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TABLE OF CONTENTS

Studies in African Linguistics
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LA RECONSTRUCTION DE QUELQUES MOTS POUR 'MORTIER' EN DOMAINE BANTOU*

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This article proposes reconstructions of words for "mortar" in Bantu languages. Comparative research indicates that a nominal stem of the type *-dù ~ -nù can be reconstructed on a Proto-Bantu level; however, data from related non-narrow Bantu languages seem to indicate greater historical depth. In the eastern Bantu languages, a second nominal stem, °-tòdé, is reconstructed. It appears to be closely related to the geographical distribution of a cereal in south-eastern Africa. Finally, two other regional stems with less historical depth are reconstructed for the Great Lakes area and the central African forest region, respectively.

1. Introduction: Le mortier en Afrique subsaharienne

L'une des images les plus banales de la vie quotidienne africaine est celle d'une femme pilant de la nourriture dans un mortier en bois. Si nous sommes si souvent confrontés à un tel tableau, c'est parce que le mortier est, jusqu'à nos jours, un des ustensiles ménagers les plus courants. On trouve des mortiers de toutes les tailles. Depuis les plus petits qui servent à piler les piments jusqu'aux plus grands dans lesquels on fabrique la farine ou dans lesquels on sépare la balle du grain. Si, actuellement, le mortier africain semble être étroitement lié aux cultures du mil, du riz, et du maïs [Meynen 1927], le riz et le maïs ont été introduits récemment sur le

* Je tiens à remercier toutes les personnes qui m'ont fait part de leurs observations. Je pense en particulier à mes collègues J. Baka et B. Janssens, à Y. Bastin et Cl. Grégoire du Service de linguistique de Musée royal de L'Afrique Central, ainsi qu'à E. Cornelissen, O. Gosselain et P. Lavachery de la Section de Préhistoire. Un grand merci également à T. Schadeberg pour la lecture attentive du manuscrit et les remarques intéressantes qui s'en sont suivies. Merci aussi à tout ceux qui n'ont pas hésité à me dire " comment on dit mortier dans leur langue " ainsi qu'à M. Garsou qui a patiemment corrigé la version française de ce texte.

continent africain et Meynen suppose qu'au départ, le mortier était associé à la culture du mil.

La tentative de reconstruction amène une réflexion plus approfondie sur l'utilisation de cet objet qui ne semble pas exclusivement liée à la culture des céréales. Dans la cuisine ganda, par exemple, une multitude d'ingrédients doivent être pilés pendant la préparation. Il s'agit entre autres de plantains déshydratés (*ebigomba*), manioc (*mawogo*), arachides sèches, termites et de jeunes feuilles de l'haricot (*mpindî*) [Bennet et al. 1965]. À côté de sa fonction dans la préparation de la nourriture, le mortier a parfois un rôle cérémoniel. Chez les Hamba, le mortier *okudi* est le symbole de prestige le plus important. Les aînés du lignage ne peuvent s'y asseoir qu'une fois dans leur vie après avoir effectué d'importants dons. de Heusch [1954] suppose que ce puissant symbole de pouvoir qu'est le mortier renversé, est utilisé pendant la cérémonie *lukutu* pour mettre en évidence la valeur des dons matrimoniaux que l'on a reçus du gendre. Il faut alors se demander pourquoi un objet d'usage courant comme le mortier peut assumer une fonction rituelle aussi importante [de Heusch 1954].

Vansina, qui a essayé de reconstruire l'univers socio-politique des popula-tions de langues bantoues à partir du proto-lexique, affirme que: "*The Bantu-speaking colonists arrived south of the Sanaga with a single system of food production and acquisition that included farming as one element only, albeit a central element.*" (Vansina 1990: 83). Ces populations possédaient des technologies agricoles qui leur permettaient de cultiver entre autres l'igname (*Dioscorea cayenensis*), le palmier à l'huile et les calebasses [Sinclair et al. 1995]. Vansina ne mentionne aucune céréale comme faisant partie de leur régime alimentaire [Vansina 1990]. Le manque de traces de céréales n'implique pourtant pas l'inexistence du mortier, puisque certaines préparations de l'igname peuvent également nécessiter une réduction du tubercule effectuée à l'aide de cet instrument. Le pilage des noix de palme afin d'en extraire l'huile, qui est une activité propre à la zone forestière, semble être un autre usage important du mortier [Bahuchet 1992]. En outre, les populations bantoues anciennes maîtrisaient la technologie et les outils nécessaires à la fabrication d'un mortier. Le travail du bois (*-bàìj- 'travailler le bois') était bien développé au moment de la diversification des langues bantoues [Vansina 1990], et, même si la reconstruction d'un thème pour 'forger' est moins facile—*-túd- 'frapper, forger')—nous pouvons être quasiment sûrs que la forge était suffisamment développée pour permettre la fabrication de différents outils utilisés dans la fabrication des mortiers comme l'herminette par exemple [G. Thiry, comm. pers.].

Sans vouloir projeter le présent dans le passé, il peut également être intéressant d'étudier la culture matérielle des populations forestières contemporaines de manière à identifier les implications du passage à un mode de subsistance dominé par l'agriculture. Un tel passage a également dû se passer à l'époque de la dispersion des langues bantoues et a inévitablement entraîné le développement de nouveaux objets domestiques.

En raison de leur mode de vie (semi-)nomade, les habitants de la forêt possèdent un nombre d'objets utilitaires fort réduit. Le mortier le plus courant

étant un objet lourd et volumineux, il n'est pas étonnant que nous en trouvions peu parmi eux. Selon Bahuchet, les Pygmées Aka et Baka connaissent un type de mortier plus rudimentaire dans lequel ils préparent leur poison de flèche. Ce type de mortier, entaillé dans une grosse bûche ou constitué d'une ouverture rectangulaire creusée dans une racine apparente, ne nécessite pas l'emploi de l'herminette et n'est pas incompatible avec le mode de vie nomade de ces populations [Bahuchet 1992]. L'auteur en conclut que le mortier et le pilage étaient connus des Pygmées indépendamment des plantes cultivées, céréales, ou tubercules.

Les arguments cités ci-dessus nous mènent à la conclusion qu'il est fort probable que le mortier, sous une forme ou une autre, était déjà en usage à l'époque de la diversification des langues bantoues, et que cet objet ne semble pas être exclusivement lié à la culture céréalière ou à l'agriculture tout court. Il est donc séduisant de tenter la reconstruction d'un terme désignant un outil domestique aussi répandu en Afrique contemporaine, surtout si on considère que la mauvaise conservation du bois a pour conséquence qu'on trouve très peu de traces d'un tel objet dans les fouilles archéologiques.

2. Un theme *-dù ~ *-nù au centre du domaine bantou

2.1. La distribution géographique du thème. Le premier thème que nous aborderons est *-dù ~ *-nù, dont les réflexes connaissent une distribution assez large au centre du domaine bantou.[1]

(1)	sira	B41	*-dù*	7-8	'mortier'	[Dodo 1993]
	logooli	E41	*-nu*	7-8	'mortar'	[Guthrie 1970]
	tongwe	F11	*-ɲu*	7-8	'mortar'	[Kakeya & Nishida 1976]
	ngazidja	G44a	*-nɔ*	7-8	'mortier'	[Lafon 1991]
	suundi	H13b	*-dú*	9-10	'mortier'	[J. Baka, comm. pers.]
	ganda	J15	*-nûː*	7-8	'mortar'	[F. Katamba, comm. pers.]
	dciriku	K62	*-nù*	7-8	'Mörser'	[Möhlig 1967]
	kanyok	L32	*-nú*	7-8	'mortier'	[Mukash-Kalel 1982]
	lamba	M54	*-nu*	7-8	'mortar'	[Doke 1933]
	herero	R31	*-ni*	7-8	'Mörser'	[Irle 1917]

Quand nous comparons la distribution de ce thème, telle qu'elle apparaît, dans la Carte 1, à la distribution du thème *-ìcè 'pilon' (voir carte 2), nous constatons que les mêmes vides s'établissent dans les distributions respectives des deux

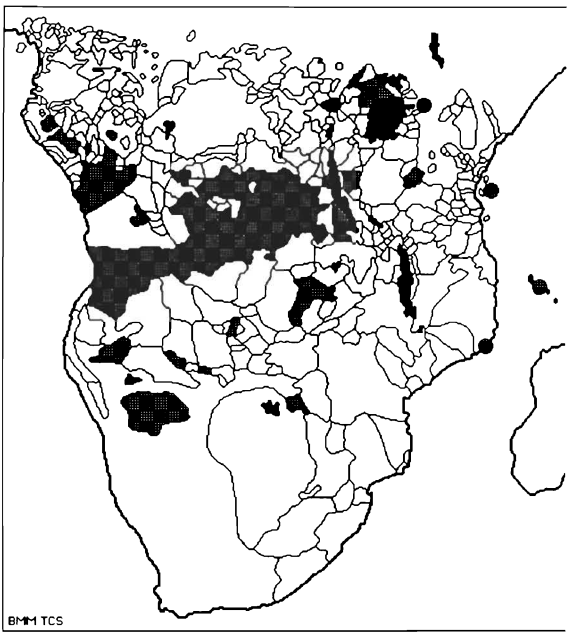
[1] Les conventions de notation utilisées dans cet article sont les suivantes: * indique une reconstruction proto bantoue sûre; ° indique une reconstruction régionale. [i e ɛ a ɔ o u] représentent le système vocalique proto-bantou.

thèmes, même si les attestations du thème *-ìcè sont plus nombreuses que celles du thème pour 'mortier': l'extrême nord-ouest, la zone C et les langues de la région interlacustre ne fournissent guère d'attestations. Les réflexes de *-ìcè sont par contre bien attestés dans l'Est et le Sud du domaine bantou, régions où les réflexes de *-dù ~ *-nù sont quasiment absents (voir Cartes 1 et 2).

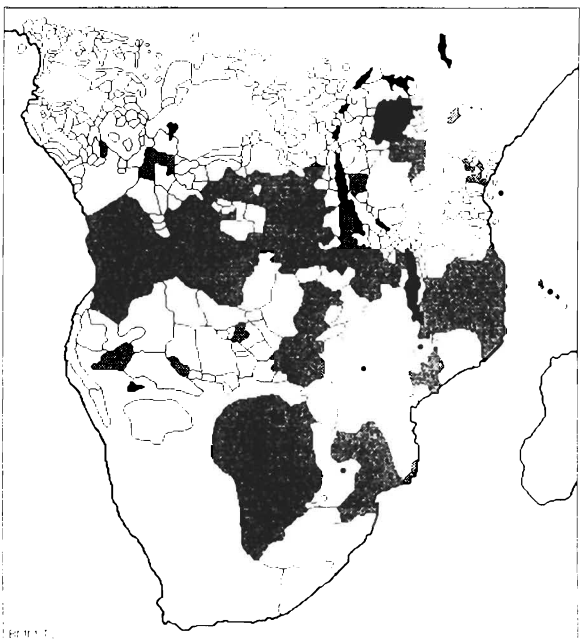
Le thème *-dù ~ *-nù n'est donc pas attesté dans les langues orientales du domaine, sauf en swahili, dans les langues comoriennes, et en koti. Bien que le swahili, en tant que langue véhiculaire, influence beaucoup les langues avoisinantes (voir °ngalawa 'pirogue' [Bulkens à paraître a] et *-cópà 'calebasse, bouteille' [Bulkens à paraître b]), il y a des champs sémantiques qui résistent davantage à cette influence. La comparaison avec la distribution de *-cópà est fort intéressante puisqu'il s'agit de deux objets domestiques. Les bouteilles (en verre) étant d'introduction plus récente, les Swahili, en tant que commerçants, ont sans doute joué un rôle important dans la distribution de cet objet et ils ont donc favorisé la diffusion simultanée du substantif avec son nouveau sens. La dénomination du mortier, objet déjà largement répandu avant une quelconque intervention des commerçants, n'a probablement pas subi l'influence de la langue commerciale. Ceci est un exemple des champs sémantiques limités (commerce, nouvelles technologies) dans lesquels une langue véhiculaire exerce préférentiellement son influence sur des langues locales.

D'autres thèmes remplissent les vides figurant dans la carte de distribution de *-dù ~ *-nù. Les réflexes de °-tòdé ont une distribution orientale et méridionale (voir Carte 3). Dans la région des Grands Lacs, nous trouvons des thèmes dérivés du radical verbal °-cɛ́k-od- 'piler'. En zones A et C, des réflexes de °-bòkà désignent 'le mortier'. Nous devons également mentionner une innovation locale de type °-bɛndɛ en zone M et quelques emprunts à l'anglais 'mortar'. La reconstruction des thèmes proto-bantou signifiant 'mortier' et 'pilon' va de soi.

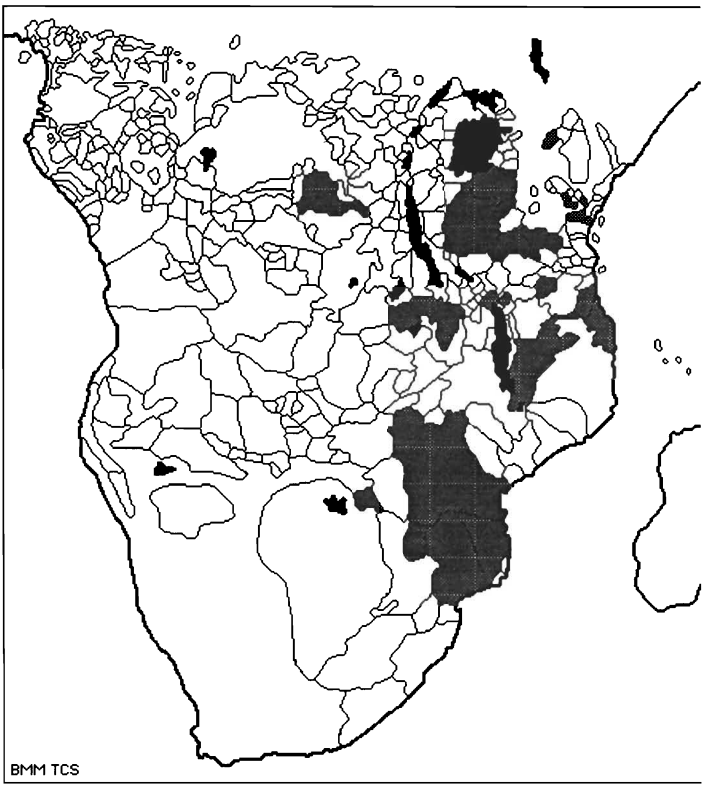
2.2. La reconstruction formelle du théme. Nous trouvons une première tentative de reconstructtion d'un thème signifiant 'mortier' chez Homburger [1925]. L'auteur retient la forme *ki-nu, mais hésite en ce qui concerne la consonne initiale du thème (*-nu vs. *-ntu). Étant donné qu'elle s'est basée sur un corpus limité, aussi bien géographiquement que numériquement, Homburger n'a pas pu s'exprimer sur l'ancienneté de la reconstructon. Guthrie, pour sa part, a attribué un passé proto-bantou au thème *-nú. Il montre dans sa Série Comparative n° 1377 que *nú est le seul thème signifiant 'mortier' qui a une distribution générale et il en tire la conclusion que "*-nú 7/8 was probably the shape of the PB-X item meaning 'mortar', if in fact the original proto-language had such a term" [Guthrie 1970]. Meeussen [1980] cite la reconstruction de Homburger, mais il reprend la reconstruction comme *-no sans y ajouter de données relatives á la tonalité. Il nous semble pourtant que la voyelle proposée par Homburger est la voyelle postérieure du premier degré d'aperture [u]. Ehret [n.d.] propose une origine soudanaise centrale pour les substantifs formés sur un thème du type -nú, dont la distribution est, selon lui, uniquement orientale. Cette hypothèse est démentie par nos données



Carte 1. Distribution des réflexes du thème *-du~ ~ *-nu~ 'mortier'



Carte 2. Distribution des réflexes du thème *-ìcè 'pilon'.



Carte 3. Distribution géographique des réflexes de °-tódè 'mortier'.

qui montrent que ce thème a une répartition beaucoup plus générale et qu'il occupe principalement le centre du domaine (voir 3.1).

2.2.1. Une alternance consonantique s'impose. La majorité des attestations reflète un réflexe direct de *n que nous pouvons, au premier abord, considérer comme l'aboutissement canonique.

(2)	rimi	F32	*-nò/-nù*	5-6	'mortier'	[Olson 1964][2]
	swahili	G42	*-nu*	7-8	'mortar'	[Sacleux 1939]
	holu	H33	*-nù*	7-8	'mortar'	[Daeleman n.d.]
	ganda	J15	*-nû:*	7-8	'mortier'	[F. Katamba, com. pers.]

[2] Olson [1964] cite deux thèmes différents signifiant 'mortier', -nù et -nò. Ceci est probablement dû à une faute de frappe.

Nous avons néanmoins récolté des données dans une série de langues en zones B, H, et P (voir (3)) dans lesquelles la consonne initiale du thème est [d], [l], [tt], ou [dz].

(3)						
	sira	B41	*-dù*	7-8	'mortier'	[Dodo 1993]
	punu	B43	*-dù*	7-8	'mortier'	[Nsuka-Nkutsi 1980]
	laali	B73b	*-dù*	7-8	'mortier'	[Bissila 1991]
	kukwa	B77a	*-dzŭ*	7-8	'mortier'	[Paulian 1975]
	ntsuo	B85d	*-dzù*	7-8	'mortier'	[Dibata 1979]
	mbuun	B87	*-dzù*	7-8	'mortier'	[Mvwanda 1987]
	suundi	H13b	*-dú*	7-8	'mortier'	[J. Baka, com. pers.]
	koti	P31	*-khittu*	3-4	'mortier'	[T. Schadeberg, com. pers.][3]

Il existe d'autres reconstructions proto-bantoues dans lesquelles se manifeste une alternance d ~ n. Guthrie [1970] les classe dans les *séries osculantes* (en (4)). Cette alternance n'est ni régulière ni prévisible et elle se produit donc dans divers environnements. La comparaison avec le thème *-dɔ́k- ~ *-nɔ́k- 'to rain' ne montre d'ailleurs aucune concordance, comme indique les exemples en (5).

(4)		*d		*n	
	n° 650	*-*dɔ́k*-	n° 1367	*-*nɔ́k*-	'to rain'
	n° 1547	*-*pídà*	n° 1553	*-*pínà*	'pus'
	n° 1565	*-*pɔ́d*	n° 1577	*-*pɔ́n*	'be cured'
	n° 1736	*-*tííd*	n° 1741	*-*tíín*	'run away'

(5)			'pleuvoir'	'mortier'	
	sira	B41	*-nɔ́g-*	*-dù*	[Dodo 1993]
	punu	B43	*-nɔ́ɣə̀-*	*-dù*	[Nsuka-Nkutsi 1980]
	suundi	H13b	*-nɔ́kà*	*-dú*	[J. Baka, com. pers.]
	luba	L31a	*-lɔ̀ká*	*-nú*	[De Clerq & Willems 1960]
	luba	L33	*-nɔ̀ká*	*-nú*	[Gillis 1981]
	umbundu	R11	*-lɔk-*	*-nɛ̀*	[Guthrie 1970]
	herero	R31	*-rɔka*	*-ni*	[Irle 1917]

Nous remarquons que les réflexes de l'initiale ne sont pas nécessairement les mêmes dans les deux séries. Certaines langues ont [d] à l'initiale du réflexe de *-dù ~ *-nù mais ont une nasale à l'initiale du réflexe *-dɔ́k- ~ *-nɔ́k-, et les langues qui ont une nasale en position initiale du réflexe *-dù ~ *-nù n'ont pas

[3] Selon T. Schadeberg, [tt] reléterait la séquence *nd de la proto-langue, ou pourrait être le résultat de l'emprunt de [d] ou [nd] à une langue voisine (voir 2.2.3).

nécessairement une nasale à l'initiale du verbe. Vu le caractère apparemment non-conditionné de l'alternance d ~ n, il est difficile de reconstruire autre chose qu'une telle alternance, *-dù ~ *-nù, à l'initiale du thème signifiant 'mortier'.

Remarquons également qu'une spirantisation du [d] a eu lieu dans trois langues dont l'appartenance à cette série comparative ne peut toutefois pas être mise en question. L'apparition de l'affriquée [dz] en kukwa (B77a) est due au passage au système à cinq voyelles [Paulian 1975].

(6)	PB			> kukwa B77a		
	*-dù/-nù	'mortier'	7	> *-dzŭ*	'mortier'	7-8
	*-bùè	'white hair'	11	> *-vì*	'cheveux blancs'	9
	*-ɗɪ	'root'	3	> *-dzà*	'racine'	3
	*-tôɪ	'ear'	15	> *-tʃwɪ̄*	'oreille'	9

Bien que le ntsuo (B85d) possède encore un système vocalique à sept voyelles, *d a, dans cette langue, un réflexe spirantisé [dz] devant une voyelle du premier degré d'aperture, tandis que le réflexe est [l] devant les autres voyelles [Dibata 1979]. En mbuun (B87) un autre exemple de spirantisation devant les voyelles du premier et du deuxième degrés a été trouvé [Mvwanda 1987].

(7)	PB			> ntsuo B 85a		
	*-dù/-nù	'mortier'	7	> *-dzù*	'mortier'	7-8
	*-ɗɪd-	'wait'		> *-dzìl-*	'attendre'	
	*-dèm-	'cultivate'		> *-lím-*	'cultivate	

(8)	PB			> mbuun B87		
	*-dù/-nù	'mortier'	7	> *-dzù*	'mortier'	7-8
	*-tóè	'head'	11	> *-tswè*	'tête'	3

Les données provenant de ces langues indiquent que les formes recueillies sont des réflexes réguliers de *-dù ~ *-nù. Le kukwa livre des preuves complémentaires concernant le caractère fermé de la voyelle du thème. Les discussions relatives à la voyelle et à la tonalité montreront du reste également que le rapprochement des deux séries comparatives est pleinement justifié (voir 2.2.2. et 2.2.4.).

Dans deux langues (dispersées), tongwe F11 et ruund L53, *-dù ~ *-nù a un réflexe palatal. En tongwe, où la séquence -nu- est très rare, *n > ɲ est régulier [Kakeya & Nishida 1976]. Dans cette langue, les anciennes séquences *nu et *no se sont confondues et ont toutes les deux abouti à [ɲu], bien qu'il s'agisse d'une langue à 7 voyelles où la distinction entre voyelles du deuxième et du premier degrés d'aperture s'est généralement maintenue.

(9)	tongwe	F11	*-ɲu*	7-8	'mortar'	[Kakeya & Nishida 1976]
	ruund	L53	*-ɲ*	7-8	'mortar'	[Hoover 1975]

(10)	PB			>	tongwe F11		
	*-nòà	12	'mouth'	>	*-ɲuwa*	12	'mouth'
	*-nùnk-		'smell, stink'	>	*-ɲunka*		'smell'

Ce réflexe peut nous aider à comprendre le réflexe du ruund (L53), *cíɲ* 7-8 'mortier' [Hoover 1975]. Le ruund est une langue dans laquelle l'érosion de la voyelle finale est un phénomène régulier. Considérons les exemples ci-dessous [Hoover 1975]. Il ressort de ces exemples que les règles *n > ɲ / V__$V_{fin[+ant]}$# et $V_{fin} \rightarrow \varnothing$ ont élidé les voyelles finales de la langue, ce qui nous conduit à retenir la forme du ruund comme réflexe de *-dù ~ *-nù.

(10)	PB			>	ruund L53		
	*-nòɛ̀	3	'finger'	>	*-múɲ*	3	'finger'
	*-gɛ̀nì	1	'stranger'	>	*-mwɛ́:ɲ*	1	'stranger'
	*-pénì	3	'handle'	>	*-swíɲ*	3	'handle'
	*-jánà	1	'child'	>	*-mwân*	1	'child'
	*-ɲ̀inà	5	'name'	>	*-dí:ɲ̀in*	1	'name'

Les langues attestées dans notre corpus fournissent donc suffisamment de preuves pour la reconstruction d'une alternance consonantique à l'initiale du thème signifiant 'mortier'.

2.2.2. La voyelle. L'image globale des réflexes vocaliques est assez fragmentée. A côté du réflexe direct de *u, qui est majoritaire, nous trouvons d'autres réflexes vocaliques variant en degré d'aperture et lieu d'articulation: [o, ɔ, i, ɛ]. Trois langues comoriennes, le ngazidja, le nzuani et le maore, attestent une voyelle ouverte [ɔ], bien qu'elles aient des réflexes directs dans d'autres thèmes.

(12)		PB				ngazidja G44a		[Lafon 1991]
	a.	*-nùnk-		'smell, stink'	>	*-nuka*		'puer'
		*-túmɔ̀	5	'spear'	>	*-fumɔ*	5	'lance'
		*-dù/-nù	7	'mortar'	>	*-nɔ*	7	'mortier'
						nzuani G44b		[Ahmed-Chamanga 1992]
	b.	*-nùnk-		'smell, stink'	>	*-nunka*		'sentir'
		*-túmɔ̀	5	'spear'	>	*-fumɔ*	5	'lance, flèche'
		*-dù/-nù	7	'mortar'	>	*-nɔ*	7	'mortier'
						maore G44c		[Blanchy 1987]
	c.	*-nùnk-		'smell; stink'	>	*-nuka*		'sentir'
		*-túmɔ̀	5	'spear'	>	*-fumɔ*	5	'flèche'
		*-dù/-nù	7	'mortar'	>	*-nɔ*	7	'mortier'

Le komoro (G44) a *-nu* 7-8 'mortier' comme réflexe et les auteurs citent la forme *-nɔ* comme variante [Ahmed-Chamanga & Gueunier 1979]. Nous pouvons alors retenir les réflexes du ngazidja, du maore, et du nzuani sans pouvoir expliquer l'ouverture irrégulière de la voyelle. La forme que Stappers a récoltée auprès des locuteurs de la variante lembwe, *-mwɛ̀* 'mortier', est l'unique exemple du corpus dans lequel la voyelle s'est diphtonguée entraînant l'assimilation de la nasale initiale [P. Kalonda, comm. pers.].

(13)	lande	L23	*-nɔ̀*	'mortier'	7-8
	lembwe	L23	*-nù/-mwɛ̀*	'mortier'	7-8
	eki	L23	*-nù*	'mortier'	7-8

Ce processus de diphtongaison entraîne la neutralisation de quelques thèmes [Stappers 1964]. La variante lembwe du songye a transformé les thèmes de structure CV ou CVV à voyelle postérieure en thèmes de type CSV. L'exemple de *-nòɛ̀ est révélateur à ce propos. La semivocalisation de la voyelle postérieure du deuxième degré a entraîné une assimilation de la consonne initiale du thème comme on le voit en (14). Le thème pour 'mortier' a subi la même évolution et la langue semble avoir aligné plusieurs thèmes. Nous pouvons donc considérer les réflexes du songye comme réguliers.

(14)	PB				lembwe L23		
	*-nòɛ̀	>	°-nwɛ̀	>	*-mwɛ̀*	3	'doigt'
	*-dù/-nù	>	°-nwɛ̀	>	*-mwɛ̀*	7	'mortier'
	*-bó	>	°-bwɛ̀	>	*-mwɛ̀*	12	'moustique'

En zone R, certaines langues ont une voyelle antérieure comme réflexe occasionnel d'une voyelle postérieure.

(15)	PB				umbundu R11			
	*-dù/-nù	7	'mortar'	>	*-nɛ̀*	7	'mortar'	[Schadeberg 1986]
	*-gùbó	9	'hippo'	>	*-ngɛ̀vɛ́*	1	'hippo'	[Schadeberg n.d.]
	*-tíkò	5	'night'	>	*-tɛ́kɛ́*	14	'night'	[Schadeberg, c. p.]
					kwanyama R21			
	*-dù/-nù	7	'mortar'	>	*-ni*	7	'mortar'	[Tobias & Turvey 1986]
	*-kúdù	9	'tortoise'	>	*-kílĩ*	1	'tortue'	[Zavoni 1991]
	*-kúpà	5	'bone'	>	*-kípà*	14	'os'	[Zavoni 1991]

Les données sont trop restreintes pour permettre de réunir beaucoup d'attestations, mais celles qui sont citées ci-dessus montrent malgré tout des régularités satisfaisantes. En conclusion, même si les réflexes vocaliques sont assez divergents, il paraît légitime de reconstruire une voyelle *u.

2.2.3. Thème dissyllabique? Il existe des thèmes dissyllabiques dont la deuxième syllabe ressemble curieusement à *-dù ~ *-nù (voir 16). Une première observation nous confronte à la similitude structurelle de quelques-uns de ces thèmes dont les syllabes initiales font penser à d'anciens PN_{15} inclus dans certains thèmes de langues de la zone B (B53, B73c), C (C84), K (K31, K333) et L (L62). Une telle inclusion est chose commune dans les langues bantoues, notamment dans des langues qui ne possèdent plus cette classe que pour les infinitifs verbaux [Doneux 1967].

(16)	tsangi	B53	*-kúdú*	'mortier'	9-10	[Loubelo 1987]
	yaa	B73c	*-kúúrú*	'mortier'	5-6	[Mouandza 1991]
	lele	C84	*-gólù*	'mortier'	9-10	[Rutinigirwa 1975]
	mwenyi	K31	*-kùnjú*	'mortar'	7-8	[Yukawa 1987]
	mbukushu	K333	*-kùndhù*	'stamping block'	12-13	[Wynne n.d.]
	nkoya	L62	*-kûnthù*	'mortar'	9-10	[Yukawa 1987]
	suundi	H13b	*tsíndù*	'pierre à moudre'	9	[J. Baka, c.p.][4]
	ntandu	H16g	*-silu*	'mortier'	5-6	[Butaye 1909]
	koti	P311	*-khittu*	'mortier'	3-4	[T. Schadeberg, c.p.]
	holoholo	D28	*-tunu*	'mortier'	7-8	[Schmitz 1912]
	taabwa	M41	*-tunu*	'mortier'	7-8	[Van Acker 1907]

Dans notre corpus nous avons également trouvé des attestations de thèmes qui semblent avoir eu une initiale complexe (K31, K333 et L62) et qui peuvent également être ramenés à cette structure. Bien que formellement chaque thème se rapproche de la structure **-NP_{15}-thème, il reste toutefois des éléments, notamment la tonalité, qui contredisent cette hypothèse. Ce n'est qu'en mbukushu (K333) et en nkoya (L62) que nous trouvons un réflexe tonal régulier, mais c'est également dans ces langues qu'une nasale apparaît dans le thème.

Une comparaison de l'aboutissement des reconstructions monosyllabiques dans les langues citées ci-dessus s'impose. Dans le tableau 17 des réflexes de reconstructions monosyllabiques sont reprises.[5] Les quelques exemples révèlent que l'inclusion de préfixes nominaux n'est pas une stratégie à laquelle ces langues s'adressent d'une façon régulière. Notons que le ntandu (H16g) est l'unique langue de cette série qui a intégré le PN_{15} dans le thème devant son réflexe de *-tôi 5 'oreille'.

L'hypothèse de l'inclusion du PN_{15} dans le thème ne semble donc pas être valable. Si ces formes ne peuvent être considérées comme apparentées, nous devons également constater que, vu la distribution des thèmes de type *-ku(n)tu* dans une région entourant l'aire occupée par les réflexes de *-dù ~ *-nù, une dispersion

[4] Voir aussi (34).

[5] Le nombre de réflexes est dépendant du contenu des sources.

(17)

PB		tsaangi B53	
*-bóà	>	mvwá	'chien'
*-gɔ̀ì	>	ngɔ́	'léopard'
*-jò	>	nzɔ́	'maison'

PB		yaa B73c	
*-bóà	>	mbwá - bámbwá	'chien'
*-bó	>	ímbú - bímbú	'moustique'
*-bòè	>	límví - bámví	'pierre'
*-tôì	>	lítswí	'oreille'
*-tóè	>	mútswé	'tête'

PB		lele C84	
*-bóà	>	mbwà	'chien'
*-tôì	>	ìtɔ́	'oreille'
*-tóè	>	ncwé	'tête'

PB		holoholo D28	
*-bóà	>	bwa - mabwa	'chien'
*-nòà	>	kanya - tunya	'bouche'
*-nòè	>	muniɛ - miniɛ	'doigt'
*-tôì	>	kutwi - matwi	'oreille'
*-tóè	>	twɛ - matwe	'tête'

PB		ntandu H16g	
*-bóà	>	mbwa - mbwa	'chien'
*-nòà	>	nwa - binwa	'bouche'
*-bó	>	lubu - mbu	'moustique'
*-tôì	>	kutu - makutu	'oreille'
*-tóè	>	ntu - ntu	'tête'

PB		mwenyi K31	
*-bóà	>	mbwà - ámbwà	'chien'
*-nòà	>	kánwá - túnwá	'bouche'
*-gì	>	múɲjí - míɲjí	'mouche'
*-tôì	>	lítwì - mátwì	'oreille'
*-tóè	>	mútwì - mítwì	'tête'

PB		mbukushu K333	
*-bóà	>	mbwá - mbwá	'chien'
*-nòà	>	kánwâ - túnwâ	'bouche'
*-nòè	>	múnwè - ménwè	'doigt'
*-tôì	>	ɗítwí - mátwí	'oreille'
*-tóè	>	mútwí - mítwí	'tête'

PB		nkoya L62	
*-bóà	>	kăwà - tŭwà	'chien'
*-nòà	>	kànwà - tùnwà	'bouche'
*-nòè	>	mùmwè - mìnwè	'doigt'
*-tôì	>	ǰítù - mătu	'oreille'
*-tóè	>	mŭtwè - mĭtwè	'tête'

PB		taabwa M41	
*-bóà	>	kabwa - tubwa	'chien'
*-nòà	>	kanwa - tunwa	'bouche'
*-nòè	>	munwɛ - minwɛ	'doigt'
*-tôì	>	kutwi - matwi	'oreille'
*-tóè	>	mutwɛ - mitwɛ	'tête'

PB		koti P311	
*-tóè	>	ɛʃwa	'tête'

par emprunt semble impossible. Nous devons nous contenter de constater qu'il existe une certaine similitude formelle entre ces thèmes géographiquement très dispersés.

L'hypothèse selon laquelle les formes de ce type refléteraient une ancienne structure **-ntu a déjà été avancée par Homburger. L'analogie avec les thèmes *-ntò 'homme' et *-ntò 'chose' s'impose donc, mais nous n'avons trouvé aucune indication d'un comportement identique des deux thèmes dans les langues de notre corpus. En outre, les thèmes de type *-ku(n)tu* n'apparaissent que très localement (zones K et L) et ne remontent sans doute pas à l'époque proto-bantoue.

Un deuxième sous-groupe des thèmes dissyllabiques contient des thèmes qui semblent avoir inclus un préfixe nominal autre que le PN15. En koti le thème, qui semble être emprunté [T. Schadeberg, comm. pers.], a trouvé son appariement en classes 3-4. En ntandu (H16g) le thème a été réclassifié en classe 5-6 après inclusion du PN7. Comme on le voit en (18), *l* est un réflexe régulier de *d en ntandu. Notons également en (19) les réflexes suivants attestant l'alternance d/n [Butaye 1909].

	PB				ntandu	H16 g	
(18)	*-dèd-		'weep, cry'	>	*-dila*		'crier'
	*-jèdá	9	'path, road'	>	*-nzila*	9	'chemin'
	*-tádè	5	'stone, iron'	>	*-tadi*		'pierre'
(19)	*-pídà/-pínà	6	'pus'	>	*-fina*	13	'pus'
	*-bɛ́ɛ̀dɛ̀	5	'breast'	>	*-bɛnɔ*	6	'sein'

En holoholo (D28) et en taabwa (M41), le thème semble avoir conservé l'appariement originel après l'inclusion d'une syllabe -tu- entre le PN et le thème. Il est difficile de décider sur base des données accessibles si ces thèmes sont des réflexes de *-dù ~ *-nù ou s'il s'agit de formes indépendantes.

2.2.4. La tonalité. Les données concernant la longueur de la voyelle permettent d'être très concis. Le réflexe du ganda (J15) est le seul à attester une voyelle longue qui semble liée à la tonalité (voir ci-dessous). La reconstruction du thème ne pose donc pas de problèmes quant à la longueur vocalique. Les réflexes de la tonalité suscitent des questions plus complexes. Le thème a été reconstruit par Guthrie avec un ton haut mais très peu d'attestations reflètent cette tonalité dans le corpus. Les langues à tonalité inversée de la zone L ont une tonalité haute et sont donc les premiers indices qui incitent à reconsidérer la tonalité proposée par Guthrie.

(20)	luba	L31a	*-nú*	7-8	'mortier'	[De Clerq & Willems 1960]
	kanyok	L32	*-nú*	7-8	'mortier'	[Mukash-Kalel 1982]
	luba	L33	*-nú*	7-8	'mortier'	[Gillis 1981]

Le kanyok étant une langue qui n'a pas encore inversé tous ses tons, il est difficile d'expliquer pourquoi elle a à la fois des réflexes directs de la tonalité et pourquoi, dans d'autres thèmes, elle inverse la tonalité. En rimi F32 (voir 21) [Olson 1964], une langue qui reflète les tons directement, le réflexe de *-dù ~ *-nù porte un ton bas, ce qui est étonnant si on considère la reconstruction à ton haut [Guthrie 1970]. Les réflexes tonals des reconstructions à tons bas en songye L23 (voir 22) sont également directs [Stappers 1964].

(21)

PB				rimi F32		
*-dù/-nù	7	'mortar'	>	*-nò/-nù*	5	'mortar'
*-té	3	'tree'	>	*-té*	3	'tree'
*-ntò	1	'person'	>	*-ntò*	1	'person'

(22)

PB				songye L23		
*-bòè	5	'stone'	>	*-bwè*	5	'steen'
*-jàdà	9	'hunger'	>	*-zàlà*	9	'honger'
*-ìcè	3	'pestle'	>	*-ìshì*	3	'stamper'

Nous avons déjà mentionné que la tonalité pouvait nous fournir des indications sur le rapport historique existant entre les thèmes de type *-du* et la reconstruction *-dù ~ *-nù. Les formes du sira (B41) montrent que les formes reconstruites avec une tonalité entièrement basse ont le type tonal A comme aboutissement. Les thèmes du type tonal D1 semblent plutôt refléter des reconstructions monosyllabiques comprenant un ton haut [Dodo 1993].[6] Les données du sira appuient donc la reconstruction d'un ton bas pour *-dù ~ *-nù.

(23)

PB				sira B41			
*-dù/-nù	7	'mortar'	>	*gìdù*	A	7	'mortier'
*-nòà	3	'mouth'	>	*mùnù*	A	9	'bouche'
*-bèdɔ	5	'thigh'	>	*bèlù*	A	5	'cuisse'
*-gé	5	'egg'	>	*dìkì*	D1	5	'œuf'
*-té	3	'tree'	>	*mùrì*	D1	3	'arbre'
*-tóè	3	'head'	>	*mùrù*	D1	3	'tête'
*-tâì	6	'spittle'	>	*dìtì*	D1	5	'cracher'

Le mbuun (B87) semble avoir aligné la tonalité de différents thèmes monosyllabiques sur un ton bas, tandis que les données du laali (B73b) semblent indiquer un alignement des thèmes sur un ton haut.

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[6] Les langues à type tonal reflètent les tons du proto-bantou d'une manière limitée. C'est-à-dire, il ne reste que quelques schémas tonals qui s'appliquent respectivement aux noms et aux verbes de la langue.

(24)

PB				mbuun B87			[Mvwanda 1987]
*-dù/-nù	7	'mortar'	>	*édzù*	7	'mortier'	
*-jò	9	'house'	>	*ńzò*	9	'maison'	
*-té	3	'tree'	>	*ótè*	3	'arbre'	
*-tóè	3	'head'	>	*ótswè*	3	'tête'	
*-gé	5	'egg'	>	*ákyè*	12	'oeuf'	

PB				laali B73b			[Bissila 1991]
*-dù/-nù	7	'mortar'	>	*édú*	7	'mortier'	
*-gì	9	'fly'	>	*ngí*	9	'mouche'	
*-té	3	'tree'	>	*mɔ́tù*	3	'arbre'	
*-bùè	11	'white hair'	>	*lɛ́fú*	11	'cheveu blanc'	
*-bó	9	'mosquito'	>	*yɛ́mbú*	7	'moustique'	
*-tóè	3	'head'	>	*mɔtsú*	3	'tête'	

Ces langues ne confirment ni nient la reconstruction d'un ton bas. En ntsuo (B85d) par exemple, un thème monosyllabique à ton haut peut avoir deux réflexes différents, haut et bas, tandis que le ton bas du thème semble toujours avoir un réflexe direct [Dibata 1979]. La confusion possible entre tons haut et bas en ntsuo empêche d'utiliser cette langue pour reconstruire la proto-tonalité. Toutefois, elle ne fournit aucune indication qui s'oppose à la reconstruction d'un ton bas.

(25)

PB				ntsuo B 85d		
*-dù/-nù	7	'mortar'	>	*dzù*	7	'mortier'
*-jò	9	'house'	>	*zò*	9	'maison'
*-té	3	'tree'	>	*té*	3	'arbre'
*-tá	14	'head'	>	*tà*	14	'arc'

En ganda (J15) le réflexe "modulé" de la tonalité, *-nû:* 7 'mortar' [F. Katamba, comm. pers.), pose problème. Meeussen [1955] affirme que la tonalité proto-bantoue des thèmes monosyllabiques est reflétée directement en ganda, ce qui est prouvé dans les exemples en (26). Tous les thèmes à ton haut final du ganda sont suivis d'une faille tonale quand ils sont prononcés en énoncé. Par contre, quand les thèmes sont prononcés en isolation, ils se prononcent avec un ton descendant [Meeussen 1955]. Cet aspect doit être considéré en même temps que la quantité vocalique qui est non-phonologique en position finale suite au comportement du ton haut en cette position.[7]

[7] "L'opposition entre voyelle brève et voyelle longue en ganda (exclue en fin de mot, devant complexe nasal et consonne longue, et après semi-voyelle précédée de consonne) est manifeste-

(26)	PB				ganda J 15		
	*-ntò	1	'person'	>	*-ntù*	1	'personne'
	*-té	3	'tree'	>	*-tí*	3	'arbre'
	*-dà	9	'abdomen'	>	*-dà*	3	'ventre'

De tout ceci il résulte que, dans un thème monosyllabique, la longueur vocalique est toujours liée à la tonalité. Dans le thème *-nû:* = *-núù* 'mortar', la deuxième more est due aux processus prosodiques de la langue. Nous pouvons alors éliminer ce premier problème. Comme le ganda comporte peu d'exceptions dans ses réflexes tonals, l'hypothèse selon laquelle la première more porterait un réflexe tonal irrégulier semble logique. Le réflexe du ganda n'appuie donc pas notre hypothèse. Il existe toutefois d'autres thèmes monosyllabiques en ganda, ayant des réflexes tonals irréguliers qui peuvent être provoqués par les séquences vocaliques dans quelques-unes des proto-formes.

(27)	PB				ganda J15			
	*-bùè	11	'white hair'	>	*-ví*	11	'white hair'	[Meeussen 1955]
	*-nàì		'four'	>	*-nâ*		'four'	[Hyman & Katamba 1991]
	*-gé	5	'egg'	>	*-gî*	5	'egg'	[Hyman & Katamba 1991]

La comparaison des réflexes des séquences vocaliques dans les autres langues de notre corpus n'a pas prouvé qu'une telle séquence serait à l'origine des irrégularités du thème *-dù ~ *-nù (voir aussi ex. 17). Le réflexe tonal du ganda n'est donc pas régulier mais, grâce aux réflexes segmentaux, il devra toutefois être retenu.

En résumé, les données venant des langues de la zone L (L23, L31a, L32 et L33) et la forme du rimi (F32) justifient la reconstruction d'un thème *-dù ~ *-nù à tonalité basse. La tonalité irrégulière de la forme du ganda (J15) semble par contre appuyer l'ancienne reconstruction à ton haut. Quant aux langues à type tonal, la confusion entre thèmes monosyllabiques à ton haut et à ton bas nous empêche de les utiliser comme preuve pour la reconstruction de la tonalité. Des formes apparentées récoltées dans des langues non-bantoues (voir ex. 58) ne permettent pas non plus de résoudre cette difficulté, mais semblent par contre livrer plus d'arguments directs en faveur de la reconstruction d'un ton haut. Bien qu'il persiste des doutes, nous proposons toutefois de reconstruire le thème protobantou signifiant 'mortier' avec un ton bas.

2.2.5. Les appariements. L'appariement du thème *-dù ~ *-nù ne suscite que très peu de questions. Presque tous les réflexes prennent les préfixes nominaux des

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ment héritée du bantou commun." p. ex. *-tóng- > *-tûnga* 'coudre' vs. *-dɔ́ɔ́t- > -lɔ́ɔ̀tà 'rêver' [Meeussen 1955].

classes 7 et 8, classes qui ont été du reste proposées dans les reconstructions antérieures.

(28)	logooli	E41	*-nu*	7-8	'mortar'	[Guthrie 1970]
	tongwe	F11	*-ɲu*	7-8	'mortar'	[Kakeya & Nishida 1976]
	ngazidja	G44a	*-nɔ*	7-8	'mortier'	[Lafon 1991]
	herero	R31	*-ni*	7-8	'Mörser	[Irle 1917]

Dans quelques langues un changement d'appariement est attesté.

(29)	pove	B30	*+dù*	3+9/4+10	'pilon'	[Mikala 1994]
	rimi	F32	*-nò/-nù*	5-6	'mortar'	[Olson 1964]
	ntandu	H16g	*-silu*	5-6	'mortier'	[Butaye 1909]
	herero	R31	*-khittu*	3-4	'mortier'	[T. Schadeberg, c. p.]

Notons toutefois qu'en ntandu et en koti l'ancien préfixe de la classe 7 semble être intégré dans le thème nominal, tandis qu'en rimi et en pove plus aucune trace de l'appariement originel n'est encore visible.

2.2.6. Le sens de la reconstruction. La grande majorité des formes attestées dans le corpus signifient 'mortier', même si ce sens n'est plus le sens principal du thème. Quelques auteurs spécifient soit le matériel dans lequel le mortier a été fabriqué, soit la fonction spécifique de l'objet. Ceci est probablement provoqué par l'homonymie qui existe dans quelques langues européennes, entre le *mortier* employé pour piler, le *mortier* utilisé en construction et un type de canon appelé *mortier* (le mortier / le mortier / le mortier ; a mortar / the mortar / a mortar). On a ainsi les cas en (30).

(30)	punu	B43	'mortier à piler'	[Nsuka-Nkutsi 1980]
	kukwa	B73b	'mortier en bois'	[Paulian 1975]
	swahili	G42	'mortar for pounding'	[Johnson 1950]
	ngazidja	G44a	'mortier pour piler'	[Lafon 1991]
	nzuani	G44b	'mortier pour piler'	[Ahmed-Chamanga 1992]
	ganda	J15	'wooden mortar'	[Snoxall 1967]
	kwangari	K33	'stamping mortar'	[Westphal 1958]
	taabwa	M41	'mortier (instrument pour piler)'	[Van Acker 1907]
	lamba	M54	'mortar for pounding'	[Doke 1933]

Cette spécification peut également être due au fait que les *mortiers* européens étaient, contrairement aux mortiers africains, surtout faits de pierre ou de cuivre, et que les auteurs ont ainsi voulu différencier ces deux types. D'autres spécifications du sens portent plutôt sur le genre de mortier qui est indiqué et sur l'usage spécifique qu'on lui connaît.

(31)	holoholo	D28	'mortier à piler le maïs et le manioc'	[Schmitz 1912]
	luba	L31a	1. 'bobine de fil'; 2. 'égrugeoir, un mortier'	[De Clercq & Willems 1960]
	luba	L33	'mortier à piler, égrugeoir'	[Gillis 1981]
	salampasu	L51	'mortier á manioc'	[Guillot n.d.]
	kwanyama	R21	'wooden cup holding grain when stamped'	[Tobias & Turvey 1976]

Le petit mortier ou 'égrugeoir', est fréquemment utilisé par les locuteurs des langues bantoues. Son emploi est différent de celui du mortier qui, dans la plupart des cas, n'est utilisé que pour le pilage des céréales ou de la nourriture. Les égrugeoirs peuvent être employés avec des buts différents. On les utilise dans la production du maquillage corporel et des produits pharmaceutiques [V. Baeke, comm. pers.]. Le tabac et le chanvre, tout comme les autres herbes et épices, sont également réduits dans ce genre de petit mortier. La manipulation effectuée étant identique à celle qui s'effectue dans le "grand" mortier, les différences majeures résident dans le matériau utilisé pour fabriquer les deux outils et dans leur utilisation: les égrugeoirs ne sont pas nécessairement taillés dans le bois mais peuvent également être faits en poterie ou en métal. Les langues luba (L31a et L33) désignent les deux types de mortier avec le même thème. Il se peut également que le terme d'égrugeoir, un terme très spécifique de l'ethnographie, ait été utilisé par les auteurs afin de distinguer le "grand" et le "petit' mortier, et que ce glissement sémantique ne soit qu'une illusion créée par l'intermédiaire de la langue française. Pour quelques langues de la série (voir 31), l'utilisation de l'objet auquel le réflexe de *-dù ~ *-nù fait référence, a été spécifié davantage en citant les vivres qui sont réduits à l'aide de ce type de mortier. Ce genre de spécification fait supposer l'existence de différents types de mortiers ayant chacun une fonction bien définie.

Dans d'autres langues le thème a acquis récemment des sens néologiques supplémentaires (voir 32). Le glissement sémantique attesté par le komoro et le

(32)	swahili	G42	'mortier à piler, presse, moulin à engrenages, machine à vapeur d'usine ou d'atelier'	[Sacleux 1939]
	komoro	G44	'mortier, moulin, presse, machine'	[Ahmed-Chamanga & Gueunier 1979]
	luba	L31a	1. 'bobine de fil'; 2. 'égrugeoir, un mortier'	[De Clercq & Willems 1960]
	luba	L33	'mortier, égrugeoir, consistant en une bille de bois évidée dans laquelle on pile le manioc, les céréales, les légumes. On appelle par analogie kinu une bobine (de fil, etc.)'	[Van Avermaet & Mbuyà 1954]

swahili semble être provoqué par la mécanisation des tâches agricoles. Il n'est pas illogique qu'un moulin ou une machine qui effectue le même travail qu'un mortier soit désigné par le même mot. Le nouveau sens qui a été attribué au thème en luba (L33) peut être dû aux ressemblances de forme existant entre une bobine et un mortier. Les deux objets ont un élargissement aux deux extrémités; le mortier repose sur l'un d'eux et, dans la bobine, ils servent à maintenir le fil (voir aussi (53) pour un glissement sémantique similaire).

Quelques auteurs attribuent le sens de 'pilon' à un réflexe de *-dù ~ *-nù (voir 32). Le réflexe du pove n'a pas pu être contrôlé, mais notons toutefois le changement de classe qui correspond aux classes dans lesquelles les thèmes pour 'pilon' trouvent leurs accords. La comparaison entre différentes versions du dictionnaire kimbundu révèle qu'il y a probablement eu amalgame entre 'pilon' et 'mortier'. Cette hypothèse est relativement crédible puisque dans la version antérieure l'auteur cite les synonymes *muixi* et *muisu* [Da Silva Maia 1964], dont la première forme est un réflexe régulier de *-ìcè 3 'pilon' (voir introduction). La différence d'aperture reste néanmoins inexpliquée.

(33)	pove	B30	*-dù*	3	'pilon'	[Mickala 1994]
	kimbundu	H21	*kinɔ*	7	'pilão'	[Da Silva Maia 1964]
	kimbundu	H21	*kinu*	7	'almofariz'	[Da Silva Maia 1994]

Notons également ces formes et leurs significations trouvées dans différentes langues kongo (voir 34). En suundi et en ntandu, où une inclusion du PN_7 dans le thème a eu lieu, le thème ne signifie pas forcément un mortier taillé mais plutôt une surface quelconque, en pierre ou en bois, sur laquelle on réduit la nourriture. Ces significations nous rappellent fortement du type de mortier qui a été trouvé chez les Pygmées Aka et Baka (voir introduction), mais le sens premier du thème *-dù ~ *-nù 7 semble toutefois être 'le mortier taillé de bois'.

En général, la majorité des attestations suggère que le sens du thème n'a pas été modifié d'une façon importante. Le sens 'mortier' est le plus largement attesté. Il existe toutefois quelques indications que ce thème ait pu désigner un autre type de mortier plus rudimentaire.

(34)	suundi	H13b	*tsíndù*	3	'pierre à moudre'	[J. Baka, c. p.]
	kongo	H16	*kidu*	7-8	'mortier'	[Laman 1936]
			kisu	7-8	'tronc creusé servant à écraser; mortier de bois pour les arachides'	
			kinzu	7-8	'mortier'	
	ntandu	H16g	*silu*	5-6	'pierre sur laquelle on appuie des objets pour les briser; mortier grossier pour piler'	[Butaye 1909]

2.3. Conclusion. Dans les paragraphes précédents il a été montré qu'une révision de la reconstruction du thème proto-bantou signifiant 'mortier' s'impose. La proto-forme *-dù ~ *-nù 7 'mortier' semble pouvoir expliquer toutes les attestations actuelles dans les différentes langues bantoues. La reconstruction d'une alternance consonantique s'est avérée indispensable, ainsi qu'une révision de la tonalité reconstruite par Guthrie [1970]. Quant aux classes nominales auxquelles ce thème appartient, les reconstructions antérieures ont pu être confirmées.

Le thème *-dù ~ *-nù semble être conservateur au niveau du sens, mais ce thème pour mortier à néanmoins subi quelques changements sémantiques. Le premier type est dû à la modernisation (moulin etc.), tandis que les changements du deuxième type sont le résultat de l'analogie formelle entre mortiers et d'autres objets (bobine de fil). En outre, dans ce corpus, deux façons de spécifier le sens des thèmes pour mortier sont attestées. Certains auteurs ont voulu éviter une homonymie existant en langues européennes, tandis que d'autres ont plutôt voulu distinguer les différentes utilisations. Cette reconstruction peut donc être considérée comme acquise et par la suite nous devrions nous concentrer sur l'étude des innovations lexicales qui ont eu lieu dans différentes régions du domaine bantou.

3. Un theme oriental : °-tòdé

3.1. Distribution géographique du thème. Dans la discussion relative au thème *-dù ~ *-nù 'mortier', nous avons signalé que la distribution de ce thème comptait des lacunes. Le thème est en effet absent de la zone C ainsi que des régions Nord-Ouest et Sud du domaine, et sa distribution orientale est plutôt discontinue. Un deuxième thème, reconstruit par Bourquin [1923] et par Guthrie [1970] comme °°-tódé, connaît une distribution exclusivement orientale et méridionale, à l'exception du fait qu'il figure en tetela (C71) qui rejoint les langues orientales aussi pour d'autres isoglosses (voir Carte 3). Voici quelques attestations de ce thème.

(35)	tetela	C71	*-tólé*	7-8	'mortier'	[Hagendorens 1984]
	kikuyu	E51	*-duri*	9-10	'petit mortier'	[Coupez et al. 1998]
	nyamwezi	F22	*-tòlèé*	5-6	'mortar'	[Maganga 1992]
	gogo	G11	*-tuli*	5-6	'mortar'	[Rossel 1988]
	ndali	M21	*-tùlì*	7-8	'mortar'	[R. Botne, p.c.]
	yao	P21	*-tuli*	5-6	'vaso'	[Viana 1961]
	tsonga	S53	*-tʃùrí*	5-6	'mortar'	[Sasavona 1978]

Vu cette distribution, Guthrie a attribué à ce thème le statut de reconstruction proto-bantoue orientale. La répartition des réflexes de ce thème dans l'aire orientale a mené Ehret à soutenir que ce thème aurait une origine *Eastern Sudanic*, *-dù ~ *-nù de l'autre côté serait emprunté aux langues Soudanaises Centrales:

" *The Eastern Sudanic influences appear most probably to have kicked in somewhat later than the Central Sudanic contacts. One indicator of such a*

> *history is the age-distribution characteristics of the semantic pair* *-nú *and* *-tòlè, *both "mortar". The former word, borrowed from Central Sudanic, has the more scattered, peripheral occurence typical of an earlier adopted item; while the latter, coming from the Eastern Sudanic source language, appears widely through the heart as well as peripheries of the Eastern Bantu speech regions today."* [Ehret n.d.: 14][8]

Remarquons qu'Ehret propose, pour les deux thèmes, une tonalité radicalement différente de celle qui a été reconstruite en proto-bantou. De plus, il ne considère que la distribution de *-dù ~ *-nù dans les langues orientales, où celle-ci est effectivement '*éparpillée*'. Si cette distribution est considérée dans l'ensemble des langues bantoues (voir Carte 1), ce thème a plutôt une distribution ancienne qui, après avoir atteint les limites orientales de l'aire bantoue, a été interrompue à l'est par les formes de type °-tòdé (voir Carte 3). Une distribution par emprunt de *-dù ~ *-nù en Afrique centrale et occidentale aurait sans doute déterminé une distribution plus massive.[9]

3.2. La reconstruction

3.2.1. Les autosegments. Le corpus ne compte que quelques attestations pour lesquelles la tonalité a été relevée, mais il y figurent néanmoins quelques indications en faveur de sa révision. Les réflexes du shona (S10) et du tsonga (S53) ne corroborent pas la reconstruction proposée anciennement. Les formes attestées semblent plutôt refléter une tonalité Bas-Haut et non les tonalités Haut-Haut ou Bas-Bas qu'ont proposées respectivement Guthrie et Ehret.[10]

(36) PB				shona S10		[Hannan 1974]
*-céndé	5	'squirrel'	>	*tsíndí*	9	'bush squirrel'
*-káđí	1	'woman, wife'	>	*mùkádzí*	1	'wife'
*-kódó	1	'adult'	>	*mùkúrú*	1	'elder'
*-gɔ̀đí	3	'string'	>	*mùkɔ́sì*	3	'string'
*-cɔ̀kɔ́	9	'monkey'	>	*shɔ̀kɔ́*	9	'Vervet monkey'
°°-tódé	5	'mortar'	>	*-dùrí*	5	'mortier'

[8] L'auteur ne cite qu'une attestation, túr 'stoßen' en soo (kuliak), qui n'a pas pu être vérifiée et qui n'a pas non plus été appuyée par des données d'autres langues soudanaises centrales ou orientales [Ehret n.d.: 10].

[9] Finalement, les attestations du thème *-dù ~ *-nù dans des langues non-bantoues apparentées dément une origine soudanaise et suggère plutôt une origine Benue-Congo pour ce thème.

[10] Les thèmes précédés de °° sont des formes supposées érronnées.

(37)	PB				tsonga S53		[Cuenod 1976]
	*-céndé	5	'squirrel'	>	*xíndzí*	9	'yellow-footed squirrel'
	*-cóngó	5	'poison'	>	*vùxúngú*	9	'snake venom'
	*-kódó	1	'adult'	>	*nkúlú*	1	'great'
	*-gɔ̀dɪ́	3	'string'	>	*ngɔ̀tí*	3	'string'
	*-cɔ̀kɔ́	9	'monkey'	>	*rìtɔ̀hɔ́*	9	'Vervet monkey'
	°°-tódé	5	'mortar'	>	*tʃùrí*	5	'mortar'

Les exemples du nyamwezi (F22) montrent que la tonalité du thème peut aussi bien être issue d'une tonalité bas-haut que d'une tonalité haut-haut ([Maganga & Schadeberg 1992]; voir exemples dans (41)). Le sukuma (F21) [Richardson & Mann 1966] confirme partiellement cette hypothèse.[11] Bien que le réflexe de °°-tódé dévie légèrement des autres réflexes des thèmes à tonalité bas-haut, il ne semble pas refléter une proto-forme à ton haut.

(38)	PB				nyamwezi F22		
	*-jámé	1	'chief, master'	>	*ŋwààmí*	1	'king, chief'
	*-bódó	9	'reptile, monitor'	>	*ìβòló*	9	'monitor lizard'
	*-kɔ́kɔ́	9	'chicken'	>	*ìgɔ̀kɔ́*	5	'chicken'
	*-kàté	5/9	'inside'	>	*mìgàtèé*	18	'in, inside'
	*-bɔ̀kɔ́	9	'buffalo'	>	*mbɔ̀gɔ̀ɔ́*	9	'buffalo'
	°°-tódé	5	'mortar'	>	*ìtòlèé*	5	'mortar'

(39)	PB				sukuma F21		
	*-kápí	9	'padde'	>	*-'gahi*	9	'padde'
	*-kɔ́bá	3	'skin, strap'	>	*-'kɔβa*	3	'belt, leather strap'
	*-tíndɛ́	5	'clod, stump'	>	*-'tindɛ*	5	'clod'
	*-gùbó	9/6	'hippopotamus'	>	*-gu'bɔ́*	9	'hippopotamus'
	*-bɔ̀mbɔ́	3	'forehead'	>	*-βɔm'bɔ́*	3	'point on bridge of nose'
	°°-tódé	5	'mortar'	>	*-to'le*	5	'pounding mortar'

[11] Nous citons la notation tonale des thèmes telle qu'elle est notée dans le vocabulaire par les auteurs: "The acute accent (á) is used to represent high tone...except that where [H]T.D. is indicated å, the realization is unmarked in the present work... In other cases, ' marks the commencement of underlining, and [H] tone displaceable on to the following word is indicated by a postposed h; where the last syllable alone is underlined, a circle (å) is placed over the final vowel." [Richardson & Mann 1966: 4]

La troisième langue de la zone F pour laquelle nous disposons de notations tonales est le nilamba (F31). Dans cette langue nous voyons que le réflexe *HH > HB est régulier [Yukawa 1989].

(40)	PB				nilamba F31		
	*-címbá	9	'wildcat'	>	*nsímbà*	9	'lion'
	*-kókó	9	'bird, chicken'	>	*kókò*	9	'chicken'
	°°-tódé	5	'mortar'	>	*t' ólè*	5	'mortar'
	*-jɔ̀ngɔ́	14	'brain'	>	*ɔ̀nkɔ́*	11	'brain'
	*-bɔ̀gɔ́	9	'buffalo'	>	*bɔ̀gɔ́*	9	'buffalo'

Le tetela (C71) redouble le ton de la première syllabe. Ainsi, les deux tons hauts de la forme -tólé 7 'mortier', peuvent refléter aussi bien un schéma tonal Haut-Haut que Haut-Bas.

Même si nous ne disposons que de très peu de données tonales, la discussion des formes citées ci-dessus semble prouver qu'une révision de la tonalité est indiquée. Des six langues discutées, seule une—nilamba (F31)—confirme la tonalité reconstruite auparavant, tandis que le tetela, à cause de ses mécanismes tonals, peut servir comme preuve contraire à la nouvelle proposition. Les quatre langues restantes, confirment la reconstruction du schéma tonal *Bas-Haut. La longueur attestée dans une seule langue (F22) y est due à un processus tonal synchronique et ne suggère donc aucune révision de la reconstruction.

3.2.2. Les consonnes. La grande majorité des thèmes du corpus atteste un réflexe identique à celui de la consonne initiale *t, reconstruite par Guthrie et Meeussen. Les réflexes du nyamwezi (F22) [Maganga et al. 1992] montrent la régularité du réflexe direct de cette consonne.

(41)	PB				nyamwezi F22		
	*-tóm-		'send'	>	*-tòmá*		'send'
	*-tòmbèdè	9	'monkey'	>	*-tòómbélé*	9	'monkey'
	*-túd-		'hammer, forge'	>	*-tòlá*		'beat, hit'

A côté des réflexes directs, quelques langues (E51, S10, S13a et S16) attestent un voisement de la consonne initiale. Considérons les exemples du nambya (S16) [Moreno 1990].

(42)	PB				nambya S16		
	°°-tòdé	5	'mortar'	>	*iduli*	5	'mortar'
	*-tòmbɔ̀	9	'belly'	>	*untumbu*	3	'belly'
					idumbu	5	'distended belly'
					chitumbu	7	'badly shaped belly'

On remarque que °t a tantôt un réflexe direct, tantôt un réflexe [d] devant *o. Ce type de renforcement, provoqué par le PN_5, se produit dans plusieurs langues bantoues, notamment en zones B, C, D, J, N et S [Janssens 1993]. En tsonga (S53) on trouve une alternance comparable [Cuenod 1976].

(43)	PB				nyamwezi F22		
	*-tákɔ̀	5	'buttocks'	>	*-rhákú*	6	'buttocks'
	*-tóm-		'send'	>	*-rhúma*		'send'
	°°-tòdé	5	'mortar'	>	*tʃùrí*	5	'mortar'

Le voisement de la consonne initiale en position postnasale, *-dere* 9-10 'wooden mortar', est régulier en kikuyu (E51) (voir aussi (51) pour les réflexes vocaliques irréguliers) [Benson 1964].

(44)	PB				kikuyu E51		
	*-ntò	1	'person'	>	*-ndo*	1	'human being, person'
	*-tónd-		'become full'	>	*-tonda*	3	'elongated swelling'
	*-té	3	'tree'	>	*-te*	3	'tree'

En tswa (S51) *t aboutit à une affriquée aspirée (notée ch) [Persson n.d.].

(45)	PB				tswa S51		
	°°-tòdé	5	'mortar'	>	*churi*	5	'mortar'
	*-tàká	5	'dirt'	>	*-chaka*	5	'dirt'
	*-téab-		'to fear'	>	*-chava*		'fear'

Dans la plupart des cas, la consonne initiale °t a donc un réflexe direct. Étant donné que la consonne initiale de °-tòdé ne se trouve pas devant une voyelle fermée, elle ne subit généralement pas de spirantisation. Un renforcement de °t derrière le préfixe nominal de la classe 5 est toutefois attesté. Dans les réflexes réunis dans ce corpus, la consonne occlusive alvéolaire en position C_2 est reflétée dans les langues bantoues contemporaines soit par une latérale alvéolaire l, soit par un trille alvéolaire r. Cette allophonie entre /d/ et /l/ remonte jusqu'au proto-bantou [Meeussen 1967]. Les exemples du nambya (S16) montrent la régularité du premier réflexe [Moreno 1990].[12]

(46)	PB				nambya S16		
	°°-tádè	5	'iron'	>	*-talɛ*	14	'iron'
	*-bèdè	3	'body'	>	*-bili*	3	'body'
	°°-pedepede		'pepper'	>	*-hilipili*	9	'pepper'

12 Mathangwane [1996] relève le thème *–dùní* 5 'mortar' du kalanga (S16), une langue qui appartient au même ensemble dialectal que le nambya décrit par Moreno [1990].

En tswa (S51) *d > r / __$V_{(+ant)}$ est le réflexe régulier [Persson n.d.].

(47)	PB				tswa S51		
	*-démì	5	'tongue'	>	*-rimi*	11	'tongue'
	*-bèdè	3	'body'	>	*-miri*	3	'body'
	*-dèd-		'weep'	>	*-rila*		'weep'

Dans deux langues *t a un réflexe zéro. Cette évolution, aussi bien que le réflexe tonal, est irrégulière en pare (G22) [Kagaya 1989] tandis qu'elle est régulière en shambaa (G23) [Yukawa 1984]. Le shambaa et le pare étant des langues géographiquement et génétiquement très proches, les locuteurs pare ont, a un moment donné, pu emprunter le thème signifiant 'mortier' aux locuteurs shambaa. *t semble donc expliquer toutes les consonnes observées en position C_2 dans les langues actuelles.

(48)	PB				pare G22		
	°°-tòdé	5	'mortar'	>	*-twì*	5	'mortar'
	*-bèdè	3	'body'	>	*-mwìrì*	3	'body'
	*-pìdà	6	'pus'	>	*-fĩrá*	6	'pus'

(49)	PB				shambaa G23		
	°°-tòdé	5	'mortar'	>	*-túí*	5	'mortar'
	*-bèdè	3	'body'	>	*-wìì*	3	'body'
	*-pìdà	6	'pus'	>	*-fĩá*	14	'pus'

3.2.3. Les voyelles. Toutes les langues à sept voyelles représentées dans le corpus (C71, F21, F22, F31) ont des voyelles du deuxième degré tant en position V_1 aussi bien qu'en position V_2. Les exemples du nyamwezi (F22) témoignent de la régularité de ces réflexes [Maganga & Schadeberg 1992].

(50)	PB				nyamwezi F22		
	*-cobe		'tiger-cat'	>	*-sòβé*	9	'leopard'
	*-kédà	3	'tail'	>	*-kèlá*	3	'tail'
	*-cópà	9	'calabash'	>	*-sòhá*	9	'calabash'
	*-kúpà	5	'bone'	>	*-gùhá*	5	'bone'

En kikuyu (E51) la première voyelle du réflexe *-dere* 9 'wooden mortar for pounding' [Benson 1964], semble avoir subi une assimilation régressive, ce qui est assez rare dans la langue. Nous n'avons trouvé qu'un autre cas d'assimilation provoqué par e, mais il s'agit là d'une assimilation progressive en degré d'ouverture. La dérivation verbale par adjonction de morphèmes dérivatifs vocaliques (i, ɔ

et u) est très productive en kikuyu [Barlow 1951]. Le thème *-duri* semble être un dérivé du verbe *-tur-* (reconstruit comme *-túd- 'frapper, forger') [Benson 1964].

(51) PB				kikuyu E51		
*-démì	11	'tongue'	>	*-reme*	11	'tongue'
				-tur-		'forge, work, hammer (metal, etc.)
				-turi	1-2	'blacksmith'
				-duri	9-10	'small wooden mortar used in the had for mashing up yam for a toothless old man or woman'

Il faut donc retenir *-dere* comme réflexe de °-tòdé, en remarquant que le kikuyu a innové en ajoutant un dérivé verbal avec le sens de 'mortier' à son lexique.

La proposition de °o (V_1) et °e (V_2) est appuyée d'une façon directe par les données des langues à sept voyelles. Les langues à cinq voyelles apportent également, par l'absence de spirantisation de la consonne initiale, des preuves en faveur des voyelles °o et °e. La différence d'aperture vocalique de la première voyelle du thème °-tòdé et celle de l'infinitif *-túd- 'forger, frapper', est d'ailleurs un argument probant contre toute relation de dérivation unissant les mots formés sur ces thèmes.

3.2.4. L'appariement. °-tòdé a les classes 5-6, l'appariement dans lequel on trouve, de façon majoritaire, le thème aujourd'hui. L'ensemble des attestations est pourtant beaucoup moins homogène à ce niveau que l'ensemble des réflexes de *-dù ~ *-nù 7-8, où c'est seulement le rimi (F32) qui a effectué un changement de classes vers 5-6. Les réflexes du thème prennent également les préfixes nominaux des classes 3-4 (P23, S21), 7-8 (C71, E74b, G22, M42) et 9-10 (E51, G23, P22).

3.2.5. Le sens du thème. Le dernier élément de la discussion relative au thème °-tòdé 'mortier' est le sens que ce thème a acquis dans ses réflexes contemporains. Indépendamment des classes dans lequel il se trouve, le thème a, dans la grande majorité des cas, le sens de *mortier*. Parmi les langues où le thème a néanmoins subi un changement de sens, nous notons le bemba (M42), et le tsonga (S53). En kikuyu (E51) nous avons trouvé les substantifs ci-dessus. Le réflexe de °-tòdé (*ndere*) est le terme générique pour mortier tandis que le dérivé verbal *nduri* a un sens plus spécifique (voir 52) [Benson 1964].

Dans notre corpus il n'y a guère de références à des mortiers à ouvertures multiples, mais ce genre d'objets n'est pas rare en Afrique subsaharienne. David [1998] mentionne notamment l'existence de mortiers à multiples creux ("*multiple mortar hollows* ") creusés dans les roches à Sukur (Cameroun). Ces cavités, ou *tson*, peuvent être disposées l'une à côté de l'autre et forment ainsi un enchaîne-

(52) kikuyu E51

ndere	9-10	'wooden mortar for pounding'
ndere ya mokɔngɔrɔ		'long log lying horizontal, in which a series of mortar holes have been dug out; a communal mortar for pounding sugar-cane for beer making'
mokɔngɔrɔ	3	1. 'very large timber-tree (*Lovoa swynnertonii)*'; 2. *'beer mortar'*
nduri	9-10	'small wooden mortar used in the hand for mashing up yam for a toothless old man or woman'

ment de mortiers qui ont des fonctions très diverses. Le *tson* sert au pilage de graines de sésame, d'arachides, de pois et de feuilles de baobab ou de tabac [David 1998]. Le *ndere ya mokɔngɔro* a une fonction bien plus spécifique que le *tson* des Sukur. Sa description fait non seulement référence au *tson*, mais fait également penser au type de mortier que l'on avait observé chez les Pygmées Aka et Baka (voir Introduction). Dans la discussion du sens du thème *-dù ~ *-nù (voir 34), nous avons déjà remarqué que certains thèmes ont un sens qui fait référence à ce que l'on pourrait considérer comme un outil qui précède le mortier proprement dit.

En bemba (M42) le thème a des réflexes segmentaux canoniques, mais son sens et son appariement ont subi des changements importants. Faute de spirantisation de la consonne initiale, l'hypothèse d'une éventuelle dérivation du verbe *-túd- 'frapper, forger' ne semble pas valable.

(53) bemba M42

ícìtúlì	7-8	'flint-lock gun'	[Guthrie n.d.]
cituli	7-8	'gun with a very short barrel'	[White Fathers 1954]

Le réflexe de °-tòdé en tsonga (S53) est régulier en ce qui concerne son appariement et son sens principal, mais la signification du thème s'est élargie. Les molaires et le mortier ont pour fonction commune la réduction de la nourriture, tandis que le rapprochement entre le mortier et le moyeu d'une roue peut s'expliquer par la forme semblable de ces deux objets.

(54) tsonga S53

-tʃùrí	5-6	'mortar; fig. molar, hub of wheel'	[Cuenod 1976]

Le mortier est un symbole de pouvoir important pour les locuteurs du tetela (C71) chez qui le réflexe du thème °-tòdé désigne un mortier neuf, tandis que le substantif *lòpòlò* désigne un mortier usé dont l'ouverture est plus profonde. Les Tetela utilisent un mortier *lòpòlò* dans les grandes occasions, comme le décès ou

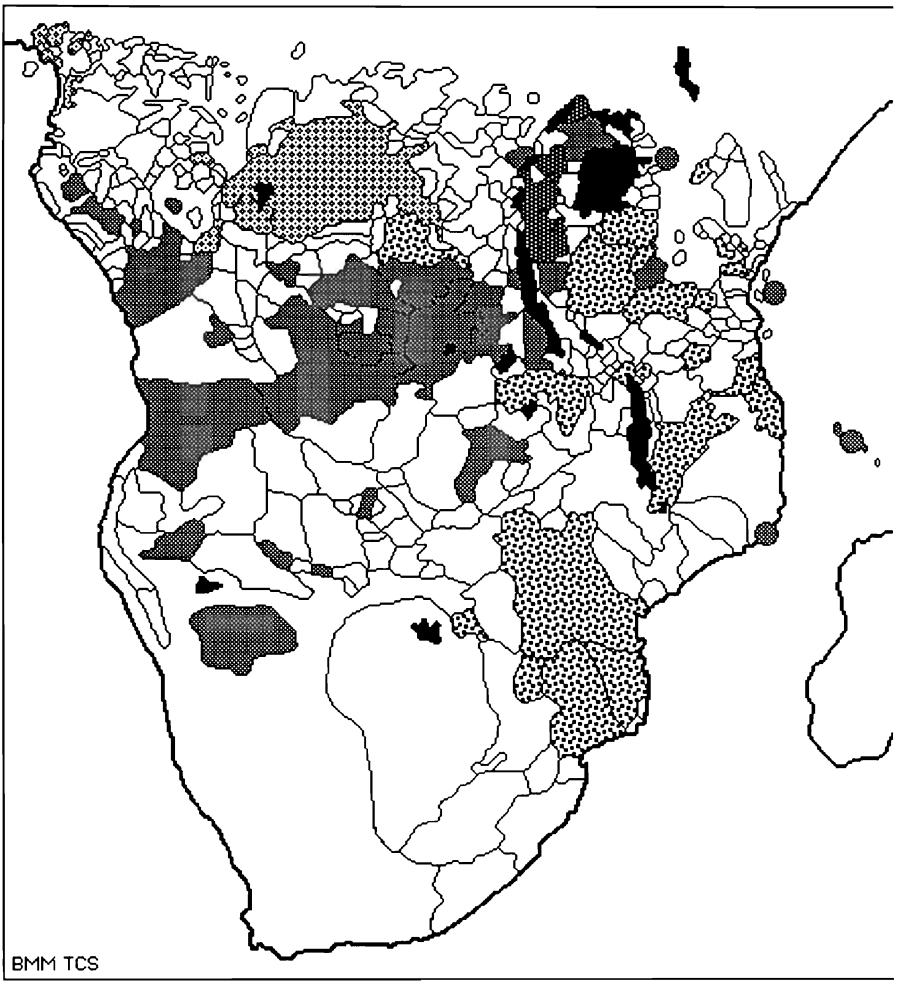
l'intronisation d'un chef. Pour annoncer ces événements, le batteur de tambour monte sur ce mortier renversé, placé au centre de la place du village [O. Tassa, comm. pers.].

3.3. Conclusion. La reconstruction d'un thème régional signifiant 'mortier' °-tòdé en classes 5-6 ne semble guère poser de problèmes. La reconstruction proposée par Bourquin et Guthrie doit seulement être modifiée au niveau de la tonalité. Il est possible d'attribuer un passé proto-bantou oriental à ce thème, mais il faut noter que le tetela (C71), une langue appartenant au sous-groupe occidental, rejoint les langues orientales pour cet isoglosse.

4. Le theme °-bòkà

D'autres lacunes dans la distribution du thème *-dù ~ *-nù sont comblées par les attestations de °-bòkà 'mortier' qui figurent en zones A et C (voir Carte 4). Considérons les exemples en (55). La finale du thème est le seul élément variable de cette série. On trouve une finale -a dans les langues de la zone C et en puku (A32b) qui, normalement, ont des réflexes directs des voyelles. La voyelle finale de cette forme sera donc proposée comme °a, puisqu'elle est reflétée directement dans la plupart des langues. Cette voyelle a toutefois subi une élision dans quelques langues de la zone A (A15, A44, A53 et A80) et dans d'autres langues (A11, A24, et D38) elle a été remplacée par [i]. Notons encore le cas du nen (A44), la seule langue où la voyelle du thème semble avoir déclenché une assimilation de la voyelle finale.

(54)	lundu	A11	*-bòkí*	7-8	'wooden bowl, mortar and pestle'	[Kuperus 1985]
	mbo	A15	*-bòg'*	7-8	'mortar'	[Hedinger 1987]
	duala	A24	*-bòkì*	7-8	'Trog, Krippe'	[Ittmann 1976]
	puku	A32b	*-bòká*	7-8	'mortier'	[Helmlinger 1972]
	nen	A44	*-bòk*	7-8	'le mortier de bois, rectangulaire, peu profond'	[Dugast 1967]
			-bòkò	7-8	'le mortier'	
	bafia	A53	*-βō?*	7-8	'mortier en bois pour piler les haricots et le maïs'	[Guarisma 1969]
	fang	A75	*-bɔ̀kh*	9-10	'pétrin, auge, mortier pour piler le manioc'	[Galley 1964]
	bikele	A80	*-ɔ̀g*	14-6	'mortar'	[Begne 1980]
	ngul	A80	*ìbùk*		'mortier'	[P. Hadermann, c. p.]
	leke	C00	*-bòkà*	7-8	'mortier'	[Vanhoudt 1988]
	koyo	C24	*-bògà*	7-8	'mortier'	[Gazania 1972]



Carte 4. Distribution des différents thèmes signifiant 'mortier' dans les langues bantoues.

Légende:

*-dù ~ -nù °-tòdé °-bòkà °-cék-od-o

(55) *continued*

bobangi	C32	*-bòká*	7-8	'large mortar'	[Whitehead 1899]
ntomba	C35a	*-bòkà*	7-8	'petit mortier, pondoir, nid de ponte'	[Mamet 1966]
lingala	C36d	*-bòkà*	7-8	'mortier, vase à piler'	[V. Everbroeck 1985]
mongo	C61	*-òkà*	7-8	'mortier'	[Hulstaert 1952]
kare	D38	*-bugi*	9-10	'mortier'	[Dijkmans 1974]

La plupart des thèmes reflètent une tonalité entièrement basse. Ce n'est qu'en lundu (A11), en puku (A32b), et en bobangi (C32) que nous trouvons une tonalité bas-haut irrégulière. La variabilité de la voyelle finale combinée avec la variation de la tonalité incite à penser qu'un mécanisme de dérivation serait à l'origine de ce thème. Faute de lien sémantique ou formel entre °-bòkà 'mortier' et une autre forme reconstruite, cette hypothèse est toutefois écartée.

En bikele (A80) une semi-voyelle peut s'insérer entre C_1 et V_1 [Begne 1980]. Dans le réflexe de °-bòkà, la séquence bw- peut avoir été interprétée comme le PN_{14} et avoir ensuite provoqué un changement d'appariement. C'est également la seule langue où une ouverture de la voyelle a eu lieu. Les exemples cités ci-dessus montrent du reste que les réflexes des voyelles postérieures se sont également confondus dans d'autres thèmes.

(56)

PB				bikele A80		
°-bòkà	7	'mortar'	>	*bwɔ̀g*	14-6+14	'mortar'
*-bɔ́kɔ̀	15	'arm'	>	*bwɔ̂*		'arm'
*-túúbá	3	'six'	>	*twɔ́b*		'six'

Il semble exister une certaine ressemblance formelle entre ces attestations et la série partielle n° 405, °-pògé 9 'pot', établie par Guthrie [1970]. La reconstruction des segments et de la tonalité confirment l'appartenance de ces thèmes à une série comparative bien distincte.

L'appariement et le sens du thème de type °-bòkà sont deux éléments très stables dans toutes les attestations. Le thème doit être proposé en classe 7-8 avec le sens de 'mortier'. On peut alors considérer la forme régionale, °-bòkà 7 'mortier', comme acquise. Notons toutefois que nous avons recueilli des formes qui semblent être apparentées à la forme °-bòkà dans quelques langues Adamawa [Monino 1988].

(57)

gbanzili	*ɲí.ɓòkà*		'mortier'
ndunga-le	*ɓòkà-*	1-2	'mortier'
ngbaka ma'bo	*ɓùkà*		'mortier'
sere	*mvogi (sa)*		'mortier'

5. Un derive verbal en zone J

Dans la région interlacustre différents dérivés verbaux servent à désigner le 'mortier' ou le 'pilon' (voir Cartes 2 et 4).

(58)	nyoro	J11	*-sɛkurɔ*	9-10	'mortar for pounding'	[Davis 1952]
			ekyana kyɛnsɛkurɔ 'pestle (enfant du mortier)'			
	nkore	J13	*-ʃékúrɔ́*	9-10	'mortar'	[Taylor 1959]
	ganda	J15	*-sékùzɔ́*	3-4	'wood, pestle'	[Snoxall 1967]
	kitalinga	J19	*-sékúdɔ̀*	3-4	'mortier'	[Paluku 1991]
	nyambo	J21	*-ʃɛkuru*		'Holzmörser zum Hirsestampfen'	[Weiss 1910]
	rwanda	J61	*-sékùrù*	9i-10i	'mortier à piler le grain ou le manioc'	[A. Coupez, c. p.]
			-sékùzɔ̀	3-4	'pilon'	
	rundi	J62	*-sékùrɔ̀*	5-6	'mortier à piler, égrugeoir'	[Rodegem 1970]
			-sékùzɔ̀	3-4	'pilon'	
	ha	J66	*-sékùrɔ̀*	9-10	'mortar for pounding'	[Nagakawa 1992
			-sékùzɔ̀	3-4	'pestle'	

Ces thèmes sont dérivés du verbe °-cék-od- 'piler', une forme locale reconstruite pour la zone J [Coupez, Bastin & Mumba 1998]. Dans quelques langues, des réflexes de ce verbe sont toujours productifs et il est alors facile de déterminer l'origine des dérivés. Ceci est notamment le cas en nkore (*-ʃékùrà* 'to pound'), en rwanda (*-sékùr-* 'piler dans un mortier'), en rundi (*-sékùr-* 'piler') et en ha (*-sékùrà* 'to pound'). En ajoutant le dérivatif instrumental -ɔ, la langue forme le déverbatif °-cék-od-ɔ 9-10 'mortier'. Les thèmes signifiant 'pilon' sont formés à partir de la forme causative °-cék-od-i du verbe signifiant 'faire piler'. En ajoutant le dérivatif -ɔ, le thème devient °-cék-od-i-ɔ 3-4 'pilon'. L'insertion du suffixe causatif explique la spirantisation du *d.

La distribution très réduite dans des langues contiguës indique qu'il s'agit probablement d'un processus assez récent (voir aussi Carte 4). Les locuteurs ganda ont conservé le thème *-dù ~ *-nù pour mortier, tandis qu'en nyoro (J11) on utilise un composé pour désigner le pilon. Ce n'est donc qu'en rwanda, en rundi et en ha que l'innovation a été effectuée pour le champ sémantique complet (mortier et pilon).

6. Agriculture et mortiers

En étudiant les thèmes pour *mortier* et en partant du lien étroit qui existe entre la préparation de la nourriture, l'agriculture et le mortier, il fallait également

s'intéresser à la distribution de ces thèmes dans les différents environnements naturels.

Il faut d'abord se rendre compte que ni le mortier ni la meule, dont la fonction ressemble fortement à celle du mortier, ne sont exclusivement liés à l'agriculture. Des traces archéologiques de meules sont attestées longtemps avant que la révolution agricole ait eu lieu [Gorecki et al. 1997] et, comme nous l'avons dit dans l'introduction, certains types de mortiers semblent être réservés aux activités de subsistance de chasseurs-cueilleurs comme les Pygmées Aka et Baka [Bahuchet 1992]. Donc s'il est probablement impossible de trouver une population d'agriculteurs qui ne possèdent ni *mortier* ni *meule*, l'inverse n'est pas vrai. Ceci implique que nous ne pouvons pas formuler de conclusions sûres concernant l'histoire de l'agriculture en nous basant sur la reconstruction des termes pour *mortier*.

La forme régionale des zones A et C, °-bòkà, n'est attestée qu'en zone forestière où la granoculture est impossible. Il semblerait donc que cette forme régionale pourrait être liée à la culture des bananes, des ignames et du manioc, communément appelée la végéculture. L'innovation propre à la région interlacustre ne semble pas être liée à une innovation locale dans la culture des céréales et même si les réflexes du thème *-dù ~ *-nù sont presque tous situés en zone de savane, nous ne pouvons pas non plus l'associer à une culture céréalière spécifique.

Ce n'est qu'en Afrique orientale et australe que nous trouvons d'étonnants parallélismes. La céréale africaine la plus ancienne, *Sorghum bicolor*, a probablement été domestiquée à partir du *Sorghum verticilliflorum* dans la région Soudano-Chadique. Il a alors été distribué sur tout le continent et vers l'Inde où il est arrivé autour de 4000 BP. Si nous étudions sa distribution, l'espèce *Kafir* semble devoir être associée aux populations de langues bantoues [De Wet 1977]. Sa distribution correspond largement à la distribution d'un thème °mà -bèdé en zones E F G J L M N R et S qui est à peu près identique à la distribution du thème °-tòdé. Le *Pearl millet* ou *Pennisetum Americanum*, une autre céréale africaine très ancienne, a son origine dans les plateaux du Sahara et est datée vers 5 à 4000 BP. Étant donné que c'est une céréale typique de la savane aride, une éventuelle distribution vers le sud a dû contourner la forêt, où cette espèce n'est pas du tout attestée.

L'étude comparative des thèmes désignant des objets ménagers, et plus particulièrement des objets en bois, peut certainement ouvrir de nouvelles perspectives sur l'histoire des technologies dans les populations à traditions orales. Si nous voulons alors nous former une meilleure idée de l'histoire du mortier, mais surtout si nous souhaitons mieux connaître l'histoire de l'agriculture dans l'aire bantoue, il est très important d'entreprendre une étude comparative des termes signifiant les plantes utiles et peut-être même des termes désignant la nourriture en général [Bulkens 1998, 1999].

7. Conclusion

Les données linguistiques permettent donc de reconstruire un thème proto-bantou *-dù ~ *-nù en classes 7-8 signifiant 'mortier'. Au sein de son aire de distribution

nous trouvons un thème °-tòdé auquel Guthrie avait déjà attribué le statut de reconstruction orientale.

La présence généralisée du mortier en Afrique subsaharienne, les fonctions rituelles que cet objet peut assumer et les nombreux interdits qui l'entourent, laissent néanmoins penser que, sous une forme ou une autre, le mortier doit y être connu depuis bien plus longtemps. De ce point de vue, il est intéressant de vérifier si nous trouvons des formes apparentées à *-dù ~ *-nù au-delà des langues bantoues stricto sensu qui, par leur distance d'apparentement, confirmeraient l'ancienneté de cet objet.

De Wolf [1971] reconstruit une forme *ú-dudo–*tì-dudo en proto-Benue-Congo. Cette forme pourrait être apparentée à la reconstruction *-dù ~ *-nù. Observons les formes en (59). La forme semble également être attestée dans quelques langues kwa cités en (60). Mis à part la différence d'aperture vocalique, ces formes semblent suggérer une origine Benue-Congo-Kwa.

(59)	Proto-Benue-Congo		*ú-dudo	'mortar'	[De Wolf 1971]
			*tì-dudo	'mortars'	
	birom	Benue-congo	*Ø-lùlūm*	'mortar'	[De Wolf 1971]
			bìlùlùm	'mortars'	
	tiv	Benue-congo	*lú - ilʸú*	'mortar made by hollowing out a tree trunk vertically'	[Abraham 1940]
(60)	igbo	Kwa	*ọdhụ /ɔdho/*	'pestle'	[Winston 1973]
	tiv	Kwa	*òdó*	'mortar'	[Abraham 1958]

Les quelques formes citées permettent de penser que les formes apparentées pourraient atteindre une profondeur historique beaucoup plus importante. L'intérêt d'une étude comparative des mots pour le *mortier* dans l'ensemble des langues Benue-Congo-Kwa[13] ou même dans les langues Niger-Congo, est alors évident et démontre également l'importance de l'approche comparative pour une meilleure connaissance de l'histoire de la culture matérielle en Afrique subsaharienne.

[13] Les premières étapes d'une étude plus approfondie des mots pour mortier dans un plus grand ensemble de langues, ont déjà été réalisées en collaboration avec Cl. Grégoire.

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ASPECTS OF THE PHONOLOGY OF LABIAL-VELAR STOPS*

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Phonological patterns of labial-velar stops [kp, gb] are distinctively different from other consonants in their distribution and participation in phonological processes. A summary of cross-linguistic (> 80 languages) patterns of labial-velars includes phonemic inventories, co-occurrence patterns with vowels and consonants, and phonological processes that involve labial-velars. To explain these patterns, phonetic distinctives of labial-velars are presented, as well as the historical development of labial-velars. Feature Geometry and Articulatory Phonology are shown to account for some patterns. The conclusion drawn is that some patterns are best explained by diachronic factors, and there is no single current phonological theory that adequately accounts for all the other patterns.

1. Introduction

Among the tasks of phonology is accounting for patterns of inventories and distribution, of alternations, and of co-occurrences. In this paper, I suggest that accounting for such patterns of labial-velar stops and nasals is best done with reference to more than one theoretical framework. This is in the spirit of Zsiga [1997], who showed that two different assimilation patterns of Igbo vowels were best handled in two quite different approaches. Indeed, I show in this paper that some labial-velar patterns are traceable to historical processes and not to active synchronic phonology *per se* at all. I also show that Feature Geometry can help resolve the disparate views

* This paper is part of a larger project in progress, and I hope to considerably expand my database of languages in the near future. For any comments or contributions of data, contact the author at SIL, 7500 W. Camp Wisdom Rd., Dallas, TX 75237, USA. I have appreciated very much the contributions made by my SIL colleagues, both with unpublished data and also in steering me to references I would not have discovered easily. Thanks also to Beth Hume, Keith Johnson, Brian Joseph, and David Odden at Ohio State University for discussions on the phonetics, history, and phonology of labial-velars, to three anonymous SAL reviewers and the editor for very helpful direction and comments, and particularly to Bruce Connell for many fruitful and enlightening suggestions over the last few years. To them be the thanks, to me be the blame for any shortcomings.

over whether labial-velars must be primarily labial (or velar), as presented in Chomsky and Halle [1968] or must be regarded as coequally both labial *and* velar, as argued by Ohala & Lorentz [1977]. The paper is organized as follows. In Section 2, I present several phonological patterns of labial-velars, including behavior that marks labial-velars as unitary sounds, phonemic inventories and allophones, co-occurrence restrictions with both consonants and vowels, nasal place assimilation, and other phenomena. In Section 3, I sketch some of the phonetic properties of labial-velars. In Section 4, I briefly discuss some historical properties of labial-velars: how they develop and how they disappear, showing that some of these are a direct result of the phonetic properties of labial-velars, and that historical developments can account for some phonological patterns. In Section 5, I examine how *some* formal theoretical models can account for *some* patterns of labial-velar phonology. We will see that the Feature Geometry and Articulatory Phonology models can account for certain aspects of labial-velar phonology, but fall short in others, and while Optimality Theory is flexible enough to be able to describe the patterns discussed here, it adds few insights to the other models. A list of languages and sources consulted for this project is appended.

Labial-velars (kp, gb, ŋm) occur in approximately 6% of the 317 languages surveyed in the UPSID database [Maddieson 1984]. They occur extensively in West and Central Africa, in a few languages of Papua New Guinea, and marginally, in at least two Caribbean Creole languages (which have an African substratum). This project currently has at least some data from over 80 languages, the references for most of which are listed in an appendix, even though not all are discussed in this text. I use "KP" as a shorthand to refer to both [gb] and [kp], and label the relatively rarer languages of Papua New Guinea with "PNG" when mentioning them.

2. The Phonological Patterns

Besides the phonological patterns discussed below which relate directly to representational issues, I also note here the extreme rarity of labial-velars syllable- or word-finally. Amele of PNG is the only language I am aware of which has a syllable-final, word-internal labial-velar [Roberts 1987]. Languages which have phonetic word-final labial-velars are almost non-existent, with only five languages I am aware of, and two of these are marginal cases. Adioukrou [Herault 1969, 1982] has labial-velars in final position,[1] as do Momi (Vere) and Hyam (Jaba) (both Roger Blench, p.c,). Ndyuka, a Creole language of Suriname, has word-final [gb] in ideophones only [Huttar & Huttar 1994], e.g., *ppagb* 'bang!', *ffagbgb* 'id. for swift action' (the *gbgb* word-finally represents an extra-long closure). The other is [kp, ŋm] in Vietnamese, which are allophones of /k, ŋ/ [Liêm 1970:138, 141].

2.1. Labial-velars as units. Labial-velars are complex sounds with more than one component, but several behavioral patterns mark them as phonologically one unit.

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[1] Thanks to Rod Casali and an anonymous reviewer for pointing out these references, and to Ralph Hill [p.c.] for confirming the pattern.

In Ewe gerund formation, the first consonant of a verb is reduplicated in a prefix to form the gerund [Ansre 1963]. If there is a consonant cluster word-initially, only the first member of that cluster is reduplicated, as in *fle* → *fe-flee* below. Significantly, when a labial-velar is the initial consonant in a verb, the entire labial-velar reduplicates as a unit in the gerund form, as seen in the last two forms below.

(1) Ewe reduplication

fo	'to beat'	*fo-fo*	'beating'
bia	'to ask'	*ba-biam*	'asking'
fle	'to buy'	*fe-flee*	'bought'
kplo	'to lead'	*kpo-kplo*	'leading'
gbla	'to exert oneself'	*gba-gblam*	'exerting oneself'

Mano and Kaanse are languages with no phonemic /ŋm/. However, phonetic [ŋm] occurs as an allophone of /gb/ before nasal vowels [Welmers 1973:47, Showalter p.c.]. The labial-velar nasalizes as a unit and not partially (but see Béarth & Zemp [1967] for partial nasalization of a labial-velar). Also in Kaanse, /kp/ is realized as [gb] in a voiced context, after a nasal [Showalter 1997].

(2) Kaanse

sànɪ kpógorò	'sheep-shelter'
sṹŋ gbógorò	'chicken-shelter

2.2 Inventories. Inventories of labial-velar stop phonemes and related sounds are given in (3), while allophones of /kp/ and /gb/ are given in (4).

There are several interesting patterns to note from the tables in (3) and (4). First, phonetic [KP^{w}] is not rare, but phonemic /KP^{w}/ is at best quite rare, and may be non-existent.[2] In Dɛg and several other languages, all stops *except* labial-velars have labialized versions as phonemes: /p, p^{w}/, /b, b^{w}/, /t, t^{w}/, /d, d^{w}/, /k, k^{w}/, /g, g^{w}/, but /kp, gb/, and *not* /kp^{w}, gb^{w}/. Second, several languages, over a dozen, have /gb/ but no /kp/, though cross-linguistically a voiced stop usually implies the presence of a voiceless one (for discussion of the phonetic basis for the bias against voiced obstruents, see Ohala [1997]). The languages in my database thus far (Efik, Ibibio, Nkonya, and Lama) which have /kp/ but no /gb/ all also have related asymmetries in

[2] KP^{w} has been reported in Nupe. Smith [1967] mentions /kpwà/ [kpwɔ̀] 'to be cheap,' but elsewhere in the same article says labial-velars have "an *allophone* [my emphasis] with a labio-velar onglide to a following back vowel" (p. 154). Thus Nupe may well group with those languages which have [KP^{w}] as an allophone of /KP/ before round vowels. Another distinct possibility is that there is a stop-glide sequence in Nupe. The distribution of the independent glides lends support to this. /w/ almost always occurs before /a, o, u/, and /y/ before /a, e, i/, quite similar to the distribution of the "labialized" and "palatalized" stops [Banfield 1914]. Because of this, Nupe cannot be regarded as a firm counter-example. Welmers [1973:62] mentions Nupe as the only case known to him with /kpw, gbw/, but he also notes the peculiarities above. Tarok [Roger Blench, p.c.] has also been reported to have a contrast between /gb/ and /gb^{w}/, but I have not had the opportunity to investigate this in detail.

(3) Phonemic Consonants

	kp	gb	k^w	g^w	kp^w	gb^w	kp^y	gb^y	p^w	b^w	ɓ
many languages	x	x									
Dɛg, Kpelle, Moru, Nchimburu, Ijo (Kal)	x	x	x	x					x	x	
Ngiti, Mündü, Mödö, Lendu, 6 from UPSID	x	x									x
Dan	x	x	x	x			x	x	x	x	x
Chakosi, Mada	x	x	x	x			x	x			
PNG, Krahn, Temne, Tepo, North. Senufo languages, Maninka, Bambara		x									
Efik*, Nkonya*, Lama*	x										

* these do not have /g/ either.

(4) Allophones of /kp, gb/

	kp	gb	k^w	g^w	kp^w	gb^w	kp^y	gb^y	tp	db
many	x	x								
Dagaari, Kusaal	x	x			x	x				
Dagbani, Nzema	x	x							x	x
Hanga	x	x					x	x		
Gwari, Nafaara	x	x				x				
Tampulma	x	x						x		

their consonantal systems. Efik, Ibibio and Nkonya not only lack /gb/, but also lack /g/. Lama has no voicing contrasts at all in its consonants. Third, Nzema has [tp, db] as allo-phones of /kp, gb/ before front vowels [Westermann & Bryan 1952:90]. Similarly, Dagbani [Wilson & Bendor-Samuel 1969] has [tp, db] as allophones of /kp, gb/ before [i] (Knut Olawsky has informed me that these sounds are phonetically more palatal than alveolar).

2.3 Co-occurrence restrictions. While in many languages, there are no co-occurrence restrictions with labial-velars, such restrictions do exist in other languages. Frafra, Buli, Gwari, Dagbani, Mayogo, Moba, Santa Ana (PNG), Digo, and others such as the western Sawabantu languages, have few or no back round vowels following /KP/ (see Appendix for references to these languages). Cross-linguistically, if there is a class of vowels missing after KP, it is the high back round vowels /U/, and sometimes the mid back round vowels /O/. In the languages in my database to date, /U/ and /O/ do occur after /b, p/, so this restriction does not apply to labial stops in general.[3]

However, in other restrictions, labial-velars do group together with labial consonants. Significantly, Ngbaka and Kukú have no labial consonants in the same word as other labial consonants, including labial-velars [Thomas 1963, Selkirk 1993, Cohen 1997]. Similarly, Kaanse has no labial consonants in the same morpheme as other labials, including labial-velars [Showalter 1997]. Also, in Nupe, /ã/ has an allophone [ɔ̃] which only occurs after /p, b, kp, gb, f, w/, that is, labial consonants [Smith 1967].

2.4. Nasal Place Assimilation. In this section, we see that a nasal has been reported as assimilating in place to a following labial-velar stop as either [ŋKP] or [ŋmKP] in various languages (and both in Kɔnni). Since these are acoustically quite similar to each other, it is legitimate to query the reliability of the transcriptions. Actually, there are two reasons why relying on published accounts of nasals before KP involves some degree of indeterminacy. One is that in some sources, there has been an orthographic convention established which is not identical with the phonetic reality. For example, Yoruba uses orthographic {p} to represent /kp/ [Folarin 1987, *inter alia*] and orthographic {m} for [ŋm]. Welmers [1973] also notes that orthographically for African languages, he prefers to write {ŋ} rather than {m} for the labial-velar nasal [ŋm].

The second reason is that, especially for the unpracticed non-native speaker, the different nasals possible before a labial-velar stop are not always easy to distinguish. The auditory difference between [ŋmkp] and [ŋkp] is not great, particularly when not preceded by a vowel. The reason for this is easy to see; [ŋm] has two places of articulation: a front [m] and a rear [ŋ]. In the resonating cavity composed of the oral and nasal tracts, [ŋm] creates a complete constriction at the same location as that produced when [ŋ] is pronounced. It is this rearmost constriction that defines the length of the oral part of the resonating cavity. As Ohala & Ohala [1993:236] note, "Any additional constriction forward of that point is acoustically irrelevant." But to distinguish [ŋmkp] and [ŋkp] reliably, it is important to use one's eyes as well as ears. That having been noted, it is possible to reliably distinguish the two when one knows what to look and listen for. The pattern that emerges from the literature across languages is that there are indeed two distinct types of nasal assimilation before labial-velars.

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[3] An anonymous reviewer points out that there are NW Bantu languages which lack a U after both labial-velars and labials. I have not seen the data for these as yet, but this appears to be a pattern where labial-velars and labials pattern together, as discussed below.

2.4.1 Assimilation as [ŋm] preceding labial-velars. Sagey [1990] cites several languages in which a nasal assimilates to KP as [ŋm], either as a full segment or as the nasal component of a pre-nasalized stop, as in (5).

(5) a. Nasal preceding labial-velars

Kpelle	***ŋḿ*-*gbiŋ***	'myself'
Yoruba	*o* ***ŋm*** *gbo*	'he is hearing'
Dan	***ŋm*** *gbe*	'my arm'

b. Prenasalized labial-velars

Sango	***ᵑᵐ****gba*	'to remain'
Tiv	*a* ***ᵑᵐ****gbahom*	'he approached'
Gwandara	*gbo****ᵑᵐ****gboro*	'steep river bank'

2.4.2 Assimilation as [ŋ] before KP. Sagey does not mention other types of nasal place assimilation, but they are actually quite common. Ryder [1987] cites several languages in which a nasal assimilates to KP as [ŋ]. Besides these and the ones cited below, Anufo (Chakosi), Birifor, Chumburung, Dagbani, Dɛg, Gã, Gwari, Konkomba, Kusaal, and Vagla (cited in the references) also display this pattern.

(6) a. Nasal preceding labial-velars: Dagaari [Kennedy 1966, personal data)

*kpà****ŋ****kpàŋ*	'upper arm'	*gbá****ŋ****gbáŋ*	'noon'
ŋ́ *kpánò*	'I lock'	***ŋ̀*** *kpìérà*	'I am entering'

b. Prenasalized labial-velars: Bongo prenasalized stop [Kilpatrick 1985]

/ᵑgb/: ***ᵑ****gbáyá* 'corn'

2.4.3 Kɔnni: both types of assimilation. Kɔnni, a Gur language of northern Ghana, exhibits both the above patterns of nasal place assimilation [Cahill 1992, 1998]. Within words, a nasal assimilates in place as [ŋ] before KP. However, across words, a nasal assimilates as [ŋm].

(7) Nasal assimilation type 1: [ŋ] before a labial-velar *within* words:

a. Single-morpheme words:

*tì****ŋ****gbáŋ*	'floor'
*bì****ŋ****kpìáŋ*	'shoulder'

b. Compound nouns[4]

tàŋ-kpíˡáŋ	'bush-partridge [lit. dirt-chicken]' (cf. *tàn-tí* 'dirt')
*kàà****ŋ****-kpíŋ*	'cheekbone [lit. cheek-sheanut]' (cf. *kàámíŋ* 'cheek')

[4] In Kɔnni, compound nouns can be distinguished from associative noun phrases by the presence of a suffix on the left noun of an associative construction and a High associative tone on the second noun in the associative construction.

c. Noun-adjective
*dùù**ŋ**-kpí˥íŋ* 'big horse [= horse-big]' (cf. *dùùn-é* 'horses')
*bí**ŋ**-kpí˩˧áŋ* 'dry seed [= seed-dry]' (cf. *bín-ní* 'the seed')

(8) Nasal assimilation type 2: [ŋm] before a labial-velar *across* words
a. Pronoun[5]
***ŋ̀m** gbìéŋ* 'my pot' ***ŋ̀m** kpàllí* 'my calabash'
***ŋ̀m** gbálígí-yà* 'I'm tired' ***ŋ̀m** kpátí-yà* 'I've finished'

b. Noun Phrases
*sìŋkpáá**ŋm** kpááŋ* 'peanut oil' (cf. *sìŋkpáá**ŋ***)

c. Verb Phrases
*ké**ŋm** kpátì* 'come finish'
*ké**ŋm** gbírígì* 'come kneel'

2.4.4 Assimilation of nasals following labial-velars. Nasals preceding consonants are much more common than nasals following them, but the latter do occur in a number of languages. One of these is Senufo, Tyebaara dialect [Mills 1984]. A nasal following a labial-velar here assimilates as [m]. Mada [Price 1989] has an unusual syllable type: a stop followed by syllabic nasal. In these cases, the nasal assimilates to a preceding labial-velar as [ŋm].

(9) a. Senufo, Tyebaara dialect
kpmɔ̃ː 'to beat' *nɛ̃̀-gbmɔ̃̀ː* 'herb doctor'

b. Mada
/kpm̀/ [kpŋm̀] 'kapok tree'
/gbm̀/ [gbŋm̀] 'canoe'
/kpakmki/ [kpa.kŋ.ki] 'tree stump'

2.4.5 Gwari. Gwari is interesting in that it may have a nasal either preceding or following a labial-velar. As analyzed by Rosendall 1992, Gwari has two nasal phonemes, /n/ and /m/. Of these two, /m/ does not assimilate to a following consonant, but /n/ does.

(10) No assimilation of /m/
àmwí 'dog' *pìsé**mgbà*** 'cock'

[5] The status of subject and possessive pronouns as words may be marginal in Kɔnni, as they do not occur as independent utterances; they may be better viewed as clitics. Nonetheless, syntactically they act as independent words, and for phonological patterns such as this assimilation they group with independent words.

(11) Assimilation of /n/ before consonants

a.	*sì**nt**óló*	'leaf'
	*mì**nt**ʃí*	'saliva'
	*mí**ns**à*	'man'
b.	*jè**mp**ʲé*	'feces'
	*kà**mb**á*	'maize'
c.	***ŋ**wá*	'to need'
	*tʃí**ŋk**pè*	'stool'
	*wʲédʒí**ŋg**bmà*	'dark'

A nasal assimilates to a preceding stop only if the stop is labial. As seen in other languages, labial-velars are included in the class of labials here.

(12)

a. No assimilation		b. Assimilation	
tn**útn**únù	'rubbish'	***ɓm**à*	'break'
***dn**ásò*	'river'	***gbm**ínà*	'feather'
***kn**á*	'send'	*ʌ̀**gbm**ʲá*	'fish'
*á**gn**áná*	'jump'	***kpm**àmí*	'okra'
		*bʷá**kpm**ì*	'left side'

From the languages examined in this section, it is evident that nasal place assimilation seems never to yield [mKP] or [KPŋ] (recall that the nasal [mgb] in (10) is analyzed as non-assimilation). A complete nasal assimilation [ŋm] is attested either preceding or following a labial-velar, but if there is partial place assimilation, it yields [ŋKP] or [KPm].

2.5 Other labial-velar phonology

2.5.1 Blocking of round harmony: Nawuri. In the Nawuri prefix /gI-/, the vowel is round if the stem vowel is round [Casali 1995]. But if the initial stem consonant is labial (including labial-velars), the process is blocked. In this process, labial-velars group together with labials as a natural class, but not with velars.

(13) a. before [-round] stem vowel

[gɨ-ɲi] 'tooth' [gɨ-keːli] 'kapok tree'

b. before [+round] stem vowel — round spread:

[gu-jo] 'yam' [gu-kuː] 'digging'

c. before [+round] stem vowel and *labial* stem consonant – blocking of spread:

[gɨ-pula] 'burial' [gɨ-kpoː] (type of dance)

2.5.2 Neutralization of KP – the case of Amele. In Amele (PNG), /gb/ is neutralized with /b/ word-finally [Roberts 1987]. The morpheme {we} word-medially, is [gb], but [p] word-finally.

(14) ['ho-**gb**-ə] 'we came (today)'
[hɔ-'lɔ-**p**] 'we used to come.'
/fe+fe+**gb**/ → [fefe**p**] 'as we see (SS)...'

Efik has been cited as a similar case [Welmers 1973], since [kp] appears only in syllable-initial position, but [p] appears only in syllable-final position. However, there are no alternations as in the Amele case, and [b] and [p] also have the same type of complementary distribution, so Cook [1969, 1985] treats [p] as an allophone of /b/ rather than of /kp/. In the light of Cahill [to appear], it is perhaps better to treat Efik /kp/ as merely having a restricted distribution, as in many other languages.

2.5.3 Vowel assimilation in Amele. In Amele (PNG), /e/ surfaces as [o] before back round vowels, across an optional consonant (see (a) below). The same happens immediately preceding /w/ or /gb/ (see (b)), but not when the /gb/ is word final and realized as [p] (see (15c)).

(15) Amele /e/ → [o]: [Roberts 1987: 363-5]

a. /fe+u+m/ → [foum] 'I would have seen'
/fe+ʔe+hul/ → [feʔohul] 'we(2) see(DS)...'
/fe+fe+hul/ → [fofohul] 'as we (2) see (DS)...'

b. /fe+w+a/ → [fowa] 'we (2) saw (today past)'
/fe+gb+a/ → [fogba] 'we saw (today past)'

c. /fe+fe+gb/ → [fefep] 'as we see (SS)...'

Note that e̲ rounds before segments which have *both* [dorsal] and [labial] features, that is [u, o, w, gb]. Neither feature by itself is sufficient to cause the rounding; e̲ does not round before [k] or [p].

2.6. Summary of above — What needs explanation. To summarize the above, an adequate explanation needs to be proposed for the following phenomena discussed above:

1. Distinguish the phonemes /KP, K^{w}/
2. Distinguish the allophones [KP], [KP^{w}], [KP^{y}], [TP]
3. Account for the rarity or lack of /KP^{w}/, but the not uncommon presence of [KP^{w}]
4. Account for the not-uncommon occurrence of /gb/ without /kp/

5. Account for single-C behavior vs. edge-effects
   a. reduplication, voicing as single C
   b. nasals → ŋ before KP and m after KP
6. Account for vowel restrictions after KP
7. Account for Nawuri blocking of round harmony.
8. Account for Amele neutralization of KP word-finally
9. Account for Ngbaka, Kukú, and Kaanse consonant co-occurrence restrictions
10. Account for the grouping of KP with u, o, w in Amele /e/ → [o]

3. Some phonetics of labial-velars

In this section a selection of phonetic characteristics relevant to the previous phonological patterns is presented. For more complete details on phonetic characteristics of labial-velars, see Connell [1994] and Ladefoged & Maddieson [1996].

3.1 Articulatory mechanisms. Ladefoged [1968] notes three mechanisms for producing labial-velars:

1. Simple pulmonic airstream. (2 languages)
2. Pulmonic egressive and velaric ingressive airstream. Dorsum slides back, air flows into oral cavity from both directions. (23 languages)
3. Pulmonic egressive, velaric ingressive, glottalic ingressive airstreams. Partly voiced. (8 languages)

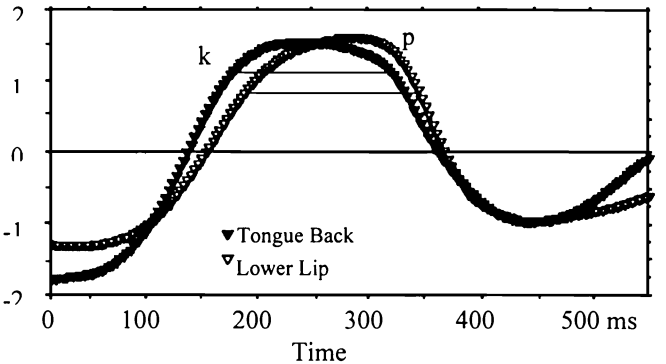
Note that most languages have an ingressive mechanism (some investigators label it "suction"). In light of Connell's [1994] discussion of intra-speaker variation, it is possible that these three categories may be reduced to two: one with pulmonic egressive airstream and one with some variety of ingressive airstream (but see discussion in Ladefoged & Maddieson [1996: 342-343]).

Two other details of the phonetics of labial-velars are relevant to their phonological patterns. First, some, such as Ibibio, Kana, and Obolo, have partial voicing even of "unvoiced" /kp/ [Connell 1994], as Ladefoged also noted. Second, labial-velars are typically unaspirated, even when other stops are aspirated. For example, in Nupe, all voiceless stops except /kp/ are aspirated [Smith 1967]. In Phwin, a Gur language of Burkina Faso, aspiration is contrastive on all voiceless stops except /kp/ [Kevin Warfel, p.c.]. These examples could be multiplied. In writings on several other languages (twelve to date), /kp/ is singled out from among voiceless stops as unaspirated. Only three phonological sketches I have seen mention /kp/ as aspirated along with the other voiceless stops. These are for Hanga [Hunt 1981], Nchimburu [Price 1975], and Dagaare [Kennedy 1966]. However, upon reexamination, none of these is correct. Adams Bodomo [p.c.] informs me that [kp] in Dagaare is less aspirated than [p], Keith Snider [p.c.] informs me that [kp] in Nchimburu is actually unaspirated, and Geoffrey Hunt [p.c.] informs me that upon examining the recordings with acoustic analysis software, [kp] in Hanga is unaspirated, unlike other

voiceless stops. (It should be noted that none of the three original writers had access to tools for acoustic analysis.) Of course, many phonologies do not even mention aspiration at all, on any stops. Such is the case in Cahill [1992] for Kɔnni, but Cahill [1999] shows in waveforms the lack of aspiration in [kp] compared to [p], [t], and [k].

3.2 Articulatory overlap. Labial-velars are generally transcribed as [kp, gb], not [pk, bg], and this is no accident.[6] Perceptually and articulatorily, the velar onset precedes the labial one, and the labial release follows the velar release. This is supported by spectrograms from Dedua (PNG), Efik, Ibibio, and others [Connell 1994, Ladefoged & Maddieson 1996 and references therein].

(16) Electromagnetic articulography shows overlap of the gestures [Ladefoged & Maddieson 1996].



Coordination of lower lip and tongue back movements in the Ewe word **akpa**. Y-axis is vertical displacement; horizontal lines indicate the likely duration of actual contact of the articulator.

Maddieson has also performed direct measurement of movement of the articulators with electromagnetic articulography, with electromagnetic sensing of the position of metal pellets glued to the articulators. The data shown below support the spectrographic evidence that the velar gesture precedes the labial one.

4. Historical

4.1 Where labial-velars come from. Several diachronic studies include labial-velars as part of larger studies; see Ponelis [1974] and Connell [1994] for more in-depth discussion of the historical development of labial-velars. To illustrate some common

[6] Occasionally in some older literature one finds a transcription as [pk, bg], in a context which suggests the author was not concentrating on the order of the articulations. Also, Shona has been transcribed as having [pk], but Maddieson (1990) shows that these are separate and not overlapping articulations.

patterns, I cite here another study which concentrates on labial-velars. In the Sawabantu group of languages in western Cameroon, Mutaka and Ebobissé [1996/97] show that a historical prefix **ku-* was realized as **kw-* before vowels, and that *kw > kp in the Western Sawabantu group (below), as well as *ŋgw > ŋgb, *ɓw > gb and *mw > ŋm.

(17) Sawabantu words with historical prefix **ku*

	Eastern Sawabantu	Western Sawabantu
a. 'diarrhea'	*kúɓwako*	*kúgbako*
'skin'	*koɓo*	*kowo*
b. 'partridge'	*kwalé, kwaɗé*	*kpaé*
'sword'	*kwátá*	*kpátá*
'death'	*kwéɗí*	*kpélí*

This historical development hypothesis is supported by the fact that synchronically, some languages produce *KP* from *Kw*. In Noni [Hyman 1981], /K+w/ often is manifested as [kp, gb] (also see Kelly [1988] for Digo).

(18) Noni nouns singular marker /w/

singular	plural	gloss
twéŋ	*téŋ*	'vine branch'
kwen ~ kpen	*ken*	'firewood'
gwéé ~ gbéé	*géé*	'hundred'

However, in Aghem [Hyman 1979], present-day /kp, gb/ came from historical *pw, *bw (see Demolin [1995], Connell [1994] for other *Pw). The immediate predecessors of labial-velars seem always to be labialized consonants, whether *Pw or *Kw.[7]

(19) Aghem nouns plural marker /w/

singular	plural	gloss
kɨ́-nâŋ	*ó-nwâŋ*	'cocoyam'
kɨ̀-tɛ̌ɛ	*ò-twɛ̌ɛ*	'cricket'
kɨ́-bá?	*ó-gbá?*	'rope'
kɨ́-bɛ́	*ó-gbɛ́*	'fufu'

4.2 Where labial-velars go. The labial-velar stops in northern Senufo languages (Gur family) merged *kp and *gb into gb. Sucite is one example of this. It has no /kp/, but /gb/ is quite common, despite the relative uncommonness of other voiced

[7] Kelly [1974] notes that **Cf** and **Cv** arose from a proto-**Cu** in Faŋ. A [kf] is a possible candidate for an intermediate between [k^{w}] and [kp] in at least some cases.

stops relative to voiceless ones [Garber 1987]. Supyire took the next step and merged gb with b, and today has no labial-velar stops, unlike most other Senufo languages [Carlson 1994:8-9]. As a result of these mergers, the Supyire /b/ is disproportionately common, the results of combining the frequencies of words with *b, *gb, and *kp.

The labial-velars in Papuan languages seem to have followed the same patterns as the African ones. For example, Ono (PNG) presently has only /gb/ as a labial-velar, unlike other stops which have voiced/voiceless pairs [Phinnemore 1985]. However Wacke [1931] reported a contrast between /kp/ and /gb/, as well as the nasal /ŋm/. Wacke's 3 /ŋm/ words are all pronounced with /m/ today. Assuming the accuracy of Wacke's report, kp merged with gb, and ŋm merged with m. The Santa Ana language of Makira Province, Solomon Islands, also has only /gb/ [Greg Mellow, p.c.].

Dolphyne & Kropp Dakubu [1988] note in their article on Volta-Comoé that "Nzema-Anyi-Baule and Chakosi have /kp/ where Akan has /p/", another case in which a labial-velar changed to a labial. For more on the historical development of labial-velars, see Demolin [1995] and Connell [1991, 1994, 1995].

In sum, historically, it seems common (though not universal) that:

(20) a) KU > KW (where U = u, ʊ)
b) KW > KP, *then*
c) kp > gb *and/or*
d) KP > P

These historical developments help account for some of the distributional patterns of labial-velars. Sound change (20a) above accounts for the vowel restrictions found after KP noted in Sec. 2.3. A perceptibly labialized K would not develop before a round vowel (i. e., *kua > k^wa, but not *kuu > k^wu, though *kwu* may develop from other paths). Sound change (20b) also helps explain the lack of /KP^w/, since labialized consonants developed prior to labial-velars, and some changed into labial-velars. Sound change (20c) explains the presence of /gb/ without /kp/ in some languages, noted in Sec. 2.6.4. Phonetic motivation for the change of /kp, gb/ > /gb/ can be found in the phonetic similarity of /kp/ to voiced stops noted in Section 3.1: their lack of aspiration, partial voicing, and ingressive air mechanism.

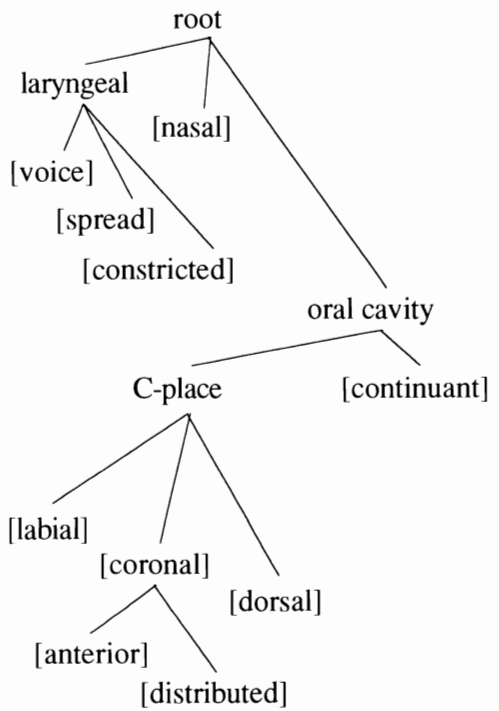
5. Phonological models

Zsiga [1997] suggests that categorical alternations are best represented featurally, but gradient processes are best represented gesturally. She follows this by analyzing Igbo ATR harmony with features and other vowel assimilation with a gestural account. She claims that neither representation can account for the full range of data (also see Zsiga [1995] for a similar approach). In a similar way, I will claim in this paper that there is no single phonological model which can successfully account for all the behaviors of labial-velars. While an appropriate Feature Geometry can

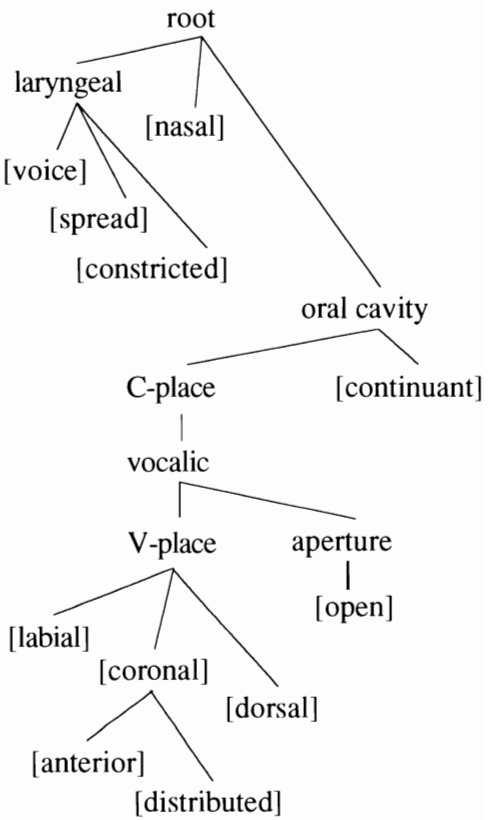
account for many patterns, it fails to account for edge behavior of labial-velars. Similarly, while Articulatory Phonology can describe the edge patterns and assimilations, it cannot account for the OCP-type consonantal co-occurrence restrictions discussed earlier.

5.1 Feature Geometry. Early generative accounts of labial-velars such as Chomsky and Halle [1968] and Anderson [1976] were forced by the set of features in place at that time and their linear organization into viewing labial-velars as either labials with extreme velarization or velars with extreme labialization. Outside of this strict generative approach, Ohala & Lorentz [1977], Ohala [1979], and Connell [1994] argue that labial-velars are neither primarily labials nor velars, but must be recognized to be a distinctly different type: labial-velars, with neither articulation primary. Here I maintain that depending on the language, either of the above approaches may be appropriate. In some languages or processes within a language both articulations act as equally prominent, but in other languages or processes, there is clearly

(21) a. Consonants



b. Vocoids



an asymmetry in phonological behavior with respect to the two articulations which argues for [labial] being primary. With the onset of non-linear approaches to phonology, both options are possible. There is still the possibility of representing labial-velars as basically velars or basically labials, but Feature Geometry opens the option of conceptualizing and representing the two articulations as equally prominent.

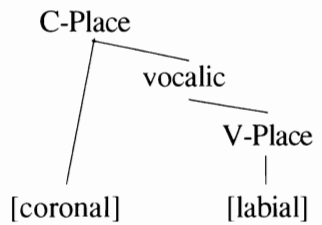
Sagey [1990] was the first to present a comprehensive treatment of labial-velars within the context of Feature Geometry. Since then, the model in Clements and Hume [1995] has been generally accepted as the "standard" model of Feature Geometry. Clements & Hume-type trees for sample consonants and vowels, showing a complete set of features, are shown in (21).

This model has the advantage that segments may be treated either as units or as groupings of features. For example, the Ewe reduplication pattern which illustrated labial-velars as units must refer to the root node above; it is the entire segment which is reduplicated. Similarly, since the [nasal] feature is a daughter of the root node, a phonological spreading of [nasal] will affect the entire segment, as we have seen in Kaanse. Also, changing the [voice] feature will affect the entire segment, not just part of it. Changing a feature of the tree affects the entire segment, and this is as true for labial-velars as for any segment.

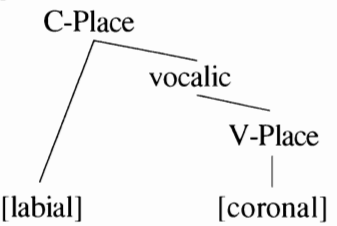
However, Feature Geometry also accommodates complex place structure, including places of articulation which may be labeled major and minor, as below, where for conciseness, the only portion of the tree displayed is the C-Place node and its daughters. The major place of articulation is given under the C-place node, and the minor place of articulation given under the V-Place node.

(22) Consonants with secondary articulation

a. t^w



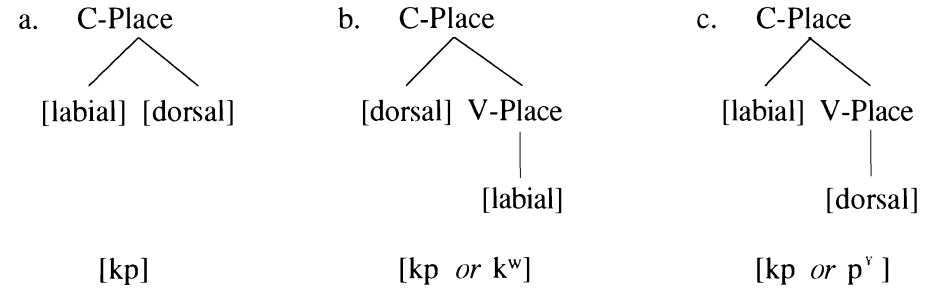
b. p^y



As Clements & Hume note [1995, fn. 36], their constriction-based model makes no formal claims about the phonetic degree of stricture of the minor articulation, so the "minor" articulation could conceivably have the same degree of stricture as the major articulation. Within this model, then, three representations of labial-velars are possible and are shown below in (23). The first representation (23a) has both [labial] and [dorsal] as major articulators, and so is unambiguously [kp], but the latter two also have an alternate phonetic interpretation. The phonological behavior of a labial-

velar in a particular language would determine which of these representations would be appropriate for that language.[8]

(23) Possible labial-velar geometries



We have seen in (3) that a language may have both /kp/ and /kʷ/ in its phonemic inventory. The above schema would predict that in such a language, (23b) would be the representation for /kʷ/ and either (a) or (c) must be the representation for /kp/.

In representation (23c), [labial] is the major place of articulation. This representation accounts for the grouping of labial-velars and labials as a natural class, since the primary articulation is labial for both. It correctly predicts that labial-velars and velars do not form a natural class. For example, several languages have co-occurrence restrictions of labial-velars and labials, but not labial-velars and velars. This would be looked on as an OCP-type constraint. The OCP within Feature Geometry prohibits identical adjacent elements (for a discussion of "adjacency" in this context, see Odden [1994] and Suzuki [1998]). Here, two [labial] consonants are prohibited in the same word or morpheme. However, a labial-velar freely occurs with velars, so an OCP-based conclusion is that the [dorsal] place and the [labial] place of labial-velars occur under different nodes in the geometry. Note also that the co-occurrence restriction is not a directional or edge effect: in these languages, both [...kpVp...] and [...pVkp...] are prohibited. Representation (23c) also accounts for [tp] as an allophone by spreading of the [coronal] feature from the V-Place of a vowel to the V-Place node of the KP, with concomitant delinking of the [dorsal].[9] It also could explain the neutralization of KP and P word-finally, if no secondary articulations are allowed in that environment.

Clements [1991] notes the possibility that (23b), representing [Kʷ], is the historical predecessor of KP, and the development of this into KP consists of the [labial] being promoted to a primary place as in (23a). I would assume this could

[8] While Sagey [1990] and Clements [1991] permit the possibility of two major articulations, Clements & Hume [1995] argue against this on the basis of maximally constraining the theory. However, if no evidence is available to argue for either [dorsal] or [labial] as primary, then the choice of one of these is purely arbitrary; there is no theory-external evidence to exclude two major articulations.

[9] Even in the Dagbani case, where the relevant allophones are phonetically more the palatals [cp] and [ɟb] than the alveolars, these are still considered to have [coronal] place. The palatals and alveolars are differentiated by the [anterior] feature [Clements & Hume 1995].

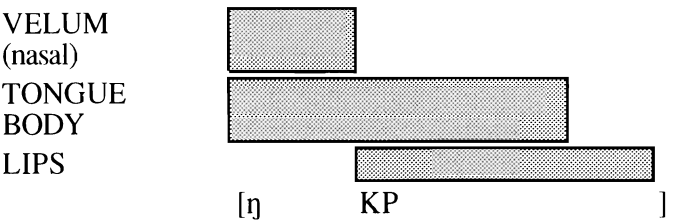
then either remain as is or develop into (23c), with the possibility of different languages currently having different representations. Interestingly, I have not found any evidence cross-linguistically that would indicate [dorsal] as the primary place for KP. The only phenomenon in which KP acts as [dorsal] is in nasal place assimilation, and this is strictly a left-edge effect; if the nasal is on the right of the KP, then it assimilates to the [labial], as we have seen. Thus nasal assimilation patterns are irrelevant to the issue of which articulation is primary.

It is possible that representation (23a), with [labial] and [dorsal] as both primary, may account for the rounding of e̲ in Amele before [u, o, w, gb], since both places of articulation are necessary in this pattern.

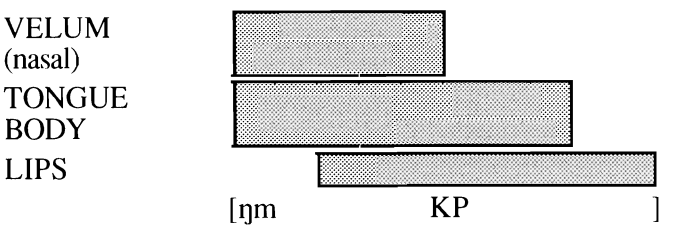
Using the assumptions and above representations of Feature Geometry, one is able to account for several phonological patterns of labial-velars. However, since the [labial] and [dorsal] features are temporally unordered, Feature Geometry does not readily account for left-right asymmetries such as nasal place assimilation. A proposal for explaining the two Kɔnni [ŋKP] and [ŋmKP] assimilations within Feature Geometry was presented in Cahill [1998] with two distinct rules. It had the disadvantage of crucially assuming [dorsal] as the primary place, and though it adequately described the patterns, it had no principled explanation for the lack of [mkp].

5.2 Articulatory Phonology. The Articulatory Phonology approach of Browman & Goldstein [1989, 1992] incorporates a much greater degree of phonetic information, such as timing relationships, directly into the representation, than do other phonological models. The primitive units of phonology in this model are *gestures* which have inherent timing. In a KP, the velar gesture slightly precedes the labial ones, as

(24) a. gestural score for **ŋKP**



b. gestural score for **ŋm-KP**



previously illustrated in (16). The "gestural score", showing the activity of the various articulators, is shown in (24) for both [ŋKP] and [ŋmKP].

Note that in (a), for [ŋKP], the velum is closed before the labial gesture; nasality is finished at approximately the same time as the lips close. However, in (b), for [ŋmKP], the velum remains open into the labial gesture; nasality persists into the lip closure.

Articulatory Phonology can thus represent the edge effects of different nasal assimilations. However, this is purely a description of the articulator movements; it does not explain why Kɔnni differentiates the two in the two environments of within words and across words.[10]

Another phenomenon that Articulatory Phonology might help explain is the neutralization of KP to P word-finally in Amele. Given that the labial gesture is more visible, the velar gesture is less perceptible and more likely to be deleted. The occurrence of [tp] as an allophone of /kp/ may also be explained in gestural terms as an extension of the vocalic place gesture into the preceding consonant.

However, the gestural schema of Articulatory Phonology alone cannot account for all the phenomena of labial-velars. For example, as has been pointed out [Zsiga 1995], Articulatory Phonology predicts a possible contrast between [KP] and [PK], with the phasing relations reversed. However, not only is the contrast of these two unattested, but the [PK] phasing of the gestures also seems to be completely unattested. Thus we need to either enrich the theory or venture outside Articulatory Phonology for an explanation.[11] Furthermore, an Articulatory Phonology account of OCP effects such as the prohibition against labial-velar and labial in the same word or morpheme would be problematic. First, since there is no way to mark one gesture as phonologically prominent, a gestural account could not single out one of two equally forceful gestures as relevant to an OCP-driven pattern. Thus there would be no reason to single out the labial gesture rather than the velar gesture, and mark the first as relevant but not the second. One might propose that the gestural timing asymmetry might be the crucial factor, but this runs into the second difficulty. There is no asymmetry in the labial-velar/labial prohibition, that is [...kpVp...] and allowing [...pVkp...] are equally disallowed. If the asymmetry of the gestures were a factor, we would expect two different co-occurrence prohibitions, depending on the left or right side of the labial-velar. That is, we would expect a prohibition against [...kVkp...] and another against [...kpVp...]. But only the latter is attested. We conclude that Articulatory Phonology cannot account for the consonantal co-occurrence restrictions involving labials and labial-velars.

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[10] One suggestion that has been tested in Kɔnni is that the inherent duration of nasals is longer at boundaries such as word breaks, since the lengthening of phonetic components before a boundary is a pattern that is cross-linguistically common [Maddieson 1996]. However, measurements do not show a significant difference in nasal durations across vs. within words [Cahill 1999].

[11] Three possibilities which I have considered are 1) greater perceptual salience for [KP] than [PK], 2) less articulatory effort for [KP] than for [PK] and 3) remnant of the historical development. Cahill [1997] is not conclusive but argues against the first possibility.

5.3 Optimality Theory. Very little has been written about labial-velars within Optimality Theory (OT). Padgett [1995] is the only attempt to account for [ŋKP] vs. [ŋmKP] in OT. He uses a constraint **SPREAD** which forces nasals adjacent to consonants to share their place values, and a constraint ***COMPSEG** which penalizes the surfacing of complex segments (such as kp, gb, ŋm). However, he does not account satisfactorily for the lack of [mKP], and does not deal with the challenge of major and minor articulations.

The only other work in OT dealing directly with general labial-velar phonology I am aware of is in Cahill [to appear], which deals with positional patterns of labial-velars. This work proposes a constraint **MULT-son:** multiply articulated segments are licensed only before sonorants. This disallows labial-velars word-finally, and most of the time syllable-finally as well, and motivates neutralization of KP word-finally.

Though organization of features has not been a major emphasis in OT work, a Feature Geometric or equivalent labeling of [labial] as primary feature and [dorsal] as secondary is still necessary in order to account for the grouping of KP with other labials to the exclusion of velars. This [labial] as primary place must be invoked to account for several patterns, including the Nupe, Amele, Efik, Nawuri, etc. groupings of KP with labials, [TP] as an allophone of /KP/, neutralization of KP with P word-finally (using the constraints **MAX(Prim-Place) > MAX(Sec-Place)**), and consonant co-occurrence restrictions (using a constraint **OCP[labial]** and assumptions about adjacency, as in Odden [1994].

Other constraints could feasibly be proposed to account for other of the phonological patterns discussed here. For example, *KPU could be proposed to account for the restriction in some languages that a labial-velar does not co-occur with round vowels following it. However, this would be an arbitrary constraint, with no reason to admit this constraint but reject *KPA, for example. In short, OT can be used to describe the patterning of labial-velars, but adds no new insights. The frameworks previously discussed, which deal with the internal structure of labial-velars and provide the motivation behind the patterns, are outside the scope of OT.

6. Conclusions

While labial-velars in many languages are phonologically inert, with no alternations or co-occurrence restrictions, there are nonetheless robust cross-linguistic patterns that labial-velars follow. To adequately account for these, several approaches, not all phonological, are necessary. Historical processes, coupled with an understanding of the phonetics of labial-velars, can account for the lack of KPU, the existence of /gb/ without /kp/, and the lack of /KP^{w}/. A Feature Geometry representation for labial-velars, with [labial] as primary, accounts for the widespread patterning of labial-velars with labials. Articulatory Phonology and phonetics can describe edge effects as well as partial vs. total nasal place assimilation, though calling this an explanatory account would be going too far. We see with Zsiga [1997] that different phenomena call for different phonological approaches. We may eventually come to the conclusion that certain of these phenomena, particularly the different patterns of nasal

place assimilation in Kɔnni, may be divided into phonological vs. phonetic, or lexical vs. postlexical. This is an area of ongoing research.

APPENDIX: SELECTED LANGUAGES AND SOURCES

[Note: These sources vary greatly in their depth of coverage.]

PAPUAN
Amele: Roberts 1987
Iai: Maddieson 1984
Ono: Phinnemore 1985, Wacke 1931
Yeletnye: Henderson 1975, Ladefoged & Maddieson 1996
Dedua: Ladefoged & Maddieson 1996
Nabak: McElhanon 1979
Santa Ana: Greg Mellow p.c.

CARIBBEAN CREOLES
Ndyuka: Huttar 1985, Huttar & Huttar 1972, 1994
Saramaccan: Rountree 1972

AFROASIATIC, Chadic
Gwandara: Sagey 1990

NIGER-CONGO
Adamawa-Ubangi
Gbeya: Samarin 1966
Mündü: Jeffrey & Polley 1981
Sango: Samarin 1967, Sagey 1990
Mayogo: McCord 1989
Ngbaka: Thomas 1963

Atlantic
Kisi: Childs 1992-1994
Temne: Maddieson 1984

Bantoid, Southern
Aghem: Hyman 1979
Tiv: Sagey 1990
Noni: Hyman 1981

Bantu
Digo: Kelly 1988
Sawabantu: Mutaka & Ebobissé 1996/1997

Cross River
Efik: Cook 1969
Kana: Connell 1994
Ibibio: Connell 1994
Obolo: Connell 1994

Defoid
Igala: Silverstein 1973
Yoruba: Bamgbose 1969, Maddieson & Ladefoged 1989, Sagey 1990

Edoid
Edoid languages: Elugbe 1986
Isoko: Mafeni 1969

Gur
Birifor: Kuch 1993
Dagaari: Kennedy 1966
Dɛg: Crouch in press
Frafra: Schaefer 1975
Kaanse: Showalter 1997
Kɔnni: Cahill 1992, 1998, to appear
Nafaara: Jordan 1980
Sisaala-Pasaale: Toupin 1995
Supyire: Carlson 1994
Tyebaara Senufo: Mills 1984
Buli: Kröger 1992
Dagbani: Wilson & Bendor-Samuel 1969
Dilo: Jones 1987
Hanga: Hunt 1981
Konkomba: Steele & Weed 1966
Kusaal: Spratt & Spratt 1968
Phwin: Kevin Warfel p.c.
Sucite: Garber 1987
Tampulma: Bergman, Gray & Gray 1969
Vagla: Crouch and Smiles 1966

Igboid
Igbo: Connell 1994, Ladefoged, Williamson, Elugbe, & Uwalaka 1976

Ijoid
Ijo: Williamson 1969

Kru
Krahn: Marchese 1989
Tepo: Marchese 1989

Kwa
Akan: Dolphyne & Dakubu 1988
Baule: Dolphyne & Dakubu 1988
Ewe: Ansre 1963, Ladefoged & Maddieson 1996
Gã: Ryder 1987
Gonja: Painter 1970
Nawuri: Casali 1995
Nkonya: Lear & Peacock ms
Anyi: Dolphyne & Dakubu 1988
Chakosi/Anufɔ: Stanford & Stanford 1970, Dolphyne & Dakubu 1988, Adjekum, Holman & Holman 1993
Gıdıɾɛ (Adele): Kleiner 1989
Guang languages: Snider 1990
Nchimburu: Price 1975
Nzema: Westermann & Bryan 1952, Chinebuah 1963, Dolphyne & Dakubu 1988

Mande
Bambara, southern: Welmers 1973
Kpelle: Welmers 1962, 1973
Maninka: Welmers 1973
Dan: Bearth & Zemp 1967
Loma/Lorma: Long 1971

Nupoid
Gwari: Rosendall 1992, Hyman & Magaji 1970
Nupe: Banfield 1914, Smith 1967

Platoid
Eggon: Ladefoged & Maddieson 1996
Mada: Price 1989

NILO-SAHARAN
Central Sudanic
Avokaya: Callinan 1981
Bongo: Kilpatrick 1985
Lulubo: Andersen 1987
Mödö: Persson 1981
Baka: Parker 1985
Lendu: Demolin 1995, Dimmendaal 1986
Madi: Andersen 1986
Ngiti: Kutsch Lojenga 1994

Eastern Sudanic
Kukú: Cohen 1997

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ATR VOWEL HARMONY IN AKPOSSO*

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This paper presents a description of the vowel harmony system of Akposso (Uwi), a Kwa language of Ghana and Togo, one of only a handful of Kwa languages with a complete ten vowel system with ATR harmony. However, the tenth vowel, /ə/, does not function as the harmonic counterpart of the low [-ATR] central vowel /a/ in affixes as it does in other ten vowel languages with cross-height vowel harmony systems. Rather, in some instances /a/ alternates with /e/ in [+ATR] contexts, while in other instances it surfaces invariably as /a/ in both [-ATR] and [+ATR] contexts. Formant measurements show the [+ATR] central vowel occupying the mid area of acoustic space, thus adding some support to the view that [+ATR] central vowels in ATR harmony systems are phonetically non-low rather than low, the more widely-assumed position. Although vowel harmony applies to a significant number of affixes, especially in the verb morphology, there are interesting limitations on how far harmony extends.

1. Introduction

Akposso is a Kwa language spoken by about 100,000 people living in the Wawa and Amou Prefectures in the Plateau Region of Togo. Approximately 5,000 Akposso speakers also reside in the Volta Region of Ghana. The language is classified in the Left Bank subgroup of Kwa [Stewart 1989]. According to Stewart, Akposso is most clearly related to Ahlo (Igo), spoken in Togo, and Bowili (Tuwili), spoken in Ghana. The Uwi dialect of Akposso described in this paper is spoken on the Akposso Plateau. Previous studies of the language include Afola-Amey [1995], Dozeman [1995a,b], Eklo [1987], Ring & Numuley [n.d.], Rongier [1989], and Wolf [1909].

The purpose of this paper is to describe the vowel harmony system of Akposso. Akposso vowel harmony is of the cross-height type [Stewart 1971] based on the feature Advanced Tongue Root (ATR). The harmony system has several points of

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interest. Unlike most Kwa languages with a five-height cross-height vowel harmony system, Akposso has ten contrastive vowels and not nine. However, the tenth vowel, /ə/, does not regularly function as the harmonic counterpart of /a/ in affixes as it does in other ten vowel systems. There are also many instances of affix harmonization that show limitations on the extent of vowel harmony.

This study is based on a period of field work lasting roughly six years, from May 1992 until present.

2. The Akposso vowel system

2.1 Oral vowel inventory. Akposso has ten phonemic oral vowels, shown in (1).[1] Examples illustrating these vowels in different contexts are given in the Appendix.

(1)

	front		central		back
			ATR		
	−		+		−
high:	ɪ	i		u	ʊ
mid:	ɛ	e	ə	o	ɔ
low:			a		

Ten vowel cross-height vowel harmony systems are relatively rare in Kwa languages in comparison to nine vowel systems. An unpublished database by Casali [1998] containing data on vowel systems in 42 Kwa languages lists only three, Abbey, Abron, and Anyi (Sanvi dialect), as being possible instances of ten vowel systems. In contrast, 24 Kwa languages are listed as definite or possible instances of nine vowel systems, and 17 as definite or possible instances of seven vowel systems.

Several Kwa languages that originally had been analyzed as seven vowel systems have been shown in more recent studies to actually have complete nine vowel systems with vowel harmony, adding to the number of Kwa languages with cross-height vowel harmony systems [Casali 1997]. Languages in which nine-vowel systems have been discovered more recently include Avatime [Schuh 1995], Gonja [Casali 1997, citing Painter 1970 and Snider 1989a,b,c, 1990], and Nkonya [Casali 1997, citing Reinecke 1972, Peacock & Lear 1997, and Snider 1989a,b,c, 1990].

Akposso also was originally analyzed as having seven vowels. A very early description of Akposso, Wolf [1909], claims the following vowels as phonemic: /i, e, ɛ, a, ɔ, o, u/. In his work, Wolf consistently transcribes [ɪ, ʊ, ə] as [i, u, a], respectively. In my initial study of Akposso, I was also tempted to transcribe [ɪ] as [i] because of their acoustic similarity. In the case of [ʊ], however, I initially found

[1] Vowel length and nasalization are not contrastive in Akposso.

it more similar to [o] than [u] until the Akposso speaker with whom I was working alerted me to the fact that this sound is neither [o] nor [u] and needed to be transcribed with a different symbol. As far as [ə] and [a] are concerned, I personally do not find them particularly similar. It is possible that Wolf missed this difference because of the relatively restricted distribution of [ə]. However, it is clear from the presentation of the data in the Appendix that /a/ and /ə/ are contrastive phonemes in Akposso, making for a ten vowel system with vowel harmony.

While it is in true contrast with [-ATR] /a/, the central [+ATR] vowel /ə/ has a limited distribution and is completely missing in word-initial position in Akposso. Moreover, as we shall see, /ə/ does not fully participate in the vowel harmony system of Akposso as one would anticipate.

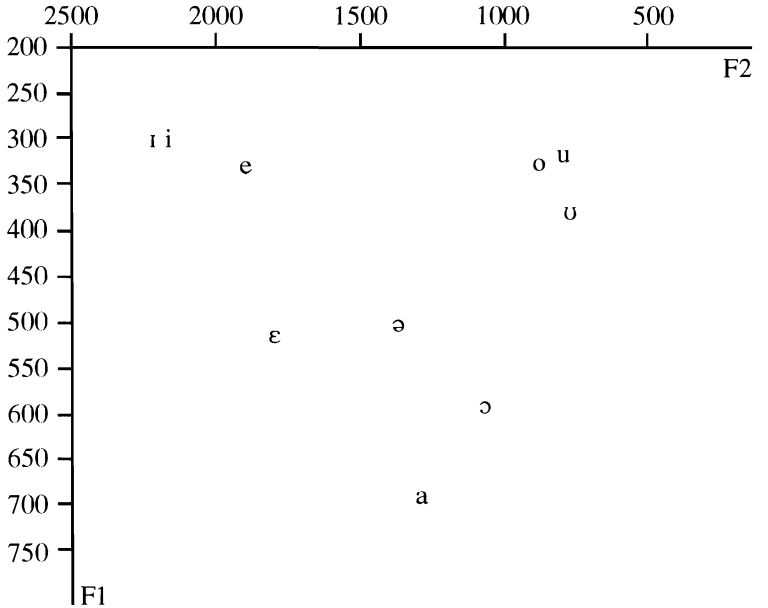
2.2 Vowel formant frequency measurements. Presented below in (2) are average values of first and second formant frequency measurements for each vowel in Akposso. Five words for each vowel in word final position were used to measure and calculate the formant averages. The words used, along with the formant values measured for each vowel, may be found in the Appendix.[2] These values are plotted in (3).

(2) Vowel formant measurements

Vowel ATR		Average F1	Average F2
+	−		
i		302	2140
	ɪ	302	2200
e		336	1902
	ɛ	516	1826
ə		504	1390
	a	696	1352
o		330	906
	ɔ	594	1060
u		320	822
	ʊ	380	810

[2] Measurements were made using the spectogram-with-formants and spectrum displays of the SIL WinCECIL (version 2.2) speech analysis software. Each measurement was made, where possible, at a steady state portion at or near the center of the vowel. All utterances were taken from the tape-recorded speech of an adult male speaker of the Uwi dialect.

(3) Plot of formant measurements – F2 vs. F1



There are several points of interest to be noted. First of all, there appears to be a disproportional use of acoustic space in the Akposso vowel system. There is a fairly large gap between the formant values of the [-ATR] mid vowels /ɛ/ and /ɔ/ and the higher front and back vowels, which are spaced together much more closely.

Secondly, the perceptual similarity of /i/ and /ɪ/ appears to be born out in the formant measurements of these two vowels; the averages of the F1 measurements are the same. However, the high back vowels /u/ and /ʊ/ do not have similar formant measurements. Rather, [-ATR] /ʊ/ occupies an acoustic space somewhat lower than /o/. This would account for the perceptual similarity of these two vowels that I pointed out earlier.

Thirdly, the [+ATR] central vowel in (Uwi) Akposso is situated in the mid area of the acoustic space. Its formant measurements put it in a region somewhat higher than /ɛ/ and /ɔ/ yet lower than /e/ and /o/.

2.3 Tone. While it is beyond the scope of this paper to fully describe the tonal system of Akposso, it will be helpful to understand some basic elements of Akposso tone before proceeding into the description of the vowel harmony system.[3] Akposso has three contrastive tones, high, mid, and low. From a database of 175 monosyllabic verbs, 106 verbs form minimal pairs which include seven minimal

[3] I have included phonetic tone data in most of my examples in this paper. In some cases, for the purposes of clarity, I have presented only phonemic tone.

triplets. For example, /vé/ 'to sharpen', /vɛ/ 'to be ripe', /vè/ 'to jump' and /ló/ 'to carry', /lʊ/ 'to hang', /lʊ̀/ 'to weave'.

Nouns also have a three way contrast between high, mid, and low. After H, however, there is a fourth level tone, a lower mid-tone. There is also a high-to-low falling tone and a high-to-mid falling tone after H. The table in (4) shows some minimal tone contrasts between these various tones after H. The lower mid-tone is represented by HM2 and the falling tones as H-M (high-to-mid fall) and H-L (high-to-low fall) in the example which follows.

The diacritics that are being used to indicate tone are as follows: ´ signifies high tone, ` low tone. ˇ low-rising, ¯ lower mid tone, ˆ high falling. The absence of a diacritic mark signifies mid tone. I am using a convention of double vowels to mark high-to-mid or mid-to-high tone glides. Note that the doubled vowel does not imply vowel length. For example, the word for 'throat' in (4) above is represented as [ɔ́mɔ́ɔ] but 'field mouse' is [ɔ́mɔ̂].

It is worthwhile mentioning that there is some grammatical tone in the verb system and also a certain amount of tone sandhi or tonal alternations applying across morpheme boundaries in Akposso. These are the subject of a work in progress.

(4) Minimal Tone Pairs

HH	HM	HM2	HL	HH-M	HH-L
útí 'pestle'	*úti* 'sorcerer'	*útī* 'fable'			
úlí 'granary'	*úli* 'outdoors'	*úlī* 'type of tree'			
úlú 'kinship'	*úlu* 'wind'		*úlù* 'spirit'		
	íto 'circumcision'		*ítò* 'body part'	*ítóo* 'mountain'	
	ɔ́tʃɔ 'mahogany'				*ɔ́tʃɔ̂* 'grasshopper'
	ɔ́gba 'dye'				*ɔ́gbâ* 'lizard'
				ɔ́mɔ́ɔ 'throat'	*ɔ́mɔ̂* 'field mouse'

3. ATR vowel harmony

3.1 Vowel harmony sets. As suggested in §2, the vowels in Akposso can be divided into two non-overlapping sets, [+ATR] vowels and [-ATR] vowels, as in (5). The vowels in a root morpheme will generally be drawn from either the [+ATR] set or the [-ATR] set, as seen in the examples in (6).

(5) ATR vowel sets

[+ATR]		[-ATR]	
i	u	ɪ	ʊ
e	o	ɛ	ɔ
ə		a	

(6)

/ísí/	[ísí]	'yam'
/ófɪ/	[ófɪ]	'marriage'
/ɪnē/	[ínē]	'animal trail'
/úgbe/	[úgbe]	'grasslands'
/ɔvè/	[ɔvê]	'sun'
/ɪɣà/	[ɪɣà]	'pig'
/ɔtá/	[ɔtá]	'rabbit'
/ónā/	[ónā]	'type of trap'
/únə̀/	[únə̀]	'type of fruit'
/útə́/	[útə́]	'saliva'
/éklə́/	[éklə́]	'taboo'
/ókɔ́/	[ókɔ́]	'twin'
/ɪkó/	[íkó]	'box'
/ɛ́kú/	[ɛ́kú]	'thing'
/ɪvú/	[ívú]	'raffia sack'

With only rare exceptions, such as in loan words, a root morpheme will not contain both [+ATR] and [-ATR] vowels. This type of vowel harmony occurs in many other West African languages, including Chumburung (Kwa; Snider [1985, 1989d]), Dilo (Gur; Jones [1987]), Ega (Kwa; Bole-Richard [1981]), Foodo (Kwa; Plunkett [1991]), Kɔnni (Gur; Cahill [1996]), Kasim (Gur; Bonvini [1974]), Kpokolo (Kru; Kaye, Lowenstamm & Vergnaud [1985]), Nawuri (Kwa; Casali [1988, 1995]), Tem (Gur; Tchagbale [1976]), Vata (Kru; Kaye [1982], Kiparsky [1985]).

3.2 Relative frequency of harmony sets. An examination of the vowels in a sample of 679 unique words (verbs and nouns) containing 769 vowels from my

lexical database yielded the number of tokens and percentages (in order of descending frequency) for each of the vowels as listed in (7).

(7)

vowel	number of tokens:	percentage of total:
/a/	135	18%
/ɔ/	118	15%
/ʊ/	81	10%
/ɛ/	80	10%
/i/	73	9%
/ɪ/	70	9%
/e/	68	9%
/u/	62	8%
/o/	47	6%
/ə/	35	5%

Note that there is a fairly even distribution of the high vowels and mid front vowels between the [+ATR] and [-ATR] harmony sets in Akposso. There is however a disproportionately high number of [-ATR] vowels among the mid back (15% [-ATR], vs. only 6% [+ATR]) and central (18% [-ATR], vs. only 5% [+ATR]) vowels. This causes an overall ratio of 2 to 1 [-ATR] to [+ATR] vowels. This is still a more balanced overall ratio than has been reported for some other languages however.[4]

3.3 The unusual status of /ə/. I have mentioned above that /ə/ is limited in its distribution; it never occurs word initially where all other vowels of both sets occur. It would also appear that /ə/, while contrasting with /a/ in roots, does not function as its harmonic counterpart as one would expect it to in harmonizing affixes. In these cases we see /a/ alternating instead with /e/. We will encounter many examples of this later. However, a few examples below, involving the incompletive aspect morpheme /ká/ ~ /ké/, will serve as an illustration.[5]

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[4] Cahill [1996] reports an 80% [-ATR] to 20% [+ATR] ratio for Kɔnni (Gur) verbs and nouns. Snider [1984] reports about a four to one ratio of [-ATR] to [+ATR] for words in Chumburung (Kwa). Jones' [1987] Swadesh 100 word list for Dilo shows only 30 words with one or more [+ATR] vowels, as opposed to 71 with exclusively [-ATR] vowels.

[5] The following abbreviations are used throughout the paper.

ART	article	INCMP	incompletive	P or PL	plural
CMP	completive	INDF	indefinite	POSS	possessive
DEF	definite	NOM	nominative	S	singular
DIM	diminutive	QUAL	qualitative	SUBJ	subjunctive

(8)

/á-ká-tɛ́/ 3P-INCMP-build.a.nest	[ákátɛ́]	'they are building a nest'
/á-ká-dá/ 3P–INCMP–vomit	[ákádá]	'they are vomiting'
/á-ká-kpɔ/ 3P–INCMP–hit	[ákákpɔ]	'they are hitting'
/á-ké-ɲı/ 3P–INCMP–close	[ákéɲi]	'they are closing'
/á-ké-ɣlé/ 3P–INCMP–take.the.roof.off	[ákéɣlé]	'they are taking the roof off'
/á-ké-gbə́/ 3P-INCMP-borrow	[ákégbə́]	'they are borrowing'

As one would expect, /e/ also functions as the [+ATR] counterpart of /ɛ/. This is illustrated with examples of the second person singular subject pronoun /e/ ~ /ɛ/ below. Again, we will see further examples later.

(9)

/ɛ-ká-tɛ́/ 3P-INCMP-build.a.nest	[ɛkátɛ́]	'you are building a nest'
/ɛ-ká-dá/ 2S–INCMP–vomit	[ɛkádá]	'you are vomiting'
/ɛ-ká-kpɔ/ 2S–INCMP–hit	[ɛkákpɔ]	'you are hitting'
/e-ké-ɲı/ 2S–INCMP–close	[ekéɲi]	'you are closing'
/e-ké-ɣlé/ 2S–INCMP–take.the.roof.off	[ekéɣlé]	'you are taking the roof off'
/e-ké-gbə́/ 3P-INCMP-borrow	[ekégbə́]	'you are borrowing'

The vowel /e/ is therefore functioning as the [+ATR] counterpart of both /ɛ/ and /a/ in Akposso. This "double-duty" of the vowel /e/ is something that has been noted in some languages with nine vowel cross-height harmony systems such as Avatime [Schuh 1995], Ega [Bole-Richard 1981], Igbira [Scholz 1976] and some varieties of Fante [Welmers 1973, Stewart 1971, Dolphyne 1988]. In ten vowel languages, on the other hand, one would expect /ə/ to serve as the harmonic counterpart of /a/. Examples of such languages are Kasem (Gur; Awedoba [1992]) and Deg (Gur; Crouch [pers. cor.]). To my knowledge, this is the first reported case of a ten vowel language where the contrastive counterpart of /a/ (viz. /ə/) is not also its harmonic counterpart in harmonizing affixes.

Further indication of the unusual status of /ə/ comes from a look at one of the other variants of Akposso, the Tomegbe variant of the Litime dialect. Eklo [1987] and Afola-Amey [1995] have both accurately described the Tomegbe variant of Akposso as a nine vowel system with ATR vowel harmony. Afola-Amey, whose work is a synchronic study of the five or six recognized dialects of Akposso,[6] claims that the phoneme /ə/ of the Uwi dialect does not exist in this Litime variant and shows in her data that where Uwi has /ə/ in the root of a word, Litime has /a/. For example, /é-gbə́/ 'he borrowed' in Uwi is /é-gbá/ in Litime. What is particularly provocative in this case is that the Litime example violates the normal rule of vowel harmony that affixes agree with the word root in their value of ATR; with a [-ATR] root such as /gbá/ one expects to see the [-ATR] form /a/of the third person pronoun rather than the [+ATR] form /e/ (cf. /á-bà/ 'he came,' /áŋɔ̀ɔ̀/ 'he cried'). I assume that the above example /é-gbá/ historically had /ə/ as the root vowel and that this accounts for the occurrence of the [+ATR] form of the third person pronoun.

3.4 Harmonizing affixes. Like other West African languages with ATR harmony, Akposso has affixes that agree with the word root in their value of ATR. There are few, if any, true suffixes in the language, most of the affixing showing up as preverbal aspectual affixes in verb morphology. In general, these prefixes harmonize in terms of ATR with the verb root, but as we shall see below, there are limits as to how far vowel harmony may extend.

We will turn first to vowel harmony in the nominal system before proceeding to verb morphology.

3.4.1 Vowel harmony and nouns. Vowel harmony is active in two areas of noun morphology. It occurs in the vestigial evidence of a previous prefixing noun class system, and also with the definite article clitic. Let us consider first the definite article.

3.4.1.1 The definite article clitic /-ɛ́/ ~ /-é/. The definite article, /-ɛ́/ ~ /-é/, is final in the noun phrase and harmonizes with the preceding root morpheme in normal and fast speech. This harmonizing clitic is an allomorph of the definite article /jɛ́/ which occurs in careful or emphasized speech.[7]

Examples showing harmonization of /-ɛ́/ ~ /-é/ following a head noun are given in (10). Note that, along with the harmonization of the clitic with the ATR value of

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[6] Afola-Amey has supported the argument that Akposso can be split into two main dialects of which Uwi and Litime each characterize the main differences between the two dialect groupings. Anderson, Dozeman, Hatfield and Kluge [1992], a sociolinguistic survey conducted among the Akposso between May and September of that year, shows a 79-81% intelligibility between the two major dialects based on a 122 word list drawn from *Les listes lexicales kwa* [1983].

[7] Although I have chosen to interpret the definite article clitic as an allomorph of /jɛ́/, I recognize that a phonological process deleting /j/ is also possible. I have not, however, found phonological evidence for such a process being active in other areas of the language. I leave the question open for further investigation.

the noun root, the final vowel of the root also undergoes changes, in that round and high-front vowels glide while non-high, non-round vowels elide.[8]

In the examples in (11), the definite article is cliticized to an adjective which follows the head noun rather than to the head noun itself. Note that the same elision (or glide formation) and vowel harmony processes occur in this case as well.

(10)	/ɔ́sɪ-é/	[ɔ́sʲɛ́]	'the woman'
	/ɲ̌ɪvlɔ́ɔ-é/	[ɪ́vlʷɛ̌]	'the bird'
	/ɲ̌ɪvú-é/	[ɪ́vʷé]	'the raffia sack'
	/édɲ̌ɪ-é/	[édʲé]	'the palm nut'
	/ègà-é/	[ègɛ̌]	'the money'
	/ɲ̌ɪnē-é/	[ɪ́nēé]	'the animal trail'
(11)	/ɲ̌ɪvlɔ́ɔ kìkà-é/	[ɪ́vlɔ́ɔ kìkɛ̀ɛ̄]	'the big bird'
	/ɲ̌ɪvlɔ́ɔ fʷe-é/	[ɪ́vlɔ́ɔ fweé]	'the white bird'
	/úɲ̌ɪ gbɔ́-é/	[úɲ̌ɪ gbʷɛ́]	'the broken granary'

The free form of the definite article /jé/, however, does not harmonize, as we can see in the data in (12). Here the article surfaces invariantly as [jɛ], whether following a [-ATR] root such as in (12a), or a [+ATR] root as in (12d).

(12)	a. /ɔ́sɪ jé/	[ɔ́sɪjé]	'the woman'
	b. /ɲ̌ɪvlɔ́ɔ jé/	[ɪ́vlɔ́ɔjé]	'the bird'
	c. /ɲ̌ɪvú jé/	[ɪ́vújé]	'the raffia sack'
	d. /édɲ̌ɪ jé/	[édɲ̌ɪjé]	'the palm nut'
	e. /ègà jé/	[ègàjɛ̌]	'the money'
	f. /ɲ̌ɪnē jé/	[ɪ́nējé]	'the animal trail'
	g. /ɲ̌ɪvlɔ́ɔ kìkà jé/	[ɪ́vlɔ́ɔkìkàjɛ̌]	'the big bird'
	h. /ɲ̌ɪvlɔ́ɔ fwe jé/	[ɪ́vlɔ́ɔfwejé]	'the white bird'
	i. /úɲ̌ɪ gbɔ́ jé/	[úɲ̌ɪgbɔ́jé]	'the broken granary'

3.4.1.2 Vestigial nominal class system. Most simple nouns in Akposso have the syllable shape V.C(C)V. C(C)VC(C)V also exists, but with less frequency. For the most part, the initial vowel of the noun of the V.CV type is not functioning as a noun class prefix in the usual understanding of noun classes, in that it does not have any clearly identifiable meaning or grammatical function associated with it. The initial vowel is not marking number since the vowels of the singular and plural forms are identical. Plurality is indicated instead by the particle /wánɪ/.

[8] For further description on the process of elision and glide formation in Akposso, see Dozeman [1995a].

(13)

/ívlɔ́ɔ/	'bird'	/ívlɔ́ɔ wánı/	'birds'
/ɔ́zazɔ̀/	'sheep'	/ɔ́zazɔ̀ wánı/	'sheep'
/ívú/	'raffia sack'	/ívú wánı/	'raffia sacks'
/éɗı/	'palm nut'	/éɗı wánı/	'palm nuts'

However, in a few cases, the initial vowel of the V.CV pattern points clearly to a marginal noun class system in Akposso. Two very limited classes consisting largely of human beings and animals have been found. In the first of these classes a singular prefix /ʊ/ ~ /u/ corresponds with /a/ ~ /e/ in the plural. Thus [+ATR] roots have /u/ in the singular and /e/ in the plural while [-ATR] roots have /ʊ/ in the singular and /a/ in the plural. This can be seen in the examples in (14).

(14)

Singular prefix /u/ ~ /ʊ/		Plural prefix /e/ ~ /a/	
/ú-mlóo/	'child'	/é-mlóo/	'children'
/ú-kpî/	'dog'	/é-kpî/	'dogs'
/ú-luví/	'male'	/é-luví/	'males'
/ú-vle/	'boar'	/é-vle/	'boars'
/ù-gbâ/	'gorilla'	/à-gbâ/	'gorillas'
/ʊ-kpa/	'person of a same age group'	/a-kpa/	'people of a same age group'

As I have said above, the [+ATR] central vowel is limited in its distribution to the roots of words; thus it is not surprising that /ə/ does not function in the right hand column as the [+ATR] form of the plural prefix corresponding to [-ATR] /a/. We will see more examples of this kind of alternation in Akposso in the verb morphology section below.

In the second noun class, limited to human beings, singular /o/ ~ /ɔ/ corresponds to plural /a/. Note that in this class of nouns, in contrast with the class above, plural /a/ does not alternate harmonically, but shows up as a [-ATR] low with roots of both ATR sets.

(15)

Singular prefix /o/ ~ /ɔ/		Plural prefix /a/	
/ó-levì/	'young man'	/á-levì/	'young men'
/ó-sjetʃū/	'young woman'	/á-sjetʃū/	'young women'
/ɔ́-lʊ/	'person'	/á-lʊ/	'people'
/ɔ́-sı/	'woman'	/á-sı/	'women'

3.4.2 Vowel harmony and verb morphology. As stated previously, Akposso has preverbal aspectual affixes which harmonize for ATR with the verb root. Akposso verb morphology employs the following morphemes: a subject pronoun marker, a morpheme marking negation, various aspect morphemes, and the verb root, as schematized in (16).

(16) Verb = Subj Prn + (Negation) + Aspect + Verb Root

There are some limitations to the extent of harmony within the morphological word, but we will first turn to the various aspects and morphemes which clearly harmonize before addressing these limitations. It is worth noting that aspect in Akposso is marked with a combination of segments and tone. However, some aspects, such as the inceptive /ja/ ~ /je/, are unmarked for tone in their underlying forms. Let us begin with the incompletive.

3.4.2.1 Incompletive. The incompletive aspect in Akposso is formed with the morpheme /ká/ ~ /ké/, which agrees in its ATR value with the verb root.

(17) With [-ATR] roots:

/á-ká-dá/	[ákádá]	'they are vomiting'
/á-ká-kpɔ/	[ákákpɔ]	'they are hitting'
/á-ká-tɛ́/	[ákátɛ́]	'they are building a nest'
/á-ká-lɔ́/	[ákálɔ́]	'they are carrying'
/á-ká-tʃɪ́/	[ákátʃɪ́]	'they are cutting'

With [+ATR] roots:

/á-ké-ɲɪ/	[ákéɲɪ]	'they are closing'
/á-ké-ɣlé/	[ákéɣlé]	'they are taking the roof off'
/á-ké-gbə́/	[ákégbə́]	'they are borrowing'
/á-ké-bó/	[ákébó]	'they are uprooting'
/á-ké-kù/	[ákékû]	'they are driving'

Notice here again that the [+ATR] counterpart of /a/ is not /ə/ but rather /e/. Also noteworthy is the fact that the third person plural subject pronoun /a/ does not harmonize. This is true for this pronoun in all other contexts as well. As we will see below, the other subject pronouns do harmonize in certain contexts.

3.4.2.2 Inceptive. The inceptive is formed with the morpheme /ja/ ~ /je/ (with no tone specified in its underlying form). It harmonizes in much the same way as the incompletive; /ja/ occurs before [-ATR] roots, while /je/ occurs with [+ATR] roots.

(18) With [-ATR] roots:

/á-já-tʃí/	[ájátʃí]	'they are beginning to cut'
/á-já-tɛ́/	[ájátɛ́]	'they are beginning to build a nest'
/á-já-dá/	[ájádá]	'they are beginning to vomit'
/á-já-ló/	[ájáló]	'they are beginning to carry'
/á-já-kpɔ/	[ájákpɔ]	'they are beginning to hit'

With [+ATR] roots:

/á-jé-mli/	[ájémli]	'they are getting up'
/á-jé-ɣlé/	[ájéɣlé]	'they are beginning to take the roof off'
/á-jé-gbə́/	[ájégbə́]	'they are beginning to borrow'
/á-jé-bó/	[ájébó]	'they are beginning to uproot'
/á-jé-kù/	[ájékû]	'they are beginning to drive'

3.4.2.3 Negation. Harmony also affects the negative morpheme /nà/ ~ /nè/ when it directly precedes the verb root, as in (19).

(19) With [-ATR] roots:

/á-nà-tʃí/	[ánâtʃī]	'they did not cut'
/á-nà-tɛ́/	[ánâtɛ̄]	'they did not build a nest'
/á-nà-dá/	[ánâdā]	'they did not vomit'
/á-nà-kpɔ/	[ánâkpɔ̄]	'they did not hit'
/á-nà-ló/	[ánâlō]	'they did not carry'

With [+ATR] roots:

/á-nè-ɲi/	[ánêɲi]	'they did not close'
/á-nè-ɣlé/	[ánêɣlē]	'they did not take the roof off'
/á-nè-gbə́/	[ánêgbə̄]	'they did not borrow'
/á-nè-bó/	[ánêbō]	'they did not uproot'
/á-nè-kù/	[ánêkù]	'they did not drive'

3.4.2.4 Completive. The completive aspect is formed with the morpheme /a/ ~ /e/, as illustrated by the examples in (20).[9]

[9] High tone appears to be a part of marking the completive aspect, showing up on high and low tone verbs. Mid tone, however, seems to be resistant to tone perturbation.

(20) With [-ATR] roots:[10]

/mɪ-a-tʃɪ́/	[mʲatʃɪ́]	'you (pl) cut'
/mɪ-a-té/	[mʲaté]	'you (pl) built a nest'
/mɪ-a-dá/	[mʲadá]	'you (pl) vomited'
/mɪ-a-lɔ́/	[mʲalɔ́]	'you (pl) carried'
/mɪ-a-kpɔ/	[mʲakpɔ]	'you (pl) hit'

With [+ATR] roots:

/mi-e-mli/	[mʲemli]	'you (pl) got up'
/mi-e-ɣlé/	[mʲeɣlé]	'you (pl) took off the roof'
/mi-e-gbɔ́/	[mʲegbɔ́]	'you (pl) borrowed'
/mi-e-bó/	[mʲebó]	'you (pl) uprooted'
/mi-e-kù/	[mʲekú]	'you (pl) drove'

3.4.2.5 Imminent future. The imminent future is formed with the morpheme /à/ ~ /è/, as in (21).

(21) With [-ATR] roots:

/mɪ-à-tʃɪ́/	[mʲàtʃɪ́]	'you (pl) will cut'
/mɪ-à-té/	[mʲàté]	'you (pl) will build a nest'
/mɪ-à-dá/	[mʲàdá]	'you (pl) will vomit'
/mɪ-à-lɔ́/	[mʲàlɔ́]	'you (pl) will carry'
/mɪ-à-kpɔ/	[mʲăkpɔ]	'you (pl) will hit'

With [+ATR] roots:

/mi-è-mli/	[mʲĕmli]	'you (pl) will get up'
/mi-è-ɣlé/	[mʲèɣlé]	'you (pl) will take the roof off'
/mi-è-gbɔ́/	[mʲègbɔ́]	'you (pl) will borrow'
/mi-è-bó/	[mʲèbó]	'you (pl) will uproot'
/mi-è-kù/	[mʲèkú]	'you (pl) will drive'

3.4.2.6 Predictive. The predictive is formed in much the same way as the imminent future but with the addition of the auxiliary verb /bá/ ~ /bé/ 'to come'. Note

[10] Although I have transcribed [mɪ-] ~ [mi-] as [mʲ] phonetically in this example, they remain distinct at slower rates of speech, [mᵻ] ~ [mⁱ]. When these pronouns precede consonant-initial morphemes, the vowels remain fully syllabic, for example /mɪ-ká-kpɔ/ 'you (pl.) are hitting', /mi-ké-kù/ 'you (pl.) are driving'.

(22) With [-ATR] roots:

/mɪ-à-bá-tʃí/	[mʲàbátʃí]	'you (pl) will cut (one day)'
/mɪ-à-bá-tɛ́/	[mʲàbátɛ́]	'you (pl) will build a nest (one day)'
/mɪ-à-bá-dá/	[mʲàbádá]	'you (pl) will vomit (one day)'
/mɪ-à-bá-lɔ́/	[mʲàbálɔ́]	'you (pl) will carry (one day)'
/mɪ-à-bá-kpɔ/	[mʲàbákpɔ]	'you (pl) will hit (one day)'

With [+ATR] roots:

/mɪ-à-bé-mli/	[mʲàbémli]	'you (pl) will get up (one day)'
/mɪ-à-bé-ɣlé/	[mʲàbéɣlé]	'you (pl) will take the roof off (one day)'
/mɪ-à-bé-gbə́/	[mʲàbégbə́]	'you (pl) will borrow (one day)'
/mɪ-à-bé-bó/	[mʲàbébó]	'you (pl) will uproot (one day)'
/mɪ-à-bé-kù/	[mʲàbékú]	'you (pl) will drive (one day)'

here that although the /à/ prefix in these examples is presumably the same morpheme that is used with the imminent future, it does not harmonize here for ATR (as it does in the imminent future), but retains an invariant [-ATR] form even before [+ATR] verbs. It is a general characteristic of Akposso that harmony will spread only one syllable to the left of the verb in the aspectual system. We will consider this in more detail later on.

3.4.2.7 Subject pronouns. As mentioned above, subject pronouns, apart from the third person plural, can undergo harmony in certain contexts. Subject pronouns generally do not occur directly before the verb root; an aspect marker or other morpheme always intervenes. These subject pronouns do, however, harmonize with some of the aspect markers we have seen so far: the incompletive, inceptive, and negation markers. In (23)-(25), I illustrate a verb of each ATR set with a complete pronoun paradigm for these three aspects.

(23) With Incompletive

a.	/nɪ-ká-kpɔ/	[nɪkákpɔ]	'I am hitting'
	/ɛ-ká-kpɔ/	[ɛkákpɔ]	'you are hitting'
	/ɔ́-ká-kpɔ/	[ɔ́kákpɔ]	'he is hitting'
	/wʊ-ká-kpɔ/	[wʊkákpɔ]	'we are hitting'
	/mɪ-ká-kpɔ/	[mɪkákpɔ]	'you (pl) are hitting'
	/á-ká-kpɔ/	[ákákpɔ]	'they are hitting'

b.	/ni-ké-kù/	[nikékû]	'I am driving'
	/e-ké-kù/	[ekékû]	'you are driving'
	/ó-ké-kù/	[ókékû]	'he is driving'
	/wu-ké-kù/	[wukékû]	'we are driving'
	/mi-ké-kù/	[mikékû]	'you (pl) are driving'
	/á-ké-kù/	[ákékû]	'they are driving'

(24) With Inceptive

a.	/nɪ-ja-kpɔ/	[nɪjakpɔ]	'I'm beginning to hit'
	/ɛ-ja-kpɔ/	[ɛjakpɔ]	'you are beginning to hit'
	/ɔ́-ja-kpɔ/	[ɔ́jákpɔ]	'he is beginning to hit'
	/wʊ-ja-kpɔ/	[wʊjakpɔ]	'we are beginning to hit'
	/mɪ-ja-kpɔ/	[mɪjakpɔ]	'you (pl) are beginning to hit'
	/á-ja-kpɔ/	[ájákpɔ]	'they are beginning to hit'
b.	/ni-je-kù/	[nijekù]	'I am beginning to drive'
	/e-je-kù/	[ejekù]	'you are beginning to drive'
	/ó-je-kù/	[ójékû]	'he is beginning to drive'
	/wu-je-kù/	[wujekù]	'we are beginning to drive'
	/mi-je-kù/	[mijekù]	'you (pl) are beginning to drive'
	/á-je-kù/	[ájékû]	'they are beginning to drive'

(25) With Negation

a.	/nɪ-nà-kpɔ/	[nɪnàkpɔ̄]	'I did not hit'
	/ɛ-nà-kpɔ/	[ɛnàkpɔ̄]	'you did not hit'
	/ɔ́-nà-kpɔ/	[ɔ́nâkpɔ̄]	'he did not hit'
	/wʊ-nà-kpɔ/	[wʊnàkpɔ̄]	'we did not hit'
	/mɪ-nà-kpɔ/	[mɪnàkpɔ̄]	'you (pl) did not hit'
	/á-nà-kpɔ/	[ánâkpɔ̄]	'they did not hit'
b.	/ni-nè-kù/	[ninèkù]	'I did not drive'
	/e-nè-kù/	[enèkù]	'you did not drive'
	/ó-nè-kù/	[ónêkù]	'he did not drive'
	/wu-nè-kù/	[wunèkù]	'we did not drive'
	/mi-nè-kù/	[minèkù]	'you (pl) did not drive'
	/á-nè-kù/	[ánêkù]	'they did not drive'

3.4.2.8 Subjunctive. As mentioned above, subject pronouns do not generally occur directly before the verb root. In the case of the subjunctive, however, we have a pronoun inventory which differs slightly from the normal subject pronouns. These subjunctive pronouns, which are formed (in every case but the first person singular) by prefixing the consonant /k-/ to the ordinary subject pronouns and adding high tone, do occur immediately before the verb root, as shown in (26).[11]

(26) /á-fú nʊ ní-kpɔ/ 'he wants me to hit'
3S.COMP–want COMP 1S.SUBJ–hit

/áfú nʊ ké-kpɔ/ 'he wants you to hit'
2S.SUBJ–hit

/áfú nʊ kɔ́-kpɔ/ 'he wants him to hit'
3S.SUBJ–hit

/áfú nʊ kʊ́-kpɔ/ 'he wants us to hit'
1P.SUBJ–hit

/áfú nʊ kí-kpɔ/ 'he wants you(pl) to hit'
2P.SUBJ–hit

/áfú nʊ ká-kpɔ/ 'he wants them to hit'
3P.SUBJ–hit

/áfú nʊ ní-dʒo/ 'he wants me to cook'
3S.COMP–want COMP 1S.SUBJ–cook

/áfú nʊ ké-dʒo/ 'he wants you to cook'
2S.SUBJ–cook

/áfú nʊ kó-dʒo/ 'he wants him to cook'
3S.SUBJ–cook

/áfú nʊ kú-dʒo/ 'he wants us to cook'
1P.SUBJ–cook

/áfú nʊ kí-dʒo/ 'he wants you (pl) to cook'
2P.SUBJ–cook

/áfú nʊ ká-dʒo/ 'he wants them to cook'
3P.SUBJ–cook

3.4.2.9 Imperative. The imperative also undergoes vowel harmony, both in its positive and negative forms. In the positive form, the second person singular is equivalent to the citation form of the verb root, therefore it will not be considered here. The second person plural is formed with /ɪ́/ ~ /ɪ/ and the first person plural with the same form as the subjunctive, /kʊ́/ ~ /kʊ/.

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[11] Segmentally, these pronouns consist, except in the case of the first person singular, of the vowel of the ordinary (non-subjunctive) subject pronoun preceded by the consonant /k/ (which replaces the consonant of the ordinary subject pronoun in the case of the first and second person plural forms). Although this generalization is surely no accident, we will regard these pronouns for purposes of this paper simply as portmanteau morphemes marking both person-number and subjunctive aspect. Tonally, these subjunctive pronouns are uniformly high.

(27)

/ɪ́-kpɔ/	[íkpɔ]	'you (pl) hit!'
/kú-kpɔ/	[kúkpɔ]	'let's hit'
/ɪ́-mli/	[ímli]	'you (pl) get up!'
/kú-mli/	[kúmli]	'let's get up'

Imperative negation is formed with the morpheme /fà/ ~ /fè/, which directly preceeds the verb root, and a particle /mɛ/, which follows the verb. Again, the same pronoun markers are employed ∅, /ɪ́/ ~ /ɪ́/, /kú/ ~ /kú/, for the second person singular, second person plural, and first person plural, respectively, as in (28).

(28)

/fà-kpɔ mɛ/	[fàkpɔ̄mɛ̄]	'don't hit!'
/ɪ́-fà-kpɔ mɛ/	[ífâkpɔ̄mɛ̄]	'you (pl) don't hit!'
/kú-fà-kpɔ mɛ/	[kúfâkpɔ̄mɛ̄]	'let's not hit'
/fè-mli mɛ/	[fèmlɪ̄mɛ̄]	'don't get up'
/ɪ́-fè-mli mɛ/	[ífêmlɪ̄mɛ̄]	'you (pl) don't get up'
/kú-fè-mli mɛ/	[kúfêmlɪ̄mɛ̄]	'let's not get up'

3.5 Extent of harmony. In the previous section, I presented an overview of harmonizing affixes in Akposso. As suggested above, there are some limitations to the extent of vowel harmony within verb morphology. This is also true for noun morphology. However, before we turn to this issue, let us first consider the extent of vowel harmony across word boundaries.

3.5.1 Word boundaries. As far as I have been able to ascertain, vowel harmony does not extend across word boundaries in Akposso. Rather, it appears that the spread of vowel harmony is restricted to the morphological word (and, as we shall see below, applies only to a limited extent within the morphological word). This may be due to a constraint in the language whereby the harmony of a morphological word is root controlled and the ATR quality of one root cannot interfere with the ATR quality of an adjacent root. Consider the examples in (29)-(34),

(29) Verb + Noun

/ɔ́-dó ɛ́dī ɲì/ 3S–be joy in	[ɔ́dʷɛ́dīɲì]	'he is joyful'
/ɔ́-dó ɛ́dɪ́nî/ 3S–be room	[ɔ́dʷɛ́dɪ́nî]	'he is inside the room'
/é-tʃɪ̂kə ivi/ 3S.COMP–become water	[étʃɪ̂kivi]	'it turned into water'
/é-tʃɪ̂kə ílɛ̄/ 3S.COMP–become cavity	[étʃɪ́kɪlɛ̄]	'it became a cavity'

(30) Verb + Adverb

/ɛ́mɛkɔ̀ jɛ́ ké-mli gùgùlùgù/ belly ART INCOMP–get.up swollen	[ɛ́mɛkʷɛ̌kémligùgùlùgù] 'the belly is swollen'
/á-blí ma gùgùlùgù/ 3S.COMP–squirt plant swollen	[áblímagùgùlùgù] 'it's pushed out and swollen'
/á-lɔ́ gbígbígbí/ 3S–black very.black	[álɔ́gbígbígbí] 'it's very black'
/é-tʃíkə klóklό/ 3S–turn rapidly	[étʃíkəklóklό] 'he's turning back and forth rapidly'

(31) Noun Phrase + Verb

/ɔ́tá é-ɥi ɔ́tɔ́ ĩ/ rabbit 3S.CMP–enter hole in	[ɔ́téɥʲɔtɔ́ĩ] 'the rabbit went into the hole'
/kofi á-ká ɔ́-ná íbɔ̄/ Koffi 3S.CMP–give 3S.POSS–mother calabash	[kofʲákɔ́níbɔ̄] 'Koffi gave his mother the calabash'
/ɔ́lúná sétu á-ká údé ɔtʃɔ̀/ work hard 3S–cause old.age quickly	[ɔ́lúnásétʷakúdɔ́ɔtʃɔ̀] 'hard work makes you grow old quickly'
/ɔ́lúná é-sétu/ work 3S–hard	[ɔ́lúnésétu] 'work is hard'
/úkpî á-tʃí ògló/ dog 3S.CMP–bite rat	[úkpʲàtʃóogloó] 'the dog bit the rat'

(32) Noun Phrase + Adverb

/ámâ nɔ̀ ɛ́tʊ gbígbí/ appearance like body black	[ámânɛ̄tʊgbígbí] 'he has a very black body'
/é-tʃíkə nɔ̀ émú jɛ̌ klɔ̀klɔ̀/ 3S–turn like eye ART back.and.forth	[étʃíkənèmʷéklóklɔ̀] 'he's turning his eyes like an owl'

(33) Indirect Object + Direct Object

/kofi á-ká ɔ́-ná íle/ Koffi 3S–give 3S.POSS–mother ladle	[kofʲákɔ́níle] 'Koffi gave his mother the ladle'
/kofi á-ká ó-nédʒə íbɔ̄/ Koffi 3S–give 3S.POSS–sister calabash	[kofʲákónédʒɪbɔ̄] 'Koffi gave his sister the calabash'

(34) Noun +Adjective

/ɔ́lúná sétu-ĕ/ work hard–ART	[ɔ́lúnásétʷĕ] 'the hard work'
/mutí vɛ á-bwé nɔ̀ ɔŋwɔ̀/ orange ripe 3S–good for drinking	[mutívábwénɔ́ŋwɔ̀] 'a ripe orange is good for drinking'

which show that ATR harmony does not spread between a verb and its object, between a verb and a following adverb, between a noun phrase and a following verb, between a noun phrase and a following adverb, between an indirect object and a following direct object, or between a noun and a following adjective. Note that the general process in Akposso that elides or glides the first of two adjacent vowels is operative in many of the examples below. The elision and glide formation process has no affect whatsoever on the ATR quality of the adjacent root.

3.5.2 Nominal contexts. Vowel harmony within the Akposso noun phrase, with the exception of the two cases presented above in section 3.4.1, does not appear to extend across morpheme boundaries. Within the inventory of definite and indefinite articles (singular and plural), for example, only the bound form of the definite article /–ɛ́/ ~ /–é/ undergoes harmony. The other articles, the definite article /jɛ́/ (which we saw earlier), as well as /dɪ/, /dɪnɪ/, the singular and plural forms of the indefinite article, and also /wá/, /nɪ/, /wánɪ/, the definite plural forms, do not.[12] We will look at examples of the indefinite articles and the plural.

(35)	/ísí dɪ/ yam INDF	[ísídɪ]	'a (certain) yam'
	/ísí dɪ-nɪ/ yam INDF–PL	[ísídɪnɪ]	'some (certain) yams'
	/ísí wá-nɪ/ yam DEF–PL	[ísíwánɪ]	'yams'
	/á-levì-nɪ/ PL–young men–PL	[álevìnī]	'young men'

True noun-noun (N–N) compounds in Akposso are relatively rare. We shall see a few examples of such compounds later. However, Akposso has a highly productive N–N construction. The first component of this construction consists of a noun whose form is identical to its citation form. The second component consists of a noun root minus its initial vowel and tone. Both components maintain their underlying ATR value. Consider the examples in (36) of the N–N construction.

[12] I have recognized various forms of pluralization in Akposso and understand that they are functioning differently on the discourse level. This is a study in process.

(36)

a.	/ɔ́kpɔ́/ + /ɲ̀nē/ deer trail	[ɔ́kpɔ́nē]	'deer trail'
b.	/úŋi/ + /ɲ̀nē/ elephant trail	[úŋinē]	'elephant trail'
c.	/ézô/ + /áwɛ́/ porridge pot	[ézôwɛ̄]	'pot with porridge residue in it'
d.	/úmólí/ + /áwɛ́/ rice pot	[úmóliwɛ]	'pot with rice residue in it'
e.	/úsé/ + /ɲ̀kó/ honey gourd	[úsékô]	'honey jar'
f.	/ɔ́lɔ́kū/ + /ɲ̀kó/ salt gourd	[ɔ́lɔ́kūkò]	'salt shaker'

(37)

a.	/ɔ́fí-kó/ drink-gourd	[ɔ́fíkó]	'palm wine container'
b.	/úlí-tʃúu/ granary-wood	[úlítʃúu]	'wood in a granary used as step'
c.	/ɔ́mlɔ́-nɪ/ hunt–NOM	[ɔ́mlɔ́nɪ]	'hunter'
d.	/ékpe-nɪ/ hike–NOM	[ékpenɪ]	'hiker'
e.	/ɲ̀vɪ-dʒa/ furrow–place	[ívɪdʒa]	'cemetery'
f.	/ékpe-dʒa/ hunt–place	[ékpedʒa]	'hunting grounds'
g.	/ɔ́ɣlɔ-vju/ chicken–DIM	[ɔ́ɣlɔvju]	'chick'
h.	/úkpî-vju/ dog–DIM	[úkpîvju]	'puppy'
i.	/ɔbɛ̀-tʃɔ/ river–DIM	[ɔbɛ̀tʃɔ]	'creek'
j.	/èvídʒe-tʃɔ/ child–DIM	[èvídʒetʃɔ]	'tiny child'
k.	/ɲ̀nâ-kà/ mother–QUAL	[ínâkà]	'grandmother'
l.	/úgbe-kà/ savanna–QUAL	[úgbekà]	'large grasslands'
m.	/ɛ́kú-jí/ thing–buy	[ɛ́kújí]	'merchandise (bought thing)'
n.	/ɛ́kú-jɛ̀/ thing–eat	[ɛ́kújɛ̀]	'food (edible things)'

Morphologically complex nouns, those formed through derivation, nominalization, and compounding, etc., also do not harmonize for ATR throughout the entire word, as this would extend across a morpheme boundary, as shown in (37).

3.5.3 Verb morphology. In section 3.4.2, we considered the various prefixing aspects and morphemes which harmonize with the verb root. Of the various aspects I have thus encountered in my study of Akposso, only one, the repetitive morpheme, /tʃi/, fails to harmonize with the verb root, as shown in (38). The same form of the morpheme occurs whether preceding [+ATR] or [-ATR] verb roots.

(38) /na-tʃi-bá / [natʃíbă] 'I've come again'
/na-tʃi-jè/ [natʃíjè] 'I've eaten again'

/na-tʃi-vu/ [natʃívu] 'I've bought again'
/na-tʃi-bó/ [natʃíbŏ] 'I've uprooted again'

As I have suggested elsewhere, there are limits to the extent of vowel harmony in prefixing aspects. It would appear that in the aspectual sequence, only the syllable directly preceding the verb root harmonizes. All other syllables in the aspectual sequence surface invariantly in their underlying [-ATR] form.

(39) a. /ɔ́m-á-bá-bá/ [ɔ́mábábá] 'he will come (someday)'
b. /ɔ́m-á-bé-mli/ [ɔ́mábémli] 'he will get up (someday)'
(not *[ómébémli])

c. /ɔ́-nà-má-bá/ [ɔ́nâmābá] 'he will not come'
d. /ɔ́-nà-mé-mli/ [ɔ́nâmēmlī] 'he will not get up'
(not *[ónêmēmlī])

e. /ɔ́-nà-dʒa-bá/ [ɔ́nâdʒābā] 'he has not come yet'
f. /ɔ́-nà-dʒe-mli/ [ɔ́nâdʒēmlī] 'he has not got up yet'
(not *[ónêdʒēmlī])

This becomes even more clear in the case of the disyllabic morpheme /kɔna/ (which marks the incompletive when it follows the negative marker) in which only the syllable immediately preceding the verb root harmonizes. While it is entirely possible that historically this was in fact two separate morphemes, synchronically it is functioning as a single morpheme.

(40) /nɪ-nà-kɔna-kpɔ/ 'I'm not hitting'
/nɪ-nà-kɔne-bó/ 'I'm not uprooting'
/nɪ-nà-kɔna-tʃi/ 'I'm not cutting'
/nɪ-nà-kɔne-kù/ 'I'm not driving'

[+ATR] harmony, however, will spread to a subject pronoun that directly precedes a [+ATR] aspect marker; in this case, a span of two syllables to the left of the verb root is affected. We have seen many examples of this in section 3.4. Consider the following examples by way of review.

(41)	/ni-nè-kù/	[ninèkù]	'I did not drive'
	/nɪ-nà-kpɔ/	[nɪnàkpɔ̄]	'I did not hit'
	/ni-je-kù/	[nijekù]	'I am beginning to drive'
	/nɪ-ja-kpɔ/	[nɪjakpɔ]	'I'm beginning to hit'

Note that, in examples (41) above, the negative morpheme /nà/ ~ /nè/ does harmonize with a verb root which it directly precedes, in contrast to some of the examples in (39) above which have an intervening aspect marker between the negative marker and the verb root.

3.5.4 Loan words. There is a general tendency for loan words to conform to vowel harmony constraints within Akposso. Consider the following English loan words that have been "Akpossoized". All vowels within the morpheme conform to one ATR set or the other.

(42)	/tʃɔ́tʃɪ/	'church'
	/pɔ́mpì/	'pump'
	/pánî/	'pan'
	/kɔ́fɛ̀/	'coffee'
	/péjə̀/	'avocado (pear)'
	/púsù/	'cat'

The Akan names for days of the week have been borrowed into Akposso, as in many of the languages spoken in the southern regions of Togo and Ghana. The Akan word [dʒʷoda] for Monday has been borrowed into Ewe and Akposso as [dʒɔ́ɖá] and [dʒɔdə́], respectively. Because the central vowel is part of a root whose initial vowel is interpreted as [+ATR] in Akposso, the /a/ is borrowed in as /ə/ in order to conform to harmony.

Compare this with the Ewe word [àtíkè] 'medicine', which has been borrowed into Akposso as [àtíke]. Here a central vowel preceding [+ATR] vowels does not surface as [+ATR] [ə], but as [-ATR] [a]. In general, /a/ preceding [+ATR] vowels tends to be quite resistant to harmony. This is well within the normal behavior of the Akposso vowel harmony system, as we have seen other examples of [+ATR] harmony not extending to initial /a/, such as the case of the third person plural subject pronoun in verb morphology, and also the second of our two vestigial noun classes, which takes /a/ rather than /ə/ as its plural prefix. Other words, whose origin is less clear, like [àkláte] 'banana' and [ànáse] 'pineapple' also fall into this category.

APPENDIX

The following data illustrate each vowel in Akposso in word-final, word-initial, and word-medial position. The first set of words, used to illustrate vowels in word-final position, were also used to make measurements of the first and second formant frequencies of the word-final vowels. These measurements appear next to each word. (Average values of the formant measurements for each vowel, presented earlier in (2), are listed following each vowel.)

The diacritics that are being used to indicate tone are as follows: ´ signifies high tone,` low tone,ˇ low-rising,¯ lower mid tone,ˆ high falling. The absence of a diacritic mark signifies mid tone.

word-final position			F1	F2
/i/:	[édí]	'palm nut'	300	2040
	[úlí]	'granary'	350	2110
	[kǐ]	'to stay'	300	2240
	[bǐ]	'to spoil'	270	2090
	[mli]	'to stand up'	290	2220
	Average formant measurements for /i/		302	2140
/ɪ/:	[édɪ̌]	'joy'	300	2130
	[álɪ]	'village'	300	2360
	[bǐ]	'to cry'	280	2220
	[tʃǐ]	'to bite, cut'	300	2260
	[ɲǐ]	'to fall'	330	2030
	Average formant measurements for /ɪ/		302	2200
/e/:	[ohé]	'one born after twins'	330	1970
	[úsé]	'honey'	360	1820
	[élúté]	'oven'	360	1960
	[kpe]	'to hunt'	300	2130
	[nĕ]	'to drill a hole'	330	1630
	Average formant measurements for /e/		336	1902
/ɛ/:	[èkpètè]	'palm branch sack'	450	1970
	[ɔ́sɛ́]	'tail'	540	1680
	[ésé]	'abstract thing'	480	1680
	[tɛ]	'to take, receive'	540	1930
	[vɛ]	'to ripen'	570	1870
	Average formant measurements for /ɛ/		516	1826

/ə/:	[ìkplə̀]	'spear'	460	1280
	[útə́]	'saliva'	510	1570
	[gbə̌]	'to borrow'	530	1290
	[də̀]	'to fish'	510	1450
	[tʃəɣlə̀]	'to praise'	510	1360
	Average formant measurements for /ə/		504	1390
/a/:	[ɛza]	'termite'	630	1260
	[únà]	'type of trap'	660	1290
	[jă]	'to wait'	700	1430
	[bă]	'to come'	750	1470
	[kpà]	'to carve wood'	740	1310
	Average formant measurements for /a/		696	1352
/o/:	[íblō]	'large calabash'	300	950
	[úklɔ́]	'cold'	350	1110
	[ùkpə̀fɔ̀]	'courtyard'	330	950
	[bŏ]	'to pull out'	340	800
	[ɣlo]	'to operate'	330	720
	Average formant measurements for /o/		330	906
/ɔ/:	[ífɔ]	'finger'	540	1040
	[álɔ́]	'face'	620	1090
	[fɔ̌]	'to rot'	610	990
	[kpɔ]	'to hit'	570	1070
	[sɔ̌]	'to flower'	630	1110
	Average formant measurements for /ɔ/		594	1060
/u/:	[émú]	'eye'	300	910
	[ívú]	'raffia sack'	370	890
	[kŭ]	'to die'	320	790
	[wŭ]	'to crush'	340	710
	[zù]	'to pound'	270	810
	Average formant measurements for /u/		320	822
/ʊ/:	[ívʊ]	'sore'	380	660
	[útú]	'ear'	360	700
	[kʊ̌]	'to sweep'	390	1000
	[ɛ́kʊ́]	'concrete thing'	330	660
	[lʊ̌]	'to carry'	440	1030
	Average formant measurements for /ʊ/		380	810

	word-initial position		word-medial position	
/i/:	[ísí]	'yam'	[íɗìkū]	'tapped palm tree'
	[ívú]	'raffia sack'	[ejidʒə]	'threshing floor'
	[íblō]	'large calabash'	[tʃìkə]	'to become'
	[ìkplà]	'spear'	[lile]	'to drop'
	[ínē]	'animal trail'		
/ɪ/:	[ívlí]	'skin, paper'	[íɲɪtí]	'fear'
	[íkplɛ]	'bone'	[áwɪɬ]	'type of tool'
	[ífɔ]	'finger'	[atɪkè]	'traditional chalk'
	[ìɣà]	'pig'	[kɬɪtɛ]	'to criticize'
	[ívʊ]	'sore'	[wĭnɪ]	'to grow up'
/e/:	[édí]	'palm nut'	[ínédʒə]	'sister'
	[émú]	'eye'	[íwétʃo]	'type of saucepan'
	[éklə]	'taboo'	[ídénū]	'a type of insect'
			[sétu]	'to be hard'
			[wele]	'to wash'
/ɛ/:	[édì]	'joy'	[émɛkù]	'stomach'
	[ésé]	'abstract thing'	[àlɛna]	'build, condition'
	[énɔ̄]	'filaria fly'	[èvlègba]	'type of plant'
	[ɛza]	'termite'	[vèlì]	'to appear'
	[ékú]	'concrete thing'	[kpĕtê]	'to pick fruit'
/a/:	[álɪ]	'village'	[álábɔ́]	'cheek'
	[ájɛ]	'fonio'	[íwátʃɔ]	'cockroach'
	[álɔ́]	'face'	[ɔ̀dàbà]	'eye lash'
	[ága]	'poverty'	[dăwlí]	'to be sweet'
	[àwò]	'clothes'	[wădí]	'to rise early'
/o/:	[ojí]	'sale'	[ɔ́lɔ́kū]	'salt'
	[ohé]	'one born after twins'	[ɛgbɔma]	'type of trap'
	[ógu]	'type of bird'	[àbɔ̀gɔ̀]	'type of hat'
	[ògló]	'rat'	[kɔ̀sú]	'to look at'
			[kpɔlá]	'to spring a trap'
/ɔ/:	[ɔ́fí]	'drink'	[úkpənu]	'clan'
	[ɔ́sé]	'tail'	[ùkpàfò]	'courtyard'
	[ɔ́tɔ́]	'hole'	[tʃəɣlə]	'to praise'
	[ɔ́tá]	'rabbit'	[yàdú]	'to help someone'
	[ɔ́nʊ]	'baggage'		

/u/:	[úlí]	'granary'	[étúlé]	'oven'
	[úlu]	'wind'	[údúnu]	'house'
	[úsé]	'honey'	[ótúdʒō]	'sparrow hawk'
	[útə]	'saliva'	[dŭŋə́]	'to be bitter'
	[úklɔ́]	'cold'	[blūnē]	'to fly'
/ʊ/:	[ólí]	'waist'	[ɔ́wúlû]	'egg'
	[ótʊ́]	'ear'	[ɛ̀wʊ̀ŋà]	'wild calabash'
	[ʊ̀dʒɔ̀]	'mud'	[ádʊkʊ́]	'knee'
	[ónà]	'type of trap'	[dŏvlí]	'to be slippery'
	[óvlɛ]	'hunger'	[dŏlʊ́]	'to be heavy'

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TONE ASSOCIATION AND F_0 TIMING IN CHICHEWA*

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In Chichewa (Bantu, Malawi), a high tone is realized as a peak in fundamental frequency (f_0). In this study, the timing of f_0 peaks relative to the duration of the high-toned syllable was measured for high tones in phrase-medial, -penultimate and -final positions. No phonetic support was found for the assumption in the literature that a phrase-medial high tone is spread over two syllables. Instead, it was found that such a high tone is realized with a significantly later f_0 peak than a high tone in the last two syllables. On the other hand, support was found for Kanerva's proposal that a phrase-final high tone is shifted in phonological representation to the phrase-penultimate syllable.

1. Introduction

There are two tone patterns in Chichewa (Bantu, Malawi) which have been described as depending on position in the phrase [Moto 1984, Louw 1987, Mtenje 1987, Kanerva 1989].

First, according to these descriptions, a high tone spreads rightward onto the following syllable *only if the high tone is not in the last three syllables of a phrase*. This is illustrated in the transcriptions from Kanerva [1989] in (1) and (2). The penultimate vowel of a phrase in Chichewa is always lengthened; all other vowels are short. A high tone in the last three syllables of a phrase, as in (1a) and (2a), is associated with just one syllable, but if a high tone occurs earlier in the phrase, it is associated with two syllables, as in (1b) and (2b).

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(1) a. *mtsíkaana* 'girl'
b. *mtsíkána uuyu* 'this girl'

(2) a. *zidzábeera* 'they will steal x for/ with you'
b. *zidzábéraana* 'they will steal x for each other'

The second restriction on tone association is that a lexical (i.e., non-intonational) high tone is disallowed in phrase-final position [Kanerva 1989].[1] A lexical high tone that would be expected to occur in phrase-final position is realized instead on the second half of the lengthened phrase-penultimate syllable, as illustrated in (3) and (4) [Kanerva 1989: 59]. In non-final position in the phrase, as in (3a) and (4a), the words *mlendo* and *peza* have a high tone on the final syllable. But in phrase-final position, as in the isolation forms in (3b) and (4b), these words have a high tone on the penultimate mora of the phrase, so that the lengthened penult syllable has rising tone. To account for this shift, Kanerva proposes a phonological rule retracting a high tone from phrase-final position (p. 58).

(3) a. *mle^{n}dó uuyu* 'this visitor
b. *mleé^{n}do* 'visitor'

(4) a. *pezá nyaama* 'find the meat!'
b. *peéza* 'find!'

Avoidance of high tone in phrase-final position, as in (3)-(4), is common across languages. Among Bantu languages, a high tone is disallowed in phrase-final position in Makua [Cheng & Kisseberth 1979: 34], Haya [Byarushengo, Hyman & Tennenbaum 1976: 186], Rimi [Schadeberg 1979: 289], Ndanda Yao [Odden, 1998: 308)], Ruciga [Cassimjee & Kisseberth 1998: 69], Tetela [Stevick 1969: 340], Chasu [Stevick 1969: 339], and Kukuya [Hyman 1987: 318]. Utterance-final high tone is also disallowed in non-Bantu languages such as Serbo-Croatian [Inkelas & Zec 1988], and Tangale [Kenstowicz & Kidda 1987]. This incompatibility of high tone with phrase-final position is presumably related to the fact that a tone in such a position is generally realized at a lower pitch than in other positions, an effect known as *final lowering* [Liberman & Pierrehumbert 1984, Pierrehumbert & Beckman 1988, Herman 1996].

The tone spread pattern in (1)-(2) above is unusual though. Tone spread from one syllable to the following one is common crosslinguistically, reported in Bantu in such languages as Shona [Odden 1981, Myers 1990], Bemba [Sharman & Meeussen 1955: 394], Kikuyu [Clements 1984: 318], and Chimaraba Makonde [Odden 1990: 69], and outside of Bantu in Navajo [Kari 1976: 59], Sanskrit [Whitney 1896], and Yoruba [Hyman & Schuh 1974: 88]. But there is no other

[1] The only high tone that can occur in phrase-final position is the boundary tone H%, marking the end of a question or a nonfinal phrase [Myers 1996].

case in the literature in which tone spread from one syllable to the next is subject to the condition that the trigger syllable be further than three syllables from the end of a phrase. Such a pattern would represent a counterexample to the otherwise well-motivated generalization that phonological patterns always involve elements that are structurally adjacent [Myers 1990, Odden 1994, Archangeli & Pulleyblank 1994], since the string of three syllables that must be counted off at the end of the phrase need not be close to the trigger and target of the spread.[2]

An alternative view of this pattern arises from work on the timing of changes in fundamental frequency (f_0), the acoustic manifestation of tone. A high tone corresponds to a period of relatively high f_0. The f_0 peak corresponding to a high-toned syllable generally occurs not in that syllable itself, but rather early in the next syllable. Such a pattern of f_0 peak timing has been described for English [Steele 1986; Silverman & Pierrehumbert 1990], Spanish [Prieto, van Santen & Hirschberg 1995], Danish [Thorsen 1978], Navajo [de Jong & McDonough 1993], Czech [Bartels 1995], Modern Greek [Arvaniti, Ladd & Mennen 1998], and Brazilian Portuguese [Madureira et al. 1999].

The interval from the beginning of the tone-bearing unit to the f_0 peak is called *peak delay* [Silverman & Pierrehumbert 1990]. Experimenters have found, however, that the more stable measure of f_0 timing is *relative peak delay*, which is the peak delay divided by the duration of the tone-bearing syllable. The f_0 peak does not occur at a constant period after the onset of the syllable, but it does tend to occur at a constant percentage of the syllable duration.

Relative peak delay is not, however, absolutely invariant. One important source of variation is that relative peak delay is systematically reduced in prosodically lengthened syllables, i.e., syllables that are longer due to their position in the phrase. Silverman and Pierrehumbert [1990] found that relative peak delay in English is reduced in two contexts in which a syllable is lengthened: (a) in phrase-final or word-final position (final lengthening), and (b) in a stressed syllable immediately preceding another stressed syllable (stress clash). Prieto, van Santen, and Hirschberg [1995] found the same result in Spanish. In Oneida, Grimm [1997] found that while the f_0 peak of a short accented vowel occurred in the next syllable, the f_0 peak of an accented long vowel occurred in the accented syllable itself.

Consider, then, how these general patterns of f_0 timing might apply to Chichewa. A high tone in an unlengthened syllable is expected to be realized with f_0 rising through the high-toned syllable up to a peak near the beginning of the next syllable. This could easily be interpreted as tone spread, since both the high-toned syllable and its successor include regions of high f_0 (cf. de Jong & McDonough [1993] on such a case in Navajo).

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[2] Kanerva [1989] proposes that the high tone spreads one mora to the right if the target mora is not included in a foot, relying on arguments that the final two syllables in a phrase are included in a trochaic foot. This formulation does not require reference to nonadjacent material, but it is just as anomalous in a typological sense. No other instance of such a condition on local tone spread has been noted in the literature.

The last two syllables in the phrase, on the other hand, are lengthened. The penult is lengthened because it is stressed, and the final syllable is subject to phrase-final lengthening. We thus would expect the f_0 peak to occur relatively early in such syllables. If it is substantial relative peak delay that leads transcribers to hear the high tone on two syllables, then such an early f_0 peak would systematically fail to give that impression. It could even give the impression that the high tone has been retracted to an earlier mora.

The phonetic hypothesis, then, is that there is no tone spread or tone retraction, but rather a gradient pattern of f_0 timing sensitive to vowel length and phrase-final position. This paper presents the results of an instrumental study of f_0 timing in Chichewa, aimed at testing the phonetic hypothesis. The timing of f_0 peaks for high tones in phrase-medial, -penultimate and -final positions was examined and modelled. The results do not support the claim in the literature that high tone in medial position is spread, but are consistent with a phonetic timing account of that position. The results do, on the other hand, support Kanerva's [1989] proposal of phonological phrase-final high tone retraction. The analysis contributes to the general discussion of the distinction between phonetic and phonological patterns [Liberman & Pierrehumbert 1984, Keating 1988, Pierrehumbert 1990], and specifically addresses the phonetic interpretation of autosegmental association.

2. Experiment 1: F_0 timing in lengthened and unlengthened vowels

In the first experiment, the timing of f_0 peaks for high tones in phrase-medial (pre-antepenultimate) position was compared to that for high tones in lengthened phrase-penultimate syllables. According to the phonological account in the literature, the f_0 peaks should be longer (i.e., more plateau-like) in the phrase-medial case than in the phrase-penultimate case, due to tone spread. According to the phonetic alternative, the difference between the two phrase positions lies in the timing of the f_0 peak, rather than its duration.[3]

2.1. Methods and Materials. The test sentence was the following. The tone marking here abstracts away from the tone spread that is at issue.

(5) *mlónda ámaye**né**ra ku**ɲéé**ɲa.*
watchman must INF.goof-off
'The watchman must goof off.'

Measurements were made for the two underlined syllables: the high-toned phrase-medial syllable *né* and the high-toned phrase-penultimate syllable *ɲée*. This sentence was chosen because it has nasals and liquids in the neighborhood of the relevant f_0 peaks. These consonants induce minimal disturbance of f_0, and are clearly distinguishable from the neighboring vowels in spectrograms and waveforms.

[3] We focus on high tones and f_0 peaks, since Myers [1998] has shown that non-high-toned syllables in Chichewa are toneless, lacking any phonetic target for f_0.

Three speakers of Chichewa produced the test sentence: SM, DJ, and CJ. All three speakers are adult native speakers of Chichewa from Malawi. SM is a male from Nkhotakota in the Central region, DJ is a male from Blantyre in the South, and CJ is a female from Mzuzu in the North. Due to a failure in the labeling of tokens, all data from Experiment 1 for speaker DJ had to be omitted. Only results from speakers SM and CJ are reported in this section.

To induce a broad range of f_0 values, speakers were instructed to vary loudness and sentence type. F_0 peaks are higher in louder speech than in less emphatic speech [Liberman & Pierrehumbert 1984], and higher in questions than in statements in Chichewa [Myers 1996]. There were three levels of loudness: *loud* (as if shouting to someone in the next room), *normal* (as if speaking to someone across a table), and *soft* (as quietly as possible without whispering). The speakers produced the sentence both as a *question* and as a *statement* .

To induce a broad range of syllable durations, speakers also varied their rate of speech. There were two self-selected speech rates: *normal* and *fast* (as fast as possible while still speaking clearly).

Speakers read the sentence from a sheet where the printed sentence was accompanied by instructions as to how loudly and quickly it was to be produced. Each speaker produced twenty repetitions of the sentence (in blocks of six) in each combination of loudness and rate conditions, for a total of 240 tokens per speaker (3 loudness conditions X 2 rate conditions X 2 sentence types X 20 repetitions).

The utterances were recorded on a Sony DAT tape recorder in a sound-treated booth in the Phonology Laboratory of the University of California at Berkeley. The recordings were redigitized and analyzed using Soundscope, a Macintosh-based sound analysis system produced by GW Instruments. Using synchronized waveform, spectrogram and f_0 displays, the following time intervals were measured in the phrase-medial syllable *né* and the lengthened penultimate syllable *ɲée*.

(6) *Measurements*

a. *Syllable duration*. The interval from the beginning of the onset nasal in the test syllable (as indicated by marked drop in amplitude in the waveform and a fall to a minimal value of F1 in the spectrogram) to the onset of the next syllable (as marked by the same indications).

b. *F_0 peak delay*. The interval from the beginning of the test syllable (as indicated in (6a)) to the onset of the f_0 peak (the first instance of the local maximum value in f_0, excluding discontinuous values during consonants).

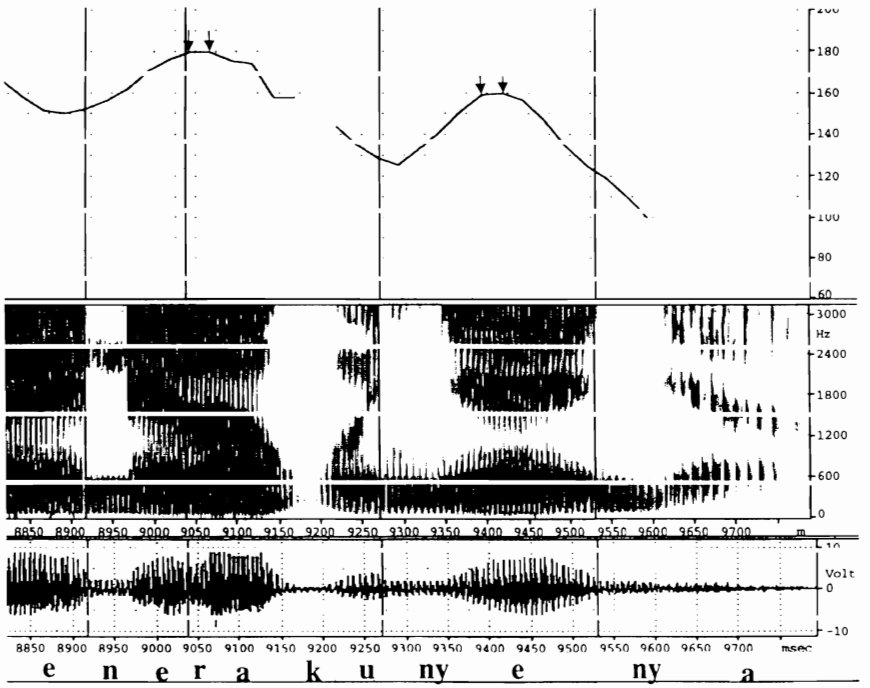
c. *F_0 plateau*. The interval from the onset of the f_0 peak (as indicated in (6b)) to its offset (i.e., the last instance of the local maximum value in f_0).

High tones were realized as a rise in f_0 up to a peak value, followed by a fall. The f_0 peak (the highest f_0 value in the region) sometimes consisted of a single point, and sometimes was held for some time. *F_0 peak delay* in (6b) is a measure

of when the peak is attained, relative to the beginning of the tone-bearing syllable. *F_0 plateau* in (6c) is a measure of how long that peak is held.

A sample display for speaker SM is given in Fig 1, with measurement points indicated. Vertical lines mark off the two syllables, and arrows mark the onset and offset of each of the two f_0 peaks. Note that the first peak, in medial position, comes after the high-toned syllable marked off by vertical lines, while the second peak lies well within the vertical lines marking the penultimate syllable. In this example, then, f_0 relative peak delay is greater in medial position than in the lengthened penult, consistent with the pattern described above for English and Spanish.

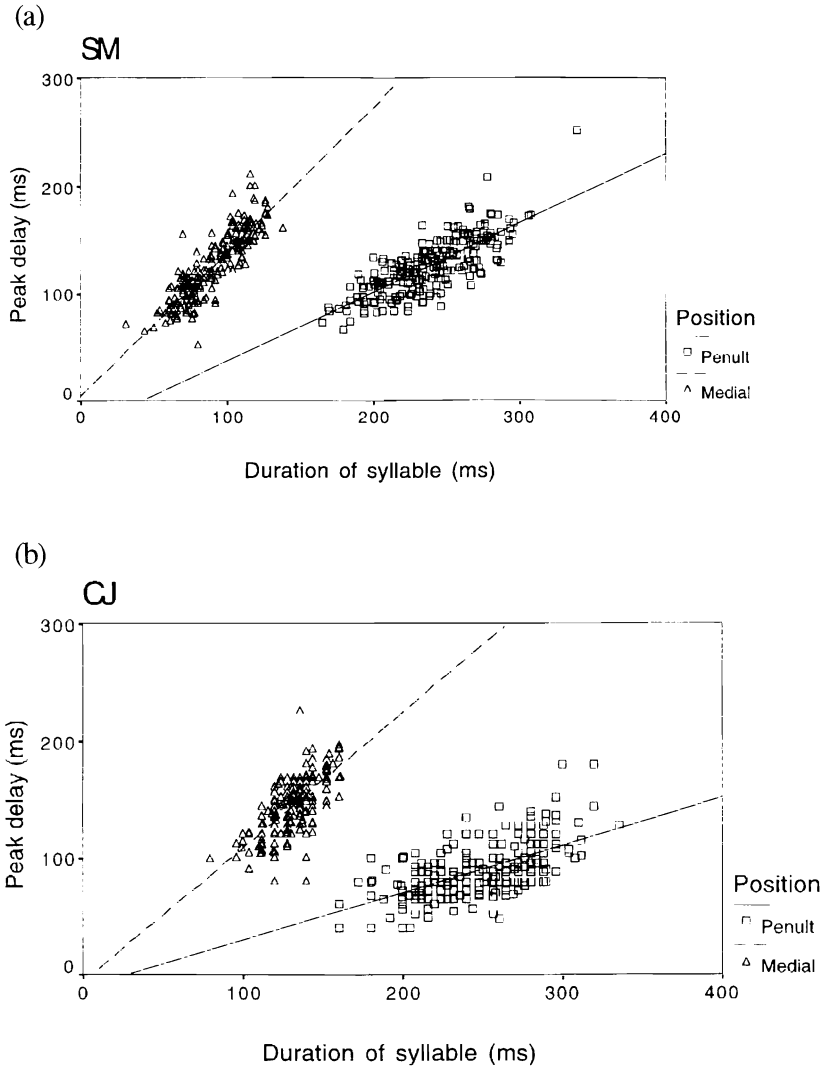
Fig. 1. Sample display with measurement points (speaker SM)



2.2. Results

2.2.1. F_0 peak delay. The data are plotted in Fig. 2, where the x-axis represents the syllable duration and the y-axis the f_0 peak delay. Datapoints from the lengthened penult syllable are plotted with squares, while those from the unlengthened phrase-medial syllable are plotted with triangles.

Fig. 2. Peak delay relative to syllable duration.



The squares in Fig. 2 are grouped to the right of the triangles, indicating that the penult syllables are longer than the medial ones. The mean duration of the penult syllables was generally about twice that of the medial syllables, as shown in (7). These differences were statistically significant, as shown by the t-tests in the fourth column (in which medial and penult syllables of each token were paired together).

(7) Mean syllable duration by phrase position (ms)

Speaker	Medial	Penult	Paired t-test
a. SM	90	238	$t_{239} = -88.4$, $p < .01$
b. CJ	131	247	$t_{239} = -55.0$, $p < .01$

Within each group in Fig. 2, the points display a strong linear trend, with f_0 peak delay being greater for longer syllables, as represented by the regression lines through each set of data. The fact that these lines are sloped rather than horizontal indicates that peak delay is not constant, but varies systematically as a function of syllable duration.

The dashed line for the medial datapoints is steeper than the solid line for the penult datapoints. This means that any given increase in syllable duration corresponds with a greater increase of peak delay in medial syllables than in penultimate ones. In other words, the peak is later in the syllable in the medial than in the penultimate syllables.

These trends can be modeled quantitatively by means of multiple linear regression, a statistical technique for calculating the linear trends that best fit the data. The model equations are given in (8) together with R^2, which represents the percentage of the variance in the data that is accounted for by the equation.

(8) Linear models of peak delay

(P (Position) = 0 for medial, 1 for penult; S = syllable duration)

Speaker	Regression equation	R^2
a. SM	Peak delay = (((–.88 P) + 1.43) * S) – 3.89	.70
b. CJ	Peak delay = (((–.77 P) + 1.18) * S) – 9.67	.75

The model equations are formulated so that *position* is reflected in the coefficient of *syllable duration*, since it is clear in Fig. 2 that the two position groups differ chiefly in the slope of the line. This position coefficient is large and negative for both speakers, indicating that the f_0 peak is earlier in penult position (P = 1) than in medial position (P = 0). The R^2 values in the last column indicate that most of the variance in peak delay is accounted for in terms of these two factors.[4]

[4] The models in (8) had significantly better fit than alternative models that were tried with other mathematical forms or other syllable landmarks as reference points (e.g. the beginning of the vowel, the beginning of the following vowel, the end of the following syllable). All models were compared by means of paired t-tests with absolute value of the residuals as the dependent variable. Such tests also showed that the models in (8) had significantly better fit than a model based on a suggestion of a reviewer, according to which peak delay is a constant, rather than sensitive to syllable duration.

These models indicate that the f_0 peak in medial syllables occurs later, relative to the tone-bearing syllable, than in penult position. To focus on this point, we look at *relative peak delay* (f_0 peak delay divided by syllable duration). The mean values for this measure are given in (9).

(9) Mean relative peak delay by phrase position.

Speaker	Medial	Penult	Paired t-test
a. SM	1.39	.53	$t_{239} = 68.0, p < .01$
b. CJ	1.10	.36	$t_{239} = 76.6, p < .01$

The mean relative peak delay in medial position is over 1 for both speakers, indicating that the f_0 peak generally occurred after the end of the high-toned syllable. It is considerably less than 1 in the penult position, indicating that the peak in that position occurred well within the high-toned syllable. The paired t-tests summarized in the last column establish that this difference in f_0 timing between the two positions is significant. As in (7), each medial measurement was paired with the penult measurement for the same utterance token.

We conclude that f_0 peak delay is significantly greater in medial position than in penult position for these speakers of Chichewa.

2.2.2. F_0 peak plateau. According to Kanerva's [1989] phonological analysis, the penultimate syllable is represented with two moras, while all other syllables have just one. Tone spread leads to a configuration in which any high tone in medial position is associated with two moras in two successive syllables, while a high tone in penult position is associated with only one mora. If moras are taken to be timing units [Hubbard 1995, Broselow et al. 1997], we then expect the *f_0* plateau (as defined in 6c) to be longer in the case of the two-mora medial tone span than in the one- mora penultimate tone span. Such a comparison is summarized in (10).

(10) F_0 plateau duration by phrase position (ms)

Speaker	Medial	Penult	Paired t-test
a. SM	26.2	21.3	$t = 3.32, p < .01$
b. CJ	23.0	25.1	$t_{239} = -1.42, p = .16$

It can be seen that the duration means for the two positions are very close, distinguished only by a few milliseconds. For CJ this small difference is insignificant and goes in the wrong direction. For SM the effect is significant, but too small to be expressed through tone spread, since then we would expect the difference to approximate the duration of a syllable (compare (7)).

The f_0 data therefore do not support the view that a medial high tone covers two moras while a penultimate high tone covers just one.

2.3. Implications of Experiment 1. The phonetic evidence, then, does not support the claim that tone is spread in certain phrase-positions in Chichewa, but does indicate a significant difference in f_0 timing for these two speakers between phrase-medial and phrase-penultimate high tones. This is a welcome result, since the phonetic timing pattern is cross-linguistically well-attested while the proposed phonological tone spread pattern is anomalous compared to tone spread patterns in other languages.[5]

The pattern of f_0 peak delay might shed light on a number of reported tone patterns in Bantu languages. In a number of languages in that family, high tone is described as being shifted one syllable to the right of its underlying position: Rimi [Olson 1964], Chiruri [Massamba 1984], Jita [Downing 1996], Kikuyu [Clements & Ford 1979], Eerati Emakhua [Cassimjee & Kisseberth 1998: 34], and Chaga [McHugh 1990]. It is possible that some or all of these cases are actually instances of the phonetic pattern of f_0 peak delay we have described here. Quantitative instrumental analysis would be needed in order to decide whether these patterns are gradient or categorical. The crucial question would be whether the f_0 peak is timed with respect to the original high-toned syllable, or to the syllable following that one (see Section 3 below).

If some or all of these cases are found to involve a genuine shift in the syllable with which the tone is associated, then it is likely that f_0 peak delay forms the phonetic basis for that shift. It is striking that shift to the right is reported much more frequently than shift to the left, described in Bantu languages only for Kinyarwanda [Kimenyi 1979] and Kinande [Hyman & Valinande 1985]. Moreover, the leftward tone shift in Kinyarwanda is disputed on the basis of f_0 data by Furere and Rialland [1985].

One might ask why a high tone should be realized *after* the syllable that it is associated with. One hypothesis might be that the vocal fold adjustments that determine f_0 modulation are more sluggish than the supralaryngeal gestures that define the syllable. Another possible explanation would be in terms of perception. House [1990] has shown that f_0 cues are more easily perceived in regions of relative spectral stability, as in the midpoint of a vowel, than in regions of rapid spectral transition, as in the consonant-vowel transition. A rapid rise in f_0 is a salient cue in identifying a high tone ['t Hart 1981]. Thus alignment of the f_0 peak with the end of the high-toned syllable insures that the f_0 rise is centered over the spectrally most stable portion of the syllable.

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[5] A preliminary report of the data for speaker SM was presented in Kim [1998] without permission of the experimenter. That paper suffers from the following problems. (a) The data on which Kim's report was based included some measurement errors, which had to be corrected before the data could be used for the present study. (b) Kim's dataset was not balanced across conditions. (c) The statistical analysis is flawed, being based on an invalid comparison of R^2 values across different populations. (d) The report only considers peak delay, a measure which provides no information about whether the peak is associated with one syllable or two.

One limitation of the experiment was that only two phrase positions were included: penultimate and pre-antepenultimate. The impressionistic descriptions, however, include the antepenultimate position as one in which a tone does not spread. I have not done a controlled study of the timing of f_0 peaks in this position, but my preliminary and informal observation suggests that f_0 peaks are earlier in antepenultimate position than in pre-antepenultimate positions. The antepenultimate syllable is not lengthened, unlike the penultimate and final, so a lessening of peak delay in this position would not be expected on that basis. However, the literature has shown that upcoming f_0 peaks or phrase-boundaries can also have the effect of diminishing peak delay, and that this effect can hold even for high tones a few syllables away from those conditioning factors [Silverman & Pierrehumbert 1990, Prieto, van Santen & Hirschberg 1995]. If the f_0 peak is indeed early in the antepenultimate syllable, it could be due to such an effect. If so, one would expect the peak to be significantly later in antepenultimate than in penultimate and final positions, since the conditioning factors would be one syllable more distant.[6]

3. F_0 timing in phrase-final position

According to Kanerva [1989], when a high-tone-final Chichewa word such as *mwaná* 'child' occurs in phrase-final position, the word-final high tone is not realized on the phrase-final syllable, but rather is shifted to the second mora of the lengthened phrase-penultimate syllable (e.g., *...mwaána.*).

An alternative view would be that the high tone is not shifted to a nonfinal tone-bearing unit, but rather that the f_0 peak realizing the high tone occurs relatively early relative to the phrase-final syllable. Steele [1986], Silverman and Pierrehumbert [1990], and Prieto, van Santen, and Hirschberg [1995] found that an f_0 peak occurred earlier in a word- or phrase- final syllable than in a syllable further from the edge of such a prosodic domain. Since word- and phrase-final syllables tend to be longer than comparable nonfinal syllables, this could be seen as an instance of the reduction of peak delay in lengthened syllables. An earlier f_0 peak in phrase-final position could also be induced by the intonational boundary tone on the phrase-final syllable, since f_0 peak delay is reduced if another f_0 target immediately follows, an effect known as "tonal crowding" [Silverman & Pierrehumbert 1990; Engstrand 1997; Arvaniti, Ladd & Mennen 1998].

Thus, as in the comparison between medial and penultimate position treated in Section 2, there are two hypotheses regarding the distinction between final and nonfinal position. According to Kanerva's phonological analysis, a phrase-final syllable cannot bear a high tone, and any potential phrase-final high tone occurs

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[6] It is important to note that no result about f_0 timing in antepenultimate position could support the tone spread analysis and refute the phonetic timing analysis provided in this section. Finding that there was tone spread in antepenultimate position would be incompatible with either analysis. On the other hand, the tone spread analysis makes no predictions about the timing within the syllable of f_0 peaks that are not spread. Thus including antepenultimate high tones in the experiment would have told us something about f_0 timing, but would not have provided evidence about tone spread, the main focus of this study.

instead in the penultimate syllable. According to the phonetic alternative, a high tone can occur in phrase-final position, but it occurs earlier relative to that syllable than in other positions.

To distinguish the two hypotheses, we must first decide how to determine on the basis of phonetic data which syllable a given tone is associated with. In the original formulation of autosegmental phonology, Goldsmith [1976] proposed that association of a tone with a vowel is phonetically interpreted as meaning that the two were simultaneous. Sagey [1988] amended this proposal, suggesting instead that the phonetic instantiations of two elements associated with each other must merely overlap in time.

Neither proposal specifically addressed phonetic data, and neither is, in fact, realistic as a proposal about phonetic timing. For example, if the f_0 peak is taken to be the phonetic instantiation of a high tone, we have seen that it need not overlap at all with the phonetic instantiation of the syllable it is associated with. Similarly, Browman and Goldstein [1990] point out that the peak of glottal spreading in an aspirated stop is timed to occur just after the end of the closure for that stop. The phonetic literature abounds with evidence that the various acoustic cues for a segment need not be either simultaneous or overlapping [e.g., Liberman et al. 1967].

Browman and Goldstein [1990] propose that autosegmental association between phonological elements *a* and *b* is to be interpreted as stating that there is a regular phasing relation between the phonetic realizations of *a* and *b*. In other words, if two things are associated, then one can predict the timing of the phonetic realization of one based on the timing of the phonetic realization of the other. This definition is consistent with the regularities of interarticulator timing [Browman & Goldstein 1990, Huffman 1993, Sproat & Fujimura 1993]. Applied to tone, it implies that we can tell which syllable a high tone is associated with by finding which syllable provides the best prediction of the timing of the f_0 peak (cf. Ladd [to appear]). This test is applied in this section to the issue of which syllable a high tone is associated with in Chichewa.[7]

3.1. Methods. The same speakers and recording procedures were used as in experiment 1 (see Section 2). The two sentences compared, listed in (11), were identical except for the final word.[8]

(11) a. *mlónda ámaiwála kuŋéeŋa.*
watchman he-forgets INF.goof-off
'The watchman forgets to goof off.'

b. *mlónda ámaiwála mwaaná.*
watchman he-forgets child
'The watchman forgets the child.'

[7] I have benefited in writing this section from reading Doran [1997], an analysis of CJ's data for Experiment 2.

[8] As above in (5), the tonal transcription in (11) abstracts away from the tone retraction and tone spread in question.

Measurements were made in the last two syllables of each phrase. The sentences were produced as a statement and as a question, and at three different loudness levels (soft, normal, loud). Speaking rate was a self-selected "normal" one. The first 20 tokens of each sentence in each condition were selected for measurement, yielding 20 tokens X 2 sentences X 2 sentence types X 3 loudness levels = 240 total tokens.

In Experiment 1, speakers produced both questions and statements in order to generate variation in f_0 level. In Experiment 2, the same distinction is exploited as an independent variable to test whether the final boundary tone marking the distinction between question and statement would have an effect on the timing of high tones in the last two syllables of the word. Myers [1996] showed that questions and nonfinal phrases in Chichewa generally end in an abrupt rise (or rise-fall) in f_0 on the final syllable, while utterance final statements end in a fall. This difference can be represented in terms of a contrast between the boundary tones H% and L% [Pierrehumbert 1980]. One question in Experiment 2 is whether the f_0 peak realizing a high tone occurs earlier in the syllable if another f_0 peak follows, as has been reported in other languages [Silverman & Pierrehumbert 1990; Engstrand 1997; Arvaniti, Ladd & Mennen 1998].

Measurements were made, as in Section 2, of the following intervals:

(12) a. *Syllable 1 duration.* The interval from the beginning of the penultimate syllable to the end of that syllable (as indicated by the criteria in (6)).

b. *Syllable 2 duration.* The interval from the beginning of the final syllable to the end of that syllable.

c. *Syllable 1 peak delay.* The time of the beginning of the f_0 peak (the first of the local maximum f_0 values) minus the time of the beginning of the penult syllable.

d. *Syllable 2 peak delay.* The time of the beginning of the f_0 peak (the first of the local maximum f_0 values) minus the time of the beginning of the final syllable.

Because of the tendency to reduction and laryngealization in the final syllable, it was sometimes impossible to obtain one of these measurements for a given token, in which case that token had to be omitted from analysis. Two tokens were omitted from SM's dataset, giving a total of 238 utterances. In DJ's data, lowering of the final high tone in the *mwaná* statements was great enough that generally no f_0 peak could be distinguished, f_0 falling in a relatively uninterrupted straight line from the high tone on *yenéra*. As a result, the whole *mwaná* statement condition had to be omitted from his dataset, since there was no f_0 peak to measure the timing of. Comparisons for DJ are only made among the remaining pairs of conditions (180 tokens). CJ also displayed final lowering in the case of *mwaná*

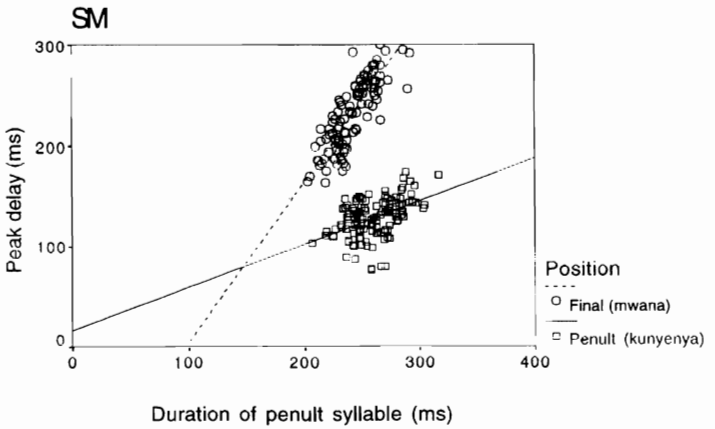
statements, but 49 instances of that condition had a measurable peak. Her total dataset included 218 tokens.

3.2. Results

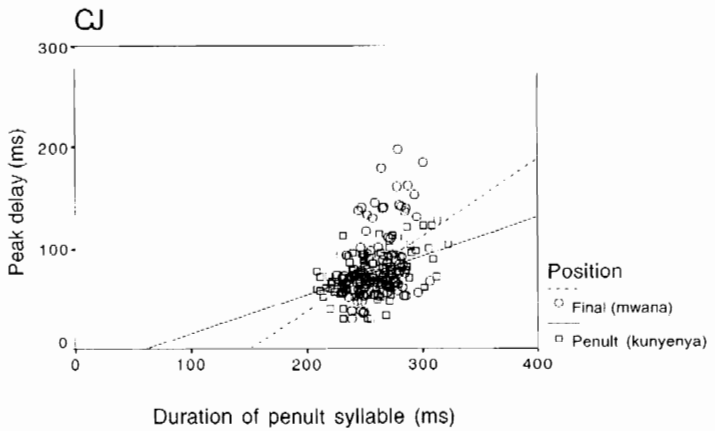
3.2.1. Linear regression models. The graphs in Figure 3 display the timing of the f_0 peak with respect to the penult syllable. Circles mark "final" high tones in

Fig. 3. Peak delay relative to penult syllable duration

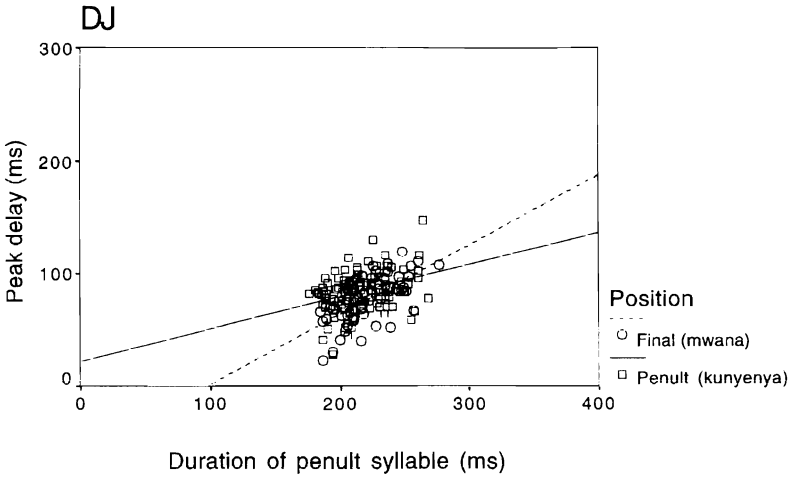
(a)



(b)



(c)



mwaná, while squares mark the penult high tones in *kuɲéɲa*. For all three speakers, the value on the y-axis for f_0 peak delay is considerably less than the x-axis value for penult syllable duration. This means that for all speakers, the f_0 peak for both classes of word normally lay within the penult syllable.

This tendency can be expressed more precisely through relative peak delay, as in (13). For all speakers, the mean values of relative peak delay are less than 1 for both position groups, indicating that the f_0 peak generally begins within the penult syllable. For speaker SM, the two position groups remain distinct (cf. the two distinct clouds of points in Fig. 3a), while for speakers CJ and DJ, the two groups are close to identical (cf. the overlapping of circles and squares in Figs. 3b and 3c). According to a t-test (for independent samples of unequal variance) reported in the last column of (13), the difference between the two groups is significant for SM but not for CJ or DJ.

(13) Mean relative peak delay by phrase position

Speaker	Penult *(kuɲéɲa)*	Final *(mwaná)*	t-test
a. SM	.49	.95	$t_{210.6} = -43.0$, $p < .01$
b. CJ	.29	.32	$t_{150.0} = -1.6$, $p = .11$ (n.s.)
c. DJ	.39	.35	$t_{118} = 0.2$, $p = .87$ (n.s.)

Thus, for all three speakers, the f_0 peak in *mwaná* occurs in the penult, not the ultima. For speakers CJ and DJ, the f_0 peak is indeed timed just as in the *kuɲéɲa* forms, neutralizing the timing distinction between the two classes.

To compare a gradient phonetic analysis of this pattern with the phonological one, we compare two classes of multiple linear regression models. In the first class of model, the phonological models, the assumption is that the high tone in both the final and the penult tone classes is associated with the phrase-penultimate syllable, i.e., that the high tone of *mwaná* is shifted to the penult. In these models, the timing of the f_0 peak is predicted on the basis of the penult syllable, regardless of the underlying position of the high tone. The dependent variable is *syllable 1 peak delay*, and the independent variables are *position*, *sentence type*, and *syllable 1 duration*. If these models are successful in predicting the location of the f_0 peak, this supports the phonological account of high tone retraction, as posited by Kanerva [1989].

In the second class of model, the phonetic timing models, the assumption is that the high tone remains in underlying position, so that the H in *kuɲéɲa* is associated with the penult, and that of *mwaná* is associated with the final syllable. In these models, the timing of the f_0 peak is predicted on the basis of the penult syllable for penult high tones and the final syllable for final high tones. The dependent variable in these models is *syllable n peak delay*, which is *syllable 1 peak delay* for penult high tones (*kuɲéɲa*) and *syllable 2 peak delay* for final high tones (*mwaná*). The crucial independent variable is *syllable n duration*, which is the duration of the penult syllable for penult high tones and the final syllable for final high tones. The other independent variable is *sentence type*, as in the phonological models.

Because the dependent variables in the two models are different, it would be inappropriate to compare R^2 values between them. Instead, we compare the absolute value of the residual, which is the amount by which the predicted value differs from the actual value for each token. We can compare the two sets of residuals using a paired t-test.

By this measure, the phonological models outperformed the phonetic timing models for all three speakers. The results are laid out in (14). The average of the amount by which each model was off was considerably less in the phonological models than in the phonetic timing models (third column), and this difference in fit was significant according to the paired t-tests (fourth column). Thus the more accurate prediction of the timing of the f_0 peak takes as its reference value the duration of the penult syllable, not the syllable to which the high tone belongs underlyingly. The penult, then, must be the syllable with which the high tone is associated, according to the phonetic test proposed above.

In the phonological models, the effect of *position* (the difference between *mwaná* and *kuɲéɲa*) is proportional to the size of the coefficient of *P*. For speaker SM, this coefficient is .47, which means that the f_0 peak occurs 47% later in the syllable in the final-high words than in the penult-high words. For speakers CJ and DJ, on the other hand, the coefficient of *P* is very small, indicating that there was effectively no contrast between the two position classes for these speakers.

(14) Linear models of peak delay in final and nonfinal positions

S1P = Syllable 1 peak delay
SnP = Syllable n peak delay
S1dur = Syllable 1 duration
Sndur = Syllable n duration
P = position (0 = penult, 1 = final)
T = sentence type (0 = statement, 1 = question)

Speaker	Regression equation	Mean absolute residual (ms)	Paired t-test
a. SM	Phonological model S1P = ((.47 P + .55) * S1dur) – (9.33 T) – 11.35	15.6	$t_{237} = -15.3$, $p < .01$
	Phonetic timing model SnP = (.95 Sndur) + (9.24 T) – 177.09	51.2	
b. CJ	Phonological model S1P = ((.03 P + .35) * S1dur) – (12.42 T) – 7.56	19.3	$t_{217} = -9.0$, $p < .01$
	Phonetic timing model SnP = (1.79 Sndur) + (54.71 T) – 430.56	44.4	
c. DJ	Phonological model S1P = ((-.04 P +.42) * S1dur) – (1.49 T) – 7.13	12.7	$t_{179} = -9.4$, $p < .01$
	Phonetic timing model SnP = (1.49 Sndur) – (33.79 T) – 236.77	38.2	

One way to make sense of this is in terms of Kanerva's [1989] phonological analysis of the tone patterns of speaker SM. Kanerva proposed that the penult syllable is the only one with two moras, and that final-high words have the high tone retracted only to the phrase-penultimate mora, i.e., the second mora of the lengthened penult, while penult-high words have the high tone on the first mora of the penult. Thus, the surface distinction between the two classes in phrase-final position would be as in (15). If we assume that each mora in the penult takes up

(15) a.

```
        H
        |
    μ μ μ μ
    | \/ |
... ku. ɲe. ɲa
```

b.

```
      H
      |
    μ μ μ
    \/ |
... mwa. na.
```

50% of that syllable's duration, then we would expect that the f_0 peak in (15b) to be about 50% later than that in (15a). That is in good agreement with the 47% found as the coefficient of *P* in Model A for SM.

This pattern can be expressed in Optimality Theory with the following two constraints:

(16) a. NONFINALITY: A high tone associated with a phrase-final mora is forbidden [Cassimjee & Kisseberth 1998: 66].

b. ANCHOR-R: If an input tone T has an output correspondent T', then the rightmost mora associated with T corresponds with the rightmost mora associated with T'.

The constraint FINAL in (16a) expresses the general avoidance of phrase-final high tones, documented above in Section 1. The constraint ANCHOR-R is a faithfulness constraint [McCarthy & Prince 1999], requiring that the right edge of a tone not be moved in the input-output mapping (cf. Cassimjee & Kisseberth [1998: 44]). A violation is assigned for each mora that separates the rightmost mora of output tone T' from the output correspondent of the rightmost mora of input tone T.

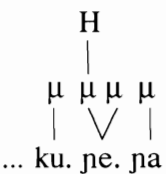
FINAL must dominate ANCHOR-R, as illustrated in the tableau in (17). The faithful candidate (17a) violates FINAL and so is less harmonic than either (17b) or (17c). Shift of the high tone to the penultimate mora, as in (17b), is preferred to further shift, as in (17c), because the former violates ANCHOR-R less. The optimal candidate is thus (17b), with H shifted from the final to the penultimate mora.

(17) Input: / ...mwaná./

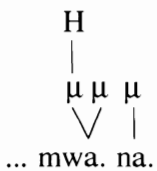
Candidates	FINAL	ANCHOR-R
a. ...mwaa.ná.	*!	
b. ☞ ...mwaá.na.		*
c. ...mwáa.na.		**!

For the other two speakers, the neutralization of the timing distinction between the two classes can be represented by shifting the high tone in *mwaná* all the way to the first mora of the penult, as in (18). The extra shift of the high tone to the an-

(18) a.



b.



tepenultimate mora could reflect the general tendency for high tone to occur at the beginning of the syllable, as reflected in the constraint NORISE [Poletto 1998: 347, Cassimjee & Kisseberth 1998: 72]:

(19) NORISE: Align the left edge of every high tone with the left edge of some syllable.

Both NORISE and FINAL must dominate ANCHOR-R for these speakers, as in the tableau in (20). This ranking selects the third candidate, with the final H shifted to the antepenultimate mora. As a reviewer notes, such a shift of tone over two moras could be considered a non-local process. But we see that in this analysis, it falls out from the interaction of strictly local constraints, i.e., constraints on structurally adjacent elements.

(20) Input: / ...mwaná./

Candidates	FINAL	NORISE	ANCHOR-R
a. ...mwaa.ná.	*!		
b. ...mwaá.na.		*!	*
c. ☞ ...mwáa.na.			**

We have been mainly considering the effect of position class on the timing of the f_0 peak. The effect of the contrast between question and statement is very small for all three speakers, as reflected in the very small coefficients for the variable *T* in (14). These coefficients indicate that the f_0 peak is earlier in questions by 1.49 to 12.42 milliseconds (depending on the speaker). For speakers CJ and DJ, one could attribute this small effect to "tonal crowding" repelling the lexical H from the H% marking questions. But speaker SM produced all the questions in this dataset without a final rise, marking them as questions just with their higher pitch range [Myers 1996]. It is unclear, therefore, why this speaker showed the same sort of timing distinction between statements and questions.

4. Conclusion

We have investigated for three speakers of Chichewa the timing of f_0 peaks in three phrase positions: medial, penultimate, and final. We have found that the f_0 peak realizing a medial high tone occurs early in the syllable following the high-toned syllable, while a high tone in a lengthened penult occurs well within the penult syllable. This follows the pattern of f_0 timing found in previous work on English, Spanish and other languages. No evidence was found supporting the claim in the literature that a high tone in medial position is subject to tone spread. Thus,

there was no support from the data for these three speakers for the claim that Chichewa has an instance of tone spread subject to the non-local condition that the trigger tone be at least four syllables from the end of the phrase.

A high tone in phrase-final syllable is shifted to the penultimate syllable, in particular to either the second mora (SM) or the first mora (CJ and DJ) of that syllable. This is an instance of the general avoidance of high tones in phrase-final syllables. It was argued that the shift must be reflected in the phonological representation, since the f_0 peak realizing a final high tone was timed with respect to the phrase-penultimate syllable, not the phrase-final one.

These results, obtained through quantitative analysis of instrumental acoustic data, support a revision of the basic facts of Chichewa tonology as they have been described on the basis of impressionistic tone transcriptions. Such transcriptions have, of course, provided a great deal of important information about Chichewa and other tone languages. But the present study provides new evidence as to the inherent vagueness of transcription data, and supports the view that tonology is put on a firmer foundation when tone transcriptions are augmented with objective experimental methods (cf. Bruce [1977] on Swedish, and Pierrehumbert & Beckman [1988] on Japanese). Only such quantitative data can allow us to distinguish categorical phonological patterns from gradient phonetic ones [Liberman & Pierrehumbert 1984].

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LENGTH AND SYLLABLE WEIGHT IN IBIBIO*

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This paper presents a study of segment length and its relationship to the syllable in Ibibio, a Lower Cross language spoken in Nigeria. Syllable structure pro-cesses such as consonant lengthening, lenition, vowel lengthening and trunca-tion all occur to satisfy syllable weight requirements.

1.0 Introduction

The issue of length and its linguistic representation has been of interest to linguists for many years. One reason for this is that long segments sometimes function as a sequence of short segments and at other times as a single unit. Research on Hausa plurals [Leben 1980], Berber [Guerssel 1977], Hebrew [Barkai 1974; McCarthy 1981] and Greek [Schein & Steriade 1986] provide some of the evidence for this position. Given a non-linear approach, length can be viewed as an autonomous property on an independent tier of the phonological representation, separate yet related to the segmental tier (cf. Smith & Van der Hulst [1982]; Hyman [1982]). In the present study, I seek to extend the results of this previous work to Ibibio, a Lower Cross language spoken in Akwa Ibom State in the southeastern part of Nigeria.

I investigate here length phenomena in both consonants and vowels in Ibibio. Two different consonant processes—lengthening and lenition—occur in what appears to be the same intervocalic environment. Vowels, too, may be affected, either lengthened or truncated. The question this raises is why this should be the case. Although it appears superficially that the environments for consonantal lengthening and lenition are the same, on one hand, and the environments for vowel lengthening and truncation identical, on the other hand, there is a crucial distinction

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in terms of syllable weight. Hence, the position adopted here is that of moraic phonology, which assumes a basic weight distinction between different syllable types. Adopting such an approach, I believe, clarifies and simplifies the analysis of length phenomena in Ibibio.

The paper is organised along the following lines. In section 2 a phonological sketch of Ibibio is presented. Section 3 provides data and a descriptive account of length in Ibibio, followed by an account of previous analyses of length in section 4. Length and syllable weight constitute the focus of section 5. Section 6 presents concluding remarks. Examples in the paper are given in phonetic representation.

2.0 Ibibio phonological sketch

Ibibio manifests dialect variation depending on the clan groupings within Ibibio land. The varieties used in this study are those spoken in the Uyo (the state capital), Uruan, and Etinan areas, broadly covering the Uruan and Iman dialects. The data collected in these areas cut across sex and age. Being a native speaker of the Ibibio language myself, I can confirm that distinctive vowel length, exemplified by the examples in (1), is quite widespread across the Lower Cross group to which Ibibio belongs

(1)	Ibibio	Annang	Gloss
	nám	*nám*	'do'
	náam	*náam*	'intoxicate'
	dɔ̀k	*dɔ̀k*	'dig (a) hole'
	dɔ́ɔ́k	*dɔ́ɔ́k*	'climb'

Various analyses of the Ibibio phoneme system are found in the literature. For the purpose of this paper, we assume a system consisting of thirteen consonant phonemes and seven vowel phonemes[1] [Urua 1990], plus a length feature for six of these vowels, as shown in (2).

(2) /i, e, a, ʌ, ɔ, o, u/
/ii, ee, aa, ɔɔ, oo, uu/

2.1 Ibibio vowel phonemes. There is some debate in the literature concerning the number of vowel phonemes found in Ibibio [Kaufman 1968, 1985, Essien 1983, 1990, Utip 1991, Urua 1990]. This may, to some extent, be due to dialect variation, but to some extent it is also due to problems in analysis. In this work, we assume a seven-vowel inventory, as listed in (3).

(3) /i, e, a, ʌ, ɔ, o, u/

[1] The vowel phonemes have posed major difficulties for analysts, and this has resulted in a range of different proposals. Six vowel phonemes are proposed by Kaufman [1968]; seven by Boys [1978] and Urua [1990]; eight by Connell [1991]; nine by Utip [1991] and ten by Essien [1983, 1990], largely as a result of dialect variation.

Apart from /ʌ/, which is restricted in distribution to C_C position, the other six vowels are realised as such in open syllables. In closed syllables, there is a degree of shortening and centralisation, especially for the higher vowels, such that /i, o, u/ are realised as [ɨ, ə, ʉ], respectively. The symbol [ɨ] represents a lowered and centralised high front vowel.

These six vowels may all occur in prefixes, typically with their open syllable realisations, though there appears to be some dialect variation with respect to realisation, which may be due to variation in the harmony system; it remains a question that requires further exploration. There are restrictions as to which vowels may occur in suffixes; typically /i, u/ do not occur, and the phonetic realisation of those vowels that do is determined by harmony considerations which vary across dialects. The facts of vowel harmony across Ibibio dialects are of substantial interest but do not bear on the issues discussed in this paper.

Ibibio exhibits phonemic vowel length, a fact on which all writers agree, though there is some debate as to whether all vowels may be lengthened. The high vowels /i/ and /u/, in particular, are problematic in this regard, where a length contrast seems restricted to northern dialects.

Vowel length may also be derived, indicating the frequentative or pluractional nature of verbs; it also occurs ideophonically for pragmatic purposes. Constraints on the distribution of Ibibio vowels are summarised in (4).

(4) Vowel distribution

Prefix	C_C	Final	Suffix
i	ii, ɨ	i	
e	ee, e	e	e
a	aa, a	a	a
ɔ	ɔɔ, ɔ	ɔ	ɔ
o	oo, o	o	o
u	uu, u	u, ʉ	
	ʌ, ə		

2.2 Ibibio consonant phonemes. Ibibio has thirteen consonants in its phonemic inventory [Urua 1990]. The consonant system is particularly interesting for the restrictions that exist on the distribution and phonetic realisation of these consonants, and for the exceptions to what appears to be the basic system. Exceptions apart, it can be said that all consonants may occur stem initially, and that in this position they are typically realised with a "strong" articulation. In final position (i.e., prepausally), only stops and nasals may occur, with the stops normally being voiceless. In intervocalic, non-stem initial position, distribution is similarly restricted, though phonetic realisations are typically weak, i. e., lenition occurs. The facts of the basic system are summarised in Table 1. Symbols have IPA values with the exception of [ʀ], which represents a uvular approximant or tap.

Exceptions to this basic system are as follows. First, the approximant /j/ could also be said to occur in final and medial positions. The essence of the debate here is

Table 1: The basic Ibibio consonant system, with positional variants.

Consonant	#C	C#	-VCV-	-VCCV-
b	b	p	b, β	pp
t	t	t	ɾ	tt
d	d	d	ɾ	
k	k	k	ʀ	kk
kp	kp	–	kp	
m	m	m	m	mm
n	n	n	n	nn
ɲ	ɲ	–	–	
ŋ	ŋw	ŋ	ŋ	ŋŋ
f	f	–	–	
s	s	–	s	
j	j	j	–	jj
w	w	–	w	

whether post-vocalic [j] is part of the nucleus, i.e., forming a diphthong, or is a coda consonant. The latter analysis is assumed in this paper, following Urua [1990], and Akinlabi and Urua [1993] (see also 3.2.2, below).

The more interesting set of exceptions to the basic system is the occurrence, in medial position, of what may be termed "long" or geminate consonants. Clearly, /mm/, /nn/, and /ŋŋ/ do occur contrastively in this environment, as the examples in (5) show.

(5) a. *démé* 'ignore'
démmé 'wake up'

yòmó 'be noisy'
yòmmó 'boo at'

b. *dɔ́nɔ́* 'be smooth'
dɔ́nnɔ́ 'slip (on a slippery surface)'

mɔ́nɔ́ 'be smooth'
mɔ́nnɔ́ 'shine (a) torch'

c. *ŋwàŋá* 'be transparent'
ŋwàŋŋá 'pour (e.g., into a container)'

It may also be argued that /p, t, k/ occur as long consonants in this same environment. This claim is somewhat more contentious, in that phonetically no "short" voiceless stops occur in this position with which the ostensibly long ones contrast. Contrast can be said to occur, though, with the lenited realisations of other consonants in medial position, as seen in (6). This phenomenon is proble-

matic for the neatness of the basic system in that it can no longer be claimed that all consonants in the inventory contrast in initial position.

(6) a. *ɗíppé* 'lift up'
ɗíβé 'hide oneself'

b. *sɨ́ttɛ́* 'bore (e.g., a hole')
sɨ́ɾé 'be bushy'

c. *ɗíkkɛ́* 'frighten'
ɗìʀɛ́ 'step on'

A second critical factor affecting the assumption of long voiceless stops is that some, though by no means all, occurrences of medial /pp, tt, kk/ are a result of morphological processes, typically the addition of a -CV suffix to a CVC stem, where the initial C of the suffix is assimilated to the stem-final C. The stop consonants are an important case in point. It is often a thorny issue to decide how to analyze the relationship among the labial stops [p, b, kp] in the language. Sometimes [p] and [kp] have been assigned to the same phoneme; at other times [p] and [b] have been assigned to one phoneme, and so forth. It has even been suggested that [p] might belong with /f/. Since this paper does not strictly concern the phonological analysis of Ibibio phonological units, I have simply presented the constraints that affect these consonants and present the distribution as in Table 1 above.

2.3 Ibibio syllable structure. Although there are segment and syllable structure constraints on what may occur where, Ibibio syllable structure is uncomplicated, basically CV(V)(C). Verb stems may have an initial V or N prefix, which may be followed by an open syllable (either light or heavy) or by a closed syllable having either a short or long vowel.

2.4 Ibibio tone. There are two contrastive level tones, high and low, plus a downstep feature. Other tones are the contour rising (low-high) and falling (high-low) tones, which are combinations of high and low tones. The following marking conventions are used: [́] High tone; [̀] Low tone, [̌], Low-high rising; [̂] High-low falling, and Downstepped high tone [ꜜ]. All tone-bearing segments are marked for tone.

3.0 A descriptive account of length in Ibibio

3.1 Long vowels. Verb roots may differ in whether they exhibit short or long vowels, a few examples of CV and CVV types being provided in (7). Even though long vowels occur in open syllables, as in the examples in (7b), such examples are rare; minimal pairs exhibiting a contrast between short and long vowels in this environment do not exist.

(7) a. CV roots

tá	'chew'
sé	'look'
nɔ̀	'give'
mà	'complete (a task)'

b. CVV roots

nàá	'lie down'
kàá	'go'

Of the seven vowels identified in this study, six (/i, e, a, ɔ, o, u/) may occur as long vowels in contrast with short ones, generally in closed syllables. Minimal pairs exhibiting a phonological length contrast are presented in (8). Observe in (9) that, although there are long high vowels /ii/ and /uu/ in C_C position, there are no items with the corresponding short high vowels, /i/ and /u/. This is essentially because there is a constraint that bars high vowels from occurring in certain positions, namely C_C and as suffix vowels, as indicated above in (4).

(8) Vowel length contrasts

a.	*dép*	'buy'	*mèk*	'choose'
	déép	'scratch'	*mèèk*	'bend'
b.	*nám*	'perform/do'		
	náám	'intoxicate'		
c.	*bɔ́k*	'cook'		
	bɔ́ɔ́k	'nurture'		
d.	*ókóp*	'navel'		
	ókóóp	'calabash'		

(9) a. *síít* 'block (an) opening'
b. *túúk* 'touch'

Long vowels may be underlying, as above, or occur through derivation. In (10), vowel length is a consequence of verbal derivational morphology. The frequentative,[2] for example, may simply lengthen the vowel of the verb root, as in (10a), or append a suffix with concomitant lengthening of the verb stem vowel, as in (10b).

[2] It must be pointed out that not all verbs in Ibibio are capable of indicating frequency through vowel lengthening. Other verbs achieve this through palatalisation, reduplication, or repetition.

(10) a. Morphological vowel lengthening

Simple Root	Frequentative	
wèt	*wèèt*	'write'
ɲám	*ɲáám*	'sell'
wòt	*wòòt*	'kill'

b. Vowel lengthening and suffixation

Simple Root	Frequentative	
fèʀé	*fèè-ŋé*	'run'
dép	*déé-mé*	'buy'
kʌ́ppɔ́	*kúú-mɔ́*	'uncover (e.g., bottle)'

Although simple lengthening of the root vowel marks frequency in some verbs (10a), much more than this is involved in the cases in (10b). In addition to root vowel lengthening, a -CV suffix also appears. The -C- of this suffix is underlyingly [Nasal], while vowel harmony constraints determine the quality of the -V of the suffix. As I intend to show in section 5, this is not simply a question of consonant nasalisation, as suggested by Essien [1979], but more particularly a process of compensatory lengthening. The suffix -C- is specified for the feature [Nasal] which is homorganic to the final consonant in the CVC verb stem. The final C of the verb stem is lost, with subsequent lengthening of the stem vowel to fill the slot of the lost final C.

Although long vowels are attested in noun forms, they do not usually contrast with short vowels in the same environment. It is a difficult task to find even near minimal pairs such as *ídáárá* 'joy' and *údárà* 'type of cherry (with sticky flesh)'. It is instructive to note that these nouns are frequently derived via affixation from verb roots having long vowels.

(11)

Nouns		Verb Root	
ítòòró	'praise'	*tòòró*	'praise'
ídáárá	'joy'	*dáárá*	'rejoice'
íbɔ̀ɔ̀rɔ̀	'response'	*bɔ̀ɔ̀rɔ̀*	'respond'
ùbèèt	'room'	*bèèt*	'shut (e. g., doors, windows) (Freq.)
ùbêt	'your husband' (from *bèt* 'to support')		

Although length may be a feature of both nouns and verbs, the data in this paper are drawn largely from the verbal class because this is the class where length is used for phonological and morphological contrast.

3.2 Long consonants. Ibibio attests long consonants whose distribution is restricted to intervocalic position. Hence, one does not find long consonants in word- or stem-initial or final position. In this paper, I make a distinction between long consonants that have a contrastive function and mere phonetically long consonants

with no contrastive function. Those long consonants that exhibit a distinctive contrastive function are the nasal stops. Voiceless oral stops and the palatal glide, on the other hand, may occur phonetically as long consonants, but they have no contrastive function. Data in the following sections illustrate each kind of long consonants in Ibibio.

3.2.1 Inherent consonant length. Like vowel length, consonant length may be exploited phonologically to make a lexical contrast, as in (12), a contrast that is restricted to nasal consonants. Long voiceless and voiced oral consonants do not contrast in intervocalic position, as illustrated by the examples in (13). Although voiceless oral stops may occur as long consonants, I do not consider them to be phonologically significant since they do not contrast with a short counterpart.

(12) Contrastive nasal consonants

a.	*démé*	'ignore'	*yòmó*	'be noisy'
	démmé	'wake up'	*yòmmó*	'boo at'
b.	*dɔ́nɔ́*	'be smooth'	*mɔ́nɔ́*	'be smooth'
	dɔ́nnɔ́	'slip (on a slippery surface)'	*mɔ́nnɔ́*	'shine (a) torch'

(13) Phonetically long voiceless consonants

Non-derived		Derived	
dɨ́ppé	'lift up'	*sɨ́tté*	'uncork (e.g., bottle)'
*dɨ́pé		*sɨ́té	
tɨ́kké	'descend'		
*tɨ́ké			
tʌ̀kkɔ́	'oppress'	*dʌ̀kkɔ́*	'strain'
*tʌ̀kɔ́		*dʌ̀kɔ́	

3.2.2 Derived consonant length. Consonant length may also result from morphological affixation, as in (14)-(16) which illustrate reversive and negative suffixes. In (14) appear derived geminate nasals; in (15) and (16) appear derived geminate voiceless stops, reversive and negative, respectively. Essien [1979, 1990] has claimed that both voiced and voiceless oral stops can occur as geminate/long consonants in Ibibio, a claim which has been refuted in Urua [1990] and Connell [1991], and by the data provided here. In addition to nasals and voiceless stops, palatal glides (16d) may also occur as long consonants.

Single consonants in Ibibio undergo intervocalic weakening, long consonants do not. This is one crucial reason for considering these consonants long, since it is not possible for weakening to apply to either consonant of a geminate cluster, as evidenced by the affixation of the reversive suffix in (15).

(14) Reversive (stem-final nasal)

a. *tèm* 'cook'
tèm-mé 'remove cooking from fire'

b. *byòm* 'carry on (the) head'
byòm-mó 'remove (object) from head'

(15) Reversive (stem-final voiceless consonant)

a. *kɔ̀p* 'lock'
kɔ̀p-pɔ́ 'unlock'

b. *síít* 'cork'
sít-té 'uncork'

(16) Negative

a. *dép* 'buy'
í dép-pé 's/he is not buying'

b. *bàt* 'count'
í bàt-tá 's/he is not counting'

c. *nék* 'dance'
í nék-ké 's/he is not dancing'

d. *bɔ̀y* 'receive (Freq)'
í bɔ̀y-yɔ́ 's/he is not receiving'

The basic shapes of the suffixes are -V and -CV. A single suffix shape and melody, as will be seen throughout this paper, may have multiple functions. Table 2 provides some of the different suffixes that attach to Ibibio verbs and the functions they perform. These suffixes are ordered, each one listed in Table 2 being ordered typically before the negative suffix, as shown in Table 3.

Table 2. Ibibio suffix type, function, and structure

-V	Stative	[bùùk + V	→ *bʌ̀ʀ-ɔ́* 'be buried']
-V	Reflexive	[fʌ́k + V	→ *fʌ̀ʀ-ɔ́* 'cover oneself']
-CV/-kV	Negative	[tèm + CV	→ *…tèm-mé* 'not cooking']
-CV	Reversive	[tèm + CV	→ *tèm-mé* 'remove cooking from fire']
-CV	Reciprocal	[è-dú-má + CV	→ *è-dú-kɔ̀m-mɔ̀* 'love each other']
-NV	Frequent.	[dép + NV	→ *dée-mé* 'buy many things/times']

Table 3. Order of Ibibio verb suffixes

V–Stat–Neg	bʌ̀ʀɔ́ + Neg	→ ...*bʌ̀ʀɔ́-ké* 'not being buried'
V–Refl–Neg	fʌ̀ʀɔ́ + Neg	→ ... *fʌ̀ʀɔ́-ké* 'not covering oneself'
V–Rev–Neg	tèmmé + Neg	→ *tèmmé-ké* 'not removing cooking from fire'
V–Rec–Neg	è-dú-mà-kà + Neg	→ *í-dú-kɔ̀mmɔ̀-ké* 'they do not love each other'
V–Freq–Neg	déé-mé + Neg	→ ...*déémé-ké* 'not buying many things/ times'

Reversive action is distinct from negative action in Ibibio. Whereas negative action negates the action of the verb, reversive action simply reverses or undoes the action. Moreover, verbs that show reversive action also take the negative suffix, just as regular positive verbs do. However, sometimes the structure and melody of the different suffixes are the same, as seen in (17b-c), where the negative suffix has the same structure and melody as the reversive suffix.

(17) a.	*tèm*	'cook'
b.	*tèm-mé*	'remove cooking from fire (Rev)'
c.	*ń tèm-mé*	'I am not cooking (Neg)'
d.	*ń tèm-mé-ké*	'I am not removing cooking from fire (Rev Neg)'

Suffixation of the reversive suffix -CV to the verb stem *tèm* 'cook' creates a disyllabic stem. Disyllabic verb stems take the *-ké* negative suffix while monosyllabic verb stems take a -CV suffix, where the C is sometimes identical to the final consonant of the stem, as in (17b-c). This is reflected in (17d) where the negative suffix assumes the *-ké* shape. Moreover, the affixes are ordered with the negative suffix coming after the reversive suffix.

One problem in the analysis of long consonants in Ibibio has been how to handle glides. In previous studies, a vowel-glide sequence has been analysed as a diph-thong. For instance, the examples in (18b, d, f) were treated as a CV sequence in which the V was a diphthong. Similarly, cases such as that in (18e) were treated as CV-CV, *kóɪ-yó*. There was no attempt to explain why the same sound was treated as part of a diphthong in the stem but as a glide in the suffix [Essien 1979; Umoh 1985; Urua 1987]. However, as has been argued in Urua [1990] and Akinlabi & Urua [1993], such sequences are more properly regarded phonetically as -VC, where the C is a palatal glide. This is because, morphophonemically, the sequence behaves like other CVC verbs rather than CV verbs, as shown in (19).

Observe that in (19), a -CV suffix is used to mark negation. This suffix has various allomorphs, e.g., -ʀV and -CV for verbs with the CV(C) structure, and *-ké* for CV(V)C(C)V verbs. However, the crucial examples are those in (19a-b). If, indeed, the VG sequences (19c) are diphthongs, then they would be expected to

(18) a. *bɔ̀* 'receive'
bɔ̀y 'receive (Freq)'
í bɔ̀y-yɔ́ 's/he is not receiving (Freq Neg)'

b. *kóy* 'fetch (liquid) with a cup'
í kóy-yó 's/he is not fetching (Freq Neg)'

c. *dáy* 'lick'
í dáy-yá 's/he is not licking (Freq Neg)'

(19) a. CV

dí	'come'	*í díí-ʀé*	's/he has not come'
nɔ̀	'give'	*í nɔ̀ɔ̀-ʀɔ́*	's/he has not given'
kàá	'go'	*í kàá-ʀá*	's/he has not gone'
sé	'look'	*í séé-ʀé*	's/he has not looked'

b. CVC (C_2 = voiceless stop)

dép	'buy'	*í dép-pé*	's/he has not bought'
fòt	'peel'	*í fòt-tó*	's/he has not peeled'

c. CVC (C_2 = glide)

bɔ̀y	'receive (Freq)'	*í bɔ̀y-yɔ́*	's/he has not received (Freq Neg)'
dáy	'lick'	*í dáy-yá*	's/he has not licked'

d. CV(V)C(C)V

màná	'be born'	*í màná-ké*	's/he has not been born'
bééŋé	'make (a) request'	*í bééŋé-ké*	's/he has not made (a) request'
bèkké	'belch'	*í békké-ké*	's/he has not belched'

behave like the CV verbs in (19a). We find that this is not the case; rather, they behave like the CVC verbs in (19b), which negate by affixing a -C-, a copy of the verb final consonant, and a -V, which harmonises with the root vowel. I claim that the VG sequence is not a diphthong but a vowel followed by a palatal glide. This stem-final glide surfaces in the suffix just as the -C does in other CVC verbs [Urua 1990; Akinlabi & Urua 1993]. More importantly, treating CVG sequences as CVC stems rather than as CV stems provides a generalisation for dealing with verb suffixes in the language. Essentially the verb suffix is -CV, but, through assimilation processes, the different verb structures realize different melodies at the surface level.

In an effort to maintain the diphthong analysis, one reviewer for this journal has suggested that through the process of suffixation, the offglide /j/ is promoted up the tree; in other words, there would be glide hardening. While possible, this

approach simply complicates the analysis. Moreover, if the stem vowel were a diphthong, one might expect the suffix vowel, which is a copy of the preceding stem vowel, to be either a diphthong itself or a vowel comparable to the second component of the diphthong. This is not the case; the suffix vowel in the CVG cases is always the initial vowel in the stem and never the second component of the diphthong.

3.3 Ideophonic lengthening. Another function of lengthening in Ibibio is to indicate intensification. This type of lengthening is strictly ideophonic, as explained in Essien [1979]. Only CV verbs or verbs with final nasal consonants may be lengthened, as in (20). Verbs ending with oral stops cannot be lengthened. Rather, intensification in such verbs is marked by the repetition of the entire verb, as in (21).

(20) *dá* 'stand'
ń dááá ... 'I stood for a long time.'

sé 'look'
ń séé́é ... 'I looked for a long time.'

bɔ̀ 'receive'
ń bɔ̀ɔ̀ɔ̀ ... 'I received many times.'

nám 'perform/do'
ń námḿḿ ... 'I performed for a long time.'

(21) *dép* 'buy'
ń ˡdép ń ˡdép ń ˡdép ... 'I bought many things/times.'

bɔ́k 'cook'
ḿ ˡbɔ́k ḿ ˡbɔ́k ḿ ˡbɔ́k ... 'I cooked many things/times.'

The fact that only vowels and nasals but not oral stops get lengthened this way is not as mysterious as it is made out to be in Essien [1979]. This can be accounted for phonetically by the nature of the segments because of the nature of their articulatory occlusion, which is [-sonorant], whereas vowels and nasals may be more readily lengthened since they are [+sonorant]. It is therefore possible that segments with the feature specification [+sonorant] may be prolonged extensively, at least as far as the articulatory organs and air stream permit, but those which are [-sonorant] cannot be so prolonged. This does not in any way suggest that an oral stop length contrast might not be attested in other languages such as Italian.

3.4 Ibibio morphophonemics. At this point, it is useful to introduce some morphophonemic material for a better understanding of the issue of length. Stop consonants are lenited in an intervocalic environment, both lexically and post-lexically, creating homorganic continuants, taps, and approximants, thus, p, b →

[β]; /t, d/ → [ɾ], and /k/ → [ʀ]. Examples in (22) illustrate these changes with reflexive verbs.

(22) *díp* 'hide'
dip + Refl → / dip + V/ → / dípé/ → [dipé] 'hide oneself'
í dip + Neg → /i dip + CV/ → /i dip + pé/ → [i dippé]
's/he's not hiding'

yàt 'wear (e.g. hat) on head'
yàt + Refl → / yàt + V/ → / yàtá/ → [yàɾá]
'wear on one's head'
í yàt + Neg → /i yàt + CV/ → /i yàt + ta/ → [i yàttá]
's/he's not wearing on the head'

fʌ́k 'cover'
fʌk + Ref → /fʌk + V/ → /fʌkɔ́/ → [fʌɾɔ́] 'cover oneself'
í fʌk + Neg → /i fʌk + CV/ → /i fʌk + kɔ́/ → [i fʌkkɔ́]
's/he's not covering'

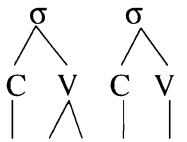
In (22) the reflexive marker is a -V suffix. When this suffix is affixed to a CVC verb, the environment for intervocalic consonant lenition is satisfied and, as expected, the final consonant becomes lenited. This applies to all oral voiceless and voiced stops in this position. However, when a -CV suffix is affixed to a CVC verb stem to mark negation, for instance, among other functions, consonant lenition does not take place, even though the conditions for its operation have been satisfied. This is part of what is to be accounted for in this paper. Falling out from this is the issue of suffix vowels. Only verb stems take -CV suffixes and it is important to note that verbal suffixes harmonise with the stem vowels. The correlation of the stem vowels with the suffix vowels is repeated in (23).

(23)

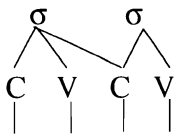
Verb Stem Vowel	Corresponding Suffix Vowel
[i, ɨ, e]	e
[u, ʉ, ə, o]	o
[ʌ, ɔ]	ɔ
[a]	a

4.0 Previous analyses of length

Essien [1979, 1990] rightly regards length as a suprasegmental feature, which may sometimes be phonologically contrastive, sometimes predictable from morphophonemic processes, and sometimes unpredictable. Umoh [1985] supports Essien's position but takes it a step further by looking at length from an autosegmental viewpoint. Her representation of both long vowels and consonants is provided in (24)-(25).

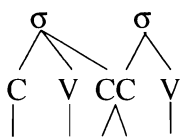
(24) 

→ màànáná 'repeat/again'

(25) 

→ dáppá 'dream (verb)'

By modifying the structure in (25), we can represent a branching intervocalic consonant, as in (26). This structure has the advantage of capturing both predictable (morphological) and unpredictable consonant length in Ibibio, as well as showing that the intervocalic consonant is long.

(26) 

→ dáppá 'dream (verb)'

Cook [1985], in discussing the question of ambisyllabicity in Efik, proposes what he calls "Open Transition" to account for the variability of consonants at syllable boundaries. According to him, the Open Transition (OT) is a type of juncture which is important in order "to be able to specify the correct organisation of consonants and vowels into syllables and syllabemes" [1985: 65]. In other words, Open Transition determines what consonants occur in what position in a syllable in Efik. Hyman [1982], in examining length in Gokana, dispenses with the syllable altogether since, for him, the syllable does not appear to be germane to the length issue in this language. Instead, he posits different representations for length arising from morphological processes and length arising from phonological processes. However, Hyman [1990] revisits the issue of vocalic length in Gokana and modifies his earlier position about the presence of syllables in this language, showing that, in Efik, the syllable and foot are crucial in resolving the idiosyncratic behaviour of certain consonants in certain positions. This analysis is related to the situation in Ibibio, where consonants also vary depending on what position they occupy in the syllable. However, we must point out that in Ibibio, as opposed to Efik, there is sufficient evidence to distinguish between open and closed syllables, as will be shown in 5.2. Given the above and the current work on prosodic

morphology, we now turn our attention to how length may best be accounted for in Ibibio by adopting moraic theory.

5.0 Length and syllable weight in Ibibio

From the data we have seen so far, it is obvious that length mainly occurs contrastively in verbs and their derivatives. Three types of processes are attested in the data on Ibibio length, viz. consonant lenition/lengthening, vowel lengthening/truncation and compensatory lengthening. It would be difficult, from a purely segmental point of view, to account for why these processes occur in certain contexts but not in others, even when these contexts are similar, and especially when it has been shown that both consonant lengthening and lenition occur in the same CV-V phonological environment. Consequently, I adopt the moraic approach to account for length phenomena in Ibibio.

5.1 Moraic phonology. In my analysis of length here, I adopt the theory of moraic phonology, which adopts a basic assumption that languages make a weight distinction between light and heavy syllables having one and two moras, respectively. A heavy syllable may have one of the following structures: CVV, CVC, CVVC, or CVCC. This is completely language dependent.

Weight considerations are important for both phonological and morphological reasons in language; for instance, it is crucial to stress placement in stress languages. Onset consonants are not weighted since they are never assigned to any mora. A syllable weight distinction is largely dependent on whether or not such languages have a vowel length distinction [Hyman 1985, McCarthy & Prince 1986, Hayes 1989]. Since we have shown Ibibio to have contrastive length with nasal consonants and vowels, there appears to be strong motivation for a weight distinction. Thus, the claim made here is that Ibibio makes a distinction between heavy and light syllables [Akinlabi & Urua 1993; Akinlabi 1995]. This claim is justified within the context of moraic theory because Ibibio manifests a vowel length contrast, as we have already shown.

In addition to a moraic theory of weight, underspecification theory [Archangelli 1988] is evoked in positing the velar consonant as an underspecified consonant in Ibibio, since it is this consonant that is often used to fill an empty -C- slot in the consonant tier [Urua 1990, 1992].

5.2 An analysis of Ibibio. The data in (27) provide a sample of monosyllabic verb stems with different syllable structures. The CV stems are both monosyllabic and monomoraic in Ibibio as in other languages. The examples in (27b), though monosyllabic, are all bimoraic in Ibibio.

(27) a. CV

dí	'come'
bɔ̀	'receive'

b. CV(V)C

dép	'buy'	*déép*	'scratch'
bɔ̀k	'cook (soup)'	*bɔ̀ɔ̀k*	'nurture'
nám	'perform/do'	*náám*	'intoxicate'

I treat the coda consonant in CVC structures in Ibibio as *weight-bearing*, so that, together with the root vowel, the syllable is bimoraic. It does not simply acquire a mora from weight by position [Hayes 1989]. However, verbs having CVVC structure are monosyllabic but bimoraic by virtue of the fact that they have long vowels, each vowel comprising two moras. The question is this: does a CVC stem have the same weighting as a CVVC stem, or is a CVVC stem monosyllabic and trimoraic? The position adopted here is that both CVC and CVVC structures are monosyllabic and bimoraic. The CVVC structure does not take a -CV suffix but rather a -V suffix. So, it has the same weight as a CVC structure and is therefore not trimoraic in itself. Once it acquires a -V suffix, thereby creating a CVVCV structure, it becomes disyllabic and trimoraic.

Ibibio attests few cases of long vowels contrasting with short ones in open syllables (pointed out earlier in section 3.1). Although a few cases of long vowels are attested in open syllables, e.g., *kàá* 'go' and *nàá* 'lie down', these do not contrast with short ones. Our reason for distinguishing between CV and CVC stems arises from the fact that CV stems need to lengthen the stem vowel to a CVV-structure before affixing a -CV suffix. In other words, a CV stem needs to be made heavy before -CV suffixation. This requirement is not needed for CVC stems, as illustrated in (29), as they are already considered heavy.

(28)	a.	*dí*	'come'	*ń díí-ʀé*	'I am not coming'
	b.	*mé*	'endure'	*ḿ méé-ʀé*	'I am not enduring'
	c.	*nɔ̀*	'give'	*ń nɔ̀ɔ̀-ʀé*	'I am not giving'
	d.	*dù*	'be alive'	*ń dùù-ʀó*	'I am not alive'
(29)	a.	*dép*	'buy'	*ń dép-pé*	'I am not buying'
	b.	*sín*	'put'	*ń sín-né*	'I am not putting'
	c.	*kòp*	'hear'	*ń kòp-pó*	'I am not hearing'
	d.	*kpáŋ*	'fold'	*ŋḿ kpáŋ-ŋá*	'I am not folding'

Further evidence supporting a moraic analysis is found in compensatory lengthening, where deletion of a stem final C in a bimoraic CVC stem necessitates lengthening of the stem vowel to fill the position of the vacated mora. This is discussed in section 5.2.1 below.

The maximum length for an Ibibio verb root is two syllables. Hence, disyllabic verbs may be either bimoraic or trimoraic, as in (30) and (31), respectively. In (30) we have examples of disyllabic/bimoraic verbs, while those in (31) are disyllabic/trimoraic. In (31a-d), trimoraicity is determined by the fact that there are bimoraic long vowels plus a final moraic vowel. In (31e-g), the third mora arises from the presence of the long consonants, which have weight by position, in addition to the

(30)	a.	*fèʀé*	'run'
	b.	*báɾá*	'make (a) fire'
	c.	*kéβé ~ kébé*	'take enema'
	d.	*tòβó ~ tòbó*	'place (an) order'

(31) a. *fááŋá* 'argue'
b. *mééŋé* 'delay in responding'
c. *tòòró* 'praise'
d. *bɔ̀ɔ̀rɔ́* 'respond'
e. *típpé* 'bore (a) hole'
f. *séppé* 'make (a) mess'
g. *wɔ́ŋŋɔ́* 'turn around'

(32) a. *tém* 'cook'
tém-é 'be on fire'
tém-mé 'remove cooking from fire'

b. *fáák* 'wedge between two objects'
fáʀ-á 'be wedged between two objects'
fák-ká 'remove wedged object'

c. *sàŋ* 'walk ahead'
sàŋ-á 'walk'
sàà-ŋá 'walk (Freq)

d. *kɔ̀p* 'lock'
kɔ̀β-ɔ́ 'be locked'
kɔ̀p-pɔ́ 'unlock'
kɔ̀ɔ̀-mɔ́ 'unlock (Freq)'

weight of the two vowel nuclei in the verb. These are all underived items. However, there are many derived verbs in Ibibio comparable in form to what is found in (30) and (31), as exemplified in (32).

Length in Ibibio may therefore be seen as operating to preserve syllabic weight oppositions. These weight oppositions include monosyllabic, monomoraic stems (i. e., CV); monosyllabic, bimoraic stems (i. e., CV(V)C); disyllabic, bimoraic stems (i. e., CVCV); and finally disyllabic, trimoraic stems (i. e., CVVCV and CVCCV). There are no free standing verbs with four moras. Where such a possibility might arise, especially in cases where the root vowel is long in addition to a potential long consonant, the root vowel becomes truncated, leaving the weight trimoraic. Conversely, where the root vowel is short and there is a possibility of the syllable weight requirement not being met, the root vowel is lengthened to meet the weight requirements of the verb, as in (34).

Note that, in (33) and (34), the verb roots are monosyllabic/bimoraic, even though the verb stem in (33) has a long vowel. But the derived verbs are disyllabic and trimoraic. If the verb root in (33) were trimoraic, assuming the final C is weight-bearing, -CV suffixation would have created a potential four moras verb, as for example, *fáák-ká and *fáák-ná. But a four mora weight is not permitted in

(33) a. *fáák* 'wedge between two objects'
b. fáák + CV → fáák + ká → fák + ká → fák-ká → *fákká*
'remove wedged object'
c. fáák + NV → fáák + ŋá → fák + ŋá → fák-ŋá → *fááŋá*
'remove wedged object (Freq)'

(34) a. *kɔ̀p* 'lock'
b. kɔ̀p + NV → kɔ̀p + mɔ́ → kɔ̀ɔ̀ + mɔ́ → kɔ̀ɔ̀-mɔ́ → *kɔ̀ɔ̀mɔ́*
'unlock (Freq)'

Ibibio and it also appears that this is rarely attested in most languages [Hayes 1989, McCarthy & Prince 1990]. To prevent such a situation from arising, the root vowel becomes truncated in (33b-c), leaving a bimoraic root on which suffixation applies. The long vowel in (33c) is a result of compensatory lengthening from the loss of the final root consonant. This process is discussed in more detail in 5.2.4 below. Conversely, in (34a), the vowel of the verb root is short. To derive (34b) which demands that it be disyllabic and trimoraic, the root vowel is lengthened compensatorily after the deletion of the verb final C to satisfy the weight requirements. Our position as argued earlier is that CVVC roots are equivalent to CVC with regard to weight.

Table 4. Verb roots, structure, and weight

Verb	*Syllables*	*Weight*
CV (*dí* 'come')	Monosyllabic	Monomoraic
CVV (*kàá* 'go')	Monosyllabic	Bimoraic
CVCV (*fɛ̀ʀé* 'run')	Disyllabic	Bimoraic
CVVCV (*bààŋá* 'share')	Disyllabic	Trimoraic
CVCCV (*dɨ̀ppé* 'lift up')	Disyllabic	Trimoraic

The weight distinction is important in Ibibio prosodic morphology because it explains why certain phonological processes may not necessarily take place in apparently identical phonological environments. Consider, for instance, the process of consonant lenition in Ibibio. As pointed out in section 3, this process occurs in intervocalic position. But, not surprisingly, long consonants are not affected by this weakening process. If weakening applied to the long consonants, then the integrity of these consonants would be lost. More crucially, it shows that consonant lenition is only permissible in light-light bimoraic (CVCV) and heavy-light trimoraic (CVVCV) feet. In this case, only the vowels make up the moras. It is therefore vital that a distinction be established between light-light (CVCV) and heavy-light feet (CVVCV/CVCCV), as well as between heavy-light (CVVCV and CVCCV), to account for why these processes may not occur in similar phonological environments [Shaw 1992; Akinlabi & Urua 1993; Akinlabi 1995]. Further evidence to show that these processes are based on syllable weight distinctions is provided in (35).

(35) a.	*sàŋá*	'walk'	*í sàŋá-ké*	's/he is not walking'
b.	*fèʀé*	'run'	*í fèʀé-ké*	's/he is not running'
c..	*fááŋá*	'argue'	*í fááŋá-ké*	's/he is not arguing'
d.	*tòòrò*	'praise'	*í tòòró-ké*	's/he is not praising'
e.	*dippé*	'lift up'	*í dippé-ké*	's/he is not lifting up'
f.	*séppé*	'make (a) mess'	*í séppé-ké*	's/he is not making (a) mess'

In (35) the negative marker is *-ké*. Crucially, observe that lenition of /k/ fails to take place even though an intervocalic environment has been satisfied. This is simply because the syllables in (35) already meet the criteria for light-light or heavy-light feet. /-ké/ in itself is only a light CV syllable and does not constitute a proper foot, i. e., light-light or heavy-light. However, it may be seen as extra-prosodic. The first two syllables already constitute a foot; therefore, lenition cannot take place outside of a complete foot, as in (36). Given our earlier submission, consonant lenition and lengthening may occur only in a light-light or heavy-light feet, respectively. When such weight distinctions are met, these processes can occur. However, when these weight distinctions are not met, it is impossible for these same processes to take place. In (36), further evidence is provided to show that consonant lenition and lengthening can only take place within specified syllable structures constituting different foot structures.

(36) a. CV				
	sé	'look'	*í séé-ʀé*	's/he is not looking
	nɔ̀	'give'	*í nɔ̀ɔ̀-ʀɔ́*	's/he is not giving'
b. CVC				
	dép	'buy'	*í dép-pé*	's/he is not buying'
	màn	'give birth'	*í màn-ná*	's/he is not giving birth'
c. CVVC				
	wùùt	'pull down'	*í wùù-ɾó*	's/he is not pulling down'
	sɔ̀ɔ̀k	'erase'	*í sɔ̀ɔ̀-ʀɔ́*	's/he is not erasing'

In (36), the same negative marker /-ké/, encountered in (35), is realised phonetically as [-ʀV] when it occurs with CV verbs, and as –CV with CV(V)C verbs. However, notice that consonant lenition and lengthening have taken place in these examples even though the verb roots are monosyllabic/monomoraic or monosyllabic/bimoraic. The addition of /-ké/, a -CV suffix, creates a heavy-light (either CVVCV or CVCCV) foot, which enables these two processes to take place. In (36b-c) where the verb root is already bimoraic, there is no need to lengthen the root vowel, as was necessary for the examples in (33a and c), to obtain a heavy-light CVV-CV. The assimilatory process in (33) is accounted for through under-specification theory [Archangelli 1988].

It has been argued that /k/ is the underspecified consonant in Ibibio [Urua 1990, 1992] for the following reasons. In many morphophonemic instances, it serves as the "back-up" consonant where a consonant is required to fill the position of an

empty -C- slot. If we look at the data in (36), we see that monosyllabic verbs without a coda are negated by an -ʀV suffix where the -V- harmonises with the root vowel. Recall also that the voiceless stops [p, t, k] are lenited in intervocalic position, resulting in [β, ɾ, ʀ]. Notice that the -C- of the -CV suffix on the CV verbs is always an -ʀ-, the same consonant that is realised after the lenition of /k/ in (36c). The argument here is that, since the suffix consonant may be assimilated as in (36b), a consonant that satisfies this function is /k/ [Essien 1990; Urua 1990, 1992; Akinalbi & Urua 1993]. Where there is no coda consonant, as in (36a), the consonant of the -CV suffix, which is /k/ underlyingly, assimilates to the coda consonant; but where the coda consonant is /k/ on the surface, this application is vacuous. Further evidence supporting /k/ as the default consonant is presented in the next section on compensatory lengthening.

5.2.1 Compensatory lengthening. There is reason to believe that the base of prosodic morphology in Ibibio is a monosyllabic structure, i. e., CV(C) [Essien 1978, 1979, 1990; Urua 1990]. Most morphophonemic processes hinge on the CV(C) verb root. I present here evidence from compensatory lengthening to show this to be the case. Chene & Anderson [1979] and Hayes [1989], among others, discuss the phenomenon of compensatory lengthening, Hayes [1989: 260] defining it as "the lengthening of a segment triggered by the deletion or shortening of a nearby segment". Given this definition, compensatory lengthening in Ibibio is triggered mainly by the absence of coda consonant segments or by the deletion of coda consonant segments in order to satisfy syllable weight requirements. Let us consider the data in (37), which we have already encountered in section 3.

As pointed out in 3.2, there are several other ways of marking frequency in Ibibio, some of which include lengthening, suffixation, and degemination. However, for our purposes, in (37)-(40) we will concentrate on compensatory lengthening as a marker of frequency. To obtain a frequentative form such as that in (37a) in which the verb root has a CVC structure and is bimoraic, we assume a -CV suffix whose -C- is underlyingly specified [Nasal]. The suffix vowel, as usual, harmonises with the root vowel. The coda consonant is deleted, thereby creating an empty moraic slot which is filled by the lengthening of the root vowel. Where the verb is disyllabic, i. e., either CVCV or CVCCV as in (37c-d) and (39)-(40), such verbs are treated as if they only had a CVC structure. It is as if the final -V- and -CV portions are "extra-prosodic", with the result that the same process that applied to the CVC forms is also applicable to the CVCV and CVCCV forms, discountenancing the last -CV. Observe that the forms with coronals as the coda consonant in (38b), (39), and (40c) do not have the expected alveolar nasal as the suffix consonant. There appears to be a constraint against coronals appearing as suffix consonants when the suffix is specified as [Nasal] [cf. Paradis & Prunet 1989]. This consonant is realised in such cases, once again establishing the status of the velar consonant as the default consonant in Ibibio.

Further evidence for this position is found in verbs without codas, as in (37). Notice that again the suffix consonant is the velar consonant. Two things take place with respect to verbs having a CV structure. One is that, although there is no

coda consonant to be deleted, the root vowel is still lengthened to create a CVV-CV structure, as in (37a-b). In the event that the root vowel is not lengthened to fill the slot of a deleted consonant, a velar consonant is introduced as the coda as in the frequentative forms in (37), where the output is CVŋŋV or CVkkV.

(37) CV

a.	*nɔ̀*	'give'
	nɔ̀ŋ-ŋɔ́	'give (Freq)'
	nɔ̀ɔ̀-ŋɔ́	'feed someone (e.g., a child)'
b.	*kpì*	'cut (with a machete)'
	kpɨ́k-ké	'cut right through'
	kpéé-ŋé	'cut right through (Freq)'
c.	*kpá*	'die'
	kpáŋ-ŋá	'die (Freq)'

(38) CVC

a.	*dép*	'buy'
	déé-mé	'buy (Freq)'
b.	*yàt*	'wear (e.g., hat) on the head'
	yààʀá	'remove (e.g., hat) from head (Reversive)'
	yàà-ŋá	'remove (e.g., hat) from head (Frequentative)'

(39) CVCV

	fèʀé	'run'
	fèè-ŋé	'run (Freq)'

(40) CVCCV

a.	*dɨ́ppé*	'lift up'
	díí-mé	'lift up (Freq)'
b.	*fákká*	'remove wedged object'
	fáá-ŋá	'remove wedged objects (Freq)'
c.	*sɨ́ttɨ́*	'uncork'
	síí-ŋé	'uncork (Freq)'

These processes take place in order to satisfy the weight requirement, which is heavy-light, in order for compensatory lengthening to take place. The suffix nasal consonant is, of course, identical to the coda nasal, thereby creating a long nasal consonant that acquires a mora from the coda through weight by position, deriving a trimoraic disyllable after suffixation. These satisfy the syllabic weight

requirements for this process. Secondly, the default nasal consonant is realised, even though there is none at the coda for the suffix consonant to copy. It has been shown that adopting moraic theory provides a straightforward and easy explanation for compensatory lengthening in Ibibio, since the deletion of the coda C in a CVC structure (which has a weight unit of a mora) and the subsequent lengthening of the root vowel to occupy the position of the deleted coda consonant, occurs just to maintain the weight of the syllable that is bimoraic.

Other processes to be examined in support of the syllabic weight theory in Ibibio include the reciprocal and reflexive formations, as illustrated in (41) and (42). Reciprocal action is action performed by two or more persons for each other. This is grammatically expressed in Ibibio through prefixation and suffixation. Reversive action, on the other hand, indicates that the action expressed by a verb is reversed, not necessarily negated, since both positive action and a reversed action may be negated, as already explained in 3.2.2.

(41) Reciprocation

a. CV

má	'love/like'	*è-dú-mà-kà*	'love one another'
sé	'look'	*è-dú-sèè-rè*	'look at one another'

b. CVC

kɨt	'see'	*è-dú-kɨt-tè*	'see one another'
kòp	'hear'	*è-dú-kòp-pò*	'listen to one another'
kɔ́m	'greet'	*è-dú-kɔ̀m-mɔ̀*	'greet one another'
táŋ	'talk'	*è-dú-tàŋ-ŋà*	'exchange strong words with one another'

c. CVCCV

képpé	'wink at'	è-dú-kèppè	'wink at one another'
kpɔ̀kkɔ́	'hit'	*è-dú-kpɔ̀kkɔ̀*	'hit one another'

It is clear that the reciprocal suffix is -CV where the verb root is CV(C). But where the verb is disyllabic, CVCV/CVCCV, there is no reason to add an additional -CV suffix. The basic structure of the verb is maintained. The -CV suffix is only necessary to balance the weight requirements of a monomoraic syllable, making it bimoraic or maximally trimoraic, as the case may be.

Reflexivisation in Ibibio is marked by a -V suffix which has the effect of weakening a preceding final stop, be it oral or nasal. Connell [1991] suggests that weakening occurs even for nasal stops in Ibibio in similar environments. Word final oral stops become corresponding continuants or taps depending on the place features of the stop. For instance, as already indicated in section 3.4 above, p, b → [β], t, d → [ɾ] and /k/ → [ʀ]. Observe that when the -V suffix is affixed to a CVC verb root, the final consonant becomes weakened, but when a -CV suffix is added to the same CVC verbs, no weakening occurs; rather, there is consonant replication. All of these serve to show that syllable weight is crucial to Ibibio phonology.

(42) Reflexivisation

a.	*sín*	'put'
	síné	'put on oneself'
	í-sínné	's/he is not putting on'
b.	*díp*	'hide'
	dípé → *díβé*	'hide oneself'
	í-díppé	's/he is not hiding'
c.	*yàt*	'wear (on the head)'
	yàtá → *yàrá*	'wear on one's head'
	í-yàttá	's/he is not wearing (on the head)'

The position taken in this paper is not at variance with the argument concerning the relevance of foot structures in Ibibio [Akinlabi 1995] and in Efik [Hyman 1990]. Ultimately, syllable structure is intricately linked to foot structure. If we consider the examples in (41), it will be observed that even though the structure *mà-kà* meets the requirement for the weakening of the voiceless velar stop, this does not occur, possibly because the *-kà* does not constitute part of a foot with *mà*. Alternatively, the failure of *-k* to lenite in this example might be historical.[3]

6.0 Conclusion

In this paper I have provided a descriptive account of length in Ibibio and shown that, using a moraic account, length can easily be accounted for as occurring to satisfy the syllabic weight oppositions in the language. It explains, for instance, why certain phonological processes such as consonant lengthening and lenition, vowel lengthening and truncation, may occur in one instance but fail to occur in another, even when the phonological requirements are satisfied. However, if a distinction is made between light-light and heavy-light feet, then it is easy enough to offer a satisfactory account [Akinlabi & Urua 1993; Akinlabi 1995]. Different syllable weight requirements are therefore needed for the different verbal suffixes to yield the surface output. Using underspecification theory, the fact that velar consonants emerge in the output, either as stops, continuants or nasals, where they were not present overtly as part of the surface structure, is accounted for if the velar consonant is regarded as the default consonant in Ibibio.

[3]This position has been suggested by an anonymous reviewer.

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PUBLICATIONS RECEIVED

Güldemann, Tom. *Verbalmorphologie und Nebenprädikation im Bantu.* Bochum. Universitätitsverlag Dr. N. Brockmeyer. 1996. Pp. vii, 365. ISBN 3-8196-0443-X.

This volume—English title "Verbal Morphology and Dependent Clauses in Bantu"—is the author's 1995 Cologne doctoral thesis as book and is No. 27 in the publisher's series on language change. It consists essentially of four chapters, two short, two long. Its aim is to bridge traditional Bantu scholarship and modern linguistics by linking verbal morphemes and morphology with their functional motivation in today's syntactic structures and specific clause types.

The first chapter (25 pages) consists of theoretical and methodological preliminaries. On the one hand he discusses predication, the linking of predicates, the function of clauses in discourse, and the relationship between morphological structures and syntax. This stands in the tradition of scholars such as Croft, Haiman, C. Lehmann, Longacre, Sasse, and Thompson. On the other hand, he sketches the relevant part of contemporary grammaticalization theory, thus standing with Bybee, Givón, and Heine on the possible range of sources for morphological affixes.

The second chapter (100 pages) is mainly a series of illustrations of the two main types of dependent clauses, adnominals (relative clauses) and adsententials (adverbial clauses). The two types are linked and mainly serve for backgrounding. The marking for these varies: *-ki-* and *-ka-*, tonal, differential prefix sets, and other devices. A lot of space is devoted to this because it is a topic not typically dealt with in Bantu studies and because establishing the distinction between main and dependent clauses is central to the following chapter.

The third chapter (nearly 200 pages) is the core of the book and really has two parts. The first (120 pages) looks at the formal distinctions between the conjugational systems occurring in main and dependent clauses. These include the use of different morphemes, the use of the same morphemes but with different meaning, and a lengthy discussion of focus types and focus sensitive verb forms and category markers, again with multiple examples. The second part deals with the distinction between two different forms of negation, made in many Bantu languages, one typically pre-, the other post-initial. Their possible origins in certain grammaticalization patterns, their respective functions, the distinction between them, and the relationship between TAM markers and negation are set out well. The final chapter (30 pages) suggests a possible functional explanation for the origins of the distinctive dependent clause morphology and links it to crosslinguistic universals.

Non-native speakers may find this book heavy reading. Nevertheless, the effort will be worthwhile, because this is a well-researched, well-documented, well-argued, and bold work. Despite occasional holes, the Bibliography has nearly 400 items. Despite deliberately excluding languages from Zones, A, B and C, nearly 20 Bantu languages or small groups are the object of specific sections of the book, and the Index refers to nearly 150 in the text. You may not always agree with Güldemann's hypotheses but you will certainly find yourself stimulated by them. [Derek Nurse, Memorial University of Newfoundland]

Scantamburlo, Luigi. *Dicionário do Guineense, Volume 1: Introdução e notas Gramaticais*. Lisbon: Edicões Cilibri/FASPEBI. 1999. Pp. 223. ISBN 972-772-070-6.

This work describes Guineense, the author's term for what has previously been called Crioulo or Portuguese Creole, spoken primarily in Guinea-Bissau. Volume 1 consists of three parts. Part One (~70 pages) relates the history of Guineense in Guinea-Bissau. It includes six chapters: Ch. 1 Formation of Guineense on the "rivers of Guinea"; Ch. 2 Features of Guineense; Ch. 3 Studies concerning the lexicon of Guineense; Ch. 4 Linguistic problems of Guinea-Bissau; Ch. 5 Guineense in primary instruction; Ch. 6 Objectives of the bilingual dictionary. Part Two (~35 pages) describes the methodology in compiling the bilingual dictionary. It consists of two chapters: Ch. 7 Lexicography and dictionary making; Ch 8 The creation of the corpus and of the articles for the dictionary. Part Three (~80 pages) provides a grammatical sketch of Guineense, consisting of three chapters: Ch. 9 The phonological system of Guineense; Ch. 10 The morphology of Guineense; Ch. 11 Syntax. Chapter 12 offers a short conclusion. Chapter 13 provides a bibliography of both general work and other dictionaries. Chapter 14, an appendix with maps, concludes the volume.

Studies in African Linguistics
Volume 28, Number 2, Fall 1999

UPCOMING MEETINGS ON AFRICAN LANGUAGES/LINGUISTICS

2000

Jamuary 11-17
AGAINST ALL ODDS: AFRICAN LANGUAGES AND LITERATURES INTO THE 21ST CENTURY. Asmara, Eritrea. (Contact: Charles Cantalupo, Organizing Chair, Against All Odds, The Pennsylvania State University, 200 University Drive, Schuykill Haven, PA 17972; tel: 1-570-385-6055; fax: 1-570-385-3672/1-610-974-9219; e-mail: cxc8@psu.edu or awprsp@eol.com.er)

January 12-14
INTERNATIONAL CONFERENCE ON LINGUISTICS IN SOUTHERN AFRICA, 1ST. University of Cape Town. (Contact: Ms. Nasma Parker, The Linguistics 2000 Secretary, P. O. Box 149, Gatesville 7764, Cape Town, South Africa; tel.: +27-21-0827790798; fax: +27-21-6332468; e-mail: parkerme@iafrica.com. Conference Convener: Raj Mesthrie, Department of Linguistics and Southern African Languages, University of Cape Town, Private Bag, Rondebosch 7700; e-mail: raj@beattie.uct.ac.za)

March 2-5
ANNUAL CONFERENCE ON AFRICAN LINGUISTICS (ACAL), 31ST. Boston University, Boston, Massachusetts. (Contact: ACAL 2000 organizers, African Studies Center, 270 Bay State Road, Boston, MA 02215; fax: 617-353-4975; e-mail: acal2000@bu.edu)

June
CONFERENCE ON AFRO-ASIATIC LANGUAGES, 5TH. Paris.

August 15-19
WEST AFRICAN LANGUAGES CONFERENCE, 22ND. The University of Ghana, Legon, Ghana. (Contact: The Organizing Committee, 22nd WALC, Linguistics Department, University of Ghana, Legon, Ghana; e-mail: medakubu@ug.edu.gh)

August 21-26

WORLD CONGRESS OF AFRICAN LINGUISTICS, 3RD. Université du Bénin, Lomé, Togo. (Contact: Kezie Lebikaza, Comité d'Organization du 3ème Congrés Mondial de Linguistique Africaine, Département des Sciences du Langage et de la Communication, Université du Bénin, P. B. 1515, Lomé, Togo; e-mail: lebikaza@syfed.tg.refer.org)

September

COLLOQUIUM ON AFRICAN LANGUAGES AND LINGUISTICS (CALL), 30TH. Leiden University, The Netherlands. (Contact: The Organizers, CALL 30, Afrikaanse Taalkunde, Rijksuniversiteit te Leiden, P.O. Box 9515, 2300 RA Leiden, The Netherlands; Tel: +31-71-527-2245)