

VOWEL HARMONY IN BIJAGÓ

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Bijagó, an Atlantic language spoken in Guinea-Bissau, has a fully operative class concord system. The vowels in several of the class prefixes harmonize with the first vowel of the stem to which they are affixed, but the number of different vowel qualities they may display varies from two to seven, according to the class concerned. Several verb affixes, too, have vowels which harmonize with the nearest vowel of the verb form. The variety both of harmonizing affixes and of analogous invariable ones, and their respective contexts, is here illustrated.

Le bijagó, langue atlantique de Guinée-Bissao, possède un système très complet d'accords de classe. Les voyelles de plusieurs des préfixes de classe s'harmonisent avec la première voyelle du thème auquel on les affixe, mais le nombre de timbres possibles de ces voyelles harmonisantes varie selon la classe en question. Plusieurs des affixes verbaux ont également une voyelle qui s'harmonise avec celle de la syllabe avoisinante dans la forme verbale où elle figure. La présente étude offre un aperçu, tant des affixes harmonisants de la langue que des affixes analogues invariables, et en fournit des exemples dans leurs contextes respectifs.

0. INTRODUCTION

The Bijagó language (vernacular name: *kà-jòokó*) is a member of the (West) Atlantic group, spoken by some 20,000 people in the islands of the Bissagos archipelago off the Guinea-Bissau coast. Each island has its own dialect, and all but that of Caravela-Caraxe-Maio are mutually comprehensible.

Lexically Bijagó remains aloof¹ from all other Atlantic languages, while having a fully operative class concord system, as many of them do. Sapir's statistical table (1971:47) shows Bijagó with the lowest overall figures in the group, averaging about 6 percent common look-alikes with the 33 other languages sampled. The language may well have split off from a common stock before the North/South divide in Atlantic became apparent. The language may indeed be coordinate with Atlantic, rather than a branch of it (cf. Williamson 1989:14).

Three Bijagó classes have concord exponents that are reflexes of items met elsewhere in Niger-Congo (p. 38–39). These are: *o/ya* for singular/plural forms of some personal nouns (compare also *wa-/ba-* in reported speech when referring to the speaker), and *N-* for nouns denoting liquids.

Bijagó is unique in that the number of harmonizing variants in the vowel of a morpheme varies considerably. While, for instance the class prefix *u-* is invariable, the prefix *ku-* has variants *kɔ-* and *kɔ̃-* depending on the first vowel of the stem to which it is affixed, and the prefix of another class has only two variants, *o* and *ɔ*. On the other hand *nu-*, *no-*, and *nɔ̃-* are but three of the harmonizing variants of a class prefix which also has front vowel variants.

In many languages, notably in the Gur and Kwa groups, the vowels fall into two sets, distinguished by the presence or absence of the feature [ATR] (= advanced tongue root), such as /i e ɔ o u/, which are [+ATR] and /i ɛ a ɔ u/ which are [-ATR]. In some systems *a* is a member of both sets, to the exclusion of *ɔ*.

In such systems the vowels of a given root all belong to the same set, and affix morphemes each have two variants, with vowels in each of the sets. The harmony then consists of matching the set of the affix vowel(s) with that of the nearest root vowel.

¹Culturally, too, the Bijagós remain distinct in some respects. Polyandry is the norm, with the mother's brother being the head of the family, and there being no bride price. In the folktales we find Frog in place of Rabbit or Spider (Ananse), while Wolf becomes Rat.

In some languages, certain vowels have coalesced, usually **i** with **e** and **u** with **o**, so that the system becomes unstable, though affixes may retain their two variants forms.

Another type of harmony is suggested by my all too brief samples of Diola dialects (Atlantic). In Diembereng, most strikingly, of about 100 nouns having CV- prefixes with vowels other than **a**, 90 percent show the correlation in (1) between prefix vowel and first root vowel.

- | | | | | | | | | |
|-----|--------------|----------|----------|----------|----------|----------|----------|----------|
| (1) | Prefix V | i | e | i | i | u | o | u |
| | First root V | i | e | ɛ | a | ɔ | o | u |

Prefixes with vowel **a**, and the **ɛ**- prefix, show no variation.

In Huluf dialect, on the other hand, no prefixes show variation. Compare the examples in (2), in which 'four' has first root vowel **a**, while 'two' has **u**.

- | | | | |
|-----|------------|-----------------|----------------|
| (2) | | 'four' | 'two' |
| | Diembereng | sibaaker | susuba |
| | Huluf | sibakii | sihluba |

For Bijagó, I shall now illustrate the various contexts in which vowel harmony occurs in the dialect of Orango island, and discuss whether one can observe this phenomenon in Koelle's *Polyglotta* sample from the neighbouring island of **Wūn** (Uno). My data was collected during a survey focussed on studying Atlantic class systems in 1958–1959.²

1. PHONOLOGY

1.1 VOWELS

The seven vowel phonemes may be distinguished by the features in (3).

- | | | | | | | | | |
|-----|-------|----------|----------|----------|----------|----------|----------|----------|
| (3) | | i | e | ɛ | a | ɔ | o | u |
| | Hi | + | - | - | - | - | - | + |
| | Lo | - | - | - | + | - | - | - |
| | Round | - | - | - | - | + | + | + |
| | ATR | + | + | - | - | - | + | + |

Vowels may be short or long, but final vowels are short.

Polysyllable finals are somewhat lax and can be hard to distinguish.

1.2 CONSONANTS

The consonants of Bijagó are given in (4).

- | | | | | | | | |
|-----|----------|----------|-----------|-----------|----------|-----------|-----|
| (4) | p | t | ts | | k | kp | |
| | b | d | ɖ | j | g | gb | |
| | β | | r | s | | | (h) |
| | m | n | | ny | | ŋ | |
| | w | | | y | | | |

²I am much indebted to the late Augusto Fernandes, my informant, and to Miss I. Arthur, who was working on the language with him.

/b/ is an interlabial stop, acoustically midway between [b] and [d], which accounts for some of Koelle's hesitations in his Wūn examples.

/d/ is a retroflex, lightly tapped stop. /ts/ is also retroflex.

Geminate nasals are quite common, as in **kónnò** 'ear' versus **kónò** 'liver' and **ḡúmmèes** 'knife' versus **ḡòmáḡgì** 'tree'. These are, however, to be regarded as NC sequences, in which almost all consonants may be found, as, for instance, in **ḡùmpàḡké** 'winnowing basket'.

NC sequences can arise from the use of the Orango causative infix -N-, which is inserted before the last consonant of a verb root. Compare these ḡo class 'infinitives': **ḡòḡántá** 'cause to arrive' versus **ḡòḡátà** 'arrive (hither)' [= 'hither'], and **ḡùḡìrìmmá** 'cause to come down' versus **ḡùḡìrìmá** 'come down'.

1.3 TONES

The tones would appear to be analysable in terms of High, Low, and Downstep.³ There is considerable contextual conditioning. Words left unmarked for tone did not occur in isolation in my data.

1.4 VOWEL SEQUENCES

While there is no apparent pattern of harmony in the vowels of lexical items such as nominal and verbal stems, there are a number of affixes whose vowel quality depends on that of the nearest vowel of the morpheme to which they are attached.

The diversity of vowel sequences within a disyllabic stem is illustrated in (5).

- | | | | |
|-----|---------------------|------------------|-----------------|
| (5) | V ₁ is i | è-tíitì | island |
| | | o-ntsítse | younger sibling |
| | | è-síḡè | cow |
| | | nì-kínà | year |
| | | kà-síitsò | leopard |
| | | è-gídù | Borassus palm |
| (6) | V ₂ is i | è-tíitì | island |
| | | è-séegì | palm nut |
| | | è-méeni | python |
| | | ne-sagi | citrus fruit |
| | | nì-tsúḡgì | bed cross-pole |

In (5) the stem vowel **i** is shown followed by each of the vowels except **ɔ**. In (6) stem final **i** is shown preceded by each of the vowels except **o** and **ɔ**. Similarly, within a stem, **a** as V₁ and as stem final can be accompanied by any of the seven vowels.

In (7) we see sequences of mid and open vowels, both front and back, in six different combinations. My data does not include examples of **e...ɛ** or **o...ɔ**, or vice versa, but this lack may be fortuitous.

³Seegerer (2000:52) prefers to talk in terms of an "accent of height and, to some extent, of intensity".

(7)	kà-jókò	house
	kà-jòokó	Bijagó...language
	mò-ηódò	sleep (n)
	ηà-dóηè	cooked rice
	ì-kèntsó	tattoo lines
	kà-nèekpó	dove

2. NOUN CLASS PREFIXES

Bijagó is a classic class language with a widely operative concord system, involving twelve classes. One class has N- as its exponent, the others have prefixes consisting either of a vowel or of a CV- sequence.

Of these,

- five, **i, u, ka, ηa, ya**, are invariable;
- two, **ε ~ e** and **ɔ ~ o**, appear with either of two vowel qualities, depending on whether the next vowel is + low or -low;
- three, **kə ~ ko ~ ku, mə ~ mo ~ mu**, and **ηə ~ ηo ~ ηu**, appear with either of three vowel qualities, depending on whether the next vowel is close, mid, or open; and
- one, symbolised **nV-**, appears with a vowel exactly matching the next vowel, though usually **nε** is preferred to **na-** before **a** as in **né-ηájò** 'voice'. Some further examples are given in (8)–(10).

(8)	ε- ~ e-		
	non-open V ₁	è-síηè	cow
		è-séegì	palm nut
		è-ηóotsu	dog
	open V ₁	è-méeni	python
		è-pàdùmá	fly
		é-tsónts	chicken
(9)	kə- ~ ko- ~ ku-		
	close V ₁	kù-tíi ti	islands
		kú-nù	knee
	mid V ₁	kò-rèedfà	nets
		kó-pónò	
	open V ₁	kò-pédè	groundnut
		kò-ηáy	wing
		kó-nnò	ear
(10)	nV-		
		nì-kínà	year
		nè-méqà	rope
		nè-nyé	blood
		nú-númè	tongue
		nò-dóonò	kidney
		nó-tókò	breast

In my Orango data of about 250 nouns in the classes with harmonizing prefix vowels, some 20 (= 8%) do not show the expected harmonies, for instance *è-tíftì* 'island', *ɔ-ŋkotota* 'elder sibling', *kú-sà* 'lake', *mú-mmées* 'knives'. In Segerer's (2000) material on Bubaque dialect, 76 out of 613 nouns listed (= 12.5%) do not show the expected harmonies.

Extensive lists of examples are given in appendix 1.

2.1 DEMONSTRATIVES AND PRONOUNS

The 'that' (distal) demonstrative has the stem *-gaŋ*, so that all class prefix vowels are in their open variant: *ɔ-gàŋ*, *é-gàŋ*, *kɔ-gàŋ*, *né-gàŋ*, etc. The 'this' demonstrative, in the classes with CV- prefixes, has the pattern CÉNCé, where the C is that of the class prefix, while in the V- prefix classes the pattern is VVnè, where V is the prefix vowel. The *ɛ* class *éɛnè* and the *ɔ* class has *ɔɔnè*, with the final vowel rounded.

The predicative demonstratives show expected harmony in all but the *nV*- class. We thus have, for the *ɛ* and *ŋɔ* classes, the examples in (11).

- (11) *ɛ-ŋgɔ* *ŋɔ-ŋgɔ* this is...
ɛ-ŋgonu *ŋɔ-ŋgonu* that is...
ɛ-ŋguŋ *ŋu-ŋguŋ* that (yonder) is...

The *nV*- class has *ni*- prefixes in all three:

- (12) *ni-ŋgɔ* *ni-ŋgonu* *ni-ŋguŋ*

The third-person class pronouns consist of *-g* with a class prefix showing the open variant of their vowel, the *nV*- class having *nɛ*, as in:

- (13) *ɔ-g* *è-g*, *kɔ-g* *nè-g*, etc.

2.2 GENITIVE/RELATIONAL LINK

With the genitive link *-nri* 'of' we meet the expected harmonies to precede the vowel *i*, as in:

- (14) *o-nri* *e-nri* *ku-nri* *ni-nri*, etc.

3. VERBS

The prefixes indicating the first and second persons as subject of a verb are:

- (15) 1s *nyV-* 2s *mV-* 1p *tV-* 2p *nV-*

These show vowel harmony analogous to that of the *nV*- noun class prefix. In the third persons the prefixes are the same as in nouns.

The actual vowel quality shown may, however, be affected by the tense, aspect, or mood of the verb form concerned.

The so-called 'infinitive' or name of action is a *ŋɔ*- class noun, with normal vowel harmony.

In some TAM forms the 1s *nyV-* prefix is 'frozen' as *nyi-*, and the 3s class prefixes *ɔ-* and *ɛ-* have their vowels raised and 'frozen' as *u-* and *i-*, respectively,⁴ whatever the next vowel may be. The 3p *ya-* class prefix is unaffected and so remains as *ya-*.

The behaviour of other class prefixes in these TAM forms was not examined. The harmonizing and frozen prefix forms are illustrated here, a fuller list being given below.

(16)	Infinitive		Past affirmative		Present affirmative	
dress	ɲú-kì	1s	nyí-kí	3s	ó-kí	1s nyí-kì 3s ú-kì
broil	ɲɔ-yè	1s	nyé-yé	3s	ɔ-yé	1s nyí-yè 3s ú-yè
go	ɲó-wò	1s	nyó-wó	3s	ó-wó	1s nyí-wò 3s ú-wò
spit	ɲú-tù	1s	(nyú-tú)	3s	ó-tú	1s nyí-tù 3s ú-tù
						(nyí-tú)

Notice that in *nyV-* the close vowel harmonizing with *u* may be unrounded in this instance.

3.1 VERBAL AFFIXES

There are two *-kV-* affixes, in which the vowel matches the first vowel of the next morpheme, again just as the vowel of the *nV-* class prefix does. One of the *-kV-* affixes marks the sequential past: 'and (then)...', the other is one of the negative markers. The verb forms in which they occur are tonally distinct. Compare the forms in (17).

(17)	nyé-ké-gén	I didn't hear	nyè-kè-gén	and I heard
	ó-ké-gén	he didn't hear	ò-kè-gén	and he heard
	nyó-kó-dó	I didn't go	nyò-kò-dó	and I went
	ó-kó-dó	he didn't go	ò-kò-dó	and he went

Here there is a chain of harmonizing vowels as *nyV-* precedes *-kV-*.

Another negative marker is *-taŋkV-*. The *V* harmonizes as above, but a personal or class prefix harmonizes with the *a*. Compare the prefix vowels in the affirmative and negative infinitives in (18).

(18)	ɲú-pùḍ	to love	ɲò-tàŋkù-pùḍ	to dislike
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Nearly a quarter of the verbs in my data take the suffix *-ak-* in certain TAM forms. It appears to add nothing to the meaning as compared with its absence in other verbs not requiring it: it is just a morphologically conditioned item. Compare:

⁴This overlap with the *â* and the *ã* class does not occur elsewhere. The following reflexion by Segerer (2000:171) is worth citing, as it highlights this interesting asymmetry in the Bijagó system *â* whatever one may think of his way of accounting for it.

ɛ and *ɔ* noun prefixes, though they are subject to harmony, never occur as [i], [u], probably to avoid overlapping with the *i* and *u* class prefixes. In verbs, however, there is no such limitation. Such overlapping is in fact very frequent, since in the imperfective the *ɛ* and *ɔ* class prefixes are identical to those of the *i* and *u* classes. Nouns and verbs thus show important differences in the behaviour of their class prefixes. Homophonic forms which are carefully avoided in the former are virtually favoured in the latter. In the nominal sphere, prefixes have a precise role, and contrast with one another. On the other hand verb prefixes have a much more mechanical function, marking concord with the nouns concerned, and, in some instances, marking aspect as well.

- (19) **nyé-gén** I heard **nyé-gés-ák** I spoke

In one set of TAM forms, the **-ak-** is replaced by **-Vk-**, in which V matches the previous vowel. Compare:

- (20) **nyì-née-yè-àn** I've been broiling
nyì-née-tsèèḍ-èk-àn I've been throwing

Here the 1s **nyV-** is frozen as **nyì-**, as seen earlier.

See appendix 2 for more examples of verb forms showing harmony.

4. VOWEL HARMONY IN KOELLE

Having had occasion to study and admire Koelle's⁵ valuable data on Biafada, which Klingenberg famously analysed to reveal its consonant mutation system (Wilson 1984), I had hoped that Koelle's Bijagó data would be equally fruitful regarding vowel harmony. Alas this was not to be. For Biafada Koelle evidently had a good informant who quite readily gave him both singular and plural forms of nouns. For Bijagó, however, he was given only singulars, and so was not even aware that the language had class prefixes, thus deciding to place it with Wolof among his 'unclassified with final inflexion (XII a 2a/b)'. His Wuun informant was nearly 60 years old and has been in Freetown for 30 years.

Koelle seems to have had the difficulty Segerer was to acknowledge 150 years later in identifying the particular front and back vowels. Regarding the sets **i/e/ε**, **u/o/ɔ**, Segerer says, "degrees 1 and 2 are very close phonetically, while 2 and 3, albeit phonetically more distant, are seldom lexically distinctive. Thus one may be led to hesitate between degrees 1, 2 and 3 in one's transcription" (2000:25).

From a detailed analysis of the nouns in classes that show vowel harmony today it has to be concluded that though the prefix variants occur in Koelle's data (unknown to him as we have seen), harmony was barely incipient in the speech of his informants, of whom the Wuun speaker was born before 1800.

Of Koelle's 125 nouns with variable prefixes only 40 percent show harmony, as compared with 92% of the 250 nouns in my data. In the **ɔ-/o-** class of personal nouns in Koelle only half of the 16 nouns in **o-** show harmony, and one of the three in **ɔ-**. In the **ε-/é-** class the nearly 40 nouns show the same proportions with the two variants. Here there actually are examples of vowel polarity, as between open and non-open vowels.

- | | | | |
|------|------------------|------------------|-------------------------|
| (21) | Koelle | | Wilson |
| | W | A | O |
| | é-tooma | e-rántoot | pepper |
| | é-poonɔ | é-pɛeno | toad |
| | (ee-péle) | é-pfeele | groundnut |
| | (e-péde) | | kò-pédè / è-pédè |

⁵Koelle's data is here transliterated to conform to my notation. The dialect names are abbreviated in the examples as W(uun), A(ŋkaaras), O(rango), C(aravela). The hyphenation in the examples is mine. Segerer (pers. comm.) tells me that Koelle's Aŋkaaras must be a rendering of the modern name of Caraxe (or Carache) with a locative marker. The names of Caraxe and Caravela were switched on some earlier maps, so that the present Caravela island seems once to have been named Carache, and vice versa.

In the first two of these examples Wuun has an open prefix vowel followed by a non-open stem vowel, while Ankaaras has the reverse. In the third example both dialects have the same open/non-open sequence, but Wuun has harmony in the by-form cited. In my data Orango has open harmonizing vowels.

In the examples in (22), Wuun shows polarity, first open/non-open, then the reverse, while Ankaaras has harmonizing **o** vowels in both nouns. Again my data shows open harmony.

(22)	Koelle				Wilson
	W	A		O	
	ηó-koota	ηóo-kota	throat	≠	ηó-kòtá
	ηó-nóobó	mó-nooyó	thigh	ηó-nóbgò / n-nógbò	ηó-nógò / n-nógò

Such apparent inconsistency might seem attributable to confusion either of hearing or of notation as between **e** and **ε** (written **ε**), **o** and **ɔ** (written **ɔ**), but in the **kɔ-/ko-/ku-**, **ηɔ-/ηo-/ηu-**, and **mɔ-/mo-/mu-** classes, even the variants in **u** precede vowels with which they do not harmonize.

In the **nV-** class Koelle shows prefix variants having every vowel but **ɔ**. All but the variant in **u** can precede vowels with which they do not harmonize.

Of the adjectives in Koelle all but one are preceded by **o** or **ηo**, irrespective of the first stem vowel. The one exception is Wuun **ηó dan** 'dry', where **ɔ** harmonizes with **a**, while Ankaaras is given as **ηó dan**.

As to the verbs, which are cited in a first-person singular form, the 1s markers used in Wuun are **níV** and **ní**, which seem to correspond to Orango **nyV-** and **nyi-**. Koelle's glosses are all in the English simple present tense, so the question arises as to what tense his informers understood. Four of the Wuun forms are clearly pasts, since they contain the suffix **-ak**, absent from the present. The 26 **níV** subject markers mostly appear as **níe**, but only six times does this precede a **V₁ e**. It also precedes **ɔ** five times, and once or twice each **i**, **ε**, **a**, **o**, but not **u**. There are five instances of **níia** (and variant spellings) before **V₁ a** and two of **níio** before **V₁ o** and once before **u**. **níɔ** occurs just once, before **V₁ ɔ**. Though this gives a bare majority of instances with apparent vowel harmony, the counter examples in this small sample are too varied to show any system.

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APPENDIX 1: NOUN FORMS

Examples are given of nouns in each class, first in those with invariable prefixes showing no vowel harmony, then nouns in the classes where the prefixes do show vowel harmony. For each of the latter are listed the nouns in my data where the expected harmony does not occur. No N- class examples are given.

For each class the number of nouns in my data is indicated.

The Crioulo and Mandinka sources of loan words are marked Cr and Mka, respectively.

A1.1 NON-VH CLASSES

i- class (15 plurals)	ì-séegì	palm nuts	íi-βè	goats
	ì-kèntsó	tattoo lines	ì-kpémò	broom
	í-rágè	shoulders	íi-βà	hair (pl)
	ì-kòpákò	tattoo dots	ì-βókò	long grass (coll)
	íi-yò	firewood (pl)		
	í-gúubù	hearts		
u- class (11 singulars, 7 plurals)	ù-kpítšè	helmsman		
	ú-gbè	path		
	ù-kèβàaké	mark, sign		
	ù-náβàn	night	ù-wàađú	hunger
	ú-ḥò	neck		
	ù-kóḥù	sore	úu-βò	bed
	ù-nùkán	medicine		
ka- class (38 singulars)	ká-nyì	tooth	kà-ndiá	light
			<Cr kandia	
	kà-kéedì	pestle	kà-ḍèrón	iron pot
			<Cr kaleron	
	kà-nèekpó	dove	kà-rèmpéntà	mud on road
	ká-nà	mouth	kà-spátà	shoe
			<Cr sapata	
	ká-tò	mortar	kà-jókò	house
	kà-ḍóomà	canoe	kà-jòokó	Bijagó language
ka-ḥùḍá	ash heap	kà-ḥkùrè	vulture	
ḥa- class (89 plurals)	ḥá-nyì	teeth	ḥà-gídù	Borassus palms
	ḥá-gbè	paths		
	ḥà-téenà	mats	ḥá-ḥgémò	lower jaw
	ḥà-ḥàḥáy	trident	ḥà-náβàn	nights
	ḥá-nnò	ears	ḥá-nò	livers
	ḥà-tóḥkpò	hand ploughs	ḥà-ḍóḥè	cooked rice
	ḥà-mpúḍè	parcels	ḥà-túgbò	boxes

ya- class (18 plurals)	yà-mìsóm	mothers	ya-ntsitse	younger siblings
	yà-méeβì	husbands	yà-kpé	offspring (pl)
	yá-tè	fathers		
	yá-ráas	slaves	yà-kántò	women
	yà-rónyò	chiefs		
	yá-tò	persons	yá-jóokò	persons, Bijagós

A1.2 VH CLASSES

Under 'anomalous' is shown every noun in my data in which the prefix vowel does not harmonize with the first stem vowel.

ε/e- class (45 singulars, 3 plurals)	è-sìṅè	cow	è-gídù	Borassus palm
	è-séegì	palm nut	ée-βè	goat
	è-méeni	python	è-kpémò	broom strand
	è-pàḍùmá	fly	ée-βà	hair (sg)
	è-tsónts	chicken	è-kòpákò	tattoo dot
	è-ḥóotsù	dog	é-tò	sea
	é-gúubù	heart	e-kuta	goatskin pants
Anomalous:	è-tíiti	island		
	è-skáji	jigger		
	è-nóḥò	rain		
ɔ/o- class (18 singulars)	ò-mìsóm	mother	o-ntsitse	younger sibling
	ó-méeβì	husband	ò-kpé	offspring (sg)
	ó-tè	father		
	ó-ráas	slave	ò-kántò	woman
	ò-rónyò	chief		
	ó-tò	person	ó-jóokò	person, Bijagó
Anomalous:	ɔ-ḥkotota	elder sibling		
kɔ/ko/ku- class (43 singulars, 53 plurals)	kù-tíiti	islands	kù-ḍìṅ	lions
	kóo-tèny	meat	< Cr lion	
	kò-pédè	groundnut	kò-rèedià	nets
			< Cr redia	
	kò-ḥáy	wing	kò-péerà	markets
			< Cr fera	
	kó-nnò	ear	kò-pàtáakà	potatoes
	kó-pónò	scar	< Cr batata	
			kò-sóḡù	palm kernels
			kò-dòḥú	hyenas
		< Cr lobu		
		kù-púrukù	pigs	
		< Cr porku		
Anomalous:	kú-gbè	body	ku-ḥbrewe	wild cats
	kò-yàkinnán	bells		

	kú-sà	lake	kú-sámù	chin
	kò-mòrtédì	hammers		
	<Cr martel			
	kú-nò	the bush	kú-mbóonts	fish hook
	ko-kuta	goatskin pants (pl)		
mɔ/mo/mu- class (20 plurals)	mò-kéets	arrows	mò-mángì	trees
	mò-kátù	fish (pl)	mò-pòmó	fruit (pl)
	mò-ɲódò	sleep (n)	mò-kóomà	animals
	mó-βò	matters	mù-ɲkúde	birds
	mù-tùátè	thorns		
Anomalous:	mú-mmées	knives	mù-nnàaná	bananas
	mù-mpàɲké	winnowing baskets	<Cr banana	
	mò-nóbò	mud		
ɲɔ/ɲo/ɲu- class (34 singulars)	ɲù-ríngà	earth pot	(sg back-formed from mòríngù <Cr moringu , taken as pl)	
	ɲò-kéets	arrow	ɲò-mángì	tree
	ɲò-kátù	fish (sg)	ɲò-pòmó	fruit (sg)
	ɲó-mò	nose	ɲò-kóomà	animal
	ɲó-βò	affair	ɲù-tùkó	fire
	ɲù-tùátè	thorn		
Anomalous:	ɲò-bèeká	snake	ɲù-nnàaná	banana
	ɲù-mmées	knife	<Cr banana	
	ɲù-mpàɲké	winnowing basket		
	ɲò-ɖòkámme	money		
ɲɔ/ɲo/ɲu- shows fully regular VH when in 'infinitive' nouns with verb stem:	ɲù-ɲìrímá	come down		
	ɲò-téβè	stand		
	ɲò-dénà	come		
	ɲó-nàk	go up		
	ɲó-dò	go		
	ɲó-wò	go		
	ɲù-nyùβùká	come in		
nV- class (33 singulars)	nì-kínà	year	nì-nyíngù	root
	nè-médà	rope	nè-kéekè	egg
	né-mè	bee	né-nyè	blood
	né-bàɲò	voice	nè-máaji	corn type
			< Mka maaji	
	nà-tsàapé	stool	(nè-pàakóorà)	falcon
			(nà-pàakóorà)	
	nò-βóɔg	stone	nó-tókò	breast
	nò-dóonò	kidney	nò-kóokò	tail
	nù-númè	tongue	nù-kúhè	axe

Anomalous:	ní-ntsákò	finger	ní-sáar	machete
	ní-mpónts	hat		
	nè-róots	mushroom	nè-nyóà	compound
	nì-tsúŋgì	bed cross-pole		

The numeral expressing 'one' is anomalous in three of the classes in which it was noted. The forms in my data are:

ò-ḍìgέ
 è-ḍìgέ
 kò-ḍìgέ
 ḡò-ḍìgέ
 nè-ḍìgέ

The first two are regular. The expected *kù-ḍìgέ and nì-ḍìgέ do not occur, while the expected ḡù-ḍìgέ does occur, but with the meaning 'this one alone'.

The forms listed above harmonize as if the first vowel of the stem were e, as in: *kò-ḍègέ, *nè-ḍègέ.

APPENDIX 2: VERB FORMS

Examples are given of each of the verbal affixes mentioned earlier, mostly in forms with 1s, 3s, and 3p subject prefixes. In §A2.1 the CV verbs show each of the seven vowels in turn.

A2.1 CV VERBS

Infinitive			Past Aff	Past Neg	Pres Aff	Pres Neg
ḡú-kì	dress	1s	nyí-kí	nyí-kí-kí	nyí-kì	á-í-kí
		3s	ó-/kí	ó-kí-kí	ú-kì	á-ú-kí
		3p	yá-kí	yá-kí-kí	yá-kì	yá-á-kí
ḡó-rè	be (loc)	1s	nyé-ré	nyé-ké-ré	nyí-rè	á-í-ré
		3s	ó-ré	ó-ké-ré	ú-rè	á-ú-ré
		3p	yá-ré	yá-ké-ré	yá-rè	yá-á-ré
ḡò-yè	broil	1s	nyé-yé	nyé-ké-yé	nyí-yè	á-í-yé
		3s	ó-yé	ó-ké-yé	ú-yè	á-ú-yé
		3p	yá-yé	yá-ké-yé	yá-yè	yá-á-yé
ḡó-rà	bring	1s	nyé-rá	nyé-ké-rá	nyí-rà	á-í-rá
		3s	ó-rá	ó-ké-rá	ú-rá	á-ú-rá
		3p	yá-rá	yá-ké-rá	yá-rà	yá-á-rá
ḡó-dò	go	1s	nyó-dó	nyó-kó-dó	nyí-dò	á-í-dó
		3s	ó-dó	ó-kó-dó	ú-dò	á-ú-dó
		3p	yá-dó	yá-kó-dó	yá-dò	yá-á-dó
ḡó-wò	go	1s	nyó-wó	nyó-kó-wó	nyí-wò	á-í-wó
		3s	ó-wó	ó-kó-wó	ú-wò	á-ú-wó
		3p	yá-wó	yá-kó-wó	yá-wò	yá-á-wó
ḡú-tù	spit	1s	(nyú-tú) (nyí-tú)	nyú-kú-tú	nyí-tù	á-í-tú

3s	ó-tú	ó-kú-tú	ú-tù	á-ú-tú
3p	yá-tú	yá-kú-tú	yá-tù	yá-á-tú

A2.2 -ak AND -Vk-

Examples of verb forms using -ak and -Vk- are here preceded by the corresponding forms of verbs with which these suffixes are not used.

Non -ak verbs

		Past	Pres Hab	Past Hab
ηù-kpíinè	sink	1s nyí-kpíiní 3s ó-kpíiní 3p yá-kpíiní	nyí-kpíin ú-kpíin yá-kpíin	nyí-née-kpíin-àn ú-née-kpíin-àn yá-née-kpíin-àn
ηò-téβè	stand	1s nyé-téβé	nyí-tèβ	nyí-née-tèβ-àn
ηò-kánè	leave	1s nyé-káné	nyí-kàn	nyí-née-kàn-àn

-ak verbs

ηù-díigè	escape	1s nyí-díig-ák	nyí-díig	nyí-née-díig-ik-àn
ηó-gès	speak	1s nyé-gès-ák	nyí-gès	nyí-née-gès-èk-àn
ηò-ťséedè	throw at	1s nyé-ťséed-ák	nyí-ťséed	nyí-née-ťséed-èk-àn
ηò-ťsánáβè	kick	1s nyé-ťsánáβ-ák	nyí-ťsánáβ	nyí-née-ťsánáβ-àk-àn
ηò-ťóηgbè	poke in	1s nyó-ťóηgb-ák	nyí-ťóηgb	nyí-née-ťóηgb-òk-àn
ηù-túηkè	stuff in	1s (nyí-túηk-ák) (nyú-túηk-ák)	nyí-túηk	nyí-née-túηk-ùk-àn

-ak verbs with vowel change

ηù-βísarè	untie	1s nyí-βísir-ák	nyí-túηk	nyí-βísár	nyí-née-βísir-ik-àn
ηù-ťsùβányè	claw	1s (nyí-ťsùβúny-ák) (nyú-ťsùβúny-ák)			nyí-née-ťsùβúny- ùk-àk

Negative infinitive

Neg		Aff	
ηò-tàηkì-níinè	dislike	ηu-níine	want
ηò-tàηkà-βât	not be enough	ηò-βátà	reach, suffice
ηò-tàηkù-pùđ	dislike	ηú-pùđ	love

APPENDIX 3: THE ku-/ko-/kɔ CLASS NOUNS IN KOELLE

Pfx	Stem	(Koelle)		(Wilson)	
		Wuun	Ankaaras	Orango	Caravela
V	V				
u	i	—	kú-diio	leaf	—
u	i	kú-liiok	kú-diio	frog	—
u	i	kú-ηgiino	kú-ηgiino	gun	ku-ηginu
o	e	kó-gbeη	kó-gbeηk	cotton tree	—
o	e	—	ko-šéeia	hoe	—
u	e, i	ku-ťéjiina	ku-ťiina	war	ku-ťiina
o	ε	ko-nyényo	—	thread	—

o, ɔ	a	kó-daake	kó-daaye	foot	kó-dáké	kò-dàke
o	a	kó-baaro	kó-daamat	skin	kó-bárù	—
o	a	—	kó-gbag-ée-rage	upper arm	è-rágè	—
o	a	kó-nyaana	kóo-wa	mat	—	kó-βá
u	a	kú-mbáam	—	bow	—	—
u	a	ku-nágaano	—	day	—	—
ɔ	o	kóo-ko	kó-ko(o)	arm	kóo-kò	kó-kò
ɔ	o	(ɲá-no = pl)	kó-no	ear	kó-nnò/ ɲá-nnò	kó-nnò/ ɲá-nnò
u	o	(núu-no)	áɲ-kuuno	forest	kú-nò/ ɲá-nò	—
u	u	kú-ruujɔŋ	kú-ruuyɔŋ	chain	—	the bush
u	u	kú-tuugbo	kú-tuugwo	door	ku-tugbo	board
u	u	kú-tuuko	kú-tuugo	forehead	—	—
u	u	(gúdyá)	kú-dyuua	needle	(Wuun is the unadopted Crioulo form)	

An additional **kɔ-** word is given for Ankaaras, but as its Wuun counterpart has **ka-**, it seems preferable to regard this **kɔ-** as a lip-rounded version of **ka-**:

káunt **kúuunt** soup

Of nearly 100 **ku-/ko-/kɔ-** class nouns in my Orango data, only nine do not show the expected vowel harmony (see appendix 1).