

Central Vowels in the Kru Language Family: Innovation and Areal Spreading

Lynell Marchese Zogbo
University of the Free State

1. Introduction

A quick inventory of vowel systems in the Kru language family¹ reveals a striking diversity. While in Western Kru, with the exception of /a/, no phonemic central vowels are attested, in Eastern Kru, some languages have a full set, with 5 out of 13 vowels being central (or back unrounded). Citing numerous shared features in South Mande and Kru, Vydrine (2009) proposes that central vowels may be one of several areal features of the Ivorian forest region, cutting across genetic boundaries. Thus in this paper, we attempt to:

- explore the innovation of central vowels in Eastern Kru, examining the extent and possible means of this phonological innovation and
- evaluate the viability of areal hypotheses concerning the spread of central vowels within Kru and across its linguistic borders.

All Kru languages show a minimum of 9 oral vowels, featuring two sets of vowels based on the feature \pm ATR, and usually a strong vowel harmony system affecting word internal stems and suffix affixation. A typical system is seen in Kouya where vowels occur in two sets (adapted from Saunders, 2009:50):

Table 1

	Front		Central	Back	
	+ATR	-ATR		+ATR	-ATR
+high	i	ɪ		u	ʊ
-high	e	ɛ	a	o	ɔ

Words are made up of either + or – ATR vowels²:

(1) Kouya			
	-ATR		+ATR
ʋʊ ¹ ɛ ²	‘buffalo’	di ² de ²	‘father’

¹ The status of the Kru language family within Niger-Congo is still subject to debate, having been proposed as independent (Westermann), a branch of Kwa (Greenberg), closely connected to Gur (Bennett and Sterk), and of late (Williamson and Blench, 2000: 18) an offshoot of Proto West Volta Congo.

² As is traditional in Kru literature, in the examples to follow and throughout this paper, tones are marked by raised superscripts. Most Kru languages show four level tones: high (1), mid-high (2), mid (3), and low (4). Exceptionally Godié has only three level tones (high, mid, low), with only remnants of a fourth tone (Gratrix, 1975).

tiɓɛ ³³	‘snake’	bu ² bui ¹	‘smoke, vapor’
mɔ ¹³	‘tear’ (n.)	beli ²³	‘brother’
mɔ ³ mɔɛ ⁴⁴	‘smile’ (v.)	petu ⁴¹	‘grass’
bui ⁴	‘flower’	liɓo ³³	‘work’ (n.)

with /a/ co-occurring with both \pm ATR vowels:

-ATR		+ ATR	
kva ¹¹	‘bone’	bita ⁴¹	‘mat’
kpe ² la ¹	‘to refuse’	te ² la ²	‘porcupine’
yi ¹ ba ¹	‘desire, want’	gba ² gbo ³	‘partridge’

Despite its non-participatory status in vowel harmony, /a/ usually patterns in other ways as – ATR. In terms of frequency, -ATR vowels are more frequent than +ATR, and most suffixes (verbal suffixes, noun class markers and other nominal suffixes) are underlying –ATR. Casali (2008) notes in dominant harmony languages, affix harmony involves assimilation of [–ATR] to [+ATR] vowels, a fact that seems to hold in our Eastern Kru samples, for example, in Godié where rightward assimilation frequently shows a – ATR shifting to + ATR shift, as in the following example of object clitics in Godié:

(3) Godié (Marchese, 1975)	
/ɔ ² bi ² bie ² ɔ ² /	‘he begs him’ (person)
bibió ɔ	(vowel elision)
[ɔ bibi o]	(vowel harmony)

2. More elaborate systems

Though both Western and Eastern Kru attest the standard 9 oral vowel system, several Eastern Kru languages (and Western Bakwé) have much larger phonemic vowel inventories, with many additional central (or back unrounded) phonemic vowels³, as seen below:

Table 2

Language	Number of Vowels	Number of Central Vowels (excluding /a/)
Godié	13	4
Koyo	13	4
Guibéroua Bété	13	4
Gbawale	13	4
Daloa Bété	12	3
Kpɔkolo	11	2
Gaɓugbu	11	2

³ Researchers have used both terms. Central vowels in Kru are not rounded. In acoustic studies, Grégoire (1972) has called these vowels in Bete of Guiberoua *central* (see also G. Zogbo, 1981:15). In other descriptions, Werle & Gbalehi (1976:61) as well as Kipre (2007:7) analyze them as *back unrounded*. In Goprou’s more recent study of Kpɔkolo, a Bété dialect (2009, 2014:177), findings are somewhat skewed. For vowels [i, ɔ, ʌ, and a], a female speaker shows F2 readings around 1500 Hz, indicating a clear central position, while [θ] positions itself as a back rounded vowels (under 1500 Hz), as does [ʌ] in male speakers. This issue is important but out of the scope of this paper.

Guebie	10	1
Vata	10	1
Gbadi	9	0
Lakota Dida	9	0
Yocoboue Dida	9	0
Neyo	9	0
Kouya	9	0

Within Western Kru, no phonemic central vowels are attested, except in Bakwé, which lies contiguous to Eastern Godié (see Maps 1 and 2 below). For over a century (Delafosse, 1904), Bakwé has been classified as a Western Kru language based on important isoglosses such as **t/s** ('tree' *tu/su*³); **ny/ng** ('name', 'woman'); Western *ni*¹ 'water' vs. PEK **nyu*¹. (Marchese, 1989). Curiously Lewis et. al. (2014) classify Bakwé as Eastern. In this language and the four Eastern languages seen at the top of the table above (Guiberoua Bété, Gbawali, Godié, Koyo), there is a full set of five phonologically contrastive central vowels, which correspond to vowel heights of the peripheral vowels and are also defined as \pm ATR:

Table 3
Largest Oral Vowel System in Kru

Front	Central	Back	
i	ɨ [ɪɪ, ɪ] ⁴	u	(+high, +ATR)
ɪ	ʉ [ɤ, ʊ]	ɯ	(+high, -ATR)
e	ə	o	(-high, +ATR)
ɛ	ʌ	ɔ	(-high, -ATR)
	a		

Despite the fact that it is hard to find perfect sets of minimal pairs, native speakers clearly distinguish 5 central vowel qualities and can learn to read and write them without difficulty. In many languages, to establish a full set of contrasts, plural forms complete minimal pairs lists:

(4) Guiberoua Bété (Werle & Gbalehi, 1976):

kpə ¹	'chair'	pə ³	'cover'	pu ¹	'lie down'
kpɨ ¹	'chairs'	pʌ ³	'throw'	kpa ²	'mud'

(5) Godié (*Kagbawali* dialect, Association Gwëjekumö, 2004):

li ¹	'spear'	li ²	'wealth/riches'
li ²	'eat'	lula	'grill, fry'
luu ¹²	'paddle'	lo ¹	'song'
IV ² IV ²	'new'	lo ³	'law'
laa ²	'call'	la ³	'bring'

The adjective 'new' appears to be inherently + ATR and agrees with the noun it modifies (lolo, lala, lələ).

⁴ Differences among researchers in transcription complicate our task and it is difficult to identify the exact phonetic realization of such a variety of transcriptions, especially the symbol [ə] used as default schwa in languages without central vowels. As seen above, in languages with full central vowel sets, [ə] is a higher vowel than [ʌ] and is +ATR. In most instances, I tried to respect the author's original transcription.

(6) Bakwé (Centre de Traduction et d'Alphabétisation en langue bakwé, 2006)

pa ³	'enter'	go ⁴	'to be old'	go ⁴	'to dig'
pΛ ⁴	'share'	ga ⁴	'vines'	gΛ ⁴	'affair'
bi ² ti ³	'thorn'	gi ⁴	'plants'	go ⁴	'tail'
bΛ ³	'to be'	gu ⁴	'eggs'	gə ⁴ /gi ⁴	'egg'
bə ³	'to tap'	gu ⁴	'to give birth'	gε ⁴	'vine'
bu ²	'ball (of something)'				
bi ²	'balls' (PL)				
ba ² li ²	'pick up'				

Within these systems, central vowels follow the rules of vowel harmony, with typical \pm ATR word-internal constraints:

(7) Guibéroua Bété (Werle & Gbalehi, Ibid)

-ATR	+ATR
kɛ ³ ʒΛ ³	ko ⁴ su ²
ti ² mu ²	wuə ²⁻⁴
gwΛ ¹ zi ³	nuə ¹⁻¹
'to grab'	'fire'
'to pay the dowry'	'all'
'medecine'	'mouth'

(8) Gbawale (Seri, 1987)

-ATR	+ATR
wΛ ³ li ³	di ⁴ gbə ³
kɔ ⁴ kwe ¹	go ⁴ və ³
si ¹ kΛ ¹	do ⁴ pe ¹
zi ³ kpɔ ⁴	bi ² do ⁴
mɔ ⁴ mu ³	ci ³ gbe ⁴
'problem'	'mortar'
'chicken'	'tree trunk'
'rice'	'proper name'
'tomorrow'	'to wash (oneself)'
'you' (indep)	'yesterday'

As in most of these languages, /a/ occurs with both series:

(9) Gbawale (Seri, 1987)

-ATR	+ATR
pia	a ⁴ zie ³
a ⁴ mu ¹	'proper name*'
wa ² mΛ ³	
'buy'	
'me'	
'them'	

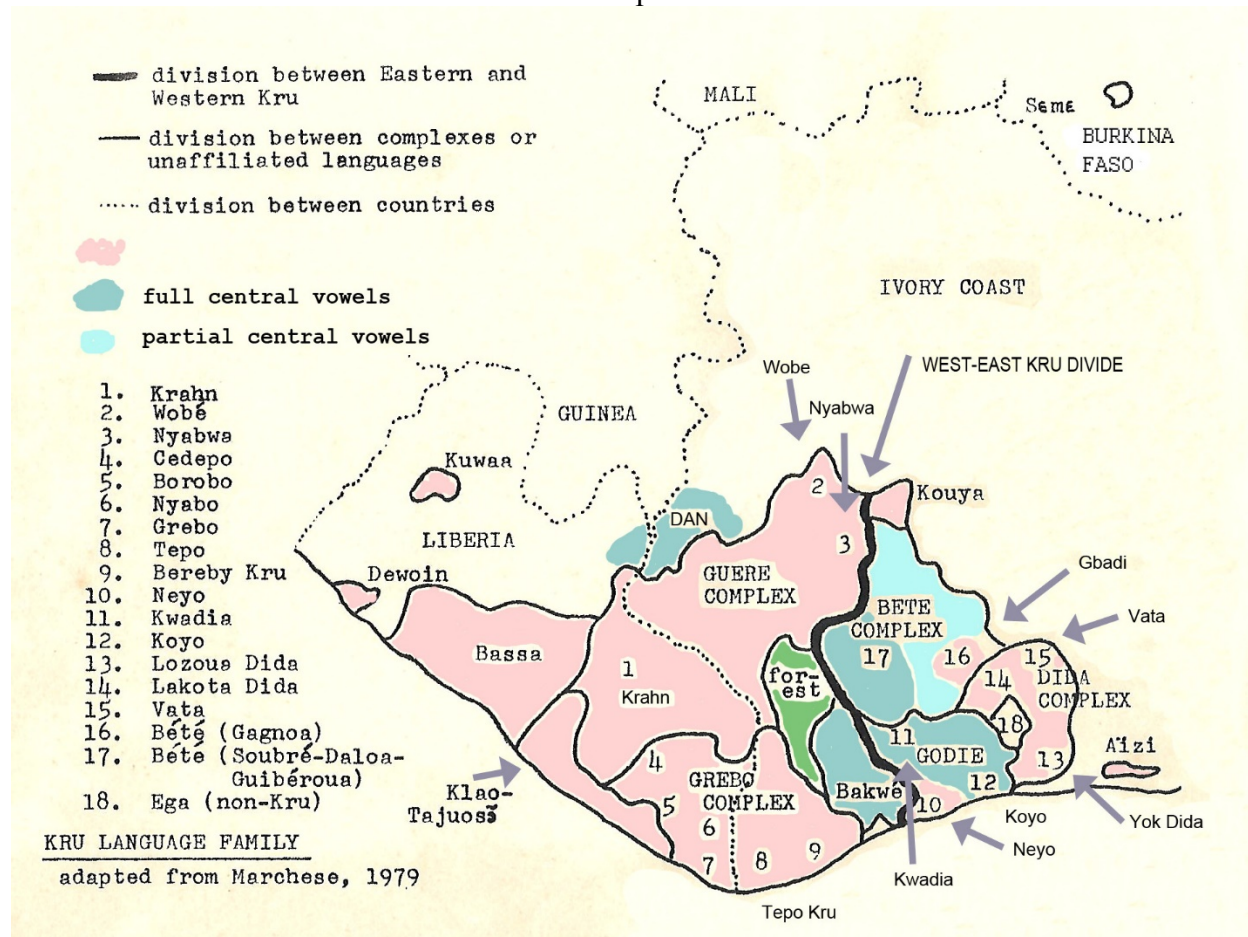
These systems of 13 phonologically contrastive vowels constitute the largest oral vowel systems in the Kru language family.

2.1 Innovation of Central Vowels

Given that, with the exception of Bakwé, no central vowels occur in Western Kru, and that within Eastern Kru, several languages have no central vowels other than /a/, we are assuming Proto Kru had a basic oral 9 vowel system, as in Kouya today, with no central vowels. Central vowels would represent an important innovation in a defined area and/or sub-branch. In the following map, the dark black line indicates the main West-East divide in Kru. Areas where full sets of 5 central vowels (darker blue) occur are distinguished from those with no central vowels (rose) and those with an incomplete set (lighter blue). As will be discussed later, the distribution

of central vowels suggest an areal spread, across the West-East border, and outside of Kru into Dan, a Mande language.

Map 1



2.2 Languages without the full set of central vowels

The top languages in Table 2 (Godié, Guiberoua Bété, etc.) along with Western Bakwé (all in darker blue) appear to be the locus of a major innovation which has not (yet?) affected some of the Eastern languages such as Noyo, Kouya, Gbadi, and various dialects of Dida. Examining those languages which have partial sets (light blue) may provide clues as to how full central series developed in certain languages.

Daloa Bété slightly east and north of Guiberoua-Godié-Bakwé has three non-low central vowels (\pm ATR) but no low $-ATR$ / Λ / (G. R. Zogbo, 2005). /a/ occurs with both sets of \pm ATR vowels. This system is not as symmetrical as those three mentioned above. However, as far as we know, this dialect shows no signs of developing the $-ATR$ counterpart / Λ /:

Table 4

i	i (III)	u
ɪ	u (Y)	ʊ
e	ə	o

ɛ		ɔ
	a	

Kpɔkolo is a dialect of Bété spoken in 20 villages south of Gagnoa. Goprou (2009, 2014:175, 179) cites the following phonetic vowel chart:

Table 5

I	i	u
ɪ	θ	ʊ
e		o
ɛ	ʌ	ɔ
	a	

He notes there are no contrastive minimal pairs for [i] and [θ] except in singular-plural forms. He thus analyzes the two high central vowels as allophones of high front vowels high /i/ and /ɪ/, an analysis which might provide some insight into how central vowels develop historically. Vahoua (2011), however, provides good evidence that /ʌ/ has phonemic status in this dialect.

Gabogbo spoken in Gagnoa, Lakota (to the south), and the villages in between, attests 11 oral vowels, including two high central (or back unrounded ones, Gnahore, 2006:5, 9).

Table 6

i	III	u
ɪ	Y	ʊ
e		o
ɛ		ɔ
	a	

If the two high central vowels are truly phonemic, this language may be one step further than Kpɔkolo in the development of central vowels. Typical vowel harmony is present, with /a/ classified as –ATR⁵.

Guebié: This language, on the border between Bété and Dida, attests only one central vowel, phonetically higher than /a/. Hannah Sande (p.c.) reports that /a/ functions as –ATR and the higher central vowel as +ATR [ə]. As in other Kru languages, /a/ shows a tendency to occur with both ± ATR. Sande notes an /-a/ suffix remains constant, no matter the ATR feature of a verbal root.

⁵ Gnahore's vowel chart presents the two high central vowels as –ATR (p. 9): ɔzwa *jama* ‘Ozoua became light’ and *Jai nyumɪ* ‘Jai became ugly’ (Ibid, 25). In her examples /a/ combines with both ± ATR: ga⁴ji¹ ‘proper name’, a⁴mi³ ‘I PERS SING’ (obj). More study is needed on how central vowels and the feature ATR combine.

Table 7

+ATR		-ATR	
i	u	ɪ	ʊ
e	o	ɛ	ɔ
ə		a	

Vata

Like Guebié, Vata shows signs of shifting to a 10 vowel system, with Kaye (1981:70) also reporting an additional central vowel as part of the +ATR series. He notes “The 10th vowel, i.e. the advanced low vowel is not pronounced in the speech of all Vata speakers. Nevertheless, there are reasons to justify in every Vata dialect, a system of 10 vowels”. In the following chart we suspect that what is marked as /Λ/ corresponds to what most Kru researchers would write as /ə/, a +ATR vowel phonetically higher than /Λ/:

Table 8

+ATR		-ATR	
i	u	ɪ	ʊ
e	o	ɛ	ɔ
Λ		a	

Gbadi

Curiously, though Gbadi is classified as Bété, with the exception of /a/, it attests no central vowels (C. Goprou.p.c. & H.Tebili, word list), underlining the issue of frequent mismatches between ethnic/social perceptions and linguistic classifications.

What is striking here is that some languages seem to be developing central vowels “from the top”, with high central vowels (Gaḃugbu, Daloa Bété), while others (Vata, Guebié) appear to be developing them “from the bottom”. In Kpɔkolo, it would appear a lower central vowel / Λ / has become phonemic, but it may be the two higher conditioned central vowels will one day become phonemic as well.

3. Historic Sources for Central Vowels

Based on the hypothesis that Proto Kru had a nine vowel oral system, the source of central vowels will now be examined. Our research shows that these vowels develop from both front and back vowels as well as central /a/, but the most frequent cases involve front vowels *i, *ɪ, and *e, and central *a. It is important to note that the emergence of central vowels in Kru never results in the disappearance of peripheral vowels in any given vocalic system.

Below reconstructions from Proto Eastern Kru (PEK) are proposed and traced to their current forms mainly in Godié, a language which shows a very high number of central vowels. In almost all cases the central vowel in question retains the same features for vowel height and \pm ATR as the proto form. Here we concentrate on *sources* of innovated central vowels, being able to identify very few conditioning factors.

However, it will be noted that a very frequent environment for central vowels to emerge is in the environment of CLV, a fact which will be discussed below. Note that in virtually all Kru

languages, /l/ has a variety of allophones (flap n, l, r) in CLV and in some languages implosive d, (Marchese, 1979/83). Dialects of Godié are cited when known (jlukɔwalɪ, kagbɔwalɪ, and koyo).

Table 9: *i → i in Godié CLV

PEK	*ɓli ² or ³	‘fall’	Kouya, Gbawale, Gaɓugbu	→	ɓli ²	Godié
PEK	*zli/e	‘fish’		→	zli ²	kagbɔwalɪ
PEK	*mli	‘bite’		→	mli ²	jlukɔwalɪ, kagbɔwalɪ, koyo
In some CV words beginning with /l/, often pronounced as implosive d (probably *d)						
PEK	*li ²	‘eat’	Kouya, Dida, Gbawale, Gaɓugbu, Vata	→	li	jlukɔwalɪ, kagbɔwalɪ

Table 10: *ɪ → u in Godié

PEK	*ɲli ¹	‘name’	Neyo, Dida Guibéroua Bété, Daloa	→	ɲlu ¹	Godié, Koyo [ɲñu ¹]
PEK	*di ²	‘news’	Dida, Daloa Bété; Kouya di ¹ ‘chat’, ‘talk’	→	du ¹	Godié, Koyo [di ¹]
PEK	*a ⁴ mi ¹	‘1 SG EMPH’	Kouya, Gaɓugbu	→	a ³ mu ¹	Godié
PEK	*ni ¹	‘and (then)’	Guibéroua Bété	→	nu ¹	Godié

Table 11: *a → ʌ in Godié

PEK	*mla ²	‘swallow’	Dida, Koyo, Neyo, Guibéroua, Daloa	→	mla ²	Godié [mʌñʌ]
PKru	*mla ^{1/2}	‘drink’	Gaɓugbu mla ³ ; Tepo mna ² , Nyabwa mna ²	→	mla ¹	Godié [mʌñʌ ¹]
PEK	*kwala ¹²	‘tortoise’	Kouya kwlaa ¹² ; Gaɓugbu kwala ¹²	→	kwla ¹²	Godié
PEK	*kpa ² la ²	‘bottle’	Bakwé	→	kpaʌ ¹	Godié (Kagbo)
PEK	*sa	‘pick (up)’	Dida, Gaɓugbu, cf. Wobe saa ‘choose’	→	sʌ	Godié
PEK	*ka ³	‘have’	Kouya ka ³	→	kʌ ³	Godié, Gbawale
PEK	*ga ³	‘to be awake’	Kouya	→	gʌ ³	Godié

Proto back vowels may also give central reflexes, though not as frequently and perhaps following a more complicated path (see 4.3).

Table 12: *ɔ → ɯ

PEK	*zɔ	‘shame’	Neyo zɔɔ ²⁻³ , zɔ ¹ , Daloa zɔ ²	→	zɯ ³	Godié
PEK	*mo ²	‘go’	Dida	→	mɯ ²	Godié
PEK	*ngbɔ	‘five’	Kouya	→	n ³ gbɯ ²	Godié ⁶

Note that examples of proto back vowels *u, *o, and *ɔ giving a central reflex are rare. One example might be PEK *blo ‘one’ → ɓlɯ (Godié, jluka dialect). Cases of low vowels *ɛ and *ɔ giving a central vowel are equally rare.

4 Mechanisms for central vowel development

The question as to how these phonologically contrastive central vowels developed from an original 9 vowel proto system is a main concern here. What caused languages to move from a seemingly stable Proto system towards a more complex one, with full or partial sets of central vowels? For the moment, putting aside the question of language contact and areal features, we will explore possible phonetic and phonological explanations of this development.

4.1 Phonetically motivated centralization

Of course the development of central vowels is not unique to Kru or to Africa. Central vowels involve less tongue displacement than peripheral vowels. Thus quite naturally many languages develop central allophones. Welmers (1962, 1973:23, 25) notes phonetically conditioned centralizing tendencies of both front and back vowels in certain Mande languages, for example Kpelle where “short front unrounded vowels /i, e, ɛ/ have centralized allophones [i,ə] after most consonants in monosyllables and in some types of bisyllabic forms”. Within Kru, Bentinck (1978) notes centralized realizations in sentence final position and after labiovelars.

However, more compelling is what appears to be a universal tendency for central vowels to emerge in proximity to resonant liquids /r/ and /l/ as well as their nasal counterparts. Well known examples are high front vowels becoming central in such environments in Middle English, for example, with *bird* losing its short “i” and evolving into a central vowel (Hickey, MS). Lynch (2015:76) notes in Proto Oceanic a central vowel reflex in Iaai: *o > i, ə, as when *ronjoR ‘hear’ becomes /ləŋ/ or /liŋ/. Though he cites no conditioning factor, the r-l connection seems clear. Closer to home, Morton (2011) notes a high *ɪ gives rise to a high central ɨ phoneme before liquids and nasals in Anii, an Akan language.

In Kru languages, where the typical syllable structures are V, CV, CVV, CCV (where C₂ is a liquid or sonorant), many researchers note the appearance synchronically of a central transition vowel in CLV words. Marchese (1983:98) initially described the phenomenon as following:

In many cases, a transition vowel appears between the first consonant and [l]. The quality of this vowel is determined by the main vowel. If the main vowel [i.e. V2] is central or back, the transition vowel is identical to the main vowel. If it is a front vowel, the transition vowel is generally a central vowel of the same height.

⁶ See also n⁴gbɔ³, Kodia (Leidenfrost, p.c.).

Obviously the vowel carries the same ATR feature as the primary vowel:

(9) Godié			
front vowel		central and back vowel	
/y ⁱ li ¹ /	[y ⁱ li]	‘eye’	/ɓ ⁱ li ¹ ...ko ¹ / [ɓ ⁱ li] ‘pick up’
/gw ⁱ le/[gw ^ʌ le]	‘remain’	/ɓ ^ʌ lu ³ /	[ɓ ^ʌ lu] ‘one (certain)’
		/pl ^ʌ ²/	[p ^ʌ la] ‘enter’

In Kouya, an Eastern language with no contrastive central vowels, Saunders reports a phonetically predictable central transition vowel which he writes as [ə], usually when V is a front vowel or /a/⁷:

(10) Kouya (Saunders, 2009)	
/y ^ʳ ra ³ /	[y ^ʳ ra] ‘to look at’
/p ^ʳ le ² /	[p ^ʳ le] ‘liver’
/f ^ʳ li ⁴¹ /	[f ^ʳ li] ‘forest’

We note for back vowels, as in Godié, the epenthetic vowel is identical to the primary vowel: /ɓlo/ [ɓ^olo] ‘one’.

For Western Glaro, where there are no central vowel phonemes, Wolfe (p.c.) reports that retracted /ɪ/ becomes central in fast speech in certain words such as /nyɪnó/ ‘woman/wife’. Note that here C₂ provides the expected liquid-nasal environment.

Of course while current synchronic analyses vary, with some positing epenthetic vowel insertion and others an underlying dissyllabic C₁V₁C₂V₂ with a subsequent reduction, it is clear that historically these sequences derived from dissyllables. Reduction to one syllable CLV is precipitated by C₂ being a liquid or nasal sonorant and tones on both vowels being identical. Identical tones speed up the realization of the word, which *favors* a centralized transitional vowel rather than a full one. A difference in tone on V₁ and V₂ blocks the reduction process. Compare wⁱ²li² ‘goat’ vs. w^{o3}lo⁴ ‘look’ in Gbawale (Seri, 1987: 20, 31) or the Godié examples in (9) to words like g^{o3}lo¹ ‘canoe’ and lu³lu² ‘tamtam’ where no reduction occurs.

Note, however, that in many languages, a reduced CLV functions synchronically as a single syllable (See Gratrix, 1975 for Godié)⁸. It is interesting to note, however, that linguists who are native speakers of Kru languages often opt for C₁V₁C₂V₂. Thus Kipre (2014) argues strongly for a synchronic underlying two syllable structure in Daloa Bété. Guehoun, as well, as a native speaker of Lakota Dida, notes in the case of CLV “the transition vowel is predictable [but] “when enunciating the word, when they are asked to slow their speech or to pronounce the sequences of a words with insistence, they pronounce two syllables”. He also notes “a child learning to speak automatically says CLV words as CVLV, without the word becoming

⁷ The exact nature of [ə] is not known, but Saunders (p.c.) reports there is no violation of ± ATR harmony.

⁸ Note also in all Kru languages, when alveolars (+cor) are involved, /l/ → r, and the vowel disappears completely, for example, t^olu ‘to blossom’ → [tru], enhancing perception as one syllable (Marchese, 1979/83).

unintelligible.” (1993:55-56). Thus Guehoun proposes /ngele/ ‘odor’ for [ngle], and /kpo³ke³le³/ ‘bench, chair’ for [kpokle].

4.2 Pathways of development

While the above discussion shows that central vowels are phonetically predictable, it does not provide a pathway for these sounds becoming phonemic. At this stage, considering the data, we can only suggest possible pathways. However, Kpɔkolo may serve as a good example of a language that appears to be currently developing central vowels. In this language, Goprou (2014:191) notes centralization in a similar environment as outlined in the preceding section (liquid-sonorant), but with dissimilar tones. Another a native speaker linguist, he too posits identical vowels as underlying:

- (11) Kpɔkolo
/br⁴lɪ²/ ‘neck’ → [bθlɪ]
/kɪ¹lɪ⁴/ ‘first’ → [kθlɪ]

He thus posits [θ] as an allophone of /ɪ/, and likewise for [i] as an allophone of /i/. He notes however that for the latter, there are some minimal pairs, but only in a singular-plural paradigm. As noted, this language has apparently developed a lower central phonemic vowel /ʌ/ (Vahoua, 2012). Our major problem is finding a pathway for development for these central vowels in Kpɔkolo and other innovating languages.

One possible pathway might be the development of a central vowel V₁ position and the loss of the final syllable CV₂, leaving the new vowel in a contrastive CV# position. Unfortunately however, we have found few examples which could justify this scenario. Also arguing against this hypothesis is the fact that Western languages, showing the most word final syllable reduction, have not developed any central vowels. Another possibility is that rightward assimilation (a common Kru process in vowel harmony) would affect V₂, with V₁ taking on a central quality and then coming to dominate V₂. This would give a central vowel in a primary vocalic position where it would come into contrast with peripheral vowels, for example: *kpala* → *kp^ʌla* → *kplʌ*.

4.3 The effect of morpheme boundaries

Examples above open up another possible pathway for central vowel development. Kru languages are primarily suffixing. Historically noun class suffixes have interacted and often coalesced with stem final vowels. To these forms are added plural markers and, in some languages, definite suffixes (Marchese, 1979/83; Zogbo, 2017). Verbs as well carry object clitics but also aspectual markers, causative, and other transitivity-changing suffixes. In some of our data, these instances of vowels “coming together” at morpheme boundaries seems to effect word (and syllable?) structure, resulting in some centralizing phenomena.

For example, the environment *noun* + *class marker* is clearly to be reconstructed for Proto Kru. Did this environment create a context where central vowels emerged in a single syllable? To give an example, current variant forms such as /kpɔ/ and /kpʊ/ ‘oil’ can be seen as deriving from *kpV + *ʊ, root + noun class suffix. In all likelihood the form could have been *kpi+ *ʊ, where

in some languages the first vowel was centralized, as in Godié and Bété (/kpʊ/). In others the initial stem vowel was lost and the noun class marker took its place yielding (/kpʊ/).

It is worth noting that Kru plurals—most often marked with human suffix *-ʊa* or non human *-ɪ*—have a peculiar feature of effecting upward centralization, a process which is hard to account for synchronically on a strictly phonological level in Eastern Kru and Bakwé (Marchese 1979/1983). This is particularly predominant in Godié, for example, in singular plural pairs such as *li¹/li¹* ‘spear’, *mi¹⁻²/mɛ¹⁻²* ‘boat’, *kpɔ/kpɛ* ‘herd’. While *mu* + *-ɪ* might give *mɛ¹⁻²*, it is hard to derive *li¹* from *li* + *-ɪ*⁹. It is as if the mere presence of the *plural morpheme boundary* produces heightening and centralization. Goprou (2014) also reports a similar centralization of back vowels (which he describes as unrounding, but could also be considered as fronting) in the environment of plural *-ɪ*. Thus Kpɔkolo shows central vowels on the surface in plural forms but not in underlying ones:

(12) Kpɔkolo (Goprou, Ibid: 202-206)					
/pɔ ² lɔ ³ / + ɪ	→ /pɔli/	→ [pθli]			‘piece’ + PL
/so ⁴ lu ² / + ɪ	→ /solu + ɪ/	→ /soli/	→ [sʏli]		‘pail + PL’
/kɔ ² li ² / + ɪ	→ [kɔli]				‘bamboo + PL’
/mu ⁴ du ² / + ɪ	→ mudu + ɪ	→ mudi	→ [midi]		‘(finger)nail’ + PL

Note that this is basically the same CLV environment as the transition vowels in other languages¹⁰, and it is again a question of vocalic assimilation of back vowels moving front. Welmers (1973) notes a similar “derounding” as well as fronting of back vowels /o/ and /ɔ/ in Kpelle when followed by a front vowel, either directly or after an intervening /l, r, n/. As Goprou, he calls these centralized forms “allophones” of other vowels. Welmers notes however, that “native speaker reaction “strongly favors the interpretation of the underlying vowel, in this case /o/ and /ɔ/”.

The data from Kpɔkolo confirms yet again the “weakness” of the position of the first vowel in a CVCV [lateral/sonorant] word. Clearly the C_LV environment lends itself to centralization in Kru (and cross-linguistically), but the addition of a morpheme boundary seems to add “additional weight” to this tendency. For Koyo, Kokora (another native speaker, 1976: 39) cites the form /mala+à/ [milá-à] (drink-PERF PAST) where in addition to the CVLV environment, we think the “added weight” of the rightward morpheme boundary causes the first /a/ to weaken, and here, to heighten as well. Another example comes from Nyabwa where no phonemic central vowels exist. Bentinck (1978:50) reports phonetic centralizing of the vowel /e/, at the end of conjugated verbs in a CV + V environment: /in² li³ ɛ⁴ pr²ɛ⁴/ (I eat-SUFFIX banana) ‘I’m eating a banana’. Word boundaries may also come into play, as seen in the following examples from Lakota Dida, where Guehon (1993:47) reports a phonetic /a/ → [ə] development, which seems a “change in progress”:

(15) Lakota Dida		
/ɔ ³ sa ³ ka ⁴ fi ¹ /	→	[ɔ sə kəfi]
		‘He’s picking coffee’
/ɔ ³ la ⁴ du ¹ to ³ bo ³ du ⁴ kwo ² /	→	[ɔ lə dutɔ bodukwo]

⁹ According to morpho-phonological rules *li* + *ɪ* should give *lii* (assimilation, vowel harmony) and *mi* + *ɪ*, *mii*.

¹⁰ We might suspect that d in the last example is a reflex of *ɖ.

/ɔ̣³ ka⁴ cɛ¹/

→ [ɔ̣ kə cɛ]

‘He brought a package to the village chief’

‘He has noise (he’s loud)’

Despite these various scenarios, we cannot say exactly *how* allophones or phonetic realizations become contrastive phonologically. Neither do we know if these changes occurred early on, i.e. high up in the Eastern Kru tree and consequently spread, or even (though extremely less probably), whether the innovation occurred in Bakwé and slowly spread eastward into Eastern Kru (See discussion below).

We do know, however, as is well attested in all types of linguistic change, that variation plays an important role in the adoption of central vowels. Indeed, in the *kagbowalı* dialect of Godié, *mɔ* and *mu* ‘go’ are in free variation, while in the *ɟlukɔ* dialect the central vowel has become the standard form. In Lakota Dida Guehon (Ibid: 48) notes that /a/ and [ə] are often in free distribution, “...since a speaker can use or not use either realization without it affecting the meaning of the message.” It would thus hardly be surprising if this dialect of Dida develops a slightly higher phonemic central vowel to join /a/, with each occurring in its own separate harmonic set.

4.4 Pressure for symmetric systems

Casali (2008:501, 502) notes that a 9 vowel systems with five [−ATR] and four [+ATR] vowels, where “a contrastive non-high [+ATR] counterpart of /a/...is absent” are “extremely common (numbering, by any reasonable estimate, in the hundreds) and are geographically and genetically widespread within Niger-Congo and Nilo-Saharan”. He further notes that while 10 vowel languages are not the most common within NC, many ATR languages “have nine contrastive vowels, with a tenth vowel on the surface, a predictable [+ATR] variant of /a/ that occurs in the neighborhood of [+ATR] vowels”. This seems to be Kaye’s mysterious 10th vowel in Vata. Certainly however, while symmetry in vowel systems is not universal, it is common for languages to attempt to “round out” their vocalic systems (Welmers, 1973:21). This tendency seems to be at work in Kru today, for example, in Guebié, where a 10th vowel /ə/ seems to have emerged to balance out the ± ATR vowel harmony system (Sande, p.c.).

One final observation seems important in regards to the high numbers of central vowels in some Eastern Kru languages and Bakwe. It may be significant that in Western languages, where phonemic central vowels have not developed, there are full sets of nasalized vowels, whereas in the languages with central vowel phonemes, nasalized vowel phonemes do not exist or are marginal (Marchese, 1979/1983). So it may be that the size of the vowel inventory may be a factor in central vowel formation in Kru. In Western Kru the full vowel inventory may have blocked the development of central vowels, due to limits on perception, while in Eastern Kru, where nasalized vowels do not appear contrastively (and presumably may have been lost), space has been created to allow for such a development. At this point, we cannot affirm this, but the complimentary distribution, noticed in other parts of Africa (Rolle, MS), is most intriguing. Note that this explanation would work for Kru but not for Dan (southern Mande) where both sets (central and nasalized) do co-occur (see below).

5. The areal hypothesis

Examining southern Mande and Kru languages, Vydrine (2009:92, 112) proposes an “Upper Guinean Coast Sprachband” sharing numerous features, including \pm ATR, vowel harmony, a high vowel inventory (7+), nasalized vowels, asymmetry of oral and nasalized vowels, lack of nasal consonants, at least three or more level tones, consonant homo-resonance, implosives, labiovelars, v and z, high frequency of CVV feet, locative nouns, and, importantly for this study, central or back unrounded vowels. While these observations are intriguing, it is important to note that some of the above features are not systemically shared by *both* Western and Eastern Kru. Thus, while most Western Kru can be analyzed as having nasalized vowels with no nasal consonants, Eastern Kru does not exhibit this behavior. And while Eastern Kru attests central or back unrounded vowels, Western Kru does not.

In this section, we would like to consider the details and/or implications of areal sharing of central vowels as it affects this region. In exploring this areal hypothesis, several questions emerge:

- First, within Kru itself, how much of the central vowel phenomenon is due to *areal contact*? Or are central vowels a result of *genetic affiliation* (for example, an innovation in PEK occurring, say, before Guibéroua Bété and Godié split)?
- Regarding the Kru-Mande areal connection, what is the locus/source of central vowel innovation and which direction is the borrowing/language contact going?
- What factors might play a role in the spread of centralization? What are the possible scenarios and what might this tell us about the history of the Kru peoples and their interaction with Mande populations?

5.1 Internal spreading of central vowels within the Kru language family

Within Eastern Kru, it is clear that central vowels are emerging, which may well be a case of family-internal areal spreading. The question remains: are languages such as Guebie and Kpokolo adopting central vowels because of natural phonetic developments (internal phonological processes and pressure as described above), or rather, is this a case of language contact? Or are both factors at work? Kru languages constitute complex and numerous dialect chains and when speaking, Kru peoples regularly “switch back and forth”, adapting words to be understood by other Kru speakers. Thus contact as well as phonological processes seem likely influences.

Most noteworthy as a candidate for areal spreading is Bakwé, traditionally considered a Western Kru language¹¹. This language seems to have acquired a full set of central vowels through language contact or areal spreading. Leidenfrost (p.c.) points out that the Bakwé, who are a very small group, pride themselves in speaking other languages and in the fact that their neighbors cannot speak their language. Though culturally they have been greatly influenced by Western Guere culture, having incorporated Guere masks (who, it turns out, must speak Guere!), their small number and sociolinguistic profile might make them susceptible to influence from adjacent and currently much larger Godié-Guibéroua Bété groups to the east. Also note in Map 1 Bakwé is today separated from related Western languages by the huge Tai forest. However, questions remain. If this such contact and borrowing did occur, it is hard to know why Bakwé, which is

¹¹ Linguistic evidence confirms this classification, as well as strong oral tradition (Centre de Traduction et d’Alphabétisation en langue Bakwé, 2013).

contiguous to Godié, would borrow central vowels, while Kouya, contiguous to Bété, would resist incorporating them! Another hypothesis is that Bakwé itself first innovated central vowels, which spread either to a Proto Eastern Kru ancestor, or spread slowly (as is still happening) throughout Eastern Kru (especially the Bété complex), but this seems less probable.

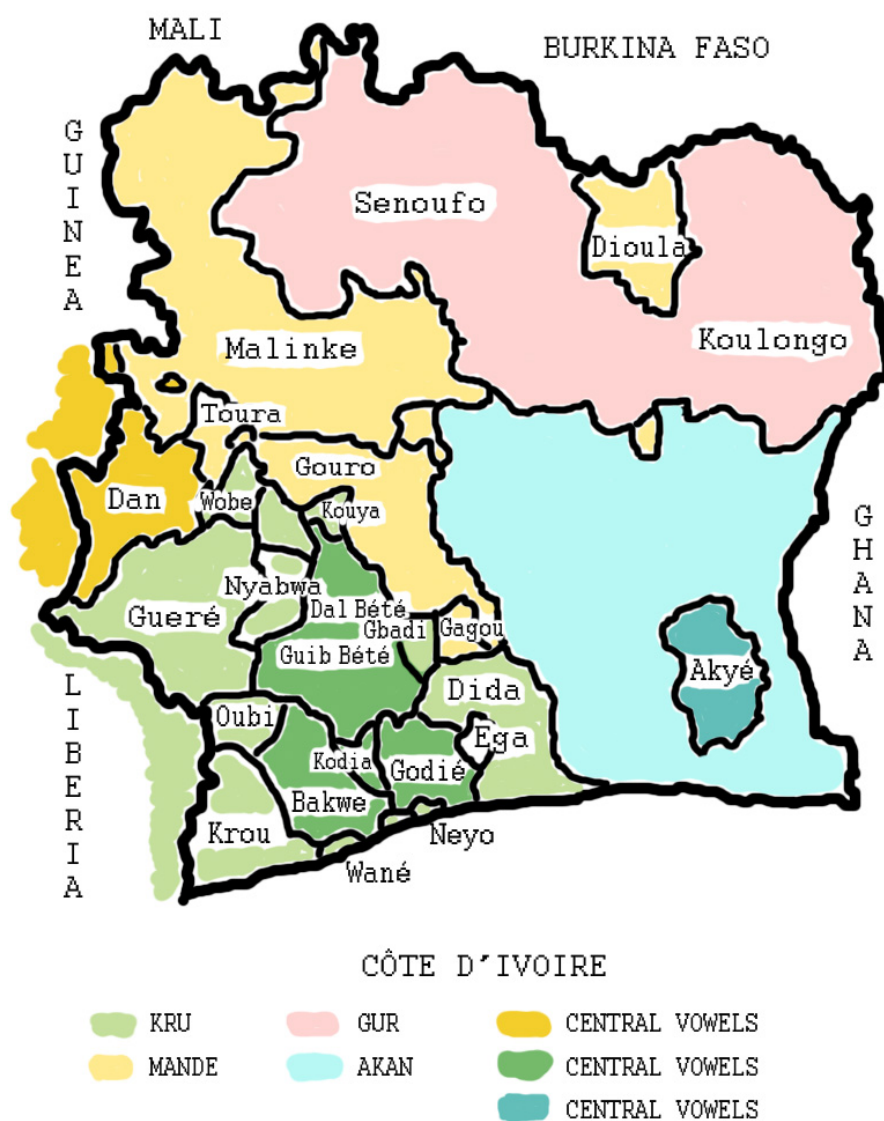
5.2 Central vowels spreading across language families

Cases of borrowing of central vowels across language families is not uncommon. M. Harley (p.c.), notes that in W. Chadic, Ywom and Goemai with 7 vowels (including 3 central vowels), “appear to have developed a third central vowel through contact with the neighbouring Tarok (a Benue-Congo language), which has an identical 7-vowel system.” Southern Mande includes two Dan languages with vowel systems which closely resemble Kru systems, in that full series of central vowels are present. Eastern Dan attests the following:

Oral vowels			Nasal vowels		
i	ɯ	u	ĩ	ũ	ũ
e	ɤ	o			
ɛ	ʌ	ɔ	ẽ	ã	õ
æ	a	ɐ	æ̃	ã	õ̃

With the exception of Goo, other languages of the southern Mande group and of other Mande branches do not have central vowels. Though it is possible that these languages underwent similar processes as Kru in developing central vowels, Vydrine (2009) is probably correct in assuming that these languages must have been influenced by Kru languages through language contact. This scenario is more likely (than the other way around, with Kru borrowing from Mande), since far more Kru languages show centralization than is the case in Mande, where, besides these 2-3 affected languages, central vowels are virtually unknown. In the map below, we see Kru languages with central vowels, those without and the area where they are attested in Mande languages.

Map 2



MAP 2

We note that Akyé, an Akan language spoken by peoples who immigrated from Ghana, also attests two central vowels¹² (ɤ and ʌ). We have yet to investigate this link, which may point to another case of language contact and areal spreading of central vowels in this region.

6. Historical explanations

¹² Bogny, Joseph, “Typological features template for Attie”, https://typecraft.org/tc2wiki/Typological_Features_Template_for_Attie.

As the above map demonstrates, one problem with the areal hypothesis concerning central vowels in subsets of southern Mande and Kru is that currently Dan is separated from the centralizing Eastern languages by a huge space occupied by Western Kru, where central vowels have not innovated. This fact suggests that historical explanations may need to come into play. If central vowels are a shared feature of Mande and Kru, this would suggest at some point the Dan peoples and the ancestors of the Godié-Bété branch of Eastern Kru and/or Bakwé were geographically contiguous. Thus, in this case, linguistic evidence may help us determine certain people movements.

Despite late oral traditions describing a movement of Kru peoples from west to east (i.e. from Liberia into the Ivorian forests), it is commonly accepted that the Kru were once located much further north, and then were pushed down into the forest by the Mande expansion. Citing Y. Person (1964) and A. Schwartz (1970), S. Lafage (1983) traces the Kru immigrations towards the south in three stages:

- 14th to 18th century: Mandes and Kru were positioned “on the Niger”, with the Mande pushing small Kru groups into the forest.
- 15th century onward: the Kru move towards the coast (in light of European trade, including the slave trade)
- 18th century: the arrival (in waves) of the Akan from the East would have pushed the Kru further south and west. P. Kipre (Ibid: 68) notes as well that in the 18th there were early Akan infiltrations and a certain “akanization” of certain Dida villages.

Though the individual Kru groups appear to be fairly autonomous, Kipre also notes a high level of contact not only between Kru themselves, but between Kru and Mande groups, describing a process of “compression”:

[in Côte d’Ivoire] ...several peoples were in contact with one another, interpenetrating each other, whether easily or not, certainly not without conflict. There were frequent confrontations between Gouro and Bété, between Gagou and Bété, between Dan and Wè during this time frame. Also we have here a “transition zone” where several peoples are **pressed together in a kind of “métissage culturel”**... Niabwa and Nidedboua are squeezed between Wè and Bété; the Bakwé’s are squeezed in between the Southern Kru and the Bété....”

This kind of geographic as well as socio-cultural ‘compression’ point to conditions which could easily lead to linguistic borrowing and the development of areal features. Kipre goes on to note (Ibid: 69) that within Côte d’Ivoire the “progressive interpenetration of peoples makes the idea of ethnic groups as ‘pure peoples’ (or races) inappropriate”.

What do these facts tell us? Probably that present territorial placements of various ethnic groups do not reflect past history. It is likely, for example, that the Dan tribes came into contact at an earlier period with parts of what today is the Godié-Bété branch of Eastern Kru, where central vowels were innovated. Despite the fact that the Mande would be considered the “dominators” over the last three to four centuries (Lafage, Ibid, Vydrine: 2009:108), it is possible that the Mande super-stratum assimilated some of the substratum language features, especially on the phonological level. Recent scholarship suggests other “higher” areal features for a wider region such as a common S AUX O V word order may have come from the other direction, namely

from Mande to Kru (J. Good, this volume, H. Sande et. al., this volume). Besides past historical contact and borrowing, it is clear that foreigners of all provenances (Mande, Akan, etc.) have penetrated and continue to penetrate into the rich and fertile Kru territory¹³. Will such mixing lead to more language change and sharing of other linguistic features?

7 Conclusions

In this study, we have tried to go beyond Vydrine's initial observations (2009), to study in some detail the innovation of central vowels in a subset of Eastern Kru languages, with the locus of initial change presumably being the Godié-Guibéroua Bété complex, possibly before this group subdivided into today's individual languages. It seems highly probable that Bakwé, a Western Kru language, but contiguous to Godié, has acquired central vowels through language contact. It may be the case that current central vowel innovations maybe constitute cases of language contact within the Kru group itself. However, Western Kru has, for whatever reasons, resisted any such innovation, perhaps due to its already very full vowel inventory.

In terms of the wider region, it would appear that two or three southern Mande languages have indeed incorporated central vowels through language contact, despite what appears to be a dominator-dominated social scenario¹⁴. Our data might suggest that the innovation of central vowels in Godié-Bété occurred rather early, that the Dan-Kru contact occurred sometime after that, but still quite some time ago, in a linguistic and geographical setting quite different from that of today. It is possible the Godié-Guibéroua Bété were initially in closer geographic contact with Dan-Glio than Western Wè was (currently contiguous to Dan), and that the Godié-Guibéroua Bété group "moved on", pushing further down into the forest into their current position, while the Wè peoples seem to have moved in between them and their Mande neighbors. It remains to be seen if any traditional accounts or historical evidence exists to justify such a scenario.

The conditions and mechanisms leading to central vowel innovation are multiple and certainly have not all been identified. The means by which areal features propagate is also not clear, but hopefully we are beginning to better understand these kinds of phenomena, and we may learn more as we continue to watch central vowels emerging (and perhaps spreading) within Kru (and beyond)¹⁵.

Acknowledgements

Thanks to H. Sande, J. Singler and V. Vydrine for comments on this and/or a previous version of this paper, to Dada Jean, I. Egner, P. Saunders, C. Leidenfrost, C. Wuesthoff and L. Wolfe for information on data as well as a special thanks to B. Alvarez for maps and H. Sande for formatting. French quotations are translated by myself.

¹³ Lafage (1983:54) notes for example that in Côte d'Ivoire today in Kru regions, Krus are in the minority, for example in the prefecture of Daloa, prior to 1980, the following figures held: Kru (from the region) 27.81 %; Non Ivoirians, 25.49 %; Akan, 18.74 %; N. Mande, 13.64%; S Mande, 9.71%; Gur, 4.57.

¹⁴ Bonny Sands (p.c.) suggests that in some African cultures, speaking "differently" is a way for leaders to gain social status and upward mobility. Could this be behind the adoption of Kru central vowels among the Dan dialects?

¹⁵ The examination of Akye central vowels is certainly a subject for further research.

References

- Ahoua, F & B. Elugbe. 2017. *Language Typology and Language Documentation in West Africa*, Paris : Harmattan.
- Associaton Gwëjekumö. 2004. *Petit dictionnaire godié, A sa gwëje zɔɔ!*, Abidjan: SIL.
- Bentinck, Julie. 1978. *Etude phonologique du niaboua*, Abidjan: Publications conjointes ILA-SIL, 1978, Vol. 3.
- Bakwɛwɛklüüa –Pɔɔkv*. 2006. (Edition préliminaire). Méagui: Centre de Traduction et d'Alphabétisation en langue Bakwé.
- Bogny, Joseph, "Typological features template for Attie",
https://typecraft.org/tc2wiki/Typological_Features_Template_for_Attie.
- Casali, Roderic F. 2008. "ATR Harmony in African Languages", *Language and Linguistics Compass* 2/3, 496–549.
- Dimmendaal, Gerrit, 2001. "Areal Diffusion versus Genetic Inheritance: An African Perspective".
- Egner, I. 1989. *Précis de grammaire wobé*, Annales de linguistique, tome XV, Abidjan.
- « Exposé historique sur le peuple bakwé de l'émission radiophonique 'au cœur de la Côte d'Ivoire' de Jules Koffi Yeboua », 2013. Méagui: Centre de Traduction et d'Alphabétisation en langue Bakwé.
- Goprou, Djaki Carlos, 2010. *Etude phonétique et phonologique du kpɔkolo, parler Bété de Gagnoa*, doctoral thesis, Université de Cocody, Abidjan.
- 2014. "Les voyelles centrales en kpɔkolo", *Cahiers d'Etudes linguistiques*, Numéro 8.
- Gratrix, Carol, 1975, "Morphotonologie du godié", *Annales de l'Université d'Abidjan*, Série H, Abidjan: ILA.
- Gnahore, Dali Laure Inès, 2005-6, *Essai sur le système verbal du gabugbu*, MA thesis, Université d'Abidjan.
- Guehoun, M. Augustin. 1993. *Description systématique du dida de Lakota*, doctoral thesis, Université Stendhal de Grenoble.
- Grégoire, H-C. 1972. *Etude acoustique du système vocalique du bete (région de Guibéroua)*. Abidjan: ILA.
- Heine, Bernd and Derek Nurse. 2000. *African Languages, an Introduction*. Cambridge University Press.
- Hickey, Raymond. MS. "Vowels before r in the history of English",
[https://www.uni-due.de/~lan300/Vowels_before_R_\(Hickey\).pdf](https://www.uni-due.de/~lan300/Vowels_before_R_(Hickey).pdf).
- Kaye, Jonthan, 1980. "The mystery of the tenth vowel", *Journal of Linguistic Research*, Vol 1, 1-14.
- Kipre, Blé François. 2015. "Interprétation phonologique des structures syllabiques CVIV et CWV du Bété revisitée", *Afrique, Langue et Cultures*, Numéro 5.
- Kipre, Pierre. 2005. *Côte d'Ivoire : la formation d'un peuple*, Paris : Éd. SIDES-IMA,
- Kokora, Dago Pascal. 1976. *Studies in the Grammar of Koyo*, doctoral thesis, University of Indiana.
- Kutsch Lojenga, C. et E. Hood. 1982. "L'Attie", *Atlas des langues kwa de Cote d'Ivoire*, Tome 1, éd. Hérault, Abidjan : ILA, pp. 227-253.
- Lafage, Philippe, 1978, *Les langues kru*, in IEL.

- Lafage, Suzanne, 1983, *Etude sociolinguistique de l'aire kru de Côte d'Ivoire*, Abidjan : ACCT-ILA, 2^e édition.
- Lewis, et. al. 2014. *Ethnologue*. SIL.
- Lynch, John, 2015, "The Phonological History of Iaa", in *Languages and Linguistics in Melanesia*, Vol 33, No. 1, 2-15.
- Marchese, Lynell. 1975. « Morphophonologie du verbe godié », *Annales de l'Université d'Abidjan*. Série H, Fasc. 1, pp. 215-239.
- _____. 1979/1983. *Atlas linguistique des langues kru: essai de typologie*. ILA, Université d'Abidjan, vol. LXXIII.
- _____. 1986. *Tense/aspect and the Development of Auxiliaries in the Kru Language Family*, SIL-University of Texas Press, Arlington.
- _____. 1988. 'Noun Classes and agreement systems in Kru: A Historical Approach', in *Agreement in natural language: Approach, theories and descriptions*. Barlow and Ferguson (eds.), Stanford University Press.
- _____. 1989. 'Kru', in *The Niger-Congo Languages*, Bendor Samuel (ed.), Lanham: University Press of America, Inc.- SIL, pp. 119-139.
- Morton, Deborah. 2012. "[ATR] Harmony in an 11 Vowel Language: the Case of Anii" in Marlo, Michael R., Nikki B. Adams, Christopher R. Green, Michelle Morrison, and Tristan M Purvis (eds.) *Selected Proceeding of the 42nd Annual Conference on African Linguistics*. Somerville, MA: Cascadilla Proceedings.
- Paradis, Carole « La règle d'élision syllabique et les séquences vocaliques en guere », pp. 181-193.
- Rolle, Nicholas. 2013. "Nasal vowel patterns in West Africa", UC Berkeley Phonology lab report.
- Saunders, Philip. 2009. *Encountering Kouya: A study of the key phonological, syntactic and discourse properties of an endangered Kru language*, Phd dissertation, University of Ulster at Jordanstown.
- Seri Guezé Martine, 1987, *Système nominal du Gbawalı* (sous groupe bété). D.E.A, Université d'Abidjan.
- Singler, John Victor, 1979, *The Segmental Phonology of Verb Suffixes in Talo Kalo (Kru)*, MA thesis, UCLA.
- Tebili, Hortense. 2010. « Esquisse phonologique du digbu, parler Bété de Guidberoua ». MA thesis, UCLA.
- Vahoua, Kallet A. 2011. "L'instabilité de la Voyelle / / dans un Parler Bete Langue kru de Cote D'ivoire » *Nordic Journal of African Studies*. 20 (2), pp. 150-176.
- Vydrine, Valentin. 2004. "Areal and genetic features in West Mande and South Mande phonology: In what sense did Mande languages evolve?" *Journal of West African Languages*, vol. XXX, # 2, pp. 113-125.
- _____. 2009. "Areal features in South Mande and Kru languages", Cyffer N. and Ziegelmeyer, *When languages meet: Language contact and change in West Africa*, Köln: Rüdiger Köppe Verlag, pp. 91-116.
- _____. 2013. "Goo : présentation d'une langue", INALCO – LLACAN, CNRS UMR 8135.
- _____. et Mongnan Alphonse Kességbéu. 2008. *Dictionnaire Dan-Français (dan de l'Est) avec une esquisse de grammaire du dan de l'Est et un index français-dan*. St Pétersbourg: Nestor-Istoria,

- Werle, Johannes-Martin et Dagou Justin Gbalehi. 1976. *Phonologie et morphonologie du bété de la région de Guibéroua*. Abidjan : Publications conjointes ILA-SIL.
- Welmers, Wm. E. 1973. *African Language Structures*. Berkeley: University of California Press.
- Williamson, K and R. Blench. 2000, "Niger Congo" in Heine and Nurse, p. 11-42.
- Zogbo, Gnoléba Raymond, 2005. *Dictionnaire Bété-Français*, Abidjan : CERAP.
- Zogbo, Lynell, 2011, 'Les langues kru', 'Le bété', *Dictionnaire des langues*, Bonvini, Busuttil, Peyraude, eds., Paris: PUF, pp. 44-57.
- Zogbo, Lynell. 2017. « Les vestiges de classes nominales dans les langues kru : accord et suffixes », in Ahoua & Elugbe, 2017, pp. 241-262.