# PREDICTING IBIBIO VOWEL DISTRIBUTION[&]

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This paper examines vowel distribution in Ibibio and accounts for the distribution with a sonority-based analysis. High vowels in Ibibio have a restricted distribution, in that high vowels do not occur in non-initial syllables in Ibibio verbs, either in an underived environment (root words) or in a derived environment (epenthesis and reduplication). In a derived environment, high vowels in non-prominent positions become mid vowels. This distribution of high vowels challenges theories of positional licensing in Optimality Theory because these theories either preserve marked structures in prominent positions (positional faithfulness and positional markedness) or ban marked structure from non-prominent positions (positional markedness). The restriction on high vowels, thus, is problematic because it occurs in non-prominent positions. We propose that markedness constraints based on nucleus-sonority hierarchy and non-prominent syllable-sonority hierarchy are necessary in the grammar in order to explain the distribution of high vowels in Ibibio.

Cet article examine la distribution des voyelles de l'ibibio à partir d'une analyse fondée sur la notion de hiérarchie de sonorité. Les voyelles hautes de l'ibibio ont une distribution limitée, puisqu'elles n'apparaissent pas dans des syllabes non-initiales des verbes, que ce soit dans des environnements dérivés (épenthèse et réduplication) ou non-dérivés (mots-racine). En contexte dérivé, les voyelles hautes en position non-proéminente deviennent moyennes. Cette distribution des voyelles hautes constitue un défi aux théories du licenciement positionnel opérant dans le cadre de la Théorie de l'Optimalité, puisque ces dernières conservent les structures marquées en position proéminente (fidélité positionnelle) ou les bannissent en position non-proéminente (marque positionnelle). La restriction portant sur les voyelles hautes est ainsi problématique, puisqu'elle se produit en position non-proéminente. Nous affirmons qu'il est nécessaire d'ajouter à la grammaire des contraintes de marque fondées sur la hiérarchie de sonorité du noyau et la hiérarchie de sonorité des syllabes non-proéminentes, afin de rendre compte de la distribution des voyelles hautes de l'ibibio.

## 0. INTRODUCTION

In Optimality Theory, segment neutralization and licensing are sometimes explained through 'positional faithfulness or positional identity' and 'positional markedness'. In this paper we examine the distribution of vowels in Ibibio, and its implication for markedness as explained by theories of positional licensing. Ibibio vowel distribution poses a challenge to 'positional faithfulness' theory (Alderete 1995, Beckman 1997, Jun 1995, Steriade 1995 and others), and 'positional markedness' theory (Ito and Mester 1994, Lombardi 1995, Steriade 1997, Zoll 1996, 1998, and others). In Ibibio, non-high vowels surface without change in situations of assimilation and epenthesis. High vowels, however, become mid vowels in the same contexts. If

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The two Ibibio dialects considered here, Uruan (from Eno Abasi Urua) and Ibakang Nsit (from Willie Udo Willie) have the same neutralization process discussed in this paper. The assimilation of the third person agreement prefix is from Ibakang Nsit; Uruan lacks this assimilation.

mid vowels are more marked than high vowels (Beckman 1997), each of these theories fails to correctly predict what happens to marked structures in weak, non-prominent positions.

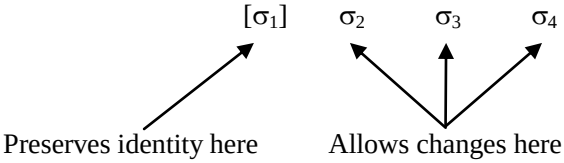
Current theories of positional licensing can account for the restriction of marked structure to prominent positions. By prominent positions, we mean here root initial syllables, stressed syllables, long vowels, et cetera.

Positional faithfulness, or positional identity theory allows marked structure in prominent positions. Positional faithfulness constraints either trigger or resist phonological processes such as assimilation and dissimilation. Furthermore, they favor the neutralization of contrast outside of prominent positions.

For example, the positional faithfulness constraint in (1), has the effect in (2)

(1) *root*-$\sigma_1$-IDENT[V]
*Vowels are preserved identically in root initial syllables*

(2) Positional Faithfulness (after Zoll 2004:367)




Positional faithfulness constraints block changes to segments in particularly strong positions, whether those segments are marked or unmarked. It is where those segments occur that matter.

As Zoll (1998, 2004) points out, positional faithfulness can limit marked structures to certain positions, but only marked structures that are already in the input. Positional faithfulness protects elements in prominent or strong positions, and has nothing to say about non-prominent positions. The implication of this is that it fails to correctly predict what happens to *derived* marked structures.

Positional markedness, on the other hand, makes no such proposal. Since it places no specific faithfulness restrictions on the prominent positions, it allows augmentation to take place in such positions (e.g. lengthening in such positions).

Positional markedness theory restricts marked structure to prominent positions. Therefore positional markedness constraints are often proposed as alternatives to positional faithfulness constraints. The theory dictates that certain marked structures either must not occur or may only occur in particular positions. Negative positional markedness rules out marked segments in a weak position, but has no effect on marked segments in a strong position.

An example of a negative positional markedness constraint is in (3).

(3) NOCODA(Labial): No labial consonants in coda position

For example, a hypothetical input /**pum-sa**/ becomes [**pun-sa**] (Zoll 2004:365). The markedness constraint in (3) rules out a segment that is marked (‘labial’), and in a weak position (‘coda’).

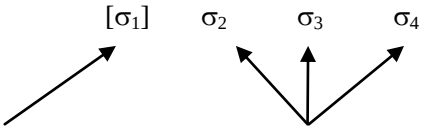
A positive positional markedness constraints calls for marked segments to be restricted to a prosodically strong position. For example,

(4) COINCIDE(heavy syllable, Head PrWd):

A heavy syllable belongs to the head prosodic word (Zoll 2004:371)

The effects of Positional Markedness may be summarized as in (5).

(5) Positional Markedness




Permits marked structure here Disallows (derived) marked structure here

Zoll (2004:376) points out that without Positional markedness there is no way to limit derived marked structure to strong positions. However, this *is* the problem we are faced with in Ibibio. The problem is that Positional Markedness constraints *wrongly* LIMIT derived marked structures to prominent positions.

In Ibibio, the more marked mid vowels are favored over the less marked high vowels in so-called weak positions. Thus, the vowel distribution data shows that marked structure and unmarked structure have to be discerned from each other in non-prominent positions as well. The Ibibio data is a case in which a positional faithfulness constraint (preventing change in the first syllable of a root), and a positional markedness constraint (high vowels make poor nuclei), together result in change to better (but more marked) nuclei in a non-prominent position. We suggest that a sonority-based analysis can complement the current positional licensing analysis of the Ibibio data.

## 1. THE DATA AND PROPOSAL

The restriction on vowel distribution in Ibibio is found in both 'underived'[1] and derived environments. In the underived environment, high vowels cannot occur in the second syllable of a verb root. The same kind of restriction is also found in derived environments, such as those created from assimilation and epenthesis.

First, we present data on vowel distribution in underived verbs, and then follow with the facts of derived environments. The facts of vowel assimilation are illustrated with output vowels in suffixation, (prefixal) reduplication, the agreement prefix, the third person singular prefix, and the first vowel of determiners. Finally, we examine the vowel quality under epenthesis in consonant contact.

The common thread in the data is that both 'positional faithfulness' theory and 'positional markedness' theory make the right prediction in allowing for marked structure in prominent positions. However, both theories make the wrong prediction when faced with a language that allows only marked structure in weak positions. In this paper, we propose that marked structures may arise in 'weak positions' due to other pressures in the grammar, such as pressures of 'sonority'.

While this paper provides evidence that any vowel, marked or unmarked, can appear in neutralization position (see, for example, Lombardi 2003, Rice 2007), and

[1] Faraclas (1989) notes that the root in Cross River languages (of which Ibibio is a member), is typified by the shape –CVC–. Therefore one can argue that the present CVCV verb 'roots' arise from a historic CVC root and a suffix. (Larry Hyman has suggested to us that this suffix vowel may be [a] historically.) Note however that Ibibio verbs vary from simple CV to CV:CV. We will therefore ignore this historic possibility here, unless it is obvious that the second vowel is a suffix, or that the preceding CVC can be inflected in other ways.

that epenthetic vowels can vary cross-linguistically (de Lacy 2002, 2007, Lombardi 2003, Rice 2007), it also shows that these are the results of other pressures in the grammar. In our case, these can be due to the pressures of sonority in Ibibio grammar.

## 2. VOWEL INVENTORY AND DISTRIBUTION IN NON-DERIVED CONTEXTS

Vowel phonemes are a controversial topic in Ibibio. The number varies because of dialect differences (See Connell 1991 for a discussion). Urua (1990, 1999, 2000) proposes a seven vowel system **/i, e, a, ʌ, ɔ, o, u/**. Of these seven, [**ʌ**] cannot occur in open syllables and it cannot be long. Furthermore, it alternates with /**u**/. Therefore, we assume a six-vowel system **/i, e, a, ɔ, o, u/**. But this has no crucial bearing on the conclusions reached here, since our focus is on high vowels. In addition, the restrictions on the distribution of high vowels discussed here occur across dialects.

These six vowels are found in monosyllabic verbs of the shape CV and CVVC, as the first vowel in bisyllabic verbs of the type CVVCV, and as the initial vowel in nouns. These vowels are illustrated with monosyllabic verbs in (6). The data in this section is from Akinlabi and Urua (2003), unless otherwise stated.

| | | | | |
|---|---|---|---|---|
| (6) | **dí** | come | **tíík** | flatter |
| | **sé** | look | **wèèm** | flow (of garment) |
| | **dá** | stand | **fáák** | wedge in |
| | **dɔ́** | marry | **ɲɔ̀ɔ̀n** | crawl |
| | **bó** | say | **kóót** | read/call |
| | **dù** | live | **túúk** | touch |

However, an interesting context is the second syllable of any bisyllabic verb (CVCV, CVVCV, or CVCCV). In this context only four vowels [**e**, **a**, **ɔ**, **o**] occur.

| | | |
|---|---|---|
| (7) | **fìi<u>mé</u>** | maltreat |
| | **yèè<u>mé</u>** | wilt |
| | **dáá<u>rá</u>** | rejoice |
| | **yɔ́ɔ<u>ŋɔ́</u>** | plaster a wall |
| | **wùù<u>ró</u>** | collapse (building) |
| | **tòò<u>ró</u>** | praise |

Thus, Ibibio vowels fall into two distributional sets. The full set [**i**, **e**, **a**, **ɔ**, **o**, **u**] appears in monosyllables and root-initial syllables. The restricted set [**e**, **a**, **ɔ**, **o**] appears in non root-initial syllables.

## 3. VOWEL DISTRIBUTION IN DERIVED CONTEXTS

The distribution of vowels in derived contexts is the same as that observed in nonderived contexts. Considering data from several Ibibio dialects, Essien (1986: 53, 1990: 44) presents the distributional data summarized in (8) (See also Akinlabi and Urua 2003, Urua 1999: 253).

| (8) | Root vowel | Suffix vowel |
|---|---|---|
| | **i, ɨ, e** | **e** |
| | **ə, o, u, ʉ** | **o** |
| | **(ʌ** | **ʌ, or ɔ)** |
| | **ɔ** | **ɔ** |
| | **a** | **a** |

In the rest of this paper, we will focus on the derived environment data, in which high vowels are positionally restricted in comparison with non-high vowels. In the process, we will provide a formal account of the distribution originally observed by Essien and others. We will abstract away from all other features, except height.

## 3.1. ASSIMILATION IN SUFFIXATION

Ibibio verbs can be inflected to make a number of grammatical distinctions, through suffixation. These distinctions include negation and relativization. Essien (1990) refers to Ibibio morphemes that mark verb negation, reversion of action, and relativization as verbal extensions. These morphemes are homophonous (for example, **[kɔ̀p-pɔ́]** (from **[kɔ̀p]** 'lock (door)') can mean either 'not lock' or 'unlock'); and their melodic form depends on the verb root. In this section what we call the negative suffix translates in English to 'not Verb-ing' while the reversive suffix translates to 'unVerb'. Other suffixes create the 'reflexive' or the 'agentless passive' (i.e. suppressed external argument) forms of verbs (Essien 1990, Urua 1990). In the following discussion, our primary focus is on the quality of suffix vowel. For an analysis of the entire verb, including the template, the reader is referred to Urua (1999), Akinlabi and Urua (2003), Harris and Urua (2001).

### 3.1.1. Verb Roots with Non-high vowels

When the verb root has a non-high (and non-central) vowel, the suffix vowel is completely identical to the root vowel, as in reversive and negative suffixes in (9) and (10). In addition, after CVC roots the reversive suffix copies the final consonant and the vowel preceding it in the form of CV.

(9) CVC Roots - reversive

| | | | |
|---|---|---|---|
| **kɔ̀p** | lock (door) | **kɔ̀p-pɔ́** | unlock |
| **sɔ̀t** | squat | **sɔ̀t-tɔ́** | move from squatting position |
| **tèm** | cook | **tèm-mé** | remove cooking from fire |
| **byòm** | carry load on the head | **byòm-mó** | remove load from the head' |

For CV verb roots, the negative suffix takes the form of a dorsal continuant [-ɣ] and a vowel identical to the preceding vowel, but the CV roots now become CVV.

(10) CV Roots - negative

| | | | |
|---|---|---|---|
| **sé** | look | **ń-séé-ɣé** | I am not looking |
| **nɔ̀** | give | **ń-nɔ̀ɔ̀-ɣɔ́** | I am not giving |
| **dó** | be (copula) | **ń-dóó-ɣó** | I am not |
| **dá** | stand | **ń-dáá-ɣá** | I am not standing |

Finally, after CVVC roots the negative suffix is a vowel identical to the root vowel. The input stop coda undergoes lenition, creating a surface CVVCV suffixed verb. In the reversive form of the verb, non-high vowels are copied identically in the suffix. The long root vowel becomes short, but the consonant geminates, resulting in a surface form identical to that of CVC roots in (9).

(11) CVVC Roots

a. Negative Forms[2]

| | | |
|---|---|---|
| **fáák** wedge between two objects/ screw on | ...**fáá-ɣá** | ...not wedged/ not screwed |
| **kɔ́ɔ́ŋ** hang on hook | ...**kɔ́ɔ́-ŋɔ́** | ...not hanging on hook |
| **ɲɔ̀ɔ̀n** crawl | ...**ɲɔ̀ɔ̀-nɔ́** | ...not crawling |
| **wèèm** flowing | ...**wèè-mé** | ...not flowing |
| **kóót** read/call | ...**kóó-ró** | ...not reading/calling |
| **déép** scratch | ...**déé-βé** | ...not scratching |

b. Reversive Forms

| | | |
|---|---|---|
| **fáák** wedge between two objects | **fák-ká** | remove wedged object |
| **kɔ́ɔ́ŋ** hang on hook | **kɔ́ŋ-ŋɔ́** | remove from hook |

In summary, the suffix vowel is assimilated completely to the root vowel, when the root vowel is non-high.

### 3.1.2. Roots with high vowels

For roots with high vowels, however, suffix vowels do not copy identically when reversive and negative suffixes are added. As demonstrated in (12-15), the suffix vowel in both negative and reversive appears as mid vowels regardless of the form of roots: CV, CVC or CVVC.

(12) CV Roots[3]

| | | | |
|---|---|---|---|
| **kpì** | cut (with matchet) | ...**kpìì-ɣé** | ...not cutting |
| **dí** | come | ...**díí-ɣé** | ...not coming |

[2] The negative suffix takes the default form [**ké**] after bisyllabic verbs, no matter the segmental melody of the verb. Consider the negated forms of the bisyllabic verbs below (Akinlabi & Urua 2003):

| | | | |
|---|---|---|---|
| **dáppá** | dream (vb.) | ...**dáppá -ké** | ...not dreaming |
| **dámmá** | be mad | ...**dámmá -ké** | ...not being mad |
| **dɔ́kkɔ́** | tell | ...**dɔ́kkɔ́ -ké** | ...not telling |

[3] As in the cases with non-high vowel roots, after bisyllabic verbs with high vowels, the negative suffix takes the invariant form [**ké**]. Negated bisyllabic verbs have the default suffix [**ké**] (Akinlabi & Urua 2003).

| | |
|---|---|
| ...**nɨ́ɣé -ké** | ...not tickling |
| ...**tʌ̀nɔ́ -ké** | ...not being disciplined |
| ...**dɨ́ppé -ké** | ...not lifting up |
| ...**yʌ́ttɔ́ -ké** | ...not twisting |

| | | | |
|---|---|---|---|
| **dù** | be alive | ...**dùù-ɣ́o** | ...not living |
| **kpù** | be in vain | ...**kpùù-ɣ́o** | ...not being in vain |

(13) CVVC Roots: Negative

| | | | |
|---|---|---|---|
| **wúúk** | drive something in | **wúú-ɣ́o** | not driving in |
| **síít** | seal an opening | **síí-ré** | not sealing an opening' |

(14) CVC Roots

| | | | |
|---|---|---|---|
| **sɨ́n** | put on (e.g. dress) | **sɨ̂né** | put on (or by) oneself |
| **yɨ́t** | fasten | **yɨ̂ré** | be fastened/fasten on oneself |
| **dɨ́p** | hide | **dɨ̂βé** | hide oneself |
| **kʌ́p** | cover (with lid) | **kʌ́βɔ́** | be covered (as with a hen) |
| **fʌ́k** | cover (with cloth) | **fʌ́ɣɔ́** | cover oneself |

(15) CVVC Roots

| | | | |
|---|---|---|---|
| **síít** | seal/block an opening | **sɨ̂ré** | be sealed/be blocked |
| **fíík** | press down | **fɨ̂yé** | be piled up |
| **fííp** | suck | **fɨ̂βé** | have an object stick out of the mouth |
| **wúúk** | drive something in [e.g. stakes for yam] | **wʌ́ɣɔ́** | be driven in |
| **bùùk** | bury | **bʌɣɔ́** | be buried |

### 3.1.3. Summary of facts from suffixation

The data presented in (9)-(15) demonstrate that assimilation proceeds from the prominent position to the non-prominent position; vowels copy from the root to suffixes. Non-high vowels copy completely (identically), whereas high vowels become mid. In other words, high vowels do not copy completely onto suffixes.

However, the observation that high vowels do not copy onto suffixes is only part of the story. The complete copying of high vowels into any position is not allowed: suffixes, prefixes, or epenthetic positions. In the next section, we present data from Ibibio prefixation.

## 3.2. ASSIMILATION IN PREFIXATION

Contrastive reduplication in Ibibio is a prefixing reduplication in verbs which gives the interpretation: 'X rather than or as opposed to...' as in for example **bɔ́p** 'build', **bɔ́ɔ́-bɔ́p** 'build rather than/as opposed to...' Non-high (and non-central) vowels copy as they are, whereas high vowels become mid vowels in a reduplicative prefix irrespective of the type of roots.[4] Again, for an account of the reduplicative template the reader is referred to Akinlabi and Urua (2003) and Urua and Akinlabi

[4] Non-reduplicated (underived) prefixes in Ibibio can be high vowels **tòòró** 'praise' (vb.), **ítòòró** 'praise' (n.) (personal name). We assume that such prefixes are protected from change by their occurrence in absolute word initial position. The focus here is affixes whose features are copied from the preceding or following root.

(1996). The examples in (16-21) are organized such that the last two forms in each set illustrate roots with high vowels.

(16) With CV Verbs

| | | |
|---|---|---|
| **bó** | say | **bóó**-bó |
| **kɔ̀** | gather | **kɔ̀ɔ́**-kɔ́ |
| **tá** | chew | **táá**-tá |
| **mé** | endure | **méé**-mé |
| **sù** | tell a lie | **sòó**-sù |
| **dí** | come | **déé**-dí |

(17) With CVC Verbs

| | | |
|---|---|---|
| **dép** | buy | **déé-dép** |
| **bɔ́p** | build | **bɔ́ɔ́-bɔ́p** |
| **kàt** | show | **kàá-kàt** |
| **kpòt** | grumble | **kpòó-kpòt** |
| **nɨ̀m** | believe | **nèé-nɨ̀m** |
| **kʌ́p** | cover (a pot) | **kɔ́ɔ́-kʌ́p** |

(18) With CVVC Verbs

| | | |
|---|---|---|
| **bɔ́ɔ́k** | nurture | **bɔ́ɔ́-bɔ́ɔ́k** |
| **kóót** | read/call | **kóó-kóót** |
| **dààk** | put underneath | **dàá-dáàk** |
| **kpéép** | teach | **kpéé-kpéép** |
| **tíík** | flatter | **téé-tíík** |
| **nùùk** | bend | **nòó-núùk** / **nɔ̀ɔ́-núùk** |

(19) With CVCV Verbs

| | | |
|---|---|---|
| **bèɣé** | arrive (from journey) | **bèé-beɣè** |
| **dòró** | be bitter | **dòó-dórò** |
| **sɔ̀βɔ́** | boil (of food) | **sɔ̀ɔ́**-sɔ́βɔ̀ |
| **yámá** | be bright | **yáá-yámá** |
| **bɨ̀mé** | scramble for | **bèé-bɨ́mè** |
| **tʌ̀nɔ́** | chastise | **tɔ̀ɔ́-tʌ̀nɔ̀** |

(20) With CVVCV Verbs

| | | |
|---|---|---|
| **bɔ̀ɔ̀rɔ́** | respond | **bɔ̀ɔ́-bɔ́ɔ́rɔ̀** |
| **tòòró** | praise | **tòó-tóórò** |
| **kààmá** | stir (food) | **kàá-káámà** |
| **bééŋé** | borrow | **béé-bééŋé** |
| **fíímé** | maltreat | **fée-fíímé** |
| **ŋwùùnó** | smell | **ŋwòó-ŋwúúnò** |

(21) With CVCCV Verbs

| | | |
|---|---|---|
| **yómmó** | be pregnant | **yóó-yómmó** |
| **wɔ́ŋŋɔ́** | turn | **wɔ́ɔ́-wɔ́ŋŋɔ́** |
| **démmé** | wake up | **déé-démmé** |
| **dáppá** | dream | **dáá-dáppá** |
| **ɲɨmmé** | agree | **ɲéé-ɲɨmmé** |
| **sʌ̀kkɔ́** | faint | **sɔ̀ɔ́-sʌ́kkɔ̀** |

As the above examples of reduplicative prefixes show, assimilation proceeds from the prominent position to the non-prominent position. Vowels are assimilated from base to reduplicant (prefix). Non-high vowels copy completely, whereas high vowels become mid. In other words, high vowels do not copy onto prefixes.

## 3.3. ASSIMILATION OF THE THIRD PERSON SINGULAR AGREEMENT PREFIX [**a**][5]

The third person singular agreement prefix [**a**] assimilates to the preceding vowel in natural speech. In slow speech, the agreement marker (AGR.) is always [**a**].

(22) Slow speech: **édèm á**bén **èsìò** (**bén** lift)
Edem AGR.lift pot

In natural speech, however, [**a**] assimilates to the final vowel of the preceding noun. The agreement marker [**a**] undergoes full assimilation if preceded by non-high vowels. If the final vowel is a high vowel, the agreement marker [**a**] does not become a high vowel, as would be expected, but it becomes a mid vowel.

(23) Natural speech: Assimilation to the final vowel of the first noun.

| | |
|---|---|
| **édèm é**bén **èsìò** | Edem is lifting a pot |
| **ɔ̀rɔ́ʁ ɔ́**bén **èsìò** | Orok is lifting a pot |
| **ínám á**bén **èsìò** | Inam is lifting a pot |
| **èkóːn ɔ́**bén **èsìò** | Ekon is lifting a pot[6] |
| **ɔ̀kʌ́ʁ ɔ́**bén **èsìò** | Okuk (lit. money) is lifting a pot |
| **átɨ̀m é**bén **èsìò** | Atim is lifting a pot |

If there are more agreement prefixes in a sentence, each agreement prefix only assimilates to the locally preceding vowel as in (24). The first agreement marker assimilates to the preceding vowel [**e**]. The second agreement marker assimilates to the preceding vowel [**ʌ**] ([**ʌ**] is underlyingly [**u**], and [**ʌ**] does not occur in an open syllable).

[5] Data in this section and in the next two sections comes from Willie Udo Willie.

[6] A reviewer notes that this should be **èkóːn á**bén **èsìò**. Our consultant has **ɔ́bén** rather than **á**bén.

(24) Two agreement prefixes assimilate to preceding vowel.

| **édèm** | **ésʌ́ʁ** | **ɔ́bén** | **èsìo** |
|---|---|---|---|
| Edem | AGR.to be | AGR.lift | pot |

Edem is lifting a pot

In some dialects, the third person agreement prefix assimilates to the vowel of the verb, when there is no overt third person noun. The asymmetry between non-high vowels and high vowels is also found when this agreement marker assimilates to verbal roots. Non-high vowels copy identically, but high vowels become mid.

(25) Agreement assimilation from verbs (Essien 1990: 45, Urua 2000: 111)

a. Non-high vowels

| | | | |
|---|---|---|---|
| **bén** | carry | **é – bên** | s/he is carrying |
| **nə́k** | push | **ó – nə̂k** | s/he is pushing |
| **kʌ̀k** | shut | **ɔ́ – kʌ̂k** | s/he is shutting |
| **kòp** | hear | **ó – kôp** | s/he is hearing |
| **bɔ́k** | make a soup | **ɔ́ – bɔ̂k** | s/he is making a soup |
| **bàk** | be early | **á – bâk** | s/he is early |

b. High vowels:

| | | | |
|---|---|---|---|
| **bít** | resemble | **é – bît** | s/he resembles |
| **bɨ́t** | spread a mat | **é – bɨ̂t** | s/he is spreading a mat |
| **kpùd** | zoom | **ó – kpûd** | s/he is zooming |
| **nʊ̀ùk** | bend | **ó – núùk** | s/he is bending |

However, not all dialects of Ibibio allow the assimilation of the third person agreement prefix to the verb. In the non-assimilating dialects, the third person agreement prefix is simply an invariant [a], as the examples in (26) show.

(26) Non-assimilating dialects (Urua 2000: 112)

| | | | |
|---|---|---|---|
| **bɨ́t** | spread a mat | **á – bɨ̂t** | s/he is spreading a mat |
| **bén** | carry | **á – bên** | s/he is carrying |
| **nə́k** | push | **á – nə̂k** | s/he is pushing |
| **kʌ̀k** | shut | **á – kʌ̂k** | s/he is shutting |
| **nùùk** | bend | **á – núùk** | s/he is bending |

etc.

The cross-dialect key point to note is that when assimilation is allowed, it is complete, as in (24) and (25), except that high vowels do not copy completely.

### 3.4. ASSIMILATION OF THE INITIAL VOWEL OF THE DETERMINER ‘THE/THAT’

The determiner ‘the/that’ in Ibibio undergoes assimilation as well. The first vowel of the determiner assimilates to the final vowel of the preceding noun. The same restriction on high vowels described above is found, namely that the four non-high

vowels assimilate completely, whereas high vowels become mid in the assimilated position. The same generalization holds for the first vowel of predicative adjectives (Data from Willie Udo Willie).

| | | | | |
|---|---|---|---|---|
| (27) | **ódò** | that/the (near) | **ókò** | that/the (far) |
| | **èkpàɾa̲dò** | that bag (near) | **èkpàɾa̲kò** | that bag (far) |

(28) Non-high vowels

| | | | |
|---|---|---|---|
| **èkpàt** | bag | **èkpàɾa̲dò** | the/that bag (near) |
| **ébót** | goat | **ébóɾo̲dò** | the goat |
| **ùdɔ̀k** | door | **ùdɔ̀ʁɔ̲dò** | the door |
| **úfɔ̀k** | house | **úfɔ̀ʁɔ̲dò** | the house |
| **ŋ̀wèt** | book | **ŋ̀wèɾe̲dò** | the book |
| **ùɾíá** | yam | **ùɾíáa̲dò** | the yam |

(29) High vowels

| | | | |
|---|---|---|---|
| **ésɨt** | heart | **ésɨɾe̲dò** | the heart |
| **úfɨk** | odor | **úfɨʁe̲dò** | the odor |
| **ísíp** | palm kernel | **ísíβe̲dò** | the palm kernel |
| **ìnì** | time | **ìnìe̲dò** | the time |
| **ùdì** | grave | **ùdìe̲dò** | the grave |
| **èbù** | termite | **èbùo̲dò** | the termite |
| **ùkù:t** | calamity | **ùkù:ɾo̲dò** | the calamity |
| **ékp͡ɑ̂k** | knot | **ékp͡ʌʁo̲do** | the knot |

The summary of the facts from the agreement prefix and the determiner 'the/that' is that assimilation proceeds from the prominent position to the non-prominent position, from the lexical words (nouns and verbs) to agreement prefixes and determiners. Non-high vowels copy completely, but high vowels become mid.

## 3.5. VOWEL EPENTHESIS

### 3.5.1. Vowel epenthesis in numeral reduplication

As noted in Akinlabi and Urua (2003), in complete reduplication of two closed monosyllabic roots, two morphemes beginning and terminating in consonants occur next to each other, creating a consonant cluster. In this situation the reduplicated form is treated as two stems; the final consonant of the first stem is syllabified as an onset of a new syllable whose nucleus is an epenthetic vowel, which breaks up the resulting consonant cluster. The epenthetic vowel is a copy of the vowel of the preceding stem. Such is the case in the following numeral reduplication.

(30) Numeral reduplication

| | | | | | |
|---|---|---|---|---|---|
| **kèèt** | one | → | **kèèrè kèèt** | (<**kèètkèèt**) | one by one / one each |
| **dwòp** | ten | → | **dwòβo̲ dwòp** | (<**dwòpdwòp**) | ten by ten / ten each |

### 3.5.2. Vowel epenthesis with a consonant initial noun [**koko**]

Another example of vowel epenthesis is found in possessive constructions before a consonant initial noun, such as the name [**kòkó**]. In the examples in 32, [**kòkó**] is combined with various nouns in this possessive construction. In each case the first noun ends in a consonant, creating a consonant cluster. The resulting consonant cluster is resolved through epenthesis, as in the nominal reduplication. The epenthetic vowel between the head noun and [**kòkó**] follows the same restriction on vowel distribution in Ibibio. Non-high vowels copy identically 32, whereas high vowels become mid 33. When the second noun is not consonant initial, like [**ókôn**], there is optional assimilation, but no vowel epenthesis, as in 34.

(31) **kòkó** personal name (lit. namesake)

(32) Non-high vowels

| | | | |
|---|---|---|---|
| a. | **òbót** | + **kòkó** | **òbóɾo̲kòkó** |
| | creator | | Koko's creator |
| b. | **úfɔ̂k** | + **kòkó** | **úfɔʁɔ̀kòkó** |
| | house | | Koko's house |

(33) High vowels

| | | | |
|---|---|---|---|
| a. | **ésìt** | + **kòkó** | **ésìɾe̲kòkó** |
| | heart | | Koko's heart |
| b. | **àkʌ́k** | + **kòkó** | **àkʌʁɔ̀kòkó** |
| | money | | Koko's money |

(34) Vowel initial second noun[7]

| | | | |
|---|---|---|---|
| a. | **èkpàt** | **ókôn** | **èkpàɾo̲kôn** / **èkpàɾákôn** |
| | bag | Okon | Okon's bag |
| b. | **úkót** | **ébót** | **úkóɾe̲bòt** / **úkóɾo̲bòt** |
| | leg | goat | Goat's leg |

Again, the facts from vowel epenthesis are that assimilation proceeds from the prominent position to the non-prominent position, from stem to the epenthetic position. Non-high vowels copy completely, but high vowels become mid. In other words, high vowels do not copy onto the epenthetic position.

## 3.6. OVERALL SUMMARY OF THE FACTS

The facts of Ibibio vowel distribution in assimilation are identical to those of vowel distribution in underived verbs. In underived monosyllabic and bisyllabic verb roots all vowels can occur in the initial syllable of the verb stem (/**i**, **e**, **a**, (**ʌ**,) **ɔ**, **o**, **u**/), but only non-high vowels ([**e**, **a**, **ɔ**, **o**]) occur in non-initial root syllables. The data on

[7] A reviewer notes that (s)he does not have assimilation in (34b). Our consultant, who speaks Ibakang Nsit, has an alternative pronunciation.

vowel distribution considered in prominent and non-prominent positions are the following.

(35) Data on vowel distribution in derived contexts
a. Stem to suffix in suffixation
b. Stem to prefix in the third person singular
c. Noun stem to vowel prefix in the determiners
d. Base to reduplicant in reduplication (prefixes)
e. The first noun stem to the following epenthetic position

Assimilation (30a-d) and epenthesis (30e) always proceed from the prominent position to the non-prominent position. In all cases observed so far, both high and non-high vowels can occur in prominent positions, but high vowels neutralize with mid vowels in non-prominent positions, with only non-high vowels occurring in the non-prominent positions.

## 4. AN ANALYSIS

One of the key points from the above is that the contrast between high vowels and mid vowels is neutralized in non-prominent positions, derived or underived, in favor of mid vowels. The question is how markedness might account for this neutralization.

Rice (2007: 80) provides a list of the characteristics that usually informs 'phonological markedness' or 'structural markedness' (Bybee 2001), as opposed to 'natural markedness' (Anderson 1985) or 'frequency markedness' (Bybee 2001) – the phonetic basis of an opposition.

(36) Phonological characteristics of feature markedness (Rice 2007: 80)

| *Marked* | *Unmarked* |
|---|---|
| subject to neutralization | result of neutralization |
| unlikely to be epenthetic | likely to be epenthetic |
| trigger of assimilation | target of assimilation |
| remains in coalescence | lost in coalescence |
| retained in deletion | lost in deletion |

The first two characteristics listed in (32) place the Ibibio mid vowels as structurally unmarked with respect to high vowels, because of the data that we have presented above. However, it has been proposed in the literature that high and low vowels are unmarked with respect to mid vowels (see for example Beckman 1997). As Rice (2007: 81) notes, 'high vowels are common in epenthesis and often result from neutralization; in addition high vowels are frequent in inventories, and the presence of mid vowels in an inventory implies the presence of high vowels'. Therefore, even on the basis of natural or frequency markedness, one expects high vowels to be less marked than mid vowels.[8]

Turning now to positional faithfulness and positional markedness, and applied in their original forms, both theories make the wrong prediction about the distribution of

[8] Recently, Hume (2006) proposes that universal markedness is not universal. She suggests that a universally marked vowel can be unmarked under the information theory, which measures Precision, Cue quality, Contrast, Contextual frequency and Social value. This approach calculates individual vowel values in a wider context in specific languages, which in turn determines whether a vowel is marked or unmarked based on the given values. By not assigning an absolute markedness value on vowels, this approach would be able to account for the vowel distribution in Ibibio. However, it is not clear to us how to calculate the values of each variable proposed in the information theory.

high vowels in Ibibio. Positional faithfulness predicts correctly that full contrast occurs in prominent positions such as onsets, first syllables, and heads of feet; and that reduction takes place in non-prominent positions such as codas, non-initial syllables, and non-heads, etc. In addition, positional faithfulness also predicts that such reduction is always to the less marked element (see for example Beckman 1997). In the case of Ibibio therefore, the reduction is supposed to be to the less marked high vowels /**i**, **u**/, and not to the more marked mid vowels. Positional markedness on the other hand prohibits marked structure from non-prominent positions, again wrongly predicting that mid vowels rather than high vowels will be prohibited from non-initial syllables. The Ibibio data represents a case in which both positional faithfulness and positional markedness are required at the same time.

In following sections, we present a sonority-based analysis that resolves problems emerging from classical positional analysis. Marked structures, such as marked vowels may arise in 'weak positions' due to other pressures, such as sonority in syllable nuclei. We claim that the conflict is between the pressure to reduce to the 'unmarked' vowel, and the pressure to have a more sonorous nucleus, as we see in Ibibio.

## 4.1 CONSTRAINTS AND CONSTRAINT RANKING

A markedness hierarchy based on sonority of vowels is adopted as in 37 and 38 (Crosswhite 1999, de Lacy 2006, Prince and Smolensky 2004). Given this hierarchy, the worst nuclei are high central [**ɨ**, **ʉ**] and the best nuclei are [**a**]. The net effect of the nucleus-sonority constraints in 36 is to increase sonority in syllable nuclei. The effect of unstressed-sonority constraints is to reduce sonority in unstressed (or 'nonprominent') syllable nuclei. The bolded constraints are the ones relevant to Ibibio.

(37) *Nucleus-sonority constraints* (Prince and Smolensky 2004)

***nuc/ɨ,ʉ** » ***nuc/ə** » ***nuc/i,u** » ***nuc/e,o** » ***nuc/ɛ,ʊ** » ***nuc/a**

(38) *Unstressed-sonority constraints* (Crosswhite 1999, de Lacy 2006)

***σ̆/a** » ***σ̆/ɛ, ɔ** » ***σ̆/e,o** » ***σ̆/i,u** » *σ̆/**ə** » *σ̆/**ɨ,ʉ**

While the sonority hierarchy in 37 shows that [**a**] is the most sonorous nucleus, the markedness hierarchy in 38 shows the opposite, that high vowels are the least marked. 38 also shows that when there are central vowels, they are less marked than high vowels, hence their positions at the bottom of the hierarchy. Therefore, if all other things are equal, reduction in non-prominent syllables in Ibibio should go in the direction of high vowels [**i**, **u**].

To account for the fact of assimilation in Ibibio, we adopt two constraints AGREE[F] (39) and IDENT (40). The constraint AGREE[F] favors candidates, in which vowel features agree between prominent and non-prominent positions. Two faithfulness constraints, IDENT[low] and IDENT[high], disfavor any change in height features between input and output.

(39) AGREE[F]

A vowel feature [F] agrees between prominent positions and nonprominent positions.

(40) IDENT[low], IDENT[high]

An input segment with feature [F] has a correspondent segment in the output with feature [F].

The basic generalization that we want to capture is that root-initial high vowels remain high. Other vowels become non-high. The ranking that places positional faithfulness constraints over context-free markedness constraints ensures the preservation of high vowels in root initial syllables (prominent positions), in spite of being marked (least sonorous) nuclei.

(41) *High vowels are preserved in root initial syllables*
*root*-$\sigma_1$-IDENT[high] » *NUC/**i**,**u**

This can be illustrated with a monosyllabic verb **dí** 'come', from (6), as in the following tableau. In tableaux, asterisks indicate the violation profile. Ranking argument is shown in comparative tableaux. 'W' means that the optimal candidate (☞) is the winner under a constraint. 'L' means that the optimal candidate loses against other candidates under a constraint. In comparative tableaux, all L's should be dominated by at least one W. For further information, see Prince (2000).

(42) High vowels in initial syllable

| /**dí**/ | *root*-$\sigma_1$-IDENT[high] | *NUC/**i**,**u** |
|---|---|---|
| ☞ (a) **dí** | | |
| (b) **dé** | W* | L |

Next, placing the context-free nucleus-sonority markedness constraint (*NUC/**i**,**u**) above the general faithfulness constraint neutralizes high vowels in any other positions (non-prominent positions). This ranking has the effect of changing any input high vowel to non-high in the second syllable of underived bisyllabic stems.

(43) *Neutralization ranking*
*root*-$\sigma_1$-IDENT[high] » *NUC/**i**,**u** » IDENT[high]

(44) *Neutralization in bisyllabic verbs* [wùù**ró**] 'collapse (building) (assuming that the second syllable has a high vowel input.)

| /**wùùrú**/ | *root*-$\sigma_1$-IDENT[high] | *NUC/**i**,**u** | IDENT[high] |
|---|---|---|---|
| (a) **wùùrú** | | W** | L |
| ☞ (b) **wùùró** | | * | * |

*NUC/**i**,**u** is fighting against a harmony process. In other words, *NUC/**i**,**u** blocks harmony with high vowels, as well as faithfulness to the high-vowel input in non-prominent syllables.

The ultimate aim of the constraint ranking in Ibibio grammar is to make sure that *whatever* the underlying vowel of the suffix is (or even if there is not an underlying vowel), the output suffix vowel ends up as follows.

(45) *Effect of Neutralization ranking*
a. The output suffix vowel must be [–high] and
b. otherwise it agrees with the stem vowel (i.e. in terms of [low], [ATR], [round]).

The problem becomes more acute, if we consider Richness of the Base. What if the underlying form of the negative (10)-(13) (or some other morpheme – it does not matter) were /**ki**/? If that were the case, we would need a ranking in which AGREE[F] dominates IDENT[F], to force a change in the assumed underlying feature specification of the suffix. Note that the constraint AGREE is not crucial here. Any constraint that forces harmony would be equally good for this analysis. [F] here refers to all relevant vowel features: [high, low, ATR, round]. So, AGREE[F] is a shorthand for AGREE[high], AGREE[low], etc. In the following ranking, the constraint *NUC/i,u blocks full harmony in stems with high vowels, therefore it must dominate AGREE[F].

(46)

| /**dí-ki**/ | *NUC/i,u | AGREE[F] | IDENT[F] |
|---|---|---|---|
| (a) **díí-ɣí** | W ** | L | L |
| ☞ (b) **díí-ɣé** | * | *[1] | * |
| (c) **díí-ɣá** | * | W **[2] | W ** |

[1] The violation mark comes from disagreeing in [high].
[2] The violation marks come from disagreeing in [high, low, ATR]

In epenthesis (29)-(32), the most desirable epenthetic vowel is one that is non-high (obeying *NUC/**i**,**u**), but otherwise harmonizes with the stem, due to the above ranking. No additional constraints are necessary to account for these cases (other than the ones triggering epenthesis, which are beyond the scope of this paper).

Note that the ranking AGREE[F] » *ŏ/**e**,**o** is needed to make sure that affix vowels can be [**e**,**o**]. If *ŏ/**e**,**o** outranked AGREE[F], both [**i**,**u**] and [**e**,**o**] would be eliminated in affixes.

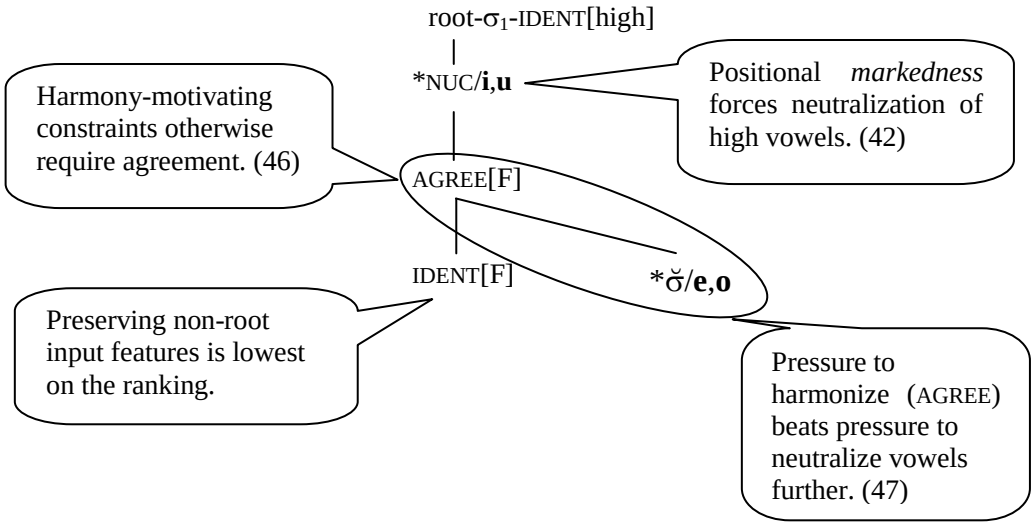
(47)

| /**dí-ki**/ | *NUC/i,u | AGREE[F] | *ŏ/e,o |
|---|---|---|---|
| (a) **díí-ɣí** | W ** | L | L |
| ☞ (b) **díí-ɣé** | * | * | * |
| (c) **díí-ɣá** | * | W ** | L |

## 4.2 RANKING SCHEME

The ranking argument for Ibibio vowel distribution is presented as follows. The explanation is fairly straightforward. At the top of the hierarchy is the preference for preserving vowel contrast in the initial syllable of roots. Outside of this syllable, high vowels may be neutralized to allow for more sonorous nuclei. Subordinate to both of these is assimilation (harmony) between the root and a suffix or a prefixed reduplicant. The pressure to assimilate takes precedence over any further sonority considerations, or retaining whatever input specifications may be assumed for the non-root (initial) vowels. (48) presents a Hasse diagram of the ranking argument.

(48) Ranking diagram (schematic)




## 5. CONCLUSION

In this paper, we have examined the restricted distribution of high vowels in Ibibio. In assimilation, prefixal reduplication and epenthesis (breaking consonant contact), non-high vowels copy identically, whereas high vowels become mid vowels. This is a challenge to classical positional theories, which cannot distinguish marked structure from unmarked structure in non-prominent positions. After presenting the crucial data of vowel processes in Ibibio, an analysis based on sonority is suggested to account for the high vowel restriction in Ibibio. In essence, this paper proposes that the reason for the neutralization of high vowels to mid vowels outside the first root syllable in Ibibio is not because mid vowels are less marked, but because they are more sonorous.

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