ̀-tɔ́ŋɔ̀ 'il a chanté' a → ɔ / ɔ

d. root has the low vowel /a/
ù-sà-sàŋâ → ù-sà-sàŋâ 'il a mangé'

e. root has one of the "abstract" vowels /I, U/
ù-sà-yÌk → ù-sà-yèk 'il a pourri'
ù-sà-yÙk → ù-sà-yɔk 'il est parti'

The realization of affixal /a/ with all nine underlying vowels is now shown in (15).

(15) Summary of realization of affixal /a/ with all nine underlying root vowels

| | Prefix /a-/ | Root Vowel | | Suffix /-a/ |
|---|---|---|---|---|
| a. | e- | i | u | -e |
| b. | e-, o- | e | o | -e, -o |
| c. | ɛ-, ɔ- | ɛ | ɔ | -ɛ, -ɔ |
| d. | a- | a | | -a |
| e. | a- | i~ɛ | u~ɔ | -a |

(15a-d) represent the seven underlying root vowels we see in §1. (15e) shows how affixal /a/ is realized before and after root /I, U/—which vary between [i~ɛ] and [u~ɔ], in open vs. closed syllables. What then can be the underlying analysis of /I, U/?

Adhering to the bottom-up approach, the Kàlɔŋ facts lead us to the feature analysis of all nine underlying vowels in (16).

(16) Featural analysis of all 9 vowels (cf. (9))

| | i | u | I | U | e | o | ɛ | ɔ | a | ə [e] |
|---|---|---|---|---|---|---|---|---|---|---|
| A | x | x | | | x | x | | | | x |
| F | x | | x | | x | | x | | | |
| R | | x | | x | | x | | x | | |
| O | | | | | x | x | x | x | x | x |

In (16) I have added /I, U/ to the table in (9). The analysis of /I, U/ is summarized in (17).

(17) Analysis of */I, U/*

a. Each vowel has only one featural specification: Front for /I/, Round for /U/
b. /I, U/ acquire the ATR feature in open syllables, merging with [i, u]
c. /I, U/ acquire the Open feature in closed syllables, merging with [ɛ, ɔ]

This analysis accounts for the following facts concerning /I, U/ :

(18) This analysis accounts for the following facts

| Fact | Reason |
|---|---|
| a. /I, U/ never condition ATR harmony | /I, U/ lack the ATR feature |
| b. /I/ never conditions Front harmony | /I/ lacks the Open feature |
| c. /U/ never conditions Round harmony | /U/ lacks the Open feature |
| d. /I, U/ become [i, u] by ATR harmony | /I, U/ differ from /i, u/ only in ATR |
| e. /I, U/ are transparent to Front/Round harmonies | /I, U/ lack the Open feature |

Thus far we have examined the properties in (18a-c). In addition, as seen in (19), /I, U/ are realized [i, u] before causative -ì :

(19) */I, U/* are realized *[i, u]* before causative *-i*

a. kù-pɛ̀k 'brûler (intr.)' → kù-pík-ì 'mettre le feu'
(cf. kù-pík-à)
b. kù-lɔ̂nd 'durcir (intr.)' → kù-lúnd-ì 'durcir (tr.)'
(cf. kù-lúnd-à)

According to what has been said thus far, this could be either because of ATR harmony (conditioned by the causative suffix) or because /I, U/ are in an open syllable. The following examples in (20) disambiguate :



(20) Closed syllable */-IC/* suffixes, e.g. diminutive */-It/*, surface with *[i]* under ATR harmony

a. root has one of the ATR vowels /i, u, e, o/

| | | | | |
|---|---|---|---|---|
| kù-fín-è | 'détester' | → | kù-fín-ít | 'ne pas beaucoup aimer' |
| | | | | Not *-ɛt |
| kù-fúk-è | 'souffler' | → | kù-fúk-ìt | 'souffler un peu' |
| kù-fén-è | 'dédaigner' | → | kù-fén-ìt | 'dédaigner un peu' |
| kù-fók-ò | 'conduire' | → | kù-fók-ìt | 'conduire un peu' |

b. root has one of the non-ATR vowels /ɛ, ɔ, a/

| | | | | |
|---|---|---|---|---|
| kù-kɛ́s-è | 'cueillir' | → | kù-kɛ́s-èt | 'cueillir un peu' |
| kù-sɔ́p-ò | 'déguster' | → | kù-sɔ́p-èt | 'goûter avec le doigt' |
| kù-yàn-à | 'jouer' | → | kù-yàn-èt | 'jouer un peu' |

c. root has one of the "abstract" vowels /I, U/

| | | | | | |
|---|---|---|---|---|---|
| kù-yík-à | 'pourrir' | → | kù-yík-èt | 'pourrir un peu' | /-yÌk/ |
| kù-kùl-à | 'écraser' | → | kù-kùl-èt | 'écraser un peu' | /-kÙl/ |

In these forms, the indicated verbs have been diminutivized via the suffix /-It/ in the forms to the right. In (20a) we see that /-It/ is realized [-it] after an ATR vowel, while it is realized [-ɛt] after the non-ATR vowels /ɛ, ɔ, a/ in (20b). Finally, (20c) shows the same [-ɛt] realization after the abstract vowels /I, U/. The reason why the ATR alternation is between [i] and [ɛ], rather than between [e] and [ɛ] as was seen above in (3b), is that the vowel of the suffix [-it ~ -ɛt] is /I/, not /ɛ/.

In addition to roots, the suffix vowel /I/ also shows [i~ɛ] alternation depending on open vs. closed syllable, as seen in (21).

(21) Suffix vowels also show *[i~ɛ]* alternations depending on open vs. closed syllable

| | | | |
|---|---|---|---|
| a. kù-yɛ̀k | 'pourrir' | cf. kù-yík-à | /-yÌk/ |
| b. kù-yík-èt | 'pourrir un peu' | | |
| c. à-yík-ít-án | 'un peu pourri' | /yÌk-Ít-án/ | (-án- = participal suffix) |

The [ɛ~i] alternation seen in (21a) clearly establishes that 'pourrir' is underlyingly /yÌk/. When diminutive /-It/ is added in (21b), /yÌk/ is

realized with [i] in open syllable, but /-It/ is realized [-ɛt] in closed syllable. When another suffix is added in (21c), /-It/ is again realized [-it], since its vowel is now in open syllable position.

There is a further relevant property referred to in (18e), namely, their transparency to vowel harmony. To see this, first consider the generalizations in (22) concerning the underlying distribution of vowel contrasts in Kàlɔ̀ŋ :

(22) Generalizations consideration the underlying distribution of vowel contrasts

a. 9 root vowels: /i, I, e, ɛ, u, U, o, ɔ, a/
b. 3 prefix vowels: /I, U, a/

As we have seen, restated in (22a), all nine underlying Kàlɔ̀ŋ vowels contrast in root position. However, as indicated in (22b), only three vowels contrast in prefix position: /I, U, a/. (23) presents the relevant observations concerning the surface properties of prefixal vowels :

(23) Prefixal vowels

a. are always in an open syllable (V- or CV-)
b. show all seven surface vowel realizations
   i. /a/ is realized [e, ɛ, o, ɔ, a]
   ii. /I, U/ are always realized [i, u] (because they are in an open syllable)
c. /I, U/ are transparent to Front and Round harmonies

As indicated, the three prefix vowels /I, U, a/ are always in open syllable, but show all seven vowel realizations : /I, U/ are always realized [i, u], while /a/ has the five realizations [e, ɛ, o, ɔ, a] in (15). In addition, as seen in (24), /I/ and /U/ are transparent both to Front and Round harmonies :

(24) Transparency of prefixal /I, U/ in Front and Round Harmonies

a. Front harmony through /I/
   /á kÌ-sIkɛl/ → é kì-sikɛl 'en ce moment-là'
b. Front harmony through /U/
   /á pÙ-té/ → é pù-té 'dans l'arbre'
c. Round harmony through /I/
   /á kÌ.tɔŋ/ → ɔ́ kì-tɔ̀ŋ 'au village'



d. Round harmony through /U/
   /á tÙ-nɔ/ → ɔ́ tù-nɔ 'en sommeil'

In each of these examples, the locative marker /á/ assimilates to the root. As seen, both Front and Round harmony may apply through either /I/ or /U/. In Archangeli & Pulleyblank's (1994) terms, (24a,d) are "sympathetic" transparencies, since F and R spread through a F and R /I/ or /U/, respectively, while (24b,c) are "antagonistic," since F spreads through the R vowel /U/ and R spreads through the F vowel /I/).

According to many authors, the above transparency is not surprising. In our analysis in (16), /I, U/ are featurally improverished, archiphonemes specified only for Front and Round, respectively. With a less complex structure, they can be skipped over.[5] One can on the other hand calculate what it would take to describe the above harmony in local terms. In the case of antagonistic transparency in (24b,c), where F must spread through R, or R must spread through F, one could refer to the non-existence of front rounded vowels in the languages. However, the account would have to be different in the sympathetic transparency cases in (24a,d). Here we see that it is instead the parasitic nature of F/R harmony which is violated : F and R harmony are permitted despite—or is it because of—the fact that the Kàlɔ̀ŋ non-open vowels cannot acquire the O feature: /i, u/ never acquire openness, while /I, U/ do so only in closed syllables (see §3). This seems to cover both cases: /i, u, I, U/ are invisible to F and R harmony precisely because they lack an O feature.[6]

## 3 Discussion

An analysis of the Kàlɔ̀ŋ vowel system was presented in §1 and §2. As promised, each decision was taken based exclusively on the

[5] To clarify, I am under the impression that virtually any vowel can be transparent in a harmony system, even complex vowels such as /ü, ö/ (Anderson 1977). What I am assuming is an implicational statement of the sort : A (relevantly) more complex vowel will be transparent to a given harmony only if a correspondingly less complex vowel is, but not vice-versa. We would thus be surprised if /i, u/, /e, o/ or /ɛ, ɔ/ were transparent, but less specified /I, U/ were not.

[6] Since unambiguous examples are difficult to identify, it is not clear whether /i, u/ are also transparent to harmony, as they are in nearby Gunu (Hyman 2001). For a recent alternative to transparency, agreement through "correspondence", see Walker (2000), Rose & Walker (2001), Hansson (2001), for consonant harmony; Baković (2000) for ATR vowel harmony.

overt properties of the vowels themselves, especially how each vowel functions as a trigger or target in ATR, Front and Round vowel harmony. The alternations [i~ɛ] and [u~ɔ] and their non-participation in the three harmony processes led to the positing of two "abstract" vowels /I, U/. This is the solution to which our bottom-up exercise has led us. As promised, we now need to see how we like it.

I begin by considering some of the possible "top down" objections to the analysis. First, the elements A, F, R, O, might be questioned. Recall that privative features were proposed for the simple reason that no evidence was found that the opposite values (RTR, Back, Unround and Close) are phonologically active in Kàlɔŋ. It would, of course, be possible to reinterpret the proposed elements as [+A, +F, +R, +O], in which case the minus values would be underspecified (cf. discussion in Inkelas 1995 and Ringen & Vago 1998). However, note that the featural analysis in (16) is not underspecified. Following Harris & Lindsay (1995), the proposed features (and their absence) have a direct interpretation : /I/ and /U/, which are specified only for Front and Round, respectively, are still pronounceable as they are, i.e. as non-ATR non-Open (i.e. high) vowels. Unlike the normal interpretation of an archiphoneme, they do not require default spell-out of the missing features. I conclude that in the case of Kàlɔŋ there is no reason to adopt binary vowel features.

A second possible objection might concern the question of phonetic grounding : why do /I, U/ have the properties they do ? Another way to phrase this question is : What *are* /I/ and /U/ in more concrete terms ? Those familiar with ATR systems will doubtless have already inferred that they are the missing non-ATR high vowels, which must once have been pronounced [ɪ, ʊ] in pre-Kàlɔŋ. As is well known, [ɪ, ʊ] are frequently missing from ATR systems (Calabrese 1993, Archangeli & Pulleyblank 1994, Baković 2000 etc.). This is captured by Archangeli & Pulleyblank's grounding condition HI/ATR, which specifically states that a high vowel should be [+ATR] or by Calabrese's constraint *[+high, -ATR]. If we started with /I, U/ in the Kàlɔŋ case there would be the need for two potentially conflicting "grounded" repairs in (25).[7]

[7]Kàlɔŋ is particularly significant in requiring two different "repairs". In languages which have only one, e.g. Okpe *ɪ, *ʊ → [e, o] (Archangeli & Pulleyblank 1994,



(25) Repairs needed for Kàlɔŋ

a. V → [+ATR], if [+high]
b. V → [-ATR], if in a closed syllable

The constraint responsible for (25a) is the oft-noted one : high vowels should be [+ATR]. The constraint responsible for (25b) says that vowels in closed syllables should be lax, i.e. [-ATR]. To my knowledge, this constraint has not yet been called into play in ATR systems, many of which restrict or disallow closed syllables. These constraints are stated as OT-style universals (or "ideals") in (26a,b) in terms of the privative elements A and O :

(26) Constraints in terms of features A, F, R, O

a. A (if ~O) repair: V → A, if ~O
b. *A (if __ C ]$_\sigma$) repair: V → O, if __ C ]$_\sigma$
c. MAX (A, F, R, O) >> *A (if __ C ]$_\sigma$) >> A (if ~O) >> DEP (A, O)

As seen in (26c), the two constraints must be ranked as indicated: the requirement that vowels be non-ATR in closed syllables takes precedence over the requirement that non-open vowels be ATR. The higher ranked MAX constraint in (26c) guarantees that underlying vowel features will not be deleted, while the lower ranking of DEP (A,O) allows those two features to be inserted as repairs (cf. the tableaux in (30c) below).

But should we prefer underlying /I, U/ to fully-specified /ɪ, ʊ/? Does it matter ? The explicit recognition of underlying /ɪ, ʊ/ would have been rejected as too "abstract" by at least some proponents of concrete phonology in the 1970s. Violating Hooper's (1976) "true surface generalization" principle, how could a child ever "know" that some occurrences of [i, u] or [ɛ, ɔ] were reflexes of vowels equivalent to the [ɪ] or [ʊ] s/he never hears ? By contrast, the archiphonemic account proposed here makes what seems to be exactly the right claim in this regard : what can the child conclude about the representation of

Omamor 1988), it is possible to query whether there has been a complete merger with /e, o/. Paulian (1986a) states that there appears to be no phonetic difference between different sources of [i], [u], [ɛ] and [ɔ]. Although I don't have acoustic data, note that if the indicated mergers were incomplete in Kàlɔŋ, it would be necessary to say that there are minute differences between the two sets of [i, u] in open syllables *and* the two sets of [ɛ, ɔ] in closed syllables, which seems less likely than the simpler Okpe case.

a vowel that alternates between [i] and [ɛ] except that it is Front ? Similarly, what can s/he conclude about the representation of a vowel that alternates between [u] and [ɔ] except that it is Round ? Given the rest of the Kàlɔ̀ŋ vowel system and the features that it motivated in our bottom-up analysis, there are no alternatives. These vowels cannot be underlyingly A, nor can they be underlyingly O. We thus arrived at this solution automatically, as it were.

The first advantage in positing the less specified vowels /I, U/ concerns abstractness. A second advantage concerns markedness : The three vowels that can occur in prefixes in Kàlɔ̀ŋ are /I/, /U/ and /a/, i.e. exactly the vowels that have only one feature specification : F, R or O.[8] Finally, a third argument concerns transparency. Why should fully specified /ɪ, ʊ/ be transparent ? In the /I, U/ analysis, it follows that the least complex vowels are the most likely to be permeable.[9]

Assuming, therefore, the above proposed analysis, if [-ATR] is not active in Kàlɔ̀ŋ, how do we capture the fact that the [i, u, ɛ, ɔ] realizations of /I, U/ derive from the constraint *[+high, -ATR] ?

The answer lies, first, in adopting a common assumption in the feature geometry of vowels : ATR and vowel height (here, Open) both occur under the Aperture node (Odden 1991; Goad 1993; Clements & Hume 1995; Hyman 1988). What this means is that the Kàlɔ̀ŋ surface

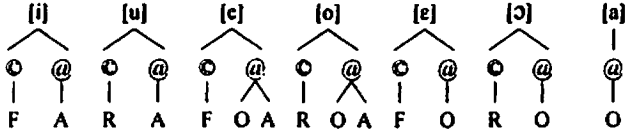
[8] Many Bantu seven-vowel languages have this character. It is interesting to note the following correlation : In Bantu languages having the vowel system /i, I, E, u, U, O, a/, where capital letters represent non-A vowels, the prefix vowels are frequently limited to /I, U, a/. On the other hand, in Bantu languages having the vowel system /i, e, E, u, o, O, a/, the prefix vowels may instead be restricted to /e, o, a/. This correlates with the tendency that the active feature will be ATR in the first set of languages, but RTR in the second (Casali 2001). Thus, the vowels which are specified only for F, R, or O are /I, U, a/ in the first system, but /e, o, a/ in the second. The same generalizations frequently characterize vowels found in suffixes, except that many Bantu languages permit an ATR high front vowel (e.g. the causative suffix -i-), which also occurs in some languages in noun prefixes such as bi- (class 8) and di- (class 10). Casali's generalization makes the prediction that Bantu languages with the RTR system /i, e, E, u, o, O, a/ should not also have ATR harmony, e. g. conditioned by the causative suffix -i-. While this appears to be generally true, the prediction merits closer examination.

[9] No one of these is a knock-out argument by itself. Thus, Calabrese's (1993) invisibility of non-contrastive features in an approach with full specification works for prefix transparency in Kàlɔ̀ŋ. Taken together, however, the arguments in favor of /I, U/ seem compelling.



vowels will have the representations in (27), where © stands for a "color" node and @ for the aperture node :

(27) Representation of the seven output vowels




Recall that /I, U/ have only an F or R feature. The reason why they cannot surface as *[ɪ, ʊ] is because of the Aperture Constraint in (28).

(28) Aperture Constraint

> An output vowel in Kàlɔ̀ŋ must have Aperture (i.e. an A or O feature)

In order to surface, /I, U/ acquire either an O feature (in closed syllables), otherwise an A feature.[10]

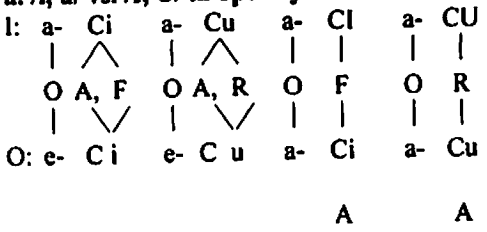
Returning to our analysis, the system driven account has the following properties. First, it points us towards specific underlying representations, e.g. the "archiphonemes" /I, U/. Second, it points us towards the privative elements, A, F, R, O in underlying representations and phonological processes, which turn have four properties : (i) /A, F, R/ harmonize (not the opposite values). (ii) [A, O] are inserted—but only in response to the Aperture Constraint (28). (iii) F is inserted only to covert AO [ə] to [e]. (iv) underlying /A, F, R, O/ are "faithful" in outputs, i.e. they always surface, are never deleted/delinked. Concerning this last fact, the system-driven account has pointed us toward a derivationally "monotonic" relation between underlying representations and outputs. All input features are present in the output. We have seen that the inserted A and O features onto /I, U/ do not produce harmonic variants on affixes. The system-driven account of such "opaque" counterfeeding relations is to assume "direct mapping" (Kenstowicz & Kisseberth 1979) of input onto output : There is no rule ordering, nor is any need for surface-surface

[10] Concerning the geometry and features in (27), the missing vowels in Kàlɔ̀ŋ include AO *[ə], which surfaces as [e], as well as various combinations of F and R *[ü, ø, œ]). In addition, there is no vowel A *[ɪ]. Non-low vowels which either combine or are neither F nor R are rare in ATR systems (but see Kaye et al 1985 re Kpokpolo).

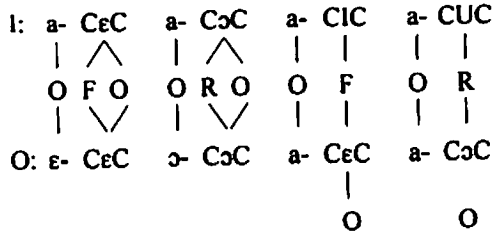
correspondence (McCarthy 1996, 1999). As seen in (29), Kàlɔŋ /I, U/ are non-problematic in two-level direct mapping models (e.g. Koskenniemi 1983, Kartunnen 1993, Goldsmith, 1993, Lakoff 1993) :

(29) Kàlɔŋ /I, U/ are non-problematic in two-level direct mapping models

**a. /i, u/ vs. /I, U/ in open syllable**




**b. /ɛ, ɔ/ vs. /I, U/ in closed syllable**




In (29a), A is inserted onto /I, U/ in open syllable, while in (29b), it is instead O that is inserted onto /I, U/ in closed syllable. In both sets of forms, the first two show an /a-/ prefix harmonizes for A, F or R.

It is not difficult to implement the above insights in OT terms. (30) provides a partial illustration of one possibility :

(30) An OT implementation :

$$\text{APERTURE} >> \left\{ \begin{array}{l} \alpha \text{ input A} \\ \alpha F \text{ (if input } \alpha O) \\ \alpha R \text{ (if input } \alpha O) \end{array} \right\} >> \text{DEP (A, F, R)}$$



a. Harmonizing input features

| /a-Cɛ/ | APERTURE | αF | DEP |
|---|---|---|---|
| a-Cɛ | | *! | |
| ɛ-Cɛ | | | |

| /a-Ci/ | APERTURE | αA | DEP |
|---|---|---|---|
| a-Ci | | *! | |
| e-Ci | | | |

b. Non-harmonizing output features F and A

| /a-CIC/ | APERTURE | αF | DEP |
|---|---|---|---|
| a-CIC | *! | | |
| ɛ-Cɛ | | | |
| a-CɛC | | | |

| /a-CI/ | APERTURE | αA | DEP |
|---|---|---|---|
| a-CI | *! | | |
| a-Ci | | | |
| e-Ci | | | |

c. Prediction of correct output aperture feature :

APERTURE >> *A(CVC) >> *O >> *A

| /a-CIC/ | *A(CVC) | *O | *A |
|---|---|---|---|
| a-CiC | *! | | |
| a-CɛC | | | |

| /a-CI/ | *A(CVC) | *O | *A |
|---|---|---|---|
| a-Cɛ | | *! | |
| a-Ci | | | |

As seen, of the constraints listed, the highest ranked is APERTURE (28). This is followed by the three harmony constraints (A, F, R), and then DEP (A, F, R). The tableaux in (30a) exemplify F and A harmony, while (30b) shows how /I/ fails to condition either harmony. The tableaux in (30c) show how /I/ is realized [i] vs. [ɛ]. APERTURE is still highest ranked, and *A(closed σ) >> *O >> *A.

## 4 Implications

As mentioned in the introduction, a lot of phonological description has a top-down character : analyses are driven by apriori theoretical assumptions rather than by the facts of the language under examination. In the preceding sections, I have tried to reverse this to see the result. I think it is an interesting one for several reasons. By looking at Kàlɔ̀ŋ in its own terms, we discover that some languages appear to "like" opacity. Not allowing one "rule" to interact with another might even be categorized as another type of "conspiracy" in phonology. In fact, as I pointed out in Hyman (1993), if phonology is non-derivational in nature, we should find more languages like Kàlɔ̀ŋ which are consistent in their toleration of counterfeeding and counterbleeding. Opacity may thus be a pervasive systemic property of a language, not just a relation between two properties taken at random.[11]

A second, similar lesson to be derived from Kàlɔ̀ŋ is that the treatment of vowel features as privative may also be systemic. Kàlɔ̀ŋ is consistent in providing no evidence of binarity anywhere in its vowel phonology. Of course this may simply reflect that view that vowel features (elements) are universally privative. Goldsmith (1985) suggested that the same feature can be binary in one language, but privative in another. If correct, might we ultimately discover another type of language which provides "bottom-up" evidence that all of its vowel features are binary?

Kàlɔ̀ŋ also provides a lesson concerning the treatment of vowel height. Many ATR systems do not provide evidence of three vowel heights or of the feature [low]. They also do not seem to exploit the

[11]While there is no evidence of any feeding relations in Kàlɔ̀ŋ, my UCLA colleagues have pointed out that a type of bleeding relation does occur : When /I, U/ are realized [ɛ, ɔ] in closed syllables, (26b) bleeds (26a). On the other hand, when /I, U/ are realized [i, u] rather than [ɛ, ɔ] in closed syllables due to ATR harmony, the latter bleeds (26b). In each case there is a competition over the way the same segments /I/ and /U/ will be realized, which can easily be captured in terms of constraint ranking. In no case does one output bleed an effect that the input would have had on a neighboring segment. In addition, I am unaware of any evidence in Kàlɔ̀ŋ of the need for cyclicity, another systemic property that direct mapping might be compared to. F- and R-harmony appear to be root-controlled, but this may have to do with the distribution of underlying constrasts. A-harmony, on the other hand, may be triggered either by the root or by the causative suffix -i.

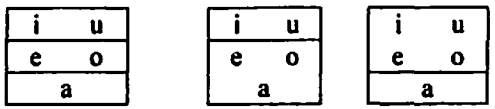


gradient nature of vowel height or proposed hierarchical arrangements of an Open feature, as proposed by Clements (1991). The treatment of vowel height may thus represent a systemic difference between languages. Do languages with the same vowel inventories exploit the same aperture features and geometry, or can they differ in interesting ways ? Kàlɔ̀ŋ has a triangular system of nine underlying and seven surface vowels. What about three- and five-vowel systems?

In (31) I provide three of the possible analyses of the five-vowel system /i, e, u, o, a/, arbitrarily assuming the features [high] and [low] and binarity :

(31) Three underlying representations of the five-vowel system /i, e, u, o, a/

a. [±high, ±low] b. [±high] c. [±low]




In (31a), both features [high] and [low] are active, thereby providing a ternary distinction in vowel height. In (31b), only the feature [high] is active, thereby segregating /i, u/ from /e, o, a/ (which might alternatively be symbolized as /ɛ, ɔ, a/—see below). In (31c), only the feature [low] is active, thereby segregating /a/ from the vowels /i, e, u, o/. Are such differences attested ? I believe the facts from Punu, a B.40 Bantu language spoken in Gabon, are particularly suggestive.

Punu has an underlying five-vowel system, symbolized as /i, e, u, o, a/ (Kwenzi Mikala 1980; Fontaney 1980). The vowels /e, o/, which occur only in the initial syllable of the stem, have the realizations in (32).

(32) Realization of /e, o/ in Punu

a. /e, o/ → [e, o] / ___ i
b. /e, o/ → [e, o] ~ [ɛ,ɔ] / ___ u
c. /e, o/ → [ɛ,ɔ] / ___ a

As seen, the mid vowels are obligatorily pronounced tense (or ATR) before /i/ as well as optionally before /u/. As indicated in (42c), the vowels /e, o/ are pronounced lax before /a/.[12]

The above and other facts about Punu suggest that the underlying five-vowel system should be analyzed as in (33).

(33) Underlying vowel system of Punu

| | | | | |
|---|---|---|---|---|
| i | | u | = A | (ATR) |
| ɛ | a | ɔ | = O | (Open) |

As indicated, /i, u/ have the same A feature we have used for Kàlɔ̀ŋ, while /ɛ, a, ɔ/ have the same O feature. As in Kàlɔ̀ŋ, the A of /i, u/ spreads leftwards onto /ɛ, ɔ/ to derive [e, o] (obligatorily before /i/, optionally before /u/). The complete featural analysis of the input vowels /i, u, ɛ, ɔ, a/, as well as [e, o], are as seen in (34).

(34) Feature analysis of underlying /i, ɛ, u, ɔ, a/ — and derived, surface [e], [o] and "[ə]" (cf. below)

| | i | u | ɛ | ɔ | a | | e | o | ə |
|---|---|---|---|---|---|---|---|---|---|
| A | x | x | | | | | x | x | |
| F | x | | | | | | x | | |
| R | | x | | x | | | | x | |
| O | | | x | x | x | | x | x | |

As seen, [e, o] differ from [ɛ,ɔ] in having the A feature, triggered by /i, u/. Kwenzi Mikala (1980) points out a second source of [e, o]: prefixal /a+i/ and /a+u/ sequences fuse as [e, o], not as *[ɛ, ɔ]. This is seen in (35a).

(35) /a+i/ and /a+u/ → [e, o], not *[ɛ, ɔ]

a. /a-i-lab-i/ → [é-lãb-i] 'il voit'
/a-u-lab-u/ → [ó-lãb-ɔ̀] 'il verra'

b. /a + i/ → [e] c. /a + u/ → [o]
O AF OAF O AR OAR

[12] Because /e, o/ only appear in the first CVC of a stem, there is no opportunity for them to appear before another /e, o/, nor do /e, o/ occur in monosyllabic CV stems.



Whereas the features [high] and [low] do not readily express such fusions, (35b) shows that these outcomes are automatic, given the feature analysis in (34).

There also is no evidence that /a/ is phonologically lower than /ɛ, ɔ/ in Punu—hence no need for a feature [low]. The above sources summarize the realization of /a/ as in (36).

(36) Realization of /a/

a. /a/ → [a] in prefixes and in stem-initial syllable (except monosyllabic stem /Ca/)
b. /a/ → [ə] in post-stem-initial syllable and if stem is monosyllabic /Ca/

Fontaney (1980) illustrates the assimilations of suffixal vowels in (37).

(37) Suffixal *-iC-*, *-uC-* and *-aC-* before final vowels *-a/*, *-i/* and *-u/* (Fontaney 1980)

a. /CVC-iC-a/ → CVC-iC-ə (suffixal a → [ə])
/CVC-uC-a/ → CVC-uC-ə (suffixal a → [ə])
/CVC-aC-a/ → CVC-əC-ə (suffixal a → [ə])
b. /CVC-iC-i/ → CVC-iC-i
/CVC-uC-i/ → CVC-uC-i
/CVC-aC-i/ → CVC-i̲C-i (suffixal a → i / __ i) (a → ə → i)
c. /CVC-iC-u/ → CVC-u̲C-u (suffixal i → u / __ u)
/CVC-uC-u/ → CVC-uC-u
/CVC-aC-u/ → CVC-u̲C-u (suffixal a → u / __ u) (a → ə → u)

As indicated, /i, u, a/ can appear either in -VC- verb extensions or as an inflectional final vowel (FV). When the FV is /-a/ in (37a), the only thing that happens is that suffixal /a/ reduces to what is symbolized as [ə]. In (37b) we see that what should be a schwa is instead realized as [i] before another suffixal [i]. Finally, (37c) shows that both suffixal /i/ and /a/ assimilate to a following /u/.

In my view, the a → ə change is best characterized as the deletion (or non-realization) of the O feature of /a/. As seen in the last column of (34), I propose that what Punu scholars transcribe as schwa is featureless, the equivalent of [ɪ]. In this view, suffixes (or final

vowels) must not have the feature O. Besides the suffixal assimilations schematized in (37), (38) shows that the FV /-a/ totally assimilates (or is deleted) when directly following a CV root :

(38) Final vowel */-a/ → [ə]*, which assimilates to a preceding */i/* or */u/* (Blanchon 1995)

| | | | | | |
|---|---|---|---|---|---|
| a. | /u-ba-a/ | → | [ú-bə̀] | 'to be' | cf. PB *-bá- |
| b. | /u-ji-a/ | → | [ú-jì] | 'to eat' | cf. PB *-dí- |
| | /u-βi-a/ | → | [ú-βì] | 'to be cooked' | cf. PB *-pí- |
| c. | /u-fu-a/ | → | [ú-fù] | 'to die' | cf. PB *-kú- |
| | /u-nu-a/ | → | [ú-nù] | 'to drink' | cf. PB *-ɲó- |

In (38a) we see that /a/ is realized "schwa" even when it is the only vowel of the stem. The verbs in (38b,c) show that the FV /-a/ has no realization after /i/ and /u/, respectively. (The Proto-Bantu reconstructions from Meeussen (1969) are given to the right.)

The above vowel processes amply justify the feature analysis of Punu vowels in (34), which may or may not be identical to analyses required for other underlying five-vowel systems. For example, if we were to mechanically apply Pulleyblank's (1988) underspecification account of the seven-vowel system in Yoruba to Punu's five-vowel system, we would obtain the underlying vowel specifications in (39).

(39) Pulleyblank's (1988) account of Yoruba underspecification extended to five-vowel system

| | /i/ | /u/ | /ɛ/ | /ɔ/ | /a/ |
|---|---|---|---|---|---|
| back | | + | | + | |
| high | | | - | - | |
| low | | | | | + |

As seen, /i/ is the underspecified vowel, which immediately raises the question of how /a+i/ fuses to [e]. In addition, the above feature specifications cannot readily account for how /ɛ, ɔ/ become [e, o] before /i, u/. (One unattractive idea could be to analyze /ɛ, ɔ/ as [+low] with a rule that changes this to [-low] before a [+high] vowel, which is redundantly [-low].) There are doubtless other possibilities. As Archangeli (1984) allows, different languages may underspecify the same vowel inventory differently. But do they even use the same features—and, even if so, are these features have the same privative vs. binary status in all languages?



## 5 Summary

In the preceding sections I have attempted to demonstrate that the featural representations of vowels should be determined from the vowel system itself, based on which feature values are "active". A system-driven approach to the Kàlɔ̀ŋ and Punu facts suggest that different languages may or may not use certain vowel features, which, in the present cases, appear to be privative. The resulting sparse "elemental" vowel representations are not equivalent to underspecification theories based either on markedness or on contrastiveness. Finally, a system-driven approach to Kàlɔ̀ŋ results in a natural analysis of so-called abstract vowels, /I, U/, which, in fact, are not "abstract" in any real sense. As was argued in the 1970s, such underlying representations are still a good way to capture both the structure of a language and what native speakers "know" about it. Of course, "top-down" decisions to use other feature systems, or to invoke one or another theory of underspecification, rule application, opacity etc. can probably be adapted to deal with the facts discussed above. It is, however, hard to imagine that any substantially different conception would give as direct an account of the Kàlɔ̀ŋ vowel system as the one we were driven to by the system itself.

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# Dynamic and pragmatic partial agreement in Luguru*

Lutz Marten

This paper discusses partial subject-verb and object-verb agreement structures with conjoined noun phrases in Luguru (Tanzania, G 30). While the problem of agreement resolution with conjoined NPs has been noted frequently in Bantu linguistics (e.g. Bokamba 1985, Givón 1972, Maho 1999), there are few detailed studies of the topic. However, in the light of a number of recent publications on coordination and agreement more generally (e.g. Aoun et al. 1994, 1999, Corbett 1983, 1991, Johannessen 1996, 1998, Munn 1999, Sadler 1999), it seems a good time to have another look at the Bantu facts. In particular, I argue here that agreement with conjoined NPs in Luguru reflects discourse-processing strategies, and partly depends on the order in which the NP and the agreeing verb are introduced in the discourse, and partly on the specific conjunct the speaker emphasizes. In addition, the agreement data discussed here provide evidence for a split in the morpho-syntactic status of the nominal agreement system between animate (class 1/2) and non-animate (higher classes) nouns, which has been noted in related Bantu languages. The analysis I propose is formalized in Dynamic Syntax (Kempson et al. 2001), a formal model of utterance interpretation which pays particular attention to surface word-order and the hearer's task to use words in context to establish a semantic representation. In section 1, I provide examples of word-order sensitive partial agreement with class 1/2

* I am grateful to Deograsia Ramadhani who provided the Luguru data discussed in this paper, as well as more general comments and suggestions on Luguru grammar. Part of this research has been supported by research grants from the University of London (Central Research Fund) and the British Academy (Grant SG 32379), as well as by institutional support from the Department of Swahili at the University of Dar es Salaam and the Tanzania Commission for Science and Technology, which is hereby gratefully acknowledged.