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The phonological systems of the Mbam languages of Cameroon with a focus on vowels and vowel harmony

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Preface

Languages are so rich, multiple and varied that through this study I have merely "... been at a great feast of languages and stol'n the scraps."[1] This book is dedicated to all who introduced me to that 'great feast of languages', even if I have come away with only the scraps.

This book is dedicated to the peoples of the Mbam who put up with my incessant questions about their languages, tolerated my foibles, and joked with me and about me. Despite the glazed eyes when I went on too long about some linguistic drivel interesting only to me, despite the occasional wish that you could slip by me unperceived, you have shown me love throughout it all. Thank you, my brothers and sisters, my fathers and mothers.

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[1] Shakespeare's Love's Labour's Lost, act V, scene 1.

Bissaba Pierre. **Village de Bongando :** Keloga Joseph, Oboya Marius, Nuono Suzanne, Bondong Jean-Marie, Buyaga André, Ayimba Omokolo, Kimetoumine Damien, Ambessa Simon, Abilana Antoinette, Etiaba Georges René, Atibilinsa Laurentine, Emessiene Didier, Bossiomo Sylvestre, Kilangua Dieudonné, Mombogne Jeorgette, Ndobe M Cécile, Bamalandona, Amamana Lidie. **Village de Botombo :** Bamayona Joseph, Ongnong Bessube Jariel, Moanogam Abitala Monique, Mafouma Florence, Manyala Agnes, Onboua Abitala Côme Xavier, Amakega Binjamin, Nigala Nicolas, Bamayona Berthe, Amaguiga, Ngae Dieudonné, Omossolo Jean Pierre, Ngoyo Dieudonné, Mananga Ruben, Kioak Laurent, Guimobong Joseph. **Village de Botatango :** Nolabia Dieudonné, Olemba Barnabé, Odionoloba Charles, Beyeme Bienvenu, Babiala Benjamin, Amanamba Jules, Ebinembegue, Célestine, Anihala Pelagie, Atibia Dorothée, Amolena Julienne, Nimahand Régine. **Village de Bualando :** Aboloa Thimothée, Amassoume Philo, Belebeye Ebougou, Bemesingue Alex, Mamkilanga Crescence, Behineguie Elise, Amalega Lambert, Emeguide Faustin, Omolomo Laurent, Bamalega Thérèse, Amassangalita Hélène, Mendeng Georges, Bohona, Ssolange, Atiosaya Génévieve, Abimana Dorothée, Bamamouguina, Betimé Germaine, Bamabissassiga, Abomo Cathérine, Amana Georgette, Omossola Pulehervie, Bamba Boniface, Ambassa Jacque, Bessegueye Marie, Ossonga, Badomana Joseph, Bolama Magloire, Obiona Patrice, Ossonga Zéphyrin, Bagnogna Augustin, Bobito Jérôme, Ahinaga Michel, Belongue François, Omoloma Paulin, Omossola Parfait, Ogoundé Armand, Mokassa, Dieudonné, Kitétié Bertrand, Baliyama Jeanne, Aboloa Ives, Mousondima Honorine, Abiambama Germain, Amatagana Brice, Buana François. **Village de Kilikoto :** Bahina Benoît, Obiono Célestin, Omonikiyoguino, Bessingue Paul, Omossolo Ignace, Bédédié Silvère, Oloumou François, Babiabana Barthény, Ongomo Dieudonné, Boyitogo André, Eyamo Achille, Bénénguégné Bernard, Bissaya Eugienne, Bayangona Jean-Claude, Bébindé Janvier, Bolamo Timothée, Manambang Dominique, Obilongui Christine, Agombo Guientsing, Nimayona Anne-Marie, Kbakata Clairice **Village de Kananga** : Rémy Beguide, Abihanona Cécile, Bagagne Apollinaire, Ombono Athanase, Aluna Celestin, Emebé Rigobert, Etiégne Casimir, Amatamboka, Bomossioto Blaise, Oyougou Alexandre, Joseph Omana, Ayemba Bruno, Jean Paul Omolomo, Amaba Pierre, Manaba Michel, Bébissémégné Sébastien, Bebine Laurent, Eloumé Firmin, Ngala, Atibia Rose, Abimana Esthère, Abitanga Rémy, Kimobongo Béméling, Bémétiné Cyrille, Batiba Bernard, Bahanaguina Simon, Bouéloumé Jean-Marie, Beneguéguyé Faustin, Bedilene Emile, Amita Binjamin, Ngueti Bernard, Bolikoussana André.

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In memory of Beatrice Miriam Ackor née Decker (1908-1993) who abandoned a girlhood dream of Africa, and died just weeks before it was fulfilled in her granddaughter.

Contents

Abbreviations and symbols

≠	micro-stem boundary
-	morpheme break
=	clitic boundary
(n)	noun
(v)	verb
1p	1st person pl. concord
1s	1st person sing. concord
1sIO	1st person indirect object
2p	2nd person pl. concord
2s	2nd person sing. concord
3pPOS	3rd person pl. possessive
3s.OBJ	3rd person object
3sIO	3rd person sing. indirect object
ADV	adverb
APPL	applicative suffix
ASSOC	associative
ATR	advanced tongue root
AuxV	auxiliary verb
Ave.	average
C	consonant
c9	noun class 9
CAUS	causative
cl.	cluster
COMP	completive
CONJ	conjunction
CONT	continuous
DEM	demonstrative
DIM	diminutive
DIR	directional
DIST	distal prefix
e.o.	each other
EXT	extension
EXTENS	extensive
F1	formant one
F2	formant two
Ft	front (vowel)
FT1	immediate (certain) future
FT2	distant future
FT3	distant (uncertain) future
FT	Future (not defined)
FV	final vowel
H	high tone
HAB	habitual
IMP	imperative
INC	incompletive
INF	infinitive

INTENS	intensifier
INTR	intransitive verb
IO	indirect object
ITER	iterative
L	low tone
LOC	locative
MCS	Modified Contrastive Specification
NARR	narrative tense
NC	noun class
NEG	negative marker
NPhr	noun phrase
o.s.	oneself
OBJ	object
P0	immediate past tense
P1	recent past tense
P2	yesterday past tense
P4	distant past tense
P.C.	personal communication
PFX	prefix
PL	plural
POS	positional
POSS	possessive
PR	present
PREP	preposition
PFV	perfective
PST	past tense (not defined)
RD	round (vowel)
RECP	reciprocal
REFL	reflexive
REP	repetitive
RT	root
S	subject
s.o.	someone
SDA	Successive Division Algorithm
SEPAR	separative
sffx	suffix
sg	singular
smth.	something
sp.	species
ss	same subject
STATIV	stative
SUBJ	subject
T/A	tense/aspect marker
TBU	tone bearing unit
TR	transitive verb
trad.	traditional
V	vowel
VH	vowel harmony
Vrt	verb root
V-sffx(es)	Verb-suffix(es)

1
Introduction

The languages of Mbam have a unique position in Bantu linguistics. Bastin and Piron (1999: 155), for example, consider these languages as the joint between "narrow" Bantu and "wide" Bantu, sometimes patterning with the one and sometimes with the other, while Grollemund (2012: 404) goes so far as to claim that it is "... le centre de diffusion proto-bantu, à partir duquel auraient débuté les migrations bantu..." As such, they are a rich motherlode for linguistic research to better understand both the Bantu A and Southern Bantoid languages and their relationship to each other.

The Mbam languages have another point of interest as well. They have been considered as standard 7-vowel languages (/i, e, ɛ, a, ɔ, o, u/) with Advanced Tongue Root (ATR) harmony. Several of the languages in this study, Nen (Stewart & van Leynseele 1979, Mous 1986, 2003), Maande (Taylor 1990), Gunu (Robinson 1984, Hyman 2001) and Yangben (Hyman 2003a), have been previously analysed as having ATR harmony and 7-vowel vowel inventories. Vowel harmony[2] has been described as "a requirement that vowels in some domain, typically the word, must share the same value of some vowel feature, termed the "harmonic feature" (Casali 2008: 497), in the case of the Mbam languages, an important "harmonic feature" is ATR.

Vowel harmony in African languages is a topic that has received a lot of notice and study, and the vowel harmony of not a few of the Mbam languages has also been studied. Most of these previous studies, however, have been on languages in isolation. This study seeks to compare and analyse the Mbam languages as a group;[3] by comparing their vowel inventories and their vowel-harmony systems, and to discuss how they fit into the wider picture of vowel harmony in African languages and what they may reveal about language typology.

Many African languages which have some sort of ATR harmony have either 7-vowel, 7/9-vowel or 9-vowel systems. The Mbam languages discussed in this study do not fully follow these models. While three of the Mbam languages do have 9-vowel systems, the others do not. One has ten surface vowels of which nine are contrastive. Another has nine surface vowels of which eight are contrastive and four

[2] Vowel harmony is a term used in Bantu linguistics to refer to a specific vowel assimilation process which is limited to verbal derivational suffixes. This is discussed in detail below. The kind of vowel harmony as is found in the Mbam languages is not so common in Bantu.
[3] Five of the varieties in this study (Gunu, Elip, Mmala, Yangben and Baca) have in various previous works been considered as dialects due to a relatively high lexicostatistic similarity.

others have 8-vowel systems. The tenth language has eight surface vowels of which seven are contrastive.

1.1 The Mbam languages in this study

The Mbam languages in this study are spoken in the District of the Mbam-et-Inoubou, in Cameroon's Centre region. They are located between the more straightforward Bantu A languages to the south and the Grassfields Bantu languages to the north and west.

The languages in the District of the Mbam-et-Inoubou divide into two distinct groups: The Bafia group (Guthrie code A50) and the Nen-Yambassa group (Guthrie code A40-A60). While both groups of Mbam languages are related, the main distinction is that the latter group has robust vowel harmony which the former does not have. For this reason, the Bafia group A50 languages are not included in this study. Furthermore, the Basaa[4] group A40 languages, generally found south of the Mbam are also not included. These languages are generally considered distinct from the Nen-Yambassa A40-A60 group.

While the A40-A60 languages have different Guthrie codes, they form a genetic unit both lexicostatistically and structurally. All but four of the Mbam languages found in this group are discussed in this study, although generally only the reference dialect is included. In some cases, where there are relevant known dialectal differences, that information has also been included. The four languages not included in this study are *Tuɔtɔmb* (A46) of the village of Bonek) and *Nyokon* A45, both closely related to Nen, *Hijuk* and *Bati* (A65) located in the Ndom subdivision of the Sanaga-Maritime Division of the Littoral Region of Cameroon.

Nyokon was classified by Guthrie as A45 (Guthrie 1971: 32) and by ALCAM as [514] and in the on-line Ethnologue as (nvo). While previous editions of the Ethnologue placed Nyokon as a dialect of Nen, all of the research done in the language from Guthrie and Tucker (1956: 29) to Mous (2003) show rather that they are distinct languages. The differences between Nen and Nyokon are important. The lexicostatistic similarity is very low, around 36% (Lovestrand 2011: 4 and Mous & Breedveld 1986) and Nyokon shows little evidence of ATR vowel harmony, unlike Nen (Lovestrand 2011: 34). It is, however, a Mbam language and one classified in the same group as the languages in this study.

Tuɔtɔmb (A46), ALCAM [513] is spoken in only one village, Bonek, located on the highway between the Yambeta and Nen language groups. It has an estimated 800 speakers. Phillips (1979) and Mous and Breedveld (1986: 177-241) include Swadesh-based wordlists and indicate that lexicostatistically, it is closest to Nen, but that it has -VC noun-class suffixes in addition to the CV- noun-class prefixes,

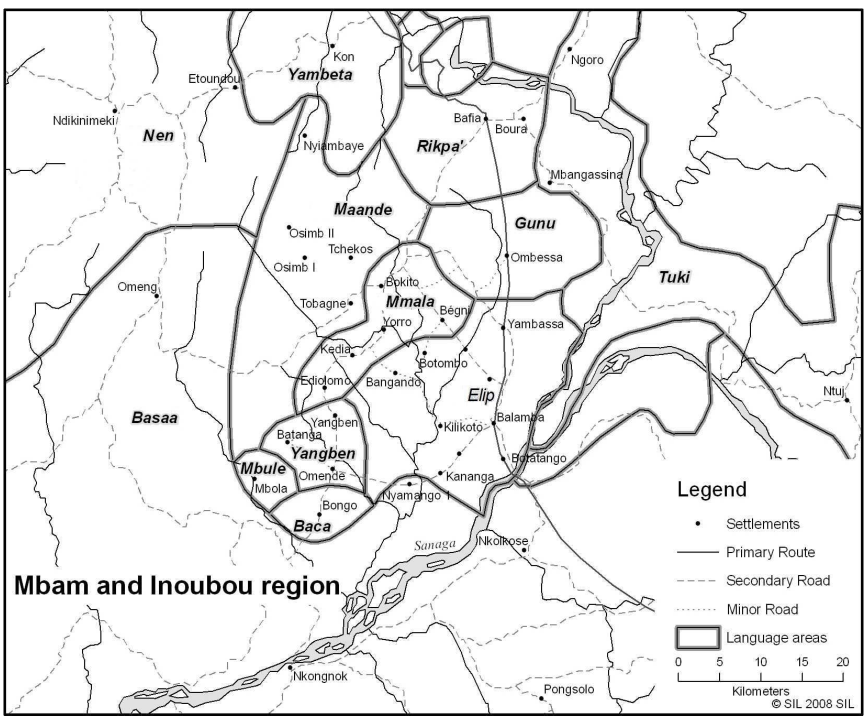
[4] Basaa is briefly discussed in Chapter 5.

although the data from the Phillips (1979) and Mous and Breedveld (1986) wordlists indicate that there is variation in the Tuɔtɔmb noun-class prefixes and suffixes. It is not included due to a lack of opportunity to collect data for it.

Hijuk ALCAM [560] is spoken only in Nike and Meke the southernmost quarters of Batanga, a Yangben village, just north of Mbola village where Mbure is spoken. While ALCAM considers it more closely related to Bafia than the A40-A60 languages surrounding it, Boone (1992c: 2, 4) considers it to be closer lexicostatistically to Basaa with an 87% similarity. Due to this similarity to Basaa, Hijuk was not included in this study.

Bati (A65), ALCAM [530] is located just south of the Mbam. It is considered to be closely related to the other A60 languages, Baca, Mbure, Yangben, Mmala, Elip and Gunu. While vowel harmony has been reported, little study[5] has been done to verify it. Bati, like Tuɔtɔmb, was not included due to lack of time and inaccessibility. The ten languages discussed in this study are located on Map 1, below.

Map 1: The location of the Mbam languages in this study



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[5] Emmanuel Ngue Um has data on Bati.

1.2 The sociolinguistics of the Mbam

The District of the Mbam-et-Inoubou is linguistically very complex. The multiplicity of languages as well as their relatively small size and close proximity lends to a high degree of multilingualism among the populations. Generally speaking, there is a very high level of bilingualism not only in French, but also in the neighbouring languages. Most people, men and women alike, can speak or at least understand one other Mbam language, and more commonly several. Due to the high level of multilingualism, most people can speak to someone from a neighbouring language in their own language and understand the other's language in return.

The Mbam peoples recognise an ethnic interrelationship and history. Although they are quick to identify their own tribe, there is a close interrelation between the tribes. This is perceived in the oral stories of their origins or migrations to the region.

1.3 Oral histories of the origins of the Mbam peoples

While oral histories are too varied to form any solid conclusions, in combination with other information, they can shed light on the history and the interrelatedness of the peoples of the Mbam.

The name “Yambassa” comes from a phrase “bunya Ambassa” *the descendents of Ambassa.* It is said that the Yangben, Baca, Mmala, Elip and Gunu peoples are all the descendents of a certain Ambassa who was, according to some, the wife of Ombono and according to others, a son of Ombono. Although the stories vary according to the people group, there are some definite points of similarity. Many of the Mbam people groups self-identify as children of Ombono and name one of his sons as their ancestor.

In most of the origin stories, Ombono or one of his descendents sets out on a hunt and gets lost. He then establishes himself in a new place (sometimes where there is a lot of game) and founds a village. For this reason, most of the villages in the area are so named after the ancestor who established the village.

Maande: The unpublished Maande text, “La Création de la Famille de Ɔmbɔ́nɔ́” (Ebaya Silas et al. 1981), tells the story of Ombono, a hunter who sets out with his dog. He finds himself in the Osimbe savannah. Being tired (and it seems unsuccessful in his hunt), he sits under a prune tree (*buhétú*) and rests. When he awakes, he collects the fallen fruits and takes them home to his wife, Ekiíkí. She soaks the fruits and prepares them for their supper. The next time, Ombono's wife comes with him on his hunt. When they arrive at the prune tree, they decide to build their house there. Ekiíkí is from the Banen people and since Ombono had not paid a bride price for her, their first son, whom they named Benenyi, was sent to his maternal uncles among the Banen in lieu of the bride price. The rest of the text lists the children of Ombono and their descendents.

Figure 1: The descendents of Ɔmbɔnɔ

1- Ɔmbɔ́nɔ́
+ Ekiíkí[6]
- 2- Benenyi[7]
- 2- Omaŋa
  - 3- Ɛnɔ́ka
    - 4- Makanà
      - 5- Nduku-Búéke
      - 5- Nduku-Likúŋé
      - 5- Nduku-Hɔ́kɔ́
      - 5- Nduku-Bisuŋe
    - 4- Aláama
  - 3- Iŋúlúku
    - 4- Nyɛnɔɔ́kɔ
    - 4- Mayabɔ́
- 2- Kóono (Yambeta)
  - 3- Ɔtɔbɔ
  - 3- Kóono-Kindúné
  - 3- Bɔnyana-Caŋa
- 2- Ɔmaándɛ́ (Maande)
  - 3- Osimbe[8]
  - 3- Nyiambya
  - 3- Anyangɛma
  - 3- Tɔbaányɛ
  - 3- Béyéke
  - 3- Nyɛkáma
  - 3- Iceku
  - 3- Ɔmɛŋa
- 2- Ekiíki (Bafia)
  - 3- Bɛtaŋɔ[9]
  - 3- Mukɔ
- 2- Omendé (Yangben)
  - 3- Balamba (Elip)
  - 3- Kefíke (Gunu)
  - 3- Bákɔ́á (Gunu)
- 2- Kalɔŋa (Yangben)
  - 3- Kɛtɛ́a (Mmala)
  - 3- Yɔɔ́rɔ́ (Mmala)
  - 3- Bényi (Mmala)

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[6] A daughter of the Banen.
[7] The first son is returned to the Banen since no bride price had been given for the mother.
[8] This and the following are the names of the Maande villages.
[9] Two villages on the Bafia-Bokito road towards the village of Kiiki.

Elip: There are three dialects of Elip. According to Abiadina (1988: 7), Ombona was a son of Belibe. His sons were Omenda, Yegele, Kiki, Bunya, Gianabina, Nimandia and Ntsiŋe.

Yegele had seven sons: Ambassa, Giligodua, Gananya, Bualunda, Bodomba, Osula and Bunyandua.

According to Esseba Ombessa Lambert, Mbɔ́nɔ́, the son of Dugalagala, had three sons, Elibie, Nimaandia and Nsiŋe. Elibie's son Ambassa's son, Olamba is the ancestor of the Elip and Gunu people Nimaandia's son Ŋŋulug is the ancestor of the Maande and Nsiŋe's son Bekɔlɔ is the ancestor of the Sanaga (Tuki).

The villages of the *Mana-Kanya* dialect of Elip consider themselves the descendents of Olouo. Olouo had two natural sons, Botombo, Kananga and an adopted son, Killikoto, who was found by the others when out on a hunt. Olouo also had an albino daughter whose son Bongando gave his name to the fourth Mana-Kanya village (Belinga 2013: 2).

The people of Balamba according to (Abiadina 1988: 9) are unrelated to the other Belip, being the children of Bayaga of unknown origins.

Yangben: Ombono's children were Koon, (ancestor of the Gunu), Kiiki (ancestor of the Maande), Muko, Bitang, Bongo, Omende, Kiyangaben (Kalɔŋ).[10]

The descendents of Kalɔŋ give their names to the major clans found today. They are divided into two larger groups the “Pɛmuɛnɛ” which include the clans of Pʊndalɔ, Pʊyɔŋ, Kapɔlɛ, Pʊnʊmanɛ, Epukie and Apʊyɛ and their descendents. The “Pʊnyɔkɪɔtɪɔ” include the clans of Kanyɛ, Pʊkɛlɛk, Mfuno, Ipayɛ, Ipeye and Kuakɛ and their descendents.

Baca: Bongo, the son of Ambono (Ombono) and brother of Balamba. The other sons of Ambono are Yangben, Omende and Kiiki. According to his Excellency Ntsomo Npong Pierre, the chief of the village of Bongo, after an unsuccessful hunt, Bongo found himself lost in the savannah of *Buyok*. He finally settles in the area at the place called *Ndaŋ mpile* (the big oil palm)[11] and founded the village of Bongo.

The Baca also acknowledge a relationship with the Bati in the Sanaga-Maritime, who, according to his Excellency Ntsomo Npong Pierre, acted as a buffer between the Baca and the Basaa further south.

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[10] p.c. Kibassa Otoke (2013)
[11] cf. Sebineni, Alphonsine Flore (2008) also.

Gunu: Ombono was the only daughter of Kamba, the son of Nnyole. Kamba and his wife Molela are considered by the Gunu as the ancestor of five tribes which “crossed the river”, the Gunu, Maande, Elip, Bafia (Rikpa) and the Sanaga. According to Boyomo Mouko Michel (narrative elicited by Sintsimé Crépin, p.c. Nov. 2013), Kamba was a slave of a great warrior who was chief of the tribe. He got into trouble when he fell in love with the beautiful wife of this warrior. Condemned to death, Kamba and his wife fled to the land of the Banen on the other side of the Sanaga, which was at that time sparsely populated.

Figure 2: Descendents of Kamba (Boyomo Mouko Michel. 2013, p.c.)

1- Kamba and his wife,
+ Molela
    2- Ombono (their only daughter) who gave birth to
        3- Gunu
        3- Lemande (ancestor of the Maande)
        3- Iguigui (ancestor of the Bafia)
        3- Saasa (ancestor of the Sanaga (Tuki))
        3- Zong (ancestor of the Elip)

Mmala: The Mmala, like many of the other Mbam people groups, consider themselves as the children of Ombono. While information concerning the origins of the tribe was not found, the stories of the foundation of certain of the principal towns were. According to Oyolo Jonas of Bokito, the first inhabitant of Bokito was a certain Ibondo, who came from the Maande mountains. A certain Amaboda, who was a native of the village of Baliama and a nephew of Bakoa (Gunu) and who was a criminal chased from his village, found refuge at Bokito. Amaboda and Ibondo became allies, along with Guilo of the village of Yorro, to defeat the Bakoa. Thus the village of Bokito is home to three peoples, the Maande, Mmala and Gunu.

There are two similar stories about the village of Begni (principal village of the canton Mmala), both explaining the name (which means “four” in Mmala). In one story, by Mbendé Alain, a hunter and his dog, while hunting in the bush, came across a termite mound where there were four people. In the other story, by Bébiyémé Nkono Raymond, when the colonialists were exploring the area, they came upon four people on a rock. When they asked the name of the area where they were, the people answered “four”, thus the area was named “Begni” ([bénì]). In both accounts, the village of Yorro is considered related to Begni. The first account that says Yorro was the brother of Begni, and thus it was originally a quarter of Begni, the other, that since the village was vast with few people, to protect their territory, some of the inhabitants were sent to “giɔlɔ” that's to say to the empty land or desert. The name later corrupted to “Yorro”.

Mbure: The Mbure people consider themselves to be originally from the District of Sanaga-Maritime, south of the Sanaga. Due to war with the Basaa and Bati, they fled north across the river. Massamatila is one of the ancestors of Mbola, the founder of the village. The Mbure acknowledge that they are related to the Bogando (Elip) and Batanga (Yangben) and Bongo (Baca).

Tuki: According to Dugast (1949: 65-7), the *Tsinga* or Betsinga were originally from the northern bank of the Sanaga river and were pushed south of the river by the Babute (Vute) in the late 1800's (Dugast 1949: 148). With the arrival of the Germans, some of the Tsinga returned to the northern bank of the Sanaga.

The *Bundju* (Bonjo)[12] and *Kombe* (Bakombe) are listed as separate ethno-linguistic groups (like Tsinga) in Dugast (1949: 61-2). The Bundju, who consider themselves related to the Mengisa, were pushed south of the Sanaga by the Vute and later returned to their original lands, when the Germans rebuffed the Vute. The Kombe were subjugated by the Vute and dispersed.

The *Ngoro* (Angoro) also claim to be related to the Mengisa as well as the Bundju, Kombe and Tsinga (Dugast 1949: 62-3). Like the Kombe, they were subjugated by the Vute and dispersed. Dugast relates that among the Ngoro slaves dispersed, a boy named Ndenge caught the attention of the Germans and eventually worked and reunited the Ngoro in their native land.

Interestingly, the Mengisa people speak two languages. One of these, Njowi, is most closely related to the Beti-Fang languages of Ewondo and Eton. The other, Leti, is most closely related to the Tuki variants. Njowi is spoken south of the Sanaga River and Leti to the north, in the Mbam.[13]

Yambeta: According to Phillips (1979: 8-9), the Yambeta believe they have always lived on the right bank of the Nun River (also Dugast 1954: 136). While many outside researchers group Yambeta with the Banen (Nen) group, both culturally and linguistically, the Yambeta consider themselves more closely connected with the Gunu.

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[12] The name in parenthesis is the name of the dialect identified in this study.

[13] Some time ago, I did a lexicostatistical study of these variants based on a Swadesh 100-word wordlist. The results show that there is a close linguistic distance between Njowi, Ewondo and Eton.

Mengisa-Njowi					
77%	Ewondo				
94%	77%	Eton			
23%	23%	23%	Mengisa-Leti		
24%	24%	24%	82%	Tuki-Tocenga	
27%	27%	27%	84%	83%	Tuki-Tutsingo

The distances between Njowi, Leti and the Tuki variants are much larger.

However, according to Bolioki Léonard-Albert, a Yambeta speaker, the origin of the Yambeta people is not so simple. The two main dialects of Yambeta, *Nigii* and *Nɛdɛk*, have different origin stories.

Nigii is spoken in the villages of Kon, Kon-Kidoun and Edop. The people consider themselves descendents of the same ancestor as the Gunu, a certain Mbono (Ombono). The *Nigii* separated from the Gunu over a dispute concerning the entrails of an antelope.[14]

Nɛdɛk is spoken in the villages of Babetta, Bamoko, Bayomen and Bebis. The people of *Nɛdɛk*, unlike the *Nigii*, trace their origins to the Bamoun. During a time of war, a certain Timin, who was fleeing the war, arrived on the right bank of the Nun and settled there. He had three sons, Pɛda, Onkon and Yomɛn, who founded the *Nɛdɛk* villages of Babetta, Bamoko and Bayomen. They do not consider themselves descendents from Mbono (Ombono) but believe they are the true natives of Yambeta.[15]

Like the Nen, the *Nɛdɛk* trace their origins to the region of the Bamoun near Foumban, while the *Nigii* trace their origins to Ombono and the other Yambassa groups.

Nen: Unlike many of the other groups, the Banen, like the Nɛdɛk of Yambeta, do not identify themselves as the descendents of Ombono. Rather, according to Baléhen Jacques René, two of the four sons of a certain Biwoung are implicated in the origins of the Nen people. The four sons, Ganté,[16] Onga, Munen and Bofia,[17] leave the area around Foumban (Bamoun). Ganté settles in the area of Baganté. Onga settles near Tonga, and Munen and Bofia cross the Ndé River. The two brothers stayed together until a dispute between their sons caused Bofia to move south towards the present-day city of Bafia. Munen and his two sons, Ndiki and Niméki settled in the area, which is now named after them, Ndikiniméki.

Many of the peoples speaking Mbam languages share similar oral histories, many of which recount a story of migrations. These people relate to each other by referring to related historical people and the similarities of their traditions indicate a sense of cultural relatedness which is felt by these people and is due either to a common origin or convergence.

[14] p.c from Mboussi Ntafor (Kon) collected by Bolioki Léonard-Albert.
[15] p.c. from Kibilé Victor (Babetta) collected by Bolioki Léonard-Albert.
[16] Who founded the Baganté (Mədʉmba, ALCAM [902].
[17] Who founded Bafia (Rikpa, ALCAM [584])

1.4 Previous work done in the Mbam languages

This study looks at ten of the Mbam languages, comparing their vowel inventories and vowel-harmony systems. The languages compared are:

Table 1: Identification of the Mbam languages in this study

Lang.	ISO	ALCAM	class.	other sources consulted
Nen	BAZ	511	A44[18]	Dugast 1949, Stewart et al. 1979, De Blois 1981, Van der Hulst et al. 1986, Janssens 1988, Mous 1986, 2003, Bancel 1999, Stewart 2000.
Maande	LEM	512	A46	Scruggs 1982, 1983a, 1983b, Taylor 1982, Wilkendorf 2001 *Nomaande-French lexicon*, http://www.silcam.org/documents/lexicons/nomaande/index.html
Yambeta	YAT	520	A46[19]	Phillips 1979, Yambetta Provisional Lexicon, http://www.silcam.org/download.php?sstid=030100&file=YambettaProvisionalLexicon.pdf
Tuki	BAG	551	A61	Biloa 1997, Essono 1974, 1980, Hyman 1980, Kongne 2004 *Lexique Tuki-Français,* http://www.silcam.org/download.php?sstid=030100&folder=documents&file=TukiFrenchLexicon2006.pdf.
Gunu	YAS	541	A62[20]	Gerhardt 1984, 1989, Orwig 1989, Patman 1991, Quilis et al. 1990, Robinson 1979, 1984, 1999, Hyman 2002a. *Nugunu Provisional Lexico*,. http://www.silcam.org/download.php?sstid=030401&file=NugunuProvisionalLexicon.pdf
Elip	EKM	542	(A62)	Paulian 1986b, Ekambi 1990, Onana Nkoa 2007
Mmala	MMU	542	(A62)	Paulian 1986b, Kaba 1988, Idiata 2000
Yangben	YAV	542	(A62)	Paulian 1986a, Paulian 1986b, Hyman 2003a

[18] Erroneously labelled as A60 in the 16th edition of Ethnologue.

[19] *Nigi* (Yambeta) is identified by ALCAM [520] as belonging to Guthrie's A46, along with Nomaande. Phillips (1979: 6, 45), for lexicostatistic reasons, places it with the A60 group.

[20] Guthrie identifies A62 as Yambassa. It is considered to include all the linguistic varieties identified by ALCAM as [541] to [543].

Lang.	ISO	ALCAM	class.	other sources consulted
Baca	BAF	543	(A62)	Abessolo Eto 1990, Sebineni 2008,
Mbule	MLB	544	---	---

1.5 Types of data collected

The data collected for this study consists of several types, as follows:

1) **Wordlists,** for each of the ten languages, consisting of approximately 700 to 4,000 words, depending on the language.

In five languages, Nen, Maande, Yambeta, Tuki and Gunu, these wordlists were started by others (several of which are on-line, see references). Having access to these language groups, I checked this data and elicited additional data as needed from the language areas. These same five languages have also had the most prior research done, works which I have perused in-depth. The principal of these sources are mentioned in Table 1 above for each language.

The wordlists from three of the remaining languages, Yangben, Mmala, Elip, are fully my own personal research, based on five years living among the populations (2003-2008) and an additional five years (2009-2013) working with the languages from Yaoundé. The data of the last two languages, Baca and Mbure are also personal research, based on data collected during short trips taken to the locations, and checked with individuals brought into Yaoundé for work sessions (2009-2013).

2) **Example sentences** and verb conjugations based on the wordlists, as well as recorded and transcribed narrative texts for seven of the ten languages.[21]

3) **Acoustic recordings**: Selected words and phrases from the wordlists have been recorded for acoustic analysis for each of the ten languages. The principal informants who provided me with acoustic data are the following:

Nen:	Mongele Daniel, Maniben Jean Paul, Leumou Benoit, Balehen Jacques René, Sebineni Alphonsine Flore
Maande:	Balan Marc, Bondiokin Jean-Jules
Yambeta:	Bolioki Léonard Albert, Ondaffe Nfon Emmanuel, Nkoum Ngon Andre
Tuki:	Ilomo Ntosbe, Ayissi Ndjebe Jean Pierre, Ebaka Marius, Koroko Emile, Nkengue Marie, Toue Jacqueline, Biteya Marguerite Hortense
Gunu:	Sintsimé Crépin
Elip:	Esseba Ombessa Lambert, Ologa Tite, Baboga Achille
Mmala:	Kiolé Frédéric, Bébiyémé Nkomo Raymond

[21] Languages lacking narrative texts are Baca, Mbure and Tuki.

Yangben: Kibassa Otoke, Okono Tchopito
Baca: H.E. Ntsomo Mpong Pierre, chief of Bongo, Mpong Ntsomo Pierre Gérémie, Ntsomo Ntsomo Mpong Pierre Marie
Mbure: Kibindé Babouet, Inengué Gilbert, H.E. Noueye Noueye Joachim, chief of Mbola

1.6 The language corpus

This section introduces the ten Mbam languages discussed in this study and presents some background information of their location, dialect situation, and a summary and discussion of previous studies.

1.6.1 Nen

Nen (also known as Tunen, or Banen) is spoken in the subdivision of Ndikinimeki (District of the Mbam-et-Inoubou) by an estimated 35,300 speakers (Lewis et al. 2013), and spills over in the south into the subdivision of Yingui (District of the Nkam). Nen has four dialects; the two biggest, *Tɔbɔ́ányɛ* (the reference dialect) and *Tufɔmbɔ́*, have several subdialects. The list of Nen dialects and the villages where they are spoken is listed below in Table 2. This information was collected through personal communication with Loumou Benoît (of the village of Ndɛkalɛnd), the 20/Oct/2009 at Ndikinimeki. The reference dialect is underlined.

Table 2: Dialects and villages of the Nen-speaking region

Dialects:	Ethnologue[22]	Villages:
Tɔbɔ́ányɛ		Ndikinimeki Ndiki village Ndɛkalɛnd Mafɛ Ndikmeluk Nebolen Ndikoti Ndɔkbanya Ndɛma
	Itundu	Buturu Nɛfand Ətundu I, II, III Nomalɛ
		Ndokwanen

[22] Ethnologue names eight dialects of Nen, six of which are listed here. Also included are *Logananga* and *Nyo'o*. The former, I have not been able to place in reference to the dialect names given to me in Ndikinimeki, and the latter is considered by ALCAM as a separate language. It is discussed briefly in section 1.6.3 below.

Dialects:	Ethnologue[22]	Villages:
Ninguessen (Mɛsɛ)	Mese (Paningesen, Ninguessen, Sese)	Ninguessen
Tufɔmbɔ́	Ndogbang (Ndɔkbanɔl)	Ndokbassiomi Ndokbassaben Ndokbandalemak
	Ndokbiakat	Yingui Iboti Ndokanyak Ndoknanga
Alinga	Eling (Tuling)	Nituku Nɛbassɛl Neboya
Ndoktúna	Ndoktuna	Ndoktúna

Nen is one of the better-known and documented of the smaller languages of Cameroon, due to a large degree to the work of Dugast. Other studies on Nen vowel harmony include: Wilkinson 1975; Stewart and van Leynseele 1979; Bancel 1999; De Blois 1981; Van der Hulst, Mous & Smith, 1986; Janssens, 1988; 1993-4; and Mous 1986; 2003. While Dugast mentions vowel harmony (1971: 44-47), she merely lists the vowel combinations found within the word without elaborating on how the harmony functions.

1.6.2 Maande

Maande (also known as Nomaande, Lemande etc.) is spoken in seven villages of the Lemande canton in the highlands of the Bokito subdivision (District of the Mbam) by an estimated 6,000 speakers (Lewis et al. 2013). Maande has two main dialects: *Nonyambaye*, spoken in Nyambaye and Njoko, and *Nuceku* (the reference dialect), spoken in the village of Tchekos. There are two subdialects, which fall between the two major dialects: *Nobanye*, spoken in the villages of Tobanye and Bougnougoulouk, which is closer to *Nonyambaye*, and the dialect spoken in the villages of Omeng and Ossemb, which is alternatively called *Nomeng* or *Nossemb*, depending on the speaker.

Maande is also one of the better-known and documented of the smaller languages of Cameroon. Much work has been done by various SIL linguists notably Scruggs, Taylor and Wilkendorf.

1.6.3 Yambeta

Yambeta is spoken in the subdivision of Bafia, in the grasslands between Bafia and Ndikinimeki. Yambeta has four dialects; two main dialects *Nigii* and Nɛdɛk, and two lesser dialects *Begi* (subdialect of *Nigii*) and *Nibum* (subdialect of *Nɛdɛk*). *Nɛdɛk* is spoken in the villages of Babetta, Bamoko, Bayomen and Bebis and is according to the people the “original Yambeta”. *Nigii* is spoken in the villages of Kon, Konkidoun and Edop. Begi is spoken in Bégui and *Nibum* is spoken in the villages of Kiboum I and Kiboum II. This study is based on *Nigii*, which is the largest and most centrally-located dialect, which has been chosen by the community as the reference dialect. The only in-depth study of Yambeta found is Phillips 1979 *The initial standardization of the Yambɛta language*.

1.6.4 Tuki

Tuki (also known as Sanaga) is spoken along the border of Mbam-et-Kim Division with a few villages also in the Mbam-et-Inoubou Division, from Ntui to Mbangassina to Ngoro. There are approximately 26,000 speakers (Lewis et al. 2013). Tuki consists of seven dialects, although there are some discrepancies between authors concerning both the number (6 or 7) and the names of the Tuki dialects. For the purpose of this study, I am following the lists in Huey and Mbongué (1995). The reference dialect is underlined in Table 3 below:

Table 3: dialects of Tuki (Huey & Mbongué 1995)[23]

Dialect	**People**	**Location**	**Villages**
Tangoro	Angoro	Subdivision of Ngoro	Angadjimberete, Ngoro, Ngamba, Moungo, Egona II, Bakouma, Massassa, Mbengué, Ngoro-Nguima, Nyamongo (N. of the Mbam river) and Djara-Kanga
Tuchangu[24]	Acango	Subdivision of Bafia	Egona I, Ngomo, Nyatsota and Nyamongo (S. of the Mbam river)
Tukombe	Bakombe	Subdivision of Mbangassina	Bialanguena, Boura I and Boura II
Tutsingo	Tsinga		Mbangassina, Enangana, Bilomo, Biapongo, Assola, Badissa, Nyamanga II, Nyambala, Biatombo, Yanga, Yébékolo, Etoa and Esséré
Tondjo	Bonjo		Biakoa, Bindamongo, Endingué, Tchamongo, Talba, Biatenguéna, Goura and Nyambala

[23] Kongne Welaze Jacquis' (2004) study of the verb morphology of Tuki adds *Tungijo* (what the Tuki (or Baki) call it) or *Letí* listed as one of two languages (the other being *Njowi*) spoken by the Mengisa peoples (Kongne Welaze 2004: 8-9). Neither Lewis et al. (2013) or Dieu and Renaud (1983) consider *Letí* a dialect of Tuki, although it is known to be closer to the Mbam A60 languages than the A70 languages to which *Njowi* is considered to belong (Dieu and Renaud 1983: 108-109). Many Tuki speakers do consider it a dialect.

[24] Tucangu speakers perceived that their variety is spoken in Angadjimberete, Egona II, and Ngoro as well as the villages listed. See Huey and Mbongué (1995) for more information concerning the dialect situation of Tuki.

Dialect	People	Location	Villages
Tocenga	Bacenga	Subdivision of Ntui	Nachtigal, Ehondo, Njame, Essougli, Nguété, Odon, Bétanbam Koussé, Kéla, Edjindigouli, Koro and Mbanga
Tumbele	Mvele		Bindandjengué, Biatsota I, Biatsota II, Ntui, Bindalima I, Bindalima II, Koundoung, Bilanga, Ossombé

Tuki has had a moderate amount of previous study. The most extensive work has been done by Jean-Jacques Marie Essono, notably his *Description phonologique du tuki (ati*) (1974) and his *Morphologie nominale du tuki (langue sanaga)* (1980). Other works on Tuki include Hyman's (1980) article on the Tuki noun-class system, a preliminary survey carried out in Tuki in 1994 (Huey and Mbongué 1995), Biloa's (1997) *Functional categories and the syntax of focus in tuki* and Kongne Welaze's (2004) *Morphologie verbale du tuki*.

1.6.5 The Yambassa languages

Five linguistic varieties are identified as *Yambassa* in the literature. These are: Gunu, Yangben, Mmala, Elip and Baca. The best known and most studied of these varieties is Gunu. Following Gunu, the most comprehensive study has been done on Yangben (Hyman 2003a). The other three languages, Mmala, Elip and Baca are referred to in only a few comparative or lexicostatistical articles. ALCAM further divides *Yambassa* by making a distinction between Gunu (Yambassa nord [541]), Baca (Yambassa sud [543]) and Yambassa central [542], consisting of the remaining three: Yangben, Mmala and Elip. A sixth language, *Bati* [530], located just beyond the Liwa river in the Sanaga Maritime Division of the Littoral Region is also considered closely related to the Yambassa varieties. While these languages are synchronically similar, they do not seem to form a genetic unit, as will be shown in this study.

1.6.5.1 Gunu

Gunu (also referred to as Nugunu) is spoken in sixteen villages in two cantons by an estimated 35,000 speakers (Lewis et al. 2013). It has two dialects: *Gunu sud*, spoken in the canton of the same name (Bokito subdivision) in the villages of Assala I and II, Guéfigé, Guebaba, Bokaga and Bakoa, and *Gunu nord*, spoken in the canton of the same name (Ombessa subdivision) in the villages of Ombessa, Boyaba, Essende, Baningoang, Bouaka, Guienising I and II, Boyabissoumbi, Baliama and Bogondo.

At least a dozen articles have been written on Gunu, although most concern grammatical or discourse-level study. Of most interest for this study are Robinson's (1984) *Phonology of gunu*, Paulian's (1986) lexicostatistical comparison with the other Yambassa varieties and Hyman's (2002) article on vowel harmony in Gunu. Other works consulted include: Gerhardt 1984; 1989; GULICO (Gunu Linguistic Committee) 2003; Orwig 1989; Patman 1991; and Robinson 1979; 1999.

1.6.5.2 Elip

Elip (also referred to as Nulibie or Libie) is spoken in ten villages in the Elip Canton by an estimated 6,400 (Lewis et al. 2013). Three dialects are attested. These are *Nuyambassa*, spoken in the village of Yambassa, principal village of the canton Elip, *Nulamba*, spoken in the villages of Balamba, Basolo, Botatango, Boalondo and Boatanye, and *Nukanya*, spoken in the villages of Botombo, Kananga, Bongando and Kilikoto.

Elip is referred to in only a few works, predominantly in lexicostatistical studies, and in one article (Paulian 1980: 63-66) on the noun-class system. It is referred to in *La méthode dialectométrique appliquée aux langues africaines*, 1986, edited by Guarisma and Möhlig, where it is compared with the other Yambassa languages, Mmala and Yangben (Paulian 1986b: 243-279). Other lexicostatistical studies include survey reports: Scruggs 1982; Taylor 1982; Boone et al. 1992. In addition, there are two MA theses from Yaoundé I: a phonology by Ekambi (1990), and a verb morphology by Onana Nkoa (2007).

1.6.5.3 Mmala

Mmala (referred to as Mmaala, Numala, or Numaala) is spoken in the Mmala Canton by an estimated 5,300 speakers (Lewis et al. 2013). It has two dialects: *Nuenyi*, spoken in the villages of Begni, Yorro and the Mmala quarter of Bokito, and *Nukitia*, spoken in the villages of Kedia and Ediolomo.

Mmala is referred to in only a few works, predominantly in lexicostatistical studies, and in one article (Idiata 2000: 23-32) on the noun-class system as well as in Paulian (1986: 243-279). Other lexicostatistical studies include survey reports: Scruggs 1982; Taylor 1982; Boone et al. 1992. In addition, there is a MA thesis from Yaoundé I: a phonology by Kaba (1988).

1.6.5.4 Yangben

Yangben (also referred to in some literature as Kalɔŋ or Nukalɔŋɛ) is spoken in three villages of the Yangben Canton by an estimated 5,296 speakers according to the 1977 census (Boone et al. 1992).[25]

Yangben is spoken in the villages of Yangben, Omende and Batanga. The language is known by various names. The local populations refer to their language as the speech of ___ village; or in other words, as *Nukalɔŋɛ*: speech of Kalɔŋ (Yangben) village; *Numende*: speech of Omende village; and *Nutaŋa*: speech of Batanga village. The differences between these varieties are minor. The local population has recently

[25] Lewis et al. (2013) has the figure at 2,300 based on 1982 figures. This number seems low, based on my personal knowledge of the area and locally reported population estimates.

given a more inclusive name to the speech varieties of these three villages: they call it *Nuasuɛ*: “our language”.

Yangben is referred to in a few works, predominantly in lexicostatistical studies with the notable exception of Hyman’s 2003 article on the vowel-harmony system of Yangben. Hyman’s article is also mentioned in *Vowel harmony and correspondence theory* (Krämer 2003: 13-14). Maho 1999 also refers to it in his *A comparative Study of Bantu Noun Classes*. In addition there are two separate articles on Yangben in *La méthode dialectométrique appliquée aux langues africaines*, 1986, edited by Gladys Guarisma and Wilhelm J.G. Möhlig. In one article (Guarisma and Paulian 1986: 93-176), Yangben is compared to several other Bantu A languages. In the second article (Paulian 1986b: 243-279), it is compared with the other Yambassa languages. Other lexicostatistical studies include survey reports: Scruggs 1982; Taylor 1982; Boone et al. 1992.

1.6.5.5 Baca

Baca[26] (also known as Nubaca or Bongo) is spoken only in the village of Bongo by an estimated 800 people (Boone 1992a: 1; Lewis 2009). The chief of Bongo village, his excellence Ntsomo Npong Pierre, however, says that the population of Bongo is closer to 4,500, most of whom are Baca speakers (p.c. February 2009).

The language is identified as having three dialects, *Baca*, spoken in the quarters of Ganok, Nkos, Buyatolo, Buyabikɛl, Buyabatug and Buyamboy; *Kélendé*, spoken in the quarters of Kélendé Mbat and Kélendé Mɔma; and *Nibieg*, spoken in the quarter of the same name. This study is based on personal research of the main dialect spoken in Ganok quarter.

Baca is referred to in only a few works, notably Scruggs’ 1982 linguistic survey of the Bokito region (including approximately 180 terms), Paulian’s (1986: 243-279) article on the Yambassa languages (with a bit more than 100 terms), Boone’s (1992a) survey of Baca (including approximately 100 terms). In addition to these surveys, two Université de Yaoundé I MA in linguistics theses have been produced: Abessolo Eto 1990 and Sebineni 2008; the latter includes 250 terms in the annex.

1.6.6 Mbure

Mbure (also referred to as Dumbule, Mbule or Mbola) is spoken only in the village of Mbola by an estimated 100 persons (Boone 1992b; Lewis et al. 2013). In personal communication with residents, the population figures were given as 112 persons in 34 households for the four quarters of Mbola (Nikoyo Charles Dieudonné, catechist p.c. 13 Feb. 2009). The quarters of Mbola are Bougnabog, Cade, Kidjo and Tané-Mos. There appears to be no variation in the language between the various quarters.

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[26] Pronounced as [batʃa].

Mbure is referred to in only a couple of works, notably Scruggs' 1982 linguistic survey of the Bokito region (including approximately 180 terms), and Boone's (1992b) survey of Mbure (including approximately 100 terms). Only seven vowels are identified in these works.

1.7 Divergent features of the Mbam languages

The Mbam languages in this study diverge from the general Bantu pattern in several ways and to a greater or lesser extent. The four main areas of divergence involve (1) separate preverbal elements, including differing word order (SOV) and full words interposing between the verb stem and the subject/tense complex; (2) a reflexive/middle derivational prefix replacing the proto-Bantu passive suffix; (3) differences in noun-class prefixes and (4) additional non-Bantu verbal extensions.

Separate preverbal elements:

Bantu languages are generally agglutinative, and while some of the southern Mbam languages (i.e. Yangben, Mmala and Elip) retain a highly agglutinative structure, most of the Mbam languages have phonologically separate preverbal elements. In some of these latter languages, other grammatical words such as indirect object nouns (Nen) and pronouns (Nen and Maande) or adverbs (Maande and Gunu) may be occur between the verb root and the subject/tense complex. Nen in particular is exceptional for having an SOV word order with full nouns occurring between the subject/tense complex and the verb root. Maande, while retaining a SVO word order for full object nouns, does have independent indirect-object pronouns[27] which occur before the verb root.

Reflexive/middle derivational prefix:

The majority of the Mbam languages have a reflexive/middle derivational prefix, **bá-** or **bí-**. While there is also a suffix, **-Vb**, which is a reflex of the proto-Bantu ***-ibu**, found in some of the Mbam languages (Elip, Mmala Yangben and Maande), it is not generally productive except in two of the languages. Baca has both a **bí-** prefix and a **-Vb** suffix, both with a reflexive/middle sense. Mbure exclusively[28] has the **-Vb** suffix, in Example 1.

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[27] Object pronouns, usually referred to in this study as indirect object pronouns, sometimes have additional meanings, including direct object. For simplicity, I refer to them as indirect object pronouns, the more common usage.

[28] Only one exception found: ≠**bì**-sóg-ìɾ-ìn-ì *to pray, respectfully request*

Example 1: Reflexive/middle derivational affixes in Baca and Mbure

Baca	kù-**bí**≠tós-ìn		hurt oneself
	kù-**bí**≠sím-ìn		lie oneself down
	kù≠kù^{n}tʃ-**ìb**-ìt		stoop, bend oneself over
	kù≠téɲ-**íb**-ìt		stand oneself up
	kò≠fàk-**ìb**-ìt		choke oneself
Mbure	mà≠bá^{n}d-**ìb**-è		meet e.o., assemble w/e.o.
	kì≠bík-**p**-èn-è		besmear oneself
	kì≠kɔ́^{m}b-à	kì≠kɔ́^{m}b-**àb**-è	scratch/scratch oneself

Gunu has both the **bí-** reflexive/middle prefix as well as a passive suffix **-lú (*-u**) which attaches to the verb after all other suffixes and extensions, including the final vowel (Orwig 1989: 293).

Noun-class distinctions:

All of these Mbam languages have fairly traditional Bantu noun-class systems. With a few exceptions, the noun-class prefixes are reflexes of the reconstructed proto-Bantu noun-class prefixes. There are three particularities: First, noun class 13 pairing as a plural class with either singular classes 11 or 19. All of the Mbam languages have a plural class 13.[29] Second, in many of these Mbam languages, there are two "morphologically distinct class 6 prefixes" (Maho 1999: 251). These are 6 **mà-** and 6a **àN-**. The third particularity is the plural of a class 19. In the Mbam A60 languages, the plural of class 19 is **mʊ-**, which is considered in Guthrie (1971: 32) as extraneous and was not assigned a class number. In some literature, it is identified as class 18 or in Scruggs (1982) as class 6.

Extra extensions:

There are a handful of extensions found in various of the Mbam languages which are not readily identified with Guthrie's common Bantu extensions. As these are not productive extensions, it is difficult to determine their role. Some examples found in the various Mbam languages are in Example 2.

Example 2: Extra (non-Bantu) extensions found in the Mbam languages

-ʊm	gò≠lág-**óm**-ìn	*be light (Elip)*
	ɔ̀≠bí-lɔ́k-**óm**-à	*listen, pay attention (Maande)*
	gò≠yɔ́b-**òm**-à	*stagger (Gunu)*
	ù≠hə́l-**úm**-ə̀	*rest, breathe (Nen)*

[29] In the Bafia group A50 languages, 13 is a plural class generally pairing with 19.

-ɪj (-ɪ)	ʊ̀≠sàl-**ì**-à	*divorce (v) (Nen)*
	ɔ̀≠táŋ-ál-**í**-án-à	*block (Maande)*
	≠pɔ́b-**ìj**-à	*babble (baby) (Mbure)*
	gʊ̀≠bál-**ì**-à	*swear (Gunu)*
	ʊ̀≠sìɾ-**ìj**-à	*slip (Tuki)*
-al[30]	ù≠kìt-**ə̀l**-ə̀	*slap (Nen)*
	gʊ̀≠bàᵐb-**àl**-à	*palpitate (Gunu)*
	gʊ̀≠gág-**ál**-à	*wrap up (Mmala)*
	kʊ̀≠sík-**ìl**-à	*carve smth small & round (Yangben)*
	kʊ̀≠kɔ̀k-**ɔ̀l**-à	*gnaw (Baca)*
-il/-id/-it[31]	ʊ̀≠mʲɔ̀t-**ìl**-à	*press (v)(Nen)*
	ʊ̀≠fɔ́g-**ìt**	*shake(Yambeta)*
	ù≠tʃə́ᵑg-**ít**-ə̀	*abandon (Tuki)*

1.8 Purpose of the thesis

The purpose of this study is to understand the complexities of the vowel systems and vowel harmony of these ten related languages, located in a relatively small area. The microvariation within these comparable but different vowel systems provides a greater understanding of the phonologies of each of the individual languages. Furthermore, by finding the relevant parameters of variation in a bottom-up manner, this study contributes to the understanding of phonology and specifically that of vowel harmony.

[30] Orwig (1989: 301) considers this extension to be a diminutive. One of my informants for Yangben suggested that it adds a meaning of "roundness" or "circular".

[31] In several Mbam languages, this extension does seem to be a diminutive., but in the examples given here, a diminutive meaning is not evident.

2
Phonological overviews

This chapter gives a basic summary of the contrastive consonants, vowels and tones as well as an overview of how the vowel-harmony system operates both within roots and between roots and affixes for each of the ten languages, Nen, Maande, Yambeta, Tuki, Gunu, Elip, Mmala, Yangben, Mbure and Baca respectively. The first section for each language discusses the consonant system, the second the vowel system, the third the various vowel-harmony processes in particular between the root and the affixes, the fourth various hiatus-resolution processes and the final section the lexical tone melodies.

The basic phonological overviews of these ten languages will reveal their similarities and differences. In particular the variations in their vowel inventories from Baca with nine contrastive vowels and a tenth non-contrastive vowel, Mbure, Yangben and Mmala with nine contrastive vowels, Gunu, Yambeta, Maande and Nen with eight contrastive vowels to Tuki with only seven contrastive and one non-contrastive vowel. Furthermore, while all ten languages have ATR vowel harmony, they differ as to the scope of ATR harmony as well as which, if any additional type of vowel harmony, rounding, fronting or height is present.

2.1 Nen phonological overview

This study is based on *Tɔbɔ́ányɛ*, the reference dialect. It is based on personal research as well as previous research of several linguists and an unpublished wordlist[32].

2.1.1 Consonants

This section discusses the consonant inventory of Nen (section 2.1.1.1), and consonant distribution restrictions (section 0).

[32]The main published sources I have consulted in this study are Dugast 1949, De Blois 1981, Van der Hulst et al. 1986, Mous and Breedveld 1986, Bancel 1999, and Mous 1986, 2003. The main wordlist used is an unpublished 2000+ word Toolbox lexicon. From 2002-2005, 1250 items were collected by Alphonsine Flore Sebineni, Bete Samuel, members of CODELATU (Comité de langue Tunen). From 2006-2010, additional items were added by Kongne Welaze Jacquis with the assistance of Balehen Jacques René, Loumou Benoit, Manimben Jean Paul and Monguel Daniel. I have a 2008 version of this database which I have checked and edited, with the above-mentioned team. Much of the information and analysis collected from both published and unpublished sources has been checked, and in many cases modified, by my own research.

2.1.1.1 Consonant inventory

The consonant system of Nen consists of 17 contrastive consonants. Only Dugast (1971) and Mous (2003) discuss the Nen consonants at any length.

Table 4: Nen contrastive consonants

		labial	alveolar	palatal	velar
stops		b/p	t		k
prenasalised		^{m}b	^{n}d	^{ɲ}dʒ	^{ŋ}g
fricatives		f	s		h
resonants	nasal	m	n	ɲ	ŋ
	oral	w	l	j	

2.1.1.2 Restrictions in consonant distribution

There is no voicing opposition in Nen (Mous 2003: 284). All stops are voiceless except for the bilabial stop. There is a high degree of free variation in the pronunciation of the bilabial stop among native speakers, some pronouncing it more like [b], and others favouring [p]. It also has the tendency to be more voiced in initial position and voiceless in final position. In addition, bilabial consonants are rounded before /ə/ (Mous 2003: 284; Janssens 1988: 62).

While both Mous and Dugast identify the velar fricative /x/ as contrastive (and Dugast also includes the palatal fricative /ç/ which Mous considers an allophone of /x/ after front vowels), from the data I have, it seems that both [x] and [ç] are allophones of /h/. Dugast (1971: 36) acknowledges that [x] and [ç] are probably related to /h/, and Mous (2003: 284) points out that [x] does not occur in word-initial position and is realised as [h] intervocalically. However, /h/ does not occur in word-final position in the 2,000+ word Nen database (CODELATU 2008), see Figure 3 below.

Figure 3: Allophonic variations of /h/ in Nen

/h/ □ [x] / ____#
□ [ç] / $V_{[+ft]}$______#
□ [h] / #_____; V__V

Dugast does give examples of /h/ in word-final position; however she does not take into account final-vowel elision in Nen. Rather, she refers to CVC structures with an epenthetic “voyelle de liaison” (1971: 48-51)[33]. Therefore, in Dugast’s examples, /h/ is not in word-final position but rather intervocalic position, see Example 3 below.

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[33] Dugast (1971: 50) alternatively considered that these “voyelles de liaison” may have been final vowels that have disappeared. Janssens (1988: 63) considers rather the opposite, that these vowels are underlyingly present but will elide in certain contexts. His analysis is more generally accepted (see also Mous 2003: 287).

Example 3: Dugast /h/ in word-final position

Dugast (1971: 36)	**Welaze database**	***gloss***
yúh	[jùhə́]	*bone*
-nɔ̀h	[≠nɔ̀hà]	*cease*
ìlùh	[ìlùhə̀]	*sweat*
-nyóh	[≠ɲóhʲə̀]	*suckle (baby)*

2.1.2 Vowels

This section discusses the vowel inventory of Nen (section 2.1.2.1) and the various adaptations to it due to allophonic realisations such as utterance-final devoicing (section 2.1.2.2), vowel co-occurrences and co-occurrence restrictions (section 2.1.2.3).

2.1.2.1 Vowel inventory

Nen has an inventory of eight contrastive vowels[34]. A complex system of vowel harmony regulates the co-occurrences and co-occurrence restrictions of the vowels. The vowels can be divided into two sets which are mutually exclusive within roots and stems:

Table 5: Nen contrastive vowels

	[-ATR]			**[+ATR]**	
ɪ		ʊ	i		u
		ɔ			o
	a			ə	

In the verb system, all eight contrastive vowels are attested in the verb root. While the distinction between /ɔ/ and /ʊ/ is slight, this distinction is emphasised by rounding harmony. Rounding harmony is triggered by non-high (open) round vowels and targets the final vowel /-a/. High round vowels, /u/ and /ʊ/ do not trigger rounding harmony. In the Nen verb system, the root vowel generally determines the changes in the final vowel according to ATR and/or rounding harmony, as shown in Example 4 below.

[34] This analysis of the Nen vowels differs from most previous studies. Most other studies follow Dugast (1971) in identifying seven contrastive vowels. Only Bancel identifies eight and has a similar vowel inventory and analysis to my own.

Example 4: Contrastive vowels in CVC verb stems in Nen

rt vowel	ATR	round	FV	example	*gloss*
i	x	---	-ə	ù≠tím-ə̀	*dig*
ɪ	---	---	-a	ɔ̀≠kít-à	*pick (fruit)*
ə	x	---	-ə	ù≠kə́t-ə̀	*paint, decorate*
a	---	---	-a	ɔ̀≠tát-à	*guard, watch over*
ɔ	---	x	-ɔ	ɔ̀≠sɔ́s-ɔ̀	*smoke, suck*
				ɔ̀≠kɔ́l-ɔ̀	*scratch, scrape*
o	x	x	-o	ù≠kót-ò	*bite, crunch*
				ù≠kòl-ò	*create*
ʊ	---	---	-a	ɔ̀≠kʊ́t-à	*dry*
				ɔ̀≠kʊ̀l-à	*go, buy medicine*
u	x	---	-ə	ù≠fúk-ə̀	*shake*

In the noun system, seven contrastive vowels are found in monomorphemic CV_1CV_1 roots, as in Example 5 below. The [-ATR] vowel **ʊ** is not found in CV_1CV_1 noun roots.

Example 5: Permitted vowels in CV_1CV_1 noun roots in Nen

i	nì≠tísì	*bowl*	u	nì≠fùnú	*cola nut*
	hì≠síní	*metal pot*		ì≠kútú	*fist*
ə	hì≠pə̀mə̀	*shoulder blade*	o	hì≠kótó	*small of back*
	ì≠pə̀ᵐbə́	*valley*		ù≠ⁿdòkó	*ladle*
ɪ	ì≠kìtí	*trap*	ɔ	hì≠lɔ̀kɔ̀	*poison*
	ì≠fítì	*hunting bow*		ì≠sɔ̀pɔ́	*civet cat*
a	hì≠kàsà	*firewood*			
	ì≠sáká	*palaver*			

2.1.2.2 Vowel devoicing/elision in utterance-final position

In Nen, all vowels are susceptible to devoicing or deletion in utterance-final position. This utterance-final devoicing is interdependent with the utterance-final loss of contrast in the tone melody, as shown below. Table 6 shows the tone and final-vowel reduction in disyllabic noun roots (Janssens 1988: 67; Mous 2003: 287).

Table 6: Tone and final-vowel reduction in Nen CVCV noun roots

≠Cv̀Cv̀	→	≠Cv̀C
≠Cv́Cv́	→	≠Cv̀C
≠Cv́Cv̀	→	≠Cv́C
≠Cv̀Cv́	→	≠Cv̀Cv̀

Example 6 below illustrates the melody and the associated vowel reduction in utterance-final position.

Example 6: Final-vowel devoicing in Nen

underlying forms		final	non-final	*gloss*
nì≠təlú	≠LH	[nìtəlù]	[nìtəlú]	*chin*
mɔ̀≠kàŋá		[mɔ̀kàŋà]	[mɔ̀kàŋá]	*root*
ì≠pə́kù	≠HL	[ìpə́k]	[ìpə́kù]	*wing*
hì≠páŋà		[hìpáŋ]	[hìpáŋà]	*ankle*
mì≠sə̀kù	≠L	[mìsə̀kù̥]	[mìsə̀kù]	*elephant*
hì≠lùpù		[hìlùp]	[hìlùpù]	*cocoon*
mì≠ɲàmà		[mìɲàm]	[mìɲàmà]	*grain*
ì≠lə́ŋú	≠H	[ìlə̀ŋ]	[ìlə́ŋú]	*metal*
ì≠sáká		[ìsàk]	[ìsáká]	*palaver*

2.1.2.3 Vowel co-occurrences

Several factors govern the co-occurrences of vowels in CVCV nouns. These factors include 1) ATR-harmony restrictions and 2) restrictions on V_2, depending on the features of V_1. Each of these vowel co-occurrence restrictions will be discussed in turn in sections Error! Reference source not found. and 2.1.2.3.2 below.

2.1.2.3.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ is always [-ATR] and never found in a [+ATR] environment. In Example 7 below, all ATR vowel co-occurrences in CVCV noun roots are shown.

Example 7: ATR vowel co-occurrences in CVCV noun roots in Nen

	[-ATR] vowels			**[+ATR] vowels**	
ɪ-ɪ	ì≠títí	*bowl*	i-i	ì≠kítì	*piece (of)*
ɪ-a	nì≠títà	*forehead*	i-ə	ì≠kìtə̀	*ram*
ɪ-ʊ	mì≠ílʊ̀	*sperm*	i-u	---	---
a-ɪ	ì≠hàkì	*genet*	ə-i	hì≠sə́lì	*hare*
a-a	ì≠máká	*monitor lizard*	ə-ə	mə̀≠sə́kə̀	*wailing (n)*
a-ʊ	ì≠pàkʊ́[35]	*agama lizard*	ə-u	mì≠sə̀kù	*elephant*

[35] Dugast has this word (1971: 74) glossed as 'lizard' and written with [o]. Mous (2003:286) in addition states that a-ɔ is one of the non-adjacent vowel sequences excluded in Nen. The Welaze (2008) database has this word written with [ɔ]. Based on my own recordings and analysis of the F1/F2 formants of this back round vowel, it is somewhat closer to the averages of /ʊ/ therefore more closely in accordance with Dugast's [-ATR] vowel **o**.

Dugast 1971	***gloss***	**Welaze 2008**	***gloss***	**F1 ave**	**F2 ave**
èbako	*lézard (p74)*	ɛ̀pàkɔ́	*agama lizard*	568	1003
èkaho	*crachat (p75)*	ɛ̀kàhɔ́	*phlegm*	569	1038

[-ATR] vowels			**[+ATR] vowels**		
ʊ-ɪ	pʊ̀≠ʊ̀jí	*beehive*	u-i	pù≠lùfí	*curse (n)*
ʊ-a	ɔ̀≠hʊ̀tá[36]	*hair*	u-ə	ì≠lúkə́	*latrine*
ʊ-ʊ	mʊ̀≠kʊ̀lʊ́	*foot, leg*	u-u	mə̀≠lùkù	*wine*
ɔ-ɪ	nì≠pɔ́tí	*heap, pile*	o-i	nì≠hókí	*language*
ɔ-a	---	---	o-ə	---	---
ɔ-ɔ	ì≠kɔ̀tɔ́	*hoof*	o-o	hì≠tókó	*hernia*

2.1.2.3.2 Other V_1V_2 co-occurrence restrictions

When V_1 in CV_1CV_2 nouns is a front, high vowel, V_2 may either be a high or an open (non-high) vowel. The contrastive features of Nen vowels can be analysed with only one height distinction: high vs. non-high, or following Hyman (2001, 2003a), "open". Any vowel, therefore, which is not a high vowel is an open vowel. There is no *contrastive* distinction in height between /o/ or /ɔ/ and /ə/ or /a/; the only contrast is in ATR. When V_1 is a non-high, non-back vowel, V_2 may be either a high, round or open (non-high) vowel. When V_1 is a non-high round vowel, V_2 may be either a high vowel or an identical round vowel. Which high, round or open vowel occurs in V_2 position depends on the ATR value of V_1. The high V_2 is /ɪ/ (which has a surface representation [ɛ]) in [-ATR] noun roots or /i/ in [+ATR] noun roots. The round V_2 is generally either /ʊ/ in [-ATR] noun roots or [u] in [+ATR] roots, with certain exceptions. The open (non-high) vowel is either /a/ in [-ATR] roots or /ə/ in [+ATR] roots, see Example 8 below.

Example 8: Value of V_2 in CVCV noun roots in Nen

V_2 in CVCV noun roots	**[-ATR]**	**[+ATR]**
High	ɪ ([ɛ])	i
Round	ʊ or ɔ	u or o
Open	a	ə

Table 7 summarises the possible CVCV noun-root combinations permitted in Nen.

The formants of vowel /ʊ/, according to my recordings, are 546/1000; those for /ɔ/ are 600/1061. In addition, there is a slight lowering of vowels in utterance-final position. These words were recorded in isolation, and as a result would have utterance-final lowering which would account for /ʊ/ having a slightly higher than average F1 in these examples.

[36] Welaze (2008) lists this word as [ɔ̀hɔ̀tá], but the F1/F2 frequencies place it in the range of /ʊ/. If the vowel was really /ɔ/, it would trigger rounding harmony. Any underlying /ɔ-a/ patterns would surface as [ɔ-ɔ], which is not the case here.

Table 7: Surface CV_1CV_2 combinations permitted in Nen

V_1V_2	high	round	open
/i/ /ɪ/	i-i ɪ-ɪ	--- --- (ɪ-ʊ)[37]	i-ə ɪ-a
/u/ /ʊ/	u-i ʊ-ɪ	u-u ʊ-ʊ	u-ə ʊ-a
/o/ /ɔ/	o-i ɔ-ɪ	o-o ɔ-ɔ	---[38] ---[39]
/a/ /ə/	a-ɪ ə-i	a-ʊ ə-u	a-a ə-ə

2.1.3 Vowel-harmony processes

Nen has a complex system of vowel harmony consisting of two interacting types of harmony: ATR and rounding harmony. Both types of vowel harmony cross morpheme boundaries and are found within the phonological word.

2.1.3.1 Pre-stem elements

Both nominal and verbal pre-stem elements undergo vowel harmony in Nen. These are ATR harmony and rounding harmony which will be discussed in turn below.

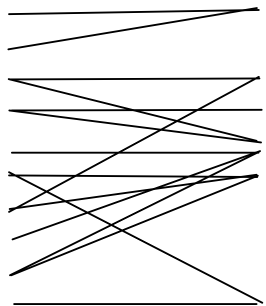
ATR harmony in pre-stem elements

Nen has a system of twelve noun classes. The nasal-initial classes, 1, 3, 4, 6 and 9 also have subclasses without a nasal (Mous 2003: 299). The subclass 6a, unlike in some of the other Mbam languages, occurs only as a collective of class 5/6 nouns (Dugast 1971: 72).

The following double-class genders occur: 1/2, 1a/2, 3/4, 3/6, 3a/4a, 3a/6, 5/6, 7/8, 9/4, 9/8, 9a/6, 14/6, 14/8, 19/13. Mous (2003: 299) also found a couple of examples of 7/13.

[37] Very few /ɪ-ʊ/ combinations have been found in Nen.
[38] Precluded due to rounding harmony; /o-ə/ is realised as /o-o/.
[39] Precluded due to rounding harmony; /ɔ-a/ is realised as /ɔ-ɔ/.

class	prefixes
1	mʊ- /mu-
1a	ʊ- / u-
3	mʊ- /mu-
3a	ʊ- / u-
5	nɪ- / ni-
7	ɪ- / i-
9	mɪ- / mi-
9a	ɪ- / i-
14	pʊ- / pu-
19	hɪ- / hi-



class	prefixes
2	pa- / pə-
4	mɪ- / mi-
4a	ɪ- / i-
6	ma- / mə-
8	pɪ- / pi-
13	tʊ- / tu-

All noun-class prefixes with a vowel undergo ATR harmony, as shown in Example 9.

Example 9: ATR harmony of Nen noun-class prefixes

class	**noun-class prefix**	**example**	***gloss***
1	mʊ- /mu-	mʊ̀≠lì^{m}bà	*sorcerer*
		mù≠kójì	*co-wife, sister-in-law*
1a	ʊ- / u-	ʊ̀≠mʊ́lá	*young woman*
		ù≠mìnə̀	*taro*
2	pa- / pə-	pà≠lì^{m}bà	*sorcerers*
		pə̀≠kójì	*co-wives, sisters-in-law*
		pà≠pʊ́lá	*young women*
		pə̀≠pìnə̀	*taros*
3	mʊ- / mu-	mʊ̀≠líŋí	*tail*
		mù≠lə́^{n}dù	*tendril*
3a	ʊ- /u-	ʊ̀≠ŋɔ̀^{n}dɔ̀	*peanut*
		ù≠mílə̀	*palm nut*
4	mɪ- / mi-	mɪ̀≠líŋí	*tails*
		mì≠lə́^{n}dù	*tendrils*
4a	ɪ- / i-	ɪ̀≠ŋɔ̀^{n}dɔ̀	*peanuts*
		ì≠mílə̀	*palm nuts*
5	nɪ- /ni-	nɪ̀≠fʊ́fá	*current (stream, river)*
		nì≠púnə́	*wall*

class	**noun-class prefix**	**example**	***gloss***
6	ma- /mə-	mà≠tàⁿdà	*urine*
		mə̀≠lùkù	*wine*
		mà≠fʊ́fá	*currents (streams, rivers)*
		mə̀≠púnə́	*walls*
7	ɪ- /i-	ɪ̀≠tátʊ́	*mushroom*
		ì≠pə́kù	*wing*
8	pɪ- / pi-	pɪ̀≠tátʊ́	*mushrooms*
		pì≠pə́kù	*wings*
9	mɪ- /mi-	mɪ̀≠ɲàmà	*meat*
		mì≠sə̀kù	*elephant*
9a	ɪ- /i-	ɪ̀≠máká	*monitor lizard*
		ì≠mítə́	*calabash*
13	tʊ- / tu-	tʊ̀≠kɔ̀lɪ̀	*squirrels*
		tù≠kòlí	*strings, threads*
14	pʊ- /pu-	pʊ̀≠nɔ̀ŋɔ̀	*village*
		pù≠nùtə̀	*swelling*
19	hɪ- /hi-	hɪ̀≠kɔ̀lɪ̀	*squirrel*
		hì≠kòlí	*string, thread*

Nen verbs have only two prefixes which obligatorily harmonise with a [+ATR] vowel in the verb root: infinitives have a /ʊ-/ (class 3) prefix and the reflexive prefix /pí-/. As with the noun-class prefixes, the reflexive prefix is subject to ATR harmony, see Example 10.

Example 10: ATR harmony of high vowels in Nen verb prefixes

ʊ-	ù≠kìt-ə̀	*strike*
	ʊ̀≠kít-à	*pick (fruit)*
	ù≠kə́t-ə̀	*carve*
	ʊ̀≠kàl-à	*patch (v)*
	ʊ̀≠kɔ́l-ɔ̀	*scrape, scratch*
	ù≠kòl-ò	*create*
	ʊ̀≠kʊ̀t-à	*gather, pile up*
	ù≠kùl-ə̀	*hoe (v)*

pí-	ù-pí≠kì^{n}d-ə	*wipe off excrement*
	ʊ̀-pí≠kís-à	*shave oneself*
	ù-pí≠lə́n-ə	*rejoice*
	ʊ̀-pí≠fàl-à	*comb oneself*
	ʊ̀-pí≠nɔ́k-ɔ̀	*slither*
	ù-pí≠hól-^{j}ə	*thank*
	ʊ̀-pí≠nʊ́m-ín-à	*grab, take hold*
	ù-pí≠fùm-ə	*dive; submerge oneself*

Nen is unusual in that it also has a few concord prefixes which are dominant and trigger ATR harmony for the numerals "one" and "two" as well as in other constituents of the noun phrase, see Example 11. The numerals with [+ATR] prefixes are bolded.

Example 11: Nen numeral prefixes

class	**num. prefix**	**example**	***gloss***
1	ɔ-	mʊ̀≠^{n}dɔ̀ ɔ̀≠mɔ̀tí	*one person*
2	pa-	pì≠^{n}dɔ̀ pá≠fà^{n}dí	*two people*
3	u-	mʊ̀≠límá **ú≠mòtí**	*one heart*
4	i-	mì≠límá **í≠fə̀^{n}dí**	*two hearts*
5	nɪ-	nì≠káɲí ní≠mɔ̀tí	*one king-fisher*
6	ma-	mà≠káɲí má≠fà^{n}dí	*two king-fishers*
7	ɪ-	ì≠hàkì í≠mɔ̀tí	*one genet*
8	pɪ-	pì≠hàkì pí≠fà^{n}dí	*two genets*
9	ɪ-	mì≠ímə̀ ì≠mɔ̀tí	*one house*
13	tʊ-	t^{w}≠á^{n}dʒì tʊ́≠fà^{n}dí	*two leaves*
14	pʊ-	pʊ̀≠l^{j}á pʊ́≠mɔ̀tí	*one tree*
19	hi-	h^{j}≠á^{n}dʒì **hí≠mòtí**	*one leaf*

Roots are either [-ATR] or [+ATR]. Those that are [+ATR] are dominant and the concord prefixes will undergo ATR harmony. Only numeral *four*[40] has a [+ATR] root which will cause a prefix to assimilate. Nen numerals have an additional peculiarity; the numbers *three, five, six, seven* and *eight* are inherently [-ATR] and dominant, causing the [+ATR] noun-class 4 numeral prefix to assimilate to [-ATR] (Bancel 1999: 5). In Example 12 below, the dominant [+ATR] vowels are bolded and the dominant [-ATR] vowels are double underlined.

[40] Other numbers such as nine and ten, are [+ATR] but they are invariable and do not take concord prefixes.

Example 12: Nen numerals

c2 (pá-)	pì≠ⁿdɔ̀ pə́≠n**ì**sə̀	*four people*
c3 (ú-)	mʷ≠ìlí **ú**≠mòtí	*one month*
c4 (í-)	mʷ≠ìlí **í**≠fəⁿdí	*two months*
	mʷ≠ìlí í≠lá̠lʊ́	*three months*
	mʷ≠ìlí **í**≠n**ì**sə̀	*four months*
	mʷ≠ìlí í≠lá̠nʊ̀	*five months*
	mʷ≠ìlí í≠lí̠ⁿdálʊ̀	*six months*
	mʷ≠ìlí í≠lí̠ⁿdálʊ́mʊ̀nà	*seven months*
	mʷ≠ìlí í≠ná̠mànì	*eight months*

The singular possessive pronouns in Nen are [-ATR] and the plural forms are [+ATR] and dominant[41]. In Example 13, the [+ATR] adjectives are bolded.

Example 13: Nen ATR harmony in Possessive pronouns

possessive	pá≠mʲá pə̀≠nísə̀	*c2≠1s.POSS c2≠brothers/cousins*
pronouns	j≠àjí ì≠ŋgílí	*c9≠3s.POSS c9≠idea*
	wə̀≠**ə́sú** ɔ̀≠ᵐbílá	*c3≠**1p**.**POSS** c3≠compound (house)*
	mə̀≠**ə́sʷə́** mə̀≠nífə́	*c6≠**1p.POSS** c6≠water*
	hʲ≠**ə́pʷə́** hì≠fʲà	*c19≠**c2.POSS** c19≠trench*

Nen verbal pre-stem elements optionally undergo ATR harmony. In normal speech, the subject concord and tense markers may assimilate to a dominant [+ATR] vowel in the verb root, depending on the speaker, if no other word interferes. However, the further one gets from the verb stem, the less likely the element will harmonise. In Example 14 below, all three possible pronunciations are found. In my recordings, Example 14b and c were the most common pronunciations.

Example 14: Optional ATR harmony of preverbal elements in Nen

a.	mí-ŋù[42]	pín-ə́k-ə̀	tʊ́nḁ̀	*I will dance again*
b.	mí-ŋù	pín-ə́k-ə̀	tʊ́nḁ̀	
c.	mí-ŋʊ̀	pín-ə́k-ə̀	tʊ́nḁ̀	
	1s-F	dance-prog-FV	again	

Nen, unlike the other Mbam languages in this study, has an OV word order and both the direct and the indirect objects, as well as certain adverbs, may occur between the subject and tense markers on the one hand and the verb stem on the other. When these other words are present, the preverbal clitics optionally harmonise with any dominant vowel present. Bancel (1999: 7-8) notes that "…harmonisation of preverbal markers does not depend on their syntactic relationships, but only on the

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[41] Bancel (1999:6) indicates that the distal demonstrative is also [+ATR].

[42] The future tense is written as **ŋo** in Mous 2003

ATR value of the word to the right”. In Example 15 below, only **(a)** and **(b)** optionally harmonise the subject and tense markers.

Example 15: Optional ATR harmony of other elements in Nen V phrase

(a)	bá-ná	hʲə́pʷə́	hìɦʲà	tìm-ək-ə
	bə́-nə́	hʲə́pʷə́	hìɦʲà	tìm-ək-ə
	c2-P2[43]	c19.3pPOSS	c19.pit	dig-pl-FV
	They dug their pit.			

(b)	hìsə́lì	à-ná	pəsú	ìᵐbátà	hík-ín-ə
	hìsə́lì	ə-nə́	pəsú	ìᵐbátà	hík-ín-ə
	duiker	c1-P2	1p	much	conquer-intensive-FV
	Duiker has completely conquered us.				

(c)	bá-ná	wíjà	òᵐb-ók-ó	ùmə́
	c2-P2	3s.OBJ	throw-prog-FV	there
	They threw him over there.			

(d)	à-ná	wíjà	píjí	pìlá	pìlàlɔ̀	pàt-à
	c1-P2	3s.OBJ	c8.DEM	c8.things	c8.three	request-FV
	S/he requested of him three things.					

2.1.3.1.1 Rounding harmony in pre-stem elements

Rounding harmony targets /a/ and is triggered by the non-high (open) round vowels /ɔ/ and in one case only, /o/. The high round vowels /u/ and /ʊ/ never trigger rounding harmony. Only two noun-class prefixes, classes 2 and 6, have an underlying /a/ which may undergo rounding harmony, and of the two, only class 6 does so consistently, see Example 16 below. Class 2 has at least one example where rounding harmony does not occur.

Example 16: Nen rounding harmony of /a/ in noun-class prefixes

class	**noun-class prefix**	**examples**	***gloss***
2	pa-	pɔ̀≠nɔ́mì	*males*
		pɔ̀≠kɔ́ŋɔ́	*frogs*
		pò≠óp-ì	*thief*
		pə̀≠kójì	*co-wives, sisters-in-law*
6	ma-	mɔ̀≠pɔ́tí	*piles*
		mɔ̀≠hɔ́ŋɔ̀	*fat*
		mò≠ló	*oil*
		mò≠tókó	*crotch (of tree)*

[43] Mous (2003: 297) refers to this as a hodiernal past, but notes that it is the most commonly used past for texts situated “in an unspecified far past”.

Rounding harmony is more restricted than ATR harmony in Nen. None of the verbal pre-stem elements with /a/ undergo rounding harmony.

2.1.3.2 Vowel harmony in suffixes

Most verb suffixes undergo vowel harmony, but there are some that trigger ATR harmony. Discussed in turn below are suffixes that undergo ATR harmony, the ATR-dominant suffix **-i,** and rounding harmony.

2.1.3.2.1 ATR harmony in suffixes

ATR harmony is triggered by a [+ATR] vowel, usually in the root from where it spreads bidirectionally. All [-ATR] vowels in the phonological word change into their [+ATR] counterpart. The final vowel will also assimilate. A few examples are shown in Example 17 below:

Example 17: ATR harmony of verbal suffixes

applicative	-ɪn	ʊ̀≠kʊ̀l-ɪ̀n-à	*go buy protective medicine*
		ʊ̀≠lʊ̀t-ɪ̀n-à	*gather up something*
		ù≠kòl-ìn-ə̀	*create*
		ù≠lòt-ìn-ə̀	*tease oneself*
reciprocal	-an	ʊ̀≠ɲán-àn-à	*join, meet, put together*
		ù≠kùs-ə̀n-ə̀	*receive, get, obtain*
positional	-ɪm	ʊ̀≠tɪ́n-ɪ́m-à	*stand, stand up*
		ʊ̀≠pà^{n}d-ɪ̀m-ɪ̀n-à	*stoop, bend over*
		ù≠kíl-ím-ə̀	*shiver, tremble*
		ù≠kùt-ìm-ìn-ə̀	*bend, bow*
separative	-ʊn	ʊ̀≠fát-ʊ́n-à	*loosen*
		ù≠súŋ-ún-ə̀	*untie*
??	-al	ʊ̀≠sɪ̀k-àl-à	*slice*
		ù≠kìt-ə̀l-ə̀	*slap*
progressive	-ak	ù≠tát-ák-à	*watch, guard*
		ù≠tìm-ə̀k-ə̀	*dig*

Some deverbal nouns are formed by adding the applicative suffix and a noun-class prefix to the verb root. These suffixes also undergo ATR harmony, see Example 18.

Example 18: Nen deverbal nouns with applicative suffix

ò≠sìk-ìl-à	*winnow*	ì≠sìk-íl-ín-á	*van*
ò≠sɔ̀n-ɔ̀	*sweep*	ì≠sɔ̀n-ín-á	*broom*
ù≠súp-ə̀	*thresh, beat*	mə̀≠súp-ín-ə́	*threshing floor*
ù≠kùs-ə̀	*get, obtain*	pì≠kùs-ín-ə́	*goods, possessions*
ù≠pít-ə̀	*hide*	nì≠pít-ím-ín-ə́	*shelter (n)*

Other deverbal nouns are formed simply by adding a noun-class prefix to a verb. Any verbal suffixes present will undergo ATR harmony, see Example 19.

Example 19: Nen deverbal nouns

ù≠púm-ə̀	*hunt (v)*	mù≠púm-ə̀	*hunter*
ò≠tà^{n}d-à	*urinate*	mà≠tà^{n}d-à	*urine*
ò≠hán-ìn-à	*give, offer (gift)*	nì≠hán-ìn-à	*gift, sacrifice*
ò≠màn-ìn-à	*govern, dominate*	nì≠màn-ìn-à	*order, command*
ù≠tú^{m}b-ə́l-ə̀n^{j}-ə̀	*announce*	mù≠tú^{m}b-ə́l-ə̀n^{j}-ə̀	*messenger*

2.1.3.2.2 ATR-dominant suffixes.

The [+ATR] causative suffixes **–i** and **-Vsi**, and the pluractional **-əni**, unlike the other verbal extensions and aspectual suffixes, are underlyingly [+ATR} and trigger ATR harmony. ATR harmony is generally bidirectional and the causative suffix spreads both to the root and to the final vowel, as seen in Example 20. Since Nen does not permit non-identical vowels in juxtaposition, the **–i** of each of these suffixes is realised on the surface as a glide preceding the final vowel.

Example 20: ATR Dominant suffix -i in Nen

caus.	-i	ò≠fɔ̀l-ɔ̀	*borrow*	ù≠fòl-ì-ə̀	*loan (cause to borrow)*
		ò≠kʊ́t-à	*dry*	ù≠kút-ì-ə̀	*cause to dry*
		ò≠fát-à	*tighten*	ù≠fə́t-ì-ə̀	*cause to tighten*
		ò≠hɪ̀k-à	*be tasty*	ù≠hìk-ì-ə̀	*please, satisfy*
	-əsi	ò≠síp-à	*peel*	ù≠síp-ə́sì-ə̀	*cause to peel*
		ò≠pʊ̀k-à	*begin*	ù≠pùk-ə̀sì-ə̀	*cause to begin*
pluract-ional	-əni	ò≠sàl-à	*chop*	ù≠sə̀l-ə̀nì-ə̀	*chop into many pieces*
		ɔ̀≠tát-à	*guard*	ù≠tə́t-ə́nì-ə̀	*guard often/together*

2.1.3.2.3 Rounding harmony in suffixes

Most verbal extensions and inflectional suffixes which contain the vowel /a/ may undergo rounding harmony as well as ATR harmony. Like ATR harmony, rounding harmony is bidirectional. Rounding harmony is triggered only by non-high (open) round vowels. The high round vowels /u/ and /ʊ/ do not trigger rounding harmony. Rounding harmony may be blocked by a high vowel. A few examples are shown in Example 21 below:

Example 21: Rounding harmony of verbal suffixes in Nen

final vowel	-a	ʊ̀≠lɔ́ŋ-ɔ́	*whistle (v)*
		ʊ̀≠sɔ̀n-ɔ̀	*sweep*
		ù≠kót-ò	*crunch*
		ù≠tóp-ò	*paint (v)*
		ʊ̀≠kʊ̀t-à	*gather, heap up*
		ù≠húk-ə̀	*blow (wind)*
progressive	-ak	ʊ̀w≠ɔ̀l-ɔ́k-ɔ̀	*fasten, bind*
		ʊ̀≠sɔ́s-ɔ́k-ɔ̀	*suck, smoke*
		ʊ̀w≠ò^m^b-òk-ò	*throw away*
		ʊ̀≠kʊ̀t-ák-à	*gather, heap up*
		ù≠húl-ə́k-ə́	*come*
??	-al	ʊ̀≠kɔ̀l-ɔ̀l-ɔ̀	*snore*
		ù≠ɲòŋ-òl-ò	*tickle*
		ʊ̀≠kʊ̀t-àl-à	*light (fire)*
		ù≠pùl-ə̀l-ə̀	*stir*
pluractional	-əni	ù≠lóŋ-ónì-ə̀	*whistle often/together*
		ù≠sùŋ-ə̀nì-ə̀	*defend*
causative	-əsi	ù≠sòn-òsì-ə̀	*cause to sweep*
		ù≠fúk-ə́sì-ə̀	*shake (TR)*

Not all variations of ATR and rounding harmony are evidenced in the causative and the pluractional verb forms. Since both the pluractional and causative suffixes are dominant, only the [+ATR] root form is found.

High vowels are opaque to rounding harmony. Where a suffix or extension with a high vowel occurs, the rounding harmony will be blocked, see Example 22. The long causative and the pluractional /i/ block rounding harmony to the final vowel as is seen above in Example 21. This is particularly true with **-ʊn** separative suffix and **-ʊm** which were only found with words such as **ù≠həl-úm-ə̀** *rest* and **ù≠təl-ún-ə̀** *explain* which can not show that /u/ blocks rounding harmony in the suffix.

Example 22: Opacity of front vowels in Nen rounding harmony

separative	-ʊn	ʊ̀≠kɔ́ŋ-**ʊ́n**-à	*tip over*
?? [44]	-ʊm	ʊ̀≠kɔ́l-**ʊ́m**-à	*be afraid*
		ʊ̀≠lɔ́ŋ-**ʊ́m**-à	*listen*
applicative	-ɪn	ʊ̀≠pɔ̀ŋ-ɔ̀l-**ɪ̀n**-à	*fence in*
		ù≠hól-**ín**-ə̀	*wrap up*
		ù≠kóp-**ín**-ə̀	*surround, protect*
diminutive	-ɪl	ʊ̀≠mʲɔ̀t-**ɪ̀l**-à	*press (v)*
positional	-ɪm	ʊ̀≠ɲɔ́ⁿd-**ɪ́m**-ɪ̀n-à	*squat*
		ù≠lòⁿd-**ìm**-ìn-ə̀	*stalk*

2.1.4 Hiatus-resolution processes

There are several hiatus-resolution processes found in Nen. These are glide formation in section 2.1.4.1, vowel assimilation in section 2.1.4.2 and hiatus retention in section 2.1.4.3.

2.1.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted. Where V_1V_2 sequences occur, either within the morpheme or across morpheme boundaries, a high vowel in V_1 position becomes a glide. Glide formation occurs principally between a high vowel in the noun-class prefix and a vowel-initial noun root, as seen in Example 23.

Example 23: Nen prefix-root glide formation

surface from	**underlying form**	**gloss**
hʲʊ̌lì	hì≠ʊ́lì	*hawk*
hʲɔ̀fɔ́	hì≠ɔ̀fɔ́	*fish*
pʷòlí	pù≠òlí	*work*
pʷɔ̀sí	pʊ̀≠ɔ̀sí	*day*
mʷìpí	mʊ̀≠ìpí	*termite*

Glide formation my also occur between a CV verb root and a –V(C) verbal extension, Example 24.

[44] Only a handful of verbs had this suffix. I have not been able to find a satisfactory definition of it.

Example 24: Nen glide formation in the verb word

surface form	underlying form	*gloss*
ùfəŋʲə̀	ʊ̀≠fàŋ-ì-à	*hang up*
ʊ̀sánʲà	ʊ̀≠sán-ì-à	*blow up, inflate*
ùhʷə́	ù≠hú-ə́	*cover*
ʊ̀kʷà	ʊ̀≠kʊ̀-à	*fall*
ùnʷə̀nʲə̀	ù≠nù-ən-ì-ə̀	*defend*
ʊ̀hʷínà	ʊ̀≠hʊ́-ín-à	*melt (INTR)*

2.1.4.2 Vowel assimilation

Nen has a few instances of vowel assimilation between noun prefix and root. These occur predominantly when the root is vowel initial and the prefix has a non-high vowel. When the root has an initial high front vowel, the root vowel assimilates to the low prefix vowel (Example 25(a)). When the vowel-initial root has a round vowel, the prefix vowel assimilates to the root vowel (Example 25(b)).

Example 25: Nen vowel assimilation

	surface form	underlying form	*gloss*
(a)	màápì	mà≠ípì	*c6.termite hills*
	mə̀ə́sə̀	mə̀≠ísə̀	*c6.eyes*
(b)	mùùmə́	mə̀≠ùmə́	*c6.baobabs*
	mʊ̀ʊ̀jí	mà≠ʊ̀jí	*c6.beehives*
	mòòní	mə̀≠òní	*c6.markets*
	mɔ̀ɔ́pɔ̀	mà≠ɔ́pɔ̀	*c6.nests*

2.1.4.3 Hiatus retention

Identical vowels in juxtaposition are permitted. This is particularly evident between the noun-class prefix and the noun root. Where the vowels are either underlyingly identical or have identical surface realisations due to a vowel-harmony process, both vowels are retained, see Example 26 below.

Example 26: Nen prefix-root hiatus retention

surface Form	underlying Form	gloss
mììlì	mì≠ìlì	*c4.months*
nìísə̀	nì≠ísə̀	*c5.eye*
mʊ̀ʊ̀kʊ̀	mʊ̀≠ʊ̀kʊ̀	*c3.stone*
mììpí	mì≠ìpí	*c4.termites*
mɔ̀ɔ̀sí	mà≠ɔ̀sí	*c6.days*
mòónì	mà≠ónì	*c6.voices*

2.1.5 Tone

Nen has a two-tone system underlyingly, high and low. Downstepped highs occur after an unrealised low tone before a high (Mous 2003: 286). In addition, Nen has high-tone spreading where a high tone will spread and replace the low tone of the following syllable. A high tone only spreads once and will not replace a low caused by the assimilation of two low-toned vowels (Mous 2003: 287). Rising and falling tones are found where there is juxtaposition of two or more dissimilar tones, usually where two vowels are juxtaposed across morpheme boundaries. As mentioned above in section 2.1.2.2, utterance-final loss of contrast in the tone melody and utterance-final vowel reduction are interdependent. The vowel reduction may also occur when the word in question is followed by a vowel-initial word. In these cases, where the final vowel of a LH noun root precedes a vowel-initial word, the vowel does not elide and the high tone is realised on the following vowel. The low tone of an elided vowel disappears and is not realised on the following vowel nor does it induce downstep (Mous 2003: 286-7; Janssens 1988: 84).

2.1.5.1 Tone melodies on nouns

High and low tone contrast in monomorphemic noun roots. Four tone melodies are attested in CVCV noun roots, see Example 27 below. Noun prefixes usually have a low tone, although there are a few exceptions.

Example 27: Nen nominal tone melodies

ì≠sàsà	≠L.L	*chest*
ì≠pàsá	≠L.H	*salt*
ì≠tákà	≠H.L	*scaffolding*
ì≠sáká	≠H.H	*palaver*

2.1.5.2 Tone melodies on verbs

Nen verb roots most commonly have a CVC structure, although there are some VC and CV roots as well. The CODELATU (comité de langue Tunen) database to which I have access lists all verbs with an extra-radical final vowel /-a/ which varies according to vowel harmony. This differs from Mous' analysis of an epenthetic vowel. The loss of the final vowel in Nen is considered to be a historical process (Mous 2003: 292).

According to Mous (2003: 291-3), Nen verb roots lexically have either a high or a low tone; there is a third class which has a floating high tone underlyingly. As with nouns, there is reduction of tone in utterance-final position. Nen verbs may have one of two tone "shapes" depending on the tense. These are the basic and a high-tone shape which is mostly found in negative tenses, the hodiernal past and the optative. The high-tone shape originates from an inflectional final high tone which attaches to the last vowel which is not part of the root. These grammatical functions of tone, however, are beyond the scope of this study. The verbal tone patterns found in the CODELATU database are as in Example 28 below.

Example 28: Nen verbal tone melodies

L	ò≠fàf-à ò≠fàf-ìt-à	*apply oil*
H	ò≠pát-à ò≠pát-íl-à	*gather, pick up*
LHL	ò≠wǎːl-à ò≠wǎːl-ìl-à	*babble (baby)*

2.2 Maande phonological overview

This study is based on *Nuceku,* the reference dialect. It is based on personal research as well as previous research of several linguists and an unpublished wordlist[45].

2.2.1 Consonants

This section discusses the consonant inventory of Maande (section 2.2.1.1), the allomorphic variation of /n/ (section 2.2.1.2) and consonant distribution restrictions (section 2.2.1.3).

2.2.1.1 Consonant inventory

The consonant system of Maande consists of 18 contrastive consonants, as is shown in Table 8.

Table 8: Maande contrastive consonants

		labial	alveolar	palatal	velar
stops		p/b[46]	t	tʃ	k
prenasalised		ᵐb	ⁿd	ᶮdʒ	ᵑg
fricatives		f	s		h
resonants	nasal	m	n	ɲ	ŋ
	oral	(w)	l	j	

[45]The main published sources I have consulted in this study are Scruggs 1983a, 1983b, Taylor 1984 and 1990, Wilkendorf 1985 and 2001. The main wordlist used is an unpublished 4,000+ word Toolbox lexicon collected by the Dictionary Development Committee (HƐNYƐNƆ) comsisting of the following members: Boulonglong Jonas, Bekoumé Pierre, Betiéné Seth, Belong David, Ondo Charles, Bélang Siméon (scribe) and Balan Marc (lexicographer). I have a 2010 version of this database which I have checked and edited with Balan Marc. Much of the information and analysis collected from published and unpublished sources has been checked, and in many cases modified by my own research.

[46] There is free variation between [p] and [b] depending on the speaker (Wilkendorf 2001: 6).

Scruggs (1983a: 6, 68-9) only identifies 13 contrastive consonants, considering "NC" combinations as clusters rather than prenasalised consonants. She comes to this conclusion by noting that in many of the neighbouring languages, there is a clear morpheme boundary between nasal and consonant, which does give preference to a N+C interpretation. However, Scruggs also notes that there are no non-suspect CC sequences within a syllable. Scruggs eventually decides in favour of N+C sequences (1983a: 69). While there are noun-class prefixes in various Mbam languages which have a N- or VN- structure causing N≠C combinations across morpheme boundaries, various noun classes, including 6, 11, 13, 14 and 19 illustrated below (see Example 29), never have a nasal in the prefix. In addition, according to Scruggs (1983a: 74; 1983b: 16), noun-class prefixes in Maande have either V- or CV- shape. No VN-prefixes occur. Such being the case, these "NC" combinations are morpheme- and syllable-internal. Therefore, only two possibilities remain: a NC sequence within the syllable (as Scruggs analyses them) or a prenasalised consonant. Since there are no unambiguous CC sequences in Maande, and unambiguous prenasalised consonants do occur in other Mbam languages, the latter interpretation is preferred in this study. Another motivation for the latter interpretation is for the sake of uniformity in these sketches since the languages do not differ significantly in this area and the choice of analysis is on grounds that are not language-specific. In addition, prenasalised consonants are not more restricted in their distribution than other consonants.

Example 29: Maande prenasalised stops in root-initial position

hì≠^{m}bòkí	tù≠^{m}bòkí	*c19/13.large terracotta pot*
nù≠^{m}bətí	tù≠^{m}bətí	*c11/13.earth worm*
hì≠^{n}dəŋə́	tù≠^{n}dəŋə́	*c19/13.calabash for drinking wine*
bù≠^{n}dìwə́	mə̀≠^{n}dìwə́	*c14/6.bush used to mark territory*
nʊ̀≠^{ŋ}gáhɔ́	tʊ̀≠^{ŋ}gáhɔ́	*c11/13.smell of good food cooking*
hì≠^{ŋ}gífílí	tù≠^{ŋ}gífílí	*c19/13.riddle*

2.2.1.2 Morphological variation of /n/

The Maande high vowels, /i/ and /ɪ/ in the causative suffixes **-i** and **-is-i** and in the neuter suffix **-ɪ** will cause anticipatory palatalisation of alveolar nasals /n/ to /ɲ/ (right-to-left). The causative suffixes occurring at the right edge of the verb word will trigger the palatalisation for several alveolar nasals in the verb word. In Example 30(a), pairs of verbs show verbal suffixes **-on** (-an) *continuous suffix* and **-ɪn** *applicative suffix* becoming **-oɲ** and **-iɲ** (bolded below) after the causative suffixes (underlined). Example 30(b) shows how multiple suffixes with /n/ may be palatalised by the causative suffix **-i**.

Example 30: Palatalisation of /n/ in Maande causative constructions

(a)	o≠ból-ót-**ón**-o	*become red*	o≠ból-ót-**óɲ**-ís-i	*make red*
	ɔ̀≠hɔ̀l-**ìn**-à	*pass by*	ò≠hùl-**ìɲ**-ì	*transmit, cause to pass*
(b)	ò≠sìm-ìn-ìn-ə̀			*enclose*
	ɔ̀≠làt-ìn-ìn-à			*add, enlarge*
	ò≠tóŋ-**íɲ-íɲ**-i			*show*

The neuter suffix **-ɪ**, unlike the causatives, occurs either in the first or second suffix slot after the root (see Example 31(b) below). In this position, there are never multiple targets for palatalisation. Non-high vowels will block the spread of palatalisation (see Example 31(c) below). In Example 31(a), the alveolar nasal of the verb root **≠san** *disperse,* (bolded below) is palatalised by the neuter suffix **-ɪ** (underlined).

Example 31: Palatalisation of /n/ with the Maande neuter suffix -ɪ

(a)	ɔ̀≠sá**n**-à	*disperse*	ɔ̀≠sá**ɲ**-ì-à	*escape, flee, scatter oneself*
(b)	ò≠tʃìk-ìl-ì-ən-ə̀			*arrange, classify*
	ɔ̀≠hàt-ì-àk-ìn-à			*catch, stop as a group*
(c)	ɔ̀≠bɔ́n-ɔ́s-ì-à			*punish*

Other suffixes and extensions with high vowels /i/ or /ɪ/ do not cause palatalisation. In Example 32, the applicative suffix **-ɪn** (bolded) does not palatalise /n/.[47]

Example 32: Non-palatalisation after applicative suffix -ɪn/-in

ò≠lə́n-ə̀	*love, desire*	ò-bí≠lə́n-**ín**-ə̀	*rejoice in, take pleasure in*
ɔ̀≠tʃàn-à	*split*	ɔ̀≠tʃàn-**ìn**-à	*split (appl.)*

2.2.1.3 Restrictions in consonant distribution

Maande has only open syllables. Consonant-glide sequences, especially when they occur at morpheme boundaries, are formed by the desyllabification of a high vowel. The consonant /w/ is very rare. Scruggs (1983a: 9-13) considers that [w] is usually either a phonetic off-glide of a round vowel or a desyllabified /u/ in most cases, however there are a few cases where neither of these two analyses fit. The predictable occurrences of [w] will be discussed in further detail in section 2.2.4 below.

[47] Hyman (1999: 267, 288) proposes that many Bantu suffixes, of particular interest for this study the applicative, should be analysed as having degree 3 vowels (i.e. *-ed), rather than degree 2 vowels (*-id). Then front height harmony involves raising [ɛ] to [ɪ] by a process of "peripheralisation", inhibited by a mid vowel. If the Mbam applicative **-ɪn** historically was *-ɛn, it would explain why this suffix does *not* cause palatalisation on /n/ in Maande as high front vowels do. The Maande applicative does not surface in the current state of the language as a degree 3 vowel. The analysis of certain suffixes as having degree 3 vowels also explains why these suffixes, including the applicative, are height dominant in Mmala, as discussed in Section 2.7.3.2.5 below.

2.2.2 Vowels

This section discusses the vowel inventory of Maande (section 2.2.2.1), long vowels (section 2.2.2.2), utterance-final devoicing (section 2.2.2.3), and vowel co-occurrences and co-occurrence restrictions (section 2.2.2.4).

2.2.2.1 Vowel inventory

Maande has an inventory of eight contrastive vowels. A complex system of vowel harmony regulates the co-occurrences and co-occurrence restrictions of the vowels. The vowels can be divided into two sets which are mutually exclusive within roots and stems:

Table 9: Maande contrastive vowels

	[-ATR]			[+ATR]	
ɪ[48]		ʊ	i		u
		ɔ			o
	a			ə	

In the verb system as well, all eight contrastive vowels are attested in the verb root. While the distinction between /ɔ/ and /ʊ/ is slight, this distinction is emphasised by rounding harmony. Rounding harmony is triggered by an open (non-high) round vowel and targets the final vowel /-a/. High round vowels, /u/ and /ʊ/ do not trigger rounding harmony. In the Maande verb system, the root vowel generally determines the changes in the final vowel according to ATR and/or rounding harmony, as shown in Example 4 below.

Example 33: Contrastive vowels in Maande CVC verb roots

rt vowel	**ATR**	**round**	**FV**	**example**	***gloss***
i	x	---	-ə	ò≠tím-ə̀	*dig*
ɪ	---	---	-a	ɔ̀≠hɪ̀k-à	*be beautiful, good*
ə	x	---	-ə	ò≠lə̀k-ə̀	*prohibit, impede*
a	---	---	-a	ɔ̀≠kát-à	*pick (fruit)*
ɔ	---	x	-ɔ	ɔ̀≠bɔ́k-ɔ̀	*create, conceive*
o	x	x	-o	ò≠bók-ò	*cry, scream*
ʊ	---	---	-a	ɔ̀≠tʊ́k-à	*draw (water)*
u	x	---	-ə	ò≠túk-ə̀	*feed, nourish*

In the noun system, all eight contrastive vowels are found in monomorphemic CV_1CV_1 roots, as in Example 34 below.

[48] The vowel /ɪ/ acoustically has a relatively high F1 and is perceptively closer to a mid vowel than a high vowel (ave F1/F2: 460.1/1699.9). However it is underlyingly /ɪ/. Because of this, [ɛ] functions in a similar manner to [ɪ] in Mmala and Yangben and differs only by the feature [ATR] from /i/. Like /i/, it causes the palatalisation of /n/.

Example 34: Permitted vowels in Maande CV_1CV_1 noun roots

i	ò≠hílì	*black monkey sp.*	u	ì≠^{n}dʒúpú	*hippopotamus*
	ə̀≠tílí	*pigeons sp.*		bù≠lúŋú	*abundance*
ɪ	nʊ̀≠bí^{m}bì	*tongue*	ʊ	à≠bʊ́lʊ́[49]	*mushroom sp.*
	à≠kìɲì	*hill*		à≠fʊ̀kʊ̀	*trad. manacle*
ə	mə̀≠sə̀kə̀	*sleeping sickness*	o	ò≠tókó	*calf (of leg)*
	mù≠jə̀kə́	*hot pepper sp.*		nù≠bókó	*squirrel sp.*
a	à≠tà^{n}dá	*grasshopper*	ɔ	nɔ̀≠bɔ́lɔ́	*rain*
	bʊ̀≠sàkà	*moustache*		ɔ̀≠fɔ̀kɔ̀	*gnat*

2.2.2.2 Long vowels

Long vowels are contrastive and occur in either the first syllable of the noun root or in the verb root, as illustrated in Example 35.

Example 35: Monomorphemic long vowels in nouns and verb roots

	noun	*gloss*	verb	*gloss*
iː	nì≠hìːtə̀	*part, turn*	ò≠hîːt-ə̀	*take*
ɪː	ɔ̀≠mɪ̂ːndí	*limit, boundary*	ɔ̀≠hɪ̀ːs-á	*pray, see*
əː	mù≠jə̌ː	*gorilla*	ò≠pə́ːt-ì	*respect, cause to rise*
aː	nʊ̀≠hâːtí	*courtyard, outside*	ɔ̀≠páːt-à	*climb, rise*
oː	ò≠sǒːsó	*fish sp.*	ò≠hóːn-ò	*make smooth*
ɔː	ɔ̀≠tɔ̀ː	*yam*	ɔ̀≠pɔ̀ːt-ɔ̀	*bump, knock*
ʊː	---	---	ɔ̀≠kʊ̀ːn-à	*say*
uː	ò≠kǔːkə̀	*notable*	ò≠sùːn-ə̀	*fart*

However, there are instances of long vowels that are not contrastive but predictable. These include bimorphemic VV sequences due to the juxtaposition of identical vowels across a morpheme boundary and therefore are not underlying long vowels. Usually these bimorphemic long vowels occur between a noun-class prefix and a VCV root. See Example 36 below:

[49] All other studies of Maande identify only seven vowels, although certain problems occur with a seven-vowel analysis which various authors were not able to resolve (see Scruggs 1983a: 55-57 and Taylor 1990: 7 "We have not determined any reason why certain verbs take /a/ and others a round vowel /ɔ/").

Example 36: Bimorphemic VV sequences in Maande

surface form	**underlying form**	***gloss***
tùúɲí	tù≠úɲí	*wood, dead trees (pl)*
bɔ̀ɔ̀fʲà	bɔ̀≠ɔ̀fìà[50]	*rodent burrow*
ɲìísə	nì≠ísə	*eye*
tʃììsɔ̀	tʃì≠ìsɔ̀	*parrot*
ààtɔ́	à≠àtɔ́	*head*
wə̀ə̀nə́	wə̀≠ə̀nə́	*head louse*

2.2.2.3 Vowel devoicing/elision

In Maande CVCV noun roots, the V_2 is susceptible to devoicing. The presence of these devoiced vowels is noticeable by aspiration for [-rd] vowels and lip rounding for [+rd] vowels. Some examples taken from Scruggs (1983a: 18-19) are listed below in Example 37. Devoiced V_2 vowels respect vowel-harmony processes.

Example 37: Indication of devoiced vowels (Scruggs 1983a: 18-19).

Underlying form	**surface form**	***gloss***
hì≠sàᵐbà[51]	hɛ̀sàᵐbʰ	*bush rat*
hì≠sáᵐbɔ́	hɛ̀sáᵐbʷ	*partridge*
nì≠hásà	ɲɛ̀hás (ɲɛ̀hásà)[52]	*twin*
nì≠hásɔ́	ɲɛ̀hásʷ	*fruit sp.*
nì≠hàtí	ɲɛ̀hàtʰ[53]	*malice*
hì≠ⁿdʒàtí	hɛ̀ⁿdʒàtʰ	*small basket*

With the devoicing of V_2, there is also some loss of contrast in the tone melody, as shown below. Table 6 shows the tone and final-vowel reduction in disyllabic noun roots. Noun-root melody Cv́Cv̀ does not permit the elision of the final vowel.

Table 10: Tone and final vowel reduction in Maande CVCV noun roots

≠Cv̀Cv̀	→	≠Cv̀C
≠Cv́Cv́	→	≠Cv́C
≠Cv́Cv̀	→	≠Cv́Cv̀
≠Cv̀Cv́	→	≠Cv̀C

2.2.2.4 Vowel co-occurrences

Several factors govern the co-occurrences of vowels in CVCV nouns. These factors include 1) ATR-harmony restrictions and 2) restrictions on V_2, depending on the

[50] The [-ATR] front vowel is underlyingly /ɪ/ although it surfaces in the syllable peak as [ɛ].
[51] All these words are found in the lexicons of Maande to which I have access. I have modified Scruggs transcriptions to correspond with my analysis.
[52] My Maande language consultant disagrees with Scruggs here saying that this word does not elide the final vowel; it can only be pronounced [ɲɛ̀hásà].
[53] These last two examples come from the Maande lexicon; not fround in Scruggs (1983a: 18-19).

features of V_1. Each of these vowel co-occurrence restrictions will be discussed in turn (sections 2.2.2.4.1 and 2.2.2.4.2) below.

2.2.2.4.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ is always [-ATR] and never found in a [+ATR] environment. In Example 38 below, all ATR vowel co-occurrences in CVCV noun roots are shown.

Example 38: ATR vowel co-occurrences in Maande CVCV noun roots

	[-ATR] vowels			[+ATR] vowels	
ɪ-ɪ	à≠sɪ̀lɪ̀	*fly sp.*	i-i	ò≠tʃílì	*termite sp.*
ɪ-a	à≠bɪ́hà	*net*	i-ə	ə̀≠kìtə̀	*ram*
ɪ-ʊ	---	---	i-u	---	---
a-ɪ	hɪ̀≠ŋàlɪ́	*striped rat*	ə-i	hì≠sə́tì	*duiker*
a-a	à≠sáká	*mushroom sp.*	ə-ə	ì≠ŋə́nə́	*infant*
a-ʊ	à≠pàkʊ́	*agama lizard*	ə-u	ə̀≠bə́kù	*wing*
ʊ-ɪ	mà≠nʊ́mɪ̀	*sperm*	u-i	hì≠kútí	*mosquito*
ʊ-a	ɪ̀≠mʊ̀tʃá	*gizzard*	u-ə	ə̀≠húnə̀	*wind*
ʊ-ʊ	à≠lʊ́ŋʊ́	*cadaver, body*	u-u	ì≠ⁿdʒúbú	*hippopotamus*
ɔ-ɪ	ɪ̀≠kɔ̀kɪ́	*hen, chicken*	o-i	nù≠kòlí	*vine, cord*
ɔ-a	---	---	o-ə	---	---
ɔ-ɔ	nʊ̀≠bɔ́lɔ̀	*rain*	o-o	hì≠tókó	*calf (leg)*

2.2.2.4.2 Other V_2 co-occurrence restrictions

When V_1 in CV_1CV_2 nouns is a front high vowel, V_2 may either be a high or an open (non-high) vowel. When V_1 is a non-high, non-back vowel, V_2 may be either a high, round or open (non-high) vowel. When V_1 is a non-high (open) round vowel, V_2 may be either a high vowel or an identical round vowel. The high round vowel /u/ patterns like the non-high vowels with a high, open (non-high) or identical round vowel in V_2 position, while /ʊ/ has the most restricted co-occurrence pattern only allowing an open vowel in V_2 position. Which high, round or open vowel occurs in V_2 position depends on the ATR value of V_1. The high V_2 is /ɪ/ (which has a surface representation [ɛ]) in [-ATR] noun roots or /i/ in [+ATR] noun roots. The round V_2 is generally either /ʊ/ in [-ATR] noun roots or [u] in [+ATR] roots, with certain exceptions. The open vowel is either /a/ in [-ATR] roots or /ə/ in [+ATR] roots, see Example 39 below.

Example 39: Value of V_2 in Maande CVCV noun roots

V_2 in CVCV noun roots	[-ATR]	[+ATR]
High	ɪ	i
Round	ʊ or ɔ	u or o
Open	a	ə

Table 11 summarises the possible CVCV noun-root combinations permitted in Maande.

Table 11: Surface CV_1CV_2 combinations permitted in Maande

V_1V_2	high	round	open
/i/	i-i	---	i-ə
/ɪ/	ɪ-ɪ	---	ɪ-a
/u/	u-i	u-u	u-ə
/ʊ/	ʊ-ɪ	ʊ-ʊ	ʊ-a
/o/	o-i	o-o	---[54]
/ɔ/	ɔ-ɪ	ɔ-ɔ	---[55]
/a/	a-ɪ	a-ʊ	a-a
/ə/	ə-i	ə-u	ə-ə

2.2.3 Vowel-harmony processes

Maande has a complex system of vowel harmony consisting of two interacting types of harmony: ATR and rounding harmony. Both types of vowel harmony cross morpheme boundaries and are found within the phonological word.

2.2.3.1 Pre-stem elements

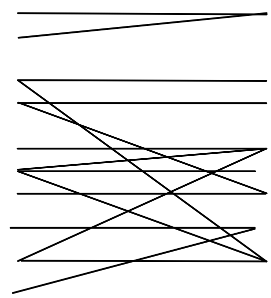
Both nominal and verbal pre-stem elements undergo vowel harmony in Maande. These are ATR harmony and rounding harmony which will be discussed in turn below.

2.2.3.1.1 ATR harmony in pre-stem elements

Maande has a system of fifteen noun classes that combine into the following double-class genders: 1/2, 3/4, 5/6a, 7/8, 9/10, 11/13, 14/6, 19/13. Some minor double-class genders are also found: 3/6, 9/8, 9/6, 14/8 (Scruggs 1983b) and 5/10.

[54] Precluded due to rounding harmony; /o-ə/ is realised as /o-o/.
[55] Precluded due to rounding harmony; /ɔ-a/ is realised as /ɔ-ɔ/.

class	prefixes	class	prefixes
1	mʊ- /mu-	2	ba- / bə-
1a	ɔ- / o-		
3	ɔ- / o-	4	ɪ- / i-
5	nɪ- / ni-	6a	a- / ə-
7	a- / ə-	8	bɪ- / bi-
9	ɪ- / i-	10	ɪ- / i-
9a	tʃɪ- / tʃi-	10a	tʃɪ- / tʃi-
11	nʊ- / nu-	13	tʊ- / tu-
14	pʊ- / pu-	6	ma- / mə-
19	hɪ- / hi-		



All noun-class prefixes may undergo ATR harmony, as shown in Example 40. The vowel of the prefix will become a glide before vowel-initial noun roots.

Example 40: ATR harmony of Maande noun-class prefixes

class	**noun-class prefix**	**example**	***gloss***
1	mʊ-	mʊ̀≠táŋà	*spokesman*
		mù≠kə́lísì	*judge*
	ɔ-	ɔ̀≠bɔ́là	*girl*
		ò≠húhə̀	*co-wife*
2	ba-	bà≠táŋà	*spokesmen*
		bə̀≠kə́lísì	*judges*
		bà≠bɔ́là	*girls*
		bə̀≠húhə̀	*co-wives*
3	ɔ-	ɔ̀≠tɛ́má	*heart*
		ò≠mə̀hú	*flesh*
4	ɪ-	ɪ̀≠tɛ́má	*hearts*
		ì≠mə̀hú	*flesh (pl)*
5	nɪ-	nɪ̀≠ⁿdáɲí	*stone*
		nì≠kə̀kú	*beard*
6	ma-	mà≠bàlà	*urine*
		mə̀≠ɲífə́	*water*
		mà≠ŋànà	*songs*
		mə̀≠húɲì	*words, speeches*
6a		à≠ⁿdáɲí	*stones*
		ə̀≠kə̀kú	*beards*

class	noun-class prefix	example	gloss
7	a-	à≠bàkʊ́	*agama lizard*
		ə̀≠bə́kù	*wing*
8	bɪ-	bɪ̀≠bàkʊ́	*agama lizards*
		bì≠bə́kù	*wings*
9/10	ɪ-	ɪ̀≠ɲàmà	*animal(s)*
		ì≠tʃə̀kù	*elephant(s)*
	tʃɪ-	tʃɪ̀≠áŋà	*guinea fowl(s)*
		tʃì≠íkə́	*porcupine(s)*
11	nʊ-	nʊ̀≠bíᵐbì	*tongue, language*
		nù≠bókó	*bush squirrel*
13	tʊ-	tʊ̀≠bíᵐbì	*tongues, languages*
		tù≠bókó	*bush squirrels*
		tʊ̀≠sàᵐbà	*bush rats*
		tù≠búbə́	*pigeons*
14	bʊ-	bʊ̀≠ŋànà	*song*
		bù≠húɲì	*word, speech*
19	hɪ-	hɪ̀≠sàᵐbà	*bush rat*
		hì≠búbə́	*pigeon*

Maande verbs have only two prefixes, which obligatorily harmonise with a [+ATR] vowel in the verb root: infinitives have an /ɔ-/ (class 3) prefix and the reflexive prefix /bí-/. As with the noun-class prefixes, /bí-/ undergoes ATR harmony, see Example 41.

Example 41: ATR harmony in Maande verb prefixes

ɔ-	ò≠kìt-ə̀	*strike, tap*
	ɔ̀≠kɪ̀l-à	*do*
	ò≠kə́k-ə̀	*respect (v), be surprised*
	ɔ̀≠kát-à	*pick (fruit)*
	ɔ̀≠sɔ́l-ɔ̀	*hoe (v)*
	ò≠bók-ò	*shout*
	ɔ̀≠sʊ̀l-à	*absorb*
	ò≠kús-ə̀	*scratch, scrape*

bí-	ò-bí≠tís-ə̀	*touch*
	ɔ̀-bí≠kíl-à	*become, realise*
	ò-bí≠lə́n-ə̀	*rejoice*
	ɔ̀-bí≠fám-à	*blow one's nose*
	ò-bí≠ój-ò	*warm oneself*
	ɔ̀-bí≠hɔ̂:k-ɔ̀	*save oneself, escape*
	ɔ̀-bí≠kʊ̂:n-à	*be prideful, arrogant*
	ò-bí≠kút-ə̀	*shave oneself*

Maande numeral concord prefixes are invariably [-ATR] and will undergo ATR harmony when the numeral root is [+ATR].

Example 42: Maande numeral concord prefixes

class	**num. prefix**	**example**	***gloss***
1	ɔ̀-	ɔ̀≠ɔ́tʃɔ̀ ɔ̀≠mɔ̀tí	*one person*
2	pá-	bà≠átʃɔ̀ bə́≠fə̀^{n}dí	*two people*
		bà≠átʃɔ̀ bá≠tátʊ́	*three people*
3	ɔ́-	ɔ̀≠tɛ́má ɔ́≠mɔ̀tí	*one heart*
4	í-	ì≠tɛ́má í≠fə̀^{n}dí	*two hearts*
		ì≠tɛ́má í≠tátʊ́	*three hearts*
5	ní-	ɲì≠^{n}dáɲí ní≠mɔ̀tí	*one stone*
6a	á-	à≠^{n}dáɲí ə́≠fə̀^{n}dí	*two stones*
		à≠^{n}dáɲí á≠tátʊ́	*three stones*
7	á-	à≠mìnà ɔ́≠mɔ̀tí	*one neck*
8	pí-	bì≠mìnà bí≠fə̀^{n}dí	*two necks*
		bì≠mìnà bí≠tátʊ́	*three necks*
9	ì-	ì≠ɲàmà ì≠mɔ̀tí	*one animal*
10	í-	ì≠ɲàmà í≠fə̀^{n}dí	*two animals*
		ì≠ɲàmà í≠tátʊ́	*three animals*
11	nʊ́-	nʊ̀≠bí^{m}bì nʊ́≠mɔ̀tí	*one tongue*
13	tʊ́-	tʊ̀≠bí^{m}bì tú≠fə̀^{n}dí	*two tongues*
		tʊ̀≠bí^{m}bì tʊ́≠tátʊ́	*three tongues*
14	bʊ́-	bʊ̀≠ŋànà bʊ́≠mɔ̀tí	*one song*
6	má-	mà≠ŋànà mə́≠fə̀ndí	*two songs*
		mà≠ŋànà má≠tátʊ́	*three songs*
19	hí-	hì≠sà^{m}bà hí≠mɔ̀tí	*one savannah rat*

Maande verbal pre-stem elements generally undergo ATR harmony. In rapid speech, the subject concord and tense markers may assimilate to a dominant [+ATR] vowel in the verb root, depending on the speaker, if no other word interferes. In a similar way to Nen, with the exception that it is *not* optional in Maande, the preverbal clitics harmonise with the ATR value of the word to the right (Bancel 1999: 7-8). Therefore, if an object pronoun or adverb intervenes, the elements to the left will harmonise with it. Taylor (1990: 11) gives some examples of this as illustrated in

Example 43[56] below. The shaded boxes show the extent of ATR harmony from the bolded [+ATR] trigger vowel.

Example 43: ATR harmony of preverbal elements (Taylor 1990: 11)

tù	tì	ŋə́		əsù		l**í**kímə̀	*we are not afraid*
1p	neg	T/A		1p		be.afraid	
tʊ̀	tì	ŋá	hánà	ə̀sù		l**í**kímə̀	*we are not afraid*
1p	neg	T/A	again	1p		be.afraid	*again*
tʊ̀	tì	ŋá		àsʊ̀		lʊ́kʊ́mà	*we do not understand*
1p	neg	T/A		1p		understand	
tù	tì	ŋə́	t**ə́**ɲì	àsʊ̀	bànɔ́	bílítʃĩ́ɲìɲ**ì**	*we did not quickly*
1p	neg	T/A	quickly	1p	2p.IO	notice	*notice you*

2.2.3.1.2 Rounding harmony in pre-stem elements

Rounding harmony targets /a/ and is triggered by the non-high (open) round vowels /ɔ/ and /o/. The high round vowels /u/ and /ʊ/ never trigger rounding harmony. Only noun-class prefixes with an underlying /a/ undergo rounding harmony, see Example 44 below.

Example 44: Rounding harmony of /a/ in Maande noun-class prefixes

class	noun-class prefix	examples	gloss
2	ba-	bɔ̀≠sɔ́:kɔ́	*others (other people)*
		bò≠ɲónó	*daughters-in-law*
		bà≠bʊ́là	*girls*
		bə̀≠húhə̀	*co-wives*
6	ma-	mɔ̀≠nɔ̀ŋɔ̀	*countries, villages*
		mò≠tòlì	*safou plum trees*
		mà≠sʊ̀là	*soup, sauce*
		mə̀≠lùkù	*drink gen. (except water)*

[56] Certain modifications of Taylor's data are made which reflect the differences in the vowel inventory between her analysis and my own.

class	**noun-class prefix**	**examples**	**gloss**
6a	a-	ɔ̀≠kɔ̀ŋɔ́	*spears*
		ò≠fò^{n}dí	*termite sp. mound*
		à≠kʊ́bà	*furrow, groove*
		ə̀≠sùsə̀	*ant hives*
7	a-	ɔ̀≠tʃɔ́kɔ́	*lump, hump*
		ò≠fòkó	*valley, hollow*
		à≠tʃʊ̀kà	*tuft (of grass, etc)*
		ə̀≠tʃùkə̀	*pike, stake*

Any verbal pre-stem elements with /a/ may undergo rounding harmony as well as ATR harmony in the environment of the non-high (open) round vowels /ɔ/ and /o/. As in other contexts, the high round vowels (/ʊ/ and /u/) do not trigger rounding harmony. Rounding harmony may be either triggered by the verb-root vowel or by the 2s subject concord clitic and is bidirectional. In Example 45, the vowel which triggers the harmony is underlined and the vowels which undergo rounding are bolded.

Example 45: Rounding harmony of Maande preverbal elements

ʊ̀-**ŋɔ̌**≠bɔ́k-**ɔ̀** *s/he creates*
c1-Pr≠create-FV

bɔ́-ŋɔ̂≠bɔ́k-**ɔ́k-ɔ̀** *they created*
c2-P1≠create-INTENS-FV

bó-ŋǒ≠bòk-**ò** *they scream*
c2-Pr-scream-FV

ú-**ŋò**≠bòk-ìt-ə̀ *s/he screamed*
c1-P1≠scream-DIM-FV

ʊ̀-ŋǎ≠tʊ́k-à *s/he draws (water)*
c1-Pr≠draw-FV

ù-ŋə̌≠túk-ə̀ *s/he nourishes (child)*
c1-Pr≠nourish-FV

ò-**ŋǒ**≠túk-ə̀ *you nourish (child)*
2s-Pr≠nourish-FV

ɔ̀-**ŋɔ̌**≠tʊ́k-à *you draw (water)*
2s-Pr≠draw-FV

2.2.3.2 Vowel harmony in suffixes

Most verb and deverbal-noun suffixes undergo vowel harmony, but there is one that triggers ATR harmony. Discussed below are suffixes that undergo ATR harmony (section 2.2.3.2.1), the ATR dominant suffix **-i** (section 2.2.3.2.2) and rounding harmony in suffixes (section 2.2.3.2.3).

2.2.3.2.1 ATR harmony in suffixes

ATR harmony is triggered by a [+ATR] vowel, usually in the root, and spreads bidirectionally. All [-ATR] vowels in the phonological word change into their [+ATR] counterpart. A few examples are shown in Example 46 below:

Example 46: ATR harmony of Maande verbal suffixes

applicative	-ɪn	ɔ̀≠táŋ-ín-à	*talk to someone*
		ò≠fə́n-ín-ə̀	*mock, ridicule someone*
reciprocal	-an	ɔ̀≠bá^{n}d-án-à	*join, unite*
		ò≠lə́n-ə́n-ə̀	*love each other*
positional	-ɪm	ɔ̀≠tál-ím-ín-à	*stand, stand up*
		ò≠kùt-ìm-ìn-ə̀	*bend down, stoop*
separative	-ʊn	ɔ̀-bí≠láŋ-ʊ̀n-à	*undress*
		ò≠tʃùk-ùn-ə̀	*uproot*
intensive	-ak	ɔ̀≠táŋ-ák-à	*talk often/a lot*
		ò-bí≠kút-ə̀k-ə̀	*shave oneself often/a lot*

Some deverbal nouns are formed by adding the applicative suffix and a noun-class prefix to the verb root. These suffixes also undergo ATR harmony, see Example 47.

Example 47: Maande deverbal nouns with applicative suffix

ɔ̀≠tʃàk-ʊ̀n-à	*play (game)*	à≠tʃàk-ʊ̀n-**ín**-á	*toy, game*
ɔ̀≠bàl-àk-à	*urinate*	à≠bál-ák-**ín**-á	*bladder*
ò≠súb-ə̀	*thresh, beat*	nì≠súb-**ín**-ə̀	*threshing floor*
ò≠fúm-ə̀	*blow*	bù≠fúm-**ín**-ə́	*fan*
ò≠bíə́n-ə̀	*give birth*	ə̀≠bíə́n-**ín**-ə̀	*placenta*

Other deverbal nouns are formed simply by adding a noun-class prefix to a verb. Any verbal suffixes present will undergo ATR harmony, as seen in Example 48.

Example 48: Maande deverbal nouns

ò≠bíə́n-ə̀	*give birth*	òm≠bíə́n-ì	*nephew, niece*
ò≠bín-ə̀	*dance (v)*	mə̀≠bín-ə̀	*dance (n)*
ɔ̀≠táŋ-à	*speak, talk*	mʊ̀≠táŋ-à	*spokesman*
ɔ̀≠nàᵐb-à	*hide*	nì≠nàᵐb-à	*hiding place*
ɔ̀≠táb-ʊ́n-à	*repair, fabricate*	mʊ̀≠táb-ʊ́n-à	*repairman*

2.2.3.2.2 ATR-dominant suffixes.

The [+ATR] causative suffixes **–i** and **-Vs[-...]-i**, unlike the other verbal extensions and aspect suffixes, are dominant and trigger ATR harmony. The causative suffixes replace the final vowel, so while ATR harmony is generally bidirectional, it is less evident due to the replacement of the final vowel as seen in Example 49. The longer causative suffix **-Vs[-...]-i** may be separated by other suffixes especially the intensifier **-ɪk** and the applicative **-ɪn**.

Example 49: ATR Dominant suffix -i

caus.	-i	ɔ̀≠lʊ̀l-à	*burn*	ò≠lùl-ì	*cause to burn*
		ɔ̀≠fɔ̀l-ɔ̀	*borrow*	ò≠fòl-ì	*cause to borrow*
		ɔ̀≠kʊ́t-à	*dry (INTR)*	ò≠kút-ì	*dry (TR)*
		ɔ̀≠kɔ̀t-ɔ̀	*refuse, miss*	ò≠kòt-ì	*cause to miss*
		ɔ̀≠tʃítʃ-à	*laugh*	ò≠tʃítʃ-ín-ì	*cause to laugh*
	-Vs-i	ɔ̀≠mʷ-á	*drink*	ò≠mú-ús-ì	*cause to drink*
		ɔ̀≠kʷ-à	*fall*	ò≠kù-ùs-ì	*cause to fall*
				ò≠kù-ùs-ìk-ì	*cause to fall often*
		ɔ̀≠màn-à	*finish*	ò≠mən-ìs-ì	*put to an end*
				ò≠mən-ìs-ìk-ì	*put to an end often*
		ɔ̀≠kíⁿd-à	*be courageous*	ò≠kíⁿd-ís-ín-ì	*encourage s.o.*
				ò≠kíⁿd-ís-ík-ì	*encourage often*

2.2.3.2.3 Rounding harmony in suffixes

Most verb extensions and inflectional suffixes with the vowel /a/ may undergo rounding harmony as well as ATR harmony. Like ATR harmony, rounding harmony is bidirectional. Rounding harmony is triggered only by non-high (open) round vowels. The high round vowels /u/ and /ʊ/ do not trigger rounding harmony. Rounding harmony may be blocked by a high vowel. A few examples are shown in Example 50 below:

Example 50: Rounding harmony of verbal suffixes

final vowel	-a	ɔ̀≠kɔ̀t-ɔ̀	*refuse*
		ò≠bók-ò	*cry (v)*
		ɔ̀≠kʊ́t-à	*dry (INTR)*
		ò≠kùt-ə̀	*shave, style hair*
intensive	-ak	ɔ̀≠bɔ̀l-ɔ̀k-ɔ̀	*pierce*
		ò≠ɲóy-ók-ò	*fill up*
		ɔ̀≠lʊ̀b-àk-à	*uproot*
		ò≠búm-ə́k-ə̀	*hunt*
reciprocal	-an	ɔ̀≠hɔ̀n-ɔ̀n-ɔ̀	*quarrel*
		ò≠ból-ót-ón-ò	*be red*
		ɔ̀≠mʊ́-án-à	*drink*
		ò≠fúúm-ə́n-ə̀	*be clean*

High vowels are opaque to rounding harmony. Where a suffix or extension with a high vowel, /u/, /ʊ/, /i/ or /ɪ/ occurs, the rounding harmony will be blocked, see Example 51. Not all possible forms were found in my data; the [+ATR] non-high (open) round vowel /o/ in particular is missing.

Example 51: Opacity of front vowels in rounding harmony

separ.	-ʊn	ɔ̀≠bɔ́ŋ-ɔ̀	ɔ̀≠bɔ́ŋ-ʊ́n-à	*find, obtain*
		ɔ̀≠sɔ́l-ɔ̀	ɔ̀≠sɔ́l-ʊ́n-à	*extract*
appl.	-ɪn	ɔ̀w≠ɔ́t-ɔ́k-ɔ̀	ɔw≠ɔ́t-ɔ́k-ín-à	*attach*
		òw≠òt-ò	òw≠òt-ìn-ə̀	*water, sprinkle*
dim.	-ɪt	ɔ̀≠lɔ́ŋ-ɔ̀	ɔ̀≠lɔ́ŋ-ít-à	*call, invite*
		ò≠bók-ò	ò≠bók-ít-ə̀	*cry*
pos.	-ɪm	---	ɔ̀≠ɲɔ́l-ím-ín-à	*squat*
		---	ò≠ɲòŋ-ìm-ìɲ-ì	*watch (a hole)*

2.2.4 Hiatus-resolution processes

There are several hiatus-resolution processes found in Maande. These are glide formation in section 2.2.4.1, hiatus retention in section 2.2.4.2, semivowel insertion in section 2.2.4.3 and vowel assimilation in section 2.2.4.4.

2.2.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted. Where V_1V_2 sequences occur, either within the morpheme or across morpheme boundaries, a high vowel in V_1 position becomes a glide. Glide formation occurs principally between a high vowel in the noun-class prefix and a vowel-initial noun root. As seen in Example 52, where the prefix vowel and the root vowel are identical, both are retained. These are discussed in further detail in Section 2.2.4.2 below.

Example 52: Prefix-root glide formation in Maande nouns

V_1V_2	**surface from**	**underlying form**	***gloss***
u-i	---	---	---
i-i	tʃìíbə̀	tʃì≠íbə̀	*c9.house*
ʊ-ɪ	---	---	---
ɪ-ɪ	tʃìítʊ̀	tʃì≠ítʊ̀	*c9.body*
ʊ-a	nʷǎɲí	nʊ̀≠áɲí	*c11.leaf*
ɪ-a	tʃʲǎŋà	tʃì≠áŋà	*c9.guinea fowl*
u-ə	bʷə̀nù	bʊ̀≠ə̀nù	*c14.yam field*
i-ə	hʲə̀tʃə́tʃə́	hì≠ə̀tʃə́tʃə́	*c19.mushroom*
ʊ-ɔ	nʷɔ̀mɔ́	nʊ̀≠ɔ̀mɔ́	*c11.river*
ɪ-ɔ	hʲɔ̀fɔ́	hì≠ɔ̀fɔ́	*c19.fish*
u-o	bʷòhó	bʊ̀≠òhó	*c14.seed for sowing*
i-o	tʃʲǒyò	tʃì≠óyò	*c9.smoke*
ʊ-ʊ	bʊ̀ʊ̀tí	bʊ̀≠ʊ̀tí	*c14.tree*
ɪ-ʊ	bʲʊ̀fà	bì≠ʊ̀fà	*c8.fur*
u-u	tùúɲí	tʊ̀≠úɲí	*c13.firewood*
i-u	hʲǔlí	hì≠úlí	*c19.ant*

Glide formation also occurs between a CV verb root and the final vowel as is seen in Example 53. The low tone of the final vowel is delinked by the high tone of the verb root.

Example 53: Glide formation between CV verb roots and verb suffixes

	surface form	**underlying form**	***gloss***
ʊa	ɔ̀mʷá	ɔ̀≠mʊ́-à	*drink*
	ɔ̀mʷákínà	ɔ̀≠mʊ́-ák-ín-à	*consume (*INTENS*) wine*
	ɔ̀hʷà	ɔ̀≠hʊ̀-à	*peel (v)*
uə	òtʷə́	ò≠tú-ə̀	*sell*
	òtʷə́nə̀	ò≠tú-ə́n-ə̀	*sell (*APPL*)*
	òhʷə̀	ò≠hù-ə̀	*harvest (yam)*
ɪa	ɔ̀bʲà	ɔ̀≠bì-à	*dig up*
	ɔ̀ɲʲá	ɔ̀≠ní-à	*eat*
	ɔ̀tʃʲà	ɔ̀≠tʃì-á	*light (v), collect*
	ɔ̀tʃʲǎkà	ɔ̀≠tʃì-ák-à	*light (v), collect (*INTENS*)*

	surface form	underlying form	*gloss*
iə	ò̀ɲʲə́	ò≠ní-ə̀	*rub*
	ò̀ɲʲə́kə̀	ò≠ní-ə́k-ə̀	*rub (INTENS)*
ɪɔ	ɔ̀ɲʲɔ̀	ɔ̀≠nɪ̀-ɔ̀	*cultivate*
	ɔ̀ɲʲɔ̀nɔ̀	ɔ̀≠nɪ̀-ɔ̀n-ɔ̀	*cultivate (APPL)*
io	---	---	---

Glide formation also occurs within a verb or noun root. Scruggs (1983a: 32-33) considers these as diphthongs and states that the high vowel is "a full mora of length and [...] carr[ies] its own tone whereas **w** is shorter and does not carry a tone." Differing from her analysis, and taking into consideration what is found in other Mbam languages, these are also to be considered glide formation as a hiatus-resolution technique. With the desyllabification of the high vowel, its tone links to the V_2. The resulting SV sequence seems to retain two morae of length. Among nouns only, four diphthongs have been found in nominal monomorphemic contexts: /ʊa/, /uə/, /ɪa/ and /iə/ as in Example 54 below.

Example 54: Monomorphemic diphthongs in Maande noun roots

	surface form	underlying form	*gloss*
ʊa	ɔ̀ᵐbʷǎŋí	ɔ̀≠ᵐbʊ̀áŋí	*arrowhead*
	ɔ̀mʷàná	ɔ̀≠mʊ̀àná	*sky*
	ìsʷǎjí	ì≠sʊ̀ájí	*wine calabash*
uə	ònʷə́	ò≠nùə́	*orifice, hole*
	bùsʷə̀	bù≠sùə̀	*whip*
	ə̀bʷə́mə́	ə̀≠búə́mə́	*fox*
ɪa	àcʲâ	à≠cɪ́à	*bird sp.*
	bʊ̀ʊ̀fʲà	bʊ̀≠ʊ̀fɪ̀à	*rodent's burrow*
iə	ə̀sʲə́nə́	ə̀≠síə́nə́	*field*
	bùùɲʲə̀	bù≠ùnìə̀	*liver*

In Maande verbs, six possible diphthongs have been found in monomorphemic verb roots. In addition to /ʊa/, /uə/, /ɪa/ and /iə/ found also in nouns, /ɪɔ/ and /io/ are found only in verbs as in Example 55.

Example 55: Diphthongs in Maande monomorphemic verbs

	surface form	**underlying form**	***gloss***
ʊa	ɔ̀tʃʷàmà	ɔ̀≠tʃʊ̀àm-à	*fidget*
	ɔ̀bíjʷâtà	ɔ̀-bí≠jʊ́àt-à	*abandon*
uə	òkʷəjì	ò≠kùə̀j-ì	*close*
	òkʷə̀jìkì	ò≠kùə̀j-ìk-ì	*close (INTENS)*
	òmʷə̀mə̀	ò≠mùə̀m-ə̀	*smile (v)*
ɪa	ɔ̀tʲábà	ɔ̀≠tɪ́áb-à	*look for firewood*
	ɔ̀bʲátínà	ɔ̀≠bɪ́át-ín-à	*break*
iə	òbʲə́nə̀	ò≠bɪ́ə́n-ə̀	*give birth*
ɪɔ	ɔ̀mʲɔ̀tìtà	ɔ̀≠mɪ̀ɔ̀t-ìt-à	*feel*
	ɔ̀mʲɔ́mínà	ɔ̀≠mɪ́ɔ́m-ín-à	*grab*
io	òhʲòlò	ò≠hìòl-ò	*get drunk*
	òbísʲóŋòɲì	ò-bí≠síóŋ-òn-ì	*become cool*
	òbítʃʲóŋòlò	ò-bí≠tʃíóŋ-òl-ò	*have nausea*

2.2.4.2 Hiatus retention

Identical vowels in juxtaposition are permitted. This is particularly evident between the noun-class prefix and the noun root. Where the vowels are either underlyingly identical or have identical surface realisations due to a vowel-harmony process, both vowels are retained, see Example 52 above and Example 56 below.

Example 56: Maande prefix-root hiatus retention

surface form	**underlying form**	***gloss***
tʃìílʊ́	tʃì≠ílʊ́	*c9.palm rat*
ɲìísə̀	nì≠ísə̀	*c5.eye*
màábá	mà≠ábá	*c6.shrubs sp (edible leaves)*
nʊ̀ʊ́là	nʊ̀≠ʊ́là	*c11.granary*
nùútʃì	nʊ̀≠útʃì	*c11.spring, stream*

2.2.4.3 Semivowel insertion

There are predictable occurrences of [w] which occur especially between the verb-infinitive class 5 prefix, **ɔ-/o-** and a vowel-initial verb stem. Unlike in other cases of hiatus resolution, the insertion of [w] occurs even between identical vowels, see Example 57.

Example 57: Semi-vowel insertion in Maande verbs

surface form	**underlying form**	***gloss***
òwíⁿdʒʲə̀[57]	ò≠íⁿdʒ-ì-ə̀	*give, offer*
ɔ̀wíⁿdʒʷà	ɔ̀≠íⁿdʒ-ʊ̀-à	*return, give back*[58]
ɔ̀wàᵐbà	ɔ̀≠àᵐb-à	*search*
òwə́bə̀	ò≠ə́b-ə̀	*steal, rob*
ɔ̀wɔ́nɔ̀	ɔ̀≠ɔ́n-ɔ̀	*kill*
òwòᵐbò	ò≠òᵐb-ò	*scratch*

2.2.4.4 Vowel assimilation

In $V_1≠V_2$ juxtaposition across morpheme boundaries, where V_1 is a non-high vowel and V_2 is a high vowel, V_2 assimilates completely to the features of V_1. The high vowels /i/, /ɪ/ ([ɛ]), /u/ and /ʊ/ in ≠VCV roots assimilate fully to the non-high vowel of the noun-class prefix. In Example 58 below, both the singular and plural forms are shown for both the surface and underlying forms. Where the root-initial vowel is non-high, it will not assimilate. **ɔ≠ʊ** and **o≠u** combinations are not attested.

Example 58: Assimilation of a high V_2 to a non-high V_1 in Maande

	surface form		**underlying form**		***gloss***
a≠ɪ	ààtʊ́	bììtʊ́	à≠ìtʊ́	bì≠ìtʊ́	*c1/2.head*
	bʊ̀ʊ̀tí	mààtí	bʊ̀≠ìtí	mà≠ìtí	*c14/6.tree*
a≠ʊ	bʊ̀ʊ̀fʲà	mààfʲà	bʊ̀≠ʊ̀fʲà	mà≠ʊ̀fʲà	*c14/6.rodent burrow*
ə≠i	ə̀ə̀ɲə̀	bììɲə̀	ə̀≠ìɲə̀	bì≠ìɲə̀	*c1/2.tomb*
ə≠u	bùúsə̀	mə̀ə́sə̀	bù≠úsə̀	mə̀≠úsə̀[59]	*c14/6.face*
ɔ≠ɪ	ɔ̀ɔ̀sɔ̀	bììsɔ̀	ɔ̀≠ìsɔ̀	bì≠ìsɔ̀	*c1/2.habit, behaviour*
o≠i	ɲììtó	òòtó	nì≠ìtó	ò≠ìtó	*c5/6a.navel*
	òòtʃó	ììtʃó	ò≠ítʃó	ì≠ìtʃó	*c3/4.fire*

Juxtaposed high vowels also assimilate. High front vowels /i/ and /ɪ/ assimilate fully to the high round vowels /u/ and /ʊ/ regardless of their location in the prefix or the root, as in Example 59.

[57] Native speakers have a strong intuition that the semivowel is present.
[58] This word and the preceding example obviously have the same root. Only a couple of examples have been found with a front vowel in a VC verb root. No examples have been found of a VC verb root with a high round vowel.
[59] If the root for *face* were ≠ə́sə̀ this word should pattern like **bʷ≠ə̀nù/mə̀≠ə̀nù** yam field.

Example 59: Assimilation between juxtaposed high vowels in Maande

	surface form		underlying form		*gloss*
u≠i	tʃìíbə̀	mə̀ə́bə̀	tʃì≠íbə̀	mà≠íbə̀	*c9/6a.house*
	hìíbə̀	tù**ú**bə̀	hì≠íbə̀	tʊ̀≠íbə̀	*c19/13.house (dim), hut*
i≠u	ɲ**ù**útə́	ə̀ə́tə́	nì≠útə́[60]	à≠útə́	*c5/6a.mouth*
	tʃ**ù**úmə́	mə̀ə́mə́	tʃì≠úmə́[61]	mà≠ə́mə́	*c9/6.boa*
ʊ≠ɪ	bʊ̀ʊ̀tɛ́	mààtɛ́	bʊ̀≠ɪ̀tɪ́[62]	mà≠ɪ̀tɪ́	*c14/6.tree*
	hɛ̀ɛ̀tɛ́tɛ́	tʊ̀ʊ̀tɛ́tɛ́	hì≠ɪ̀tɪ́-tɪ́	tʊ̀≠ɪ̀tɪ́-tɪ́	*c19/13.tree (dim)*
ɪ≠ʊ	tʃʊ̀ʊ́ŋá	tʃʊ̀ʊ́ŋá	tʃɪ̀≠ʊ́ŋá	tʃɪ̀≠ʊ́ŋá	*c9/10.giraffe*

Noun-class 19 prefix **hɪ-** is an exception[63] to this rule. Where it comes in juxtaposition with /u/ it patterns like a high vowel preceding a non-high vowel and disyllabifies as in Example 60. No examples have been found in the corpus with **ʊ-**initial root and a class 19 prefix.

Example 60: NC 19 hɪ- prefix before Maande VCV noun root

surface form		underlying form		*gloss*
hʲŭɲí	tùúɲí	hì≠úɲí	tù≠úɲí	*wood, dry tree*
hʲŭlí	tùúlí	hì≠úlí	tù≠úlí	*ant sp.*

2.2.5 Tone

Maande has a two-tone system underlyingly, high and low. Contour tones do occur, predominantly falling tones caused by the elision of the V_2 and the linking of the low tone to the previous TBU's high tone (Scruggs 1983a: 20, 66).

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[60] If the root for *mouth* were **≠ə́tə́** it should pattern like in **nʲ≠ə́lʷə̀** *return (n)* and **nʲ≠ə́kúɲì** *lesson*.

[61] If the root for *boa* were **≠ə́mə́**, it should pattern like **tʃʲ≠ə́ⁿdʒú** *female*. Scruggs (1983a: 52-4) analyses these examples as entailing the following steps: 1) prefix vowel deletion before a long vowel (in which case the root of *mouth* and *boa* would have an unusual ≠VVCV structure), and 2) "root unrounding" following a prefix containing /ə/. She states that the assimilation of the prefix vowel to the root vowel is a possible solution but rejects it as being inconsistent with the rest of her analysis.

[62] Although **≠ɪ̀tɪ́** as the root of *tree* is not evident from either the singular or plural surface forms, it can be derived from the two assimilation rules posited. In the singular form, the/ɪ/ of the root assimilates as all high front vowels to the high round vowel of the prefix. In the plural form, /ɪ/ assimilates to the non-high vowel /a/. Further justification for /ɪ/ is found in the diminutive form and in the few ≠VC(V) cognates, especially in Yambeta and Gunu. Another possible interpretation of *tree* would be **bʊ̀≠tí** / **mà≠tí**. In favour of the simpler root structure is the fact that many of the cognates for *tree* in the Mbam languages have ≠CV(...) root:

Nen	pʊ̀≠lʲá	mà≠lʲá	Baca	pʷ≠ɔ̀sɔ́	mà≠àsá
Yambeta	kʲ≠ìt	pʲ≠ìt	Gunu	bʊ̀≠ítì	mì≠ítì
Elip	bʊ̀≠dí	mà≠dí	Tuki	wʊ̀≠ɾítí	mà≠ɾítí
Mmaala	bʊ̀≠dîːd̥	mà≠dîːd̥	Mbure	bʊ̏≠bʊ̋	mʊ̏≠bʊ̋
Yangben	pʊ̀≠tí	mà≠tí			

[63] Noun class 19 shows some exceptional behaviour in Nen as well. Noun class 19 concord prefix is [+ATR] and triggers [+ATR] harmony in a [-ATR] root.

2.2.5.1 Tone melodies on nouns

High and low tone contrast in monomorphemic noun roots. Four tone melodies are attested in CVCV noun roots, see Example 61 below. Noun prefixes usually have a low tone, although there are a few exceptions.

Example 61: Maande nominal tone melodies

à≠bàkà	≠L.L	*smoked fish*
à≠bàká	≠L.H	*talisman*
à≠bátʃà	≠H.L	*piece of calabash used as a lamp*
à≠bátá	≠H.H	*horn*

2.2.5.2 Tone melodies on verbs

Maande verbs have three possible underlying tone melodies: L, H and HL. In verb stems with a H melody, the H spreads to the right. The exception is with the final vowel to which H does not spread. Since final vowels do not take a H tone in their most basic form (without extensions), H and HL verbs both have L ≠H -L surface representation. It is assumed that verbal suffixes are underlyingly toneless, and the verb melody maps to the entire verb stem. The three verbal tone melodies are illustrated in Example 62 below, showing both the H spread on verb suffixes as well as the failure of H spread onto the final vowel.

Example 62: Maande verbal tone melodies

L	ɔ̀≠bɔ̀l-ɔ̀	L ≠L -L	*pierce*
	ɔ̀≠bɔ̀l-ɔ̀k-ɔ̀	L ≠L -L -L	*pierce* (INTENS)
	ɔ̀≠bàt-à	L ≠L -L	*ask*
	ɔ̀≠bàt-àk-à	L ≠L -L -L	*ask* (INTENS)
H	ɔ̀≠táŋ-à	L ≠H -L	*speak*
	ɔ̀≠táŋ-ák-à	L ≠H -H -L	*speak* (INTENS)
	ɔ̀≠táŋ-ín-à	L ≠H -H -L	*speak against*
	ɔ̀≠kʊ́t-à	L ≠H -L	*dry*
	ɔ̀≠kʊ́t-ák-à	L ≠H -H -L	*dry* (INTENS)
	ɔ̀≠báát-à	L ≠H -L	*climb*
	ɔ̀≠báát-ák-à	L ≠H -H -L	*climb* (INTENS)

HL	ò-bí≠kút-ə	L -H ≠H -L	*shave oneself*
	ò-bí≠kút-ək-ə	L -H ≠H -L -L	*shave oneself (INTENS)*
	ɔ̀≠tám-à	L ≠H -L	*clear (land for planting)*
	ɔ̀≠tám-àk-à	L ≠H -L -L	*clear (INTENS)*
	ɔ̀-bí≠kɔ́ɔ̀n-à	L -H ≠HL -L	*be full of pride*
	ɔ̀-bí≠kɔ́ɔ̀n-àk-à	L -H ≠HL -L -L	*be full of pride (INTENS)*

2.3 Yambeta phonological overview

Yambeta has four dialects; two main dialects *Nigii* and *Nɛdɛk*, and two subdialects *Begi* a subdialect of *Nigii*, and *Nibum* a subdialect of *Nɛdɛk*. This study is based on the largest and most centrally-located dialect, *Nigii*, which has been chosen by the community as the reference dialect[64].

2.3.1 Consonants

This section discusses the consonant inventory of Yambeta (section 2.3.1.1) and allomorphic realisations of consonants (section 2.3.1.2).

2.3.1.1 Consonant inventory

The consonant system of Yambeta consists of 20 contrastive consonants.

Table 12: Yambeta contrastive consonants

		labial	alveolar	palatal	velar	glottal
stops		p	t	tʃ	k	ʔ
prenasalised	voiceless		ⁿt		ᵑk	
	voiced	ᵐb	ⁿd		ᵑg	
fricatives		f	s		h	
resonants	nasal	m	n	ɲ	ŋ	
	oral		l	j	w	

All consonants except for /tʃ/, /w/[65] and the prenasalised stops occur in word-final position. The glottal stop /ʔ/ occurs only in word-final position and contrasts with /k/, as in Example 63. According to Phillips (1979: 93), the glottal stop is elided intervocalically.

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[64] The wordlist is a Toolbox database of nearly 2,500 words collected by Mobam, Gilbert and Bolioki, Léonard-Albert, members of YALICO (Yambeta language committee) and published on the Internet in 2003. I have an unpublished 2009 revision of the Yambeta Toolbox database which I have checked and edited with Bolioki Léonard-Albert and with Ondaffe Nfon Emmanuel and Nkoum Ngon André, speakers of the reference dialect Nigii. In addition the 120 wordlist found in Phillips (1979: 23-35) was also consulted.

[65] One example of /w/ in word-final position has been found: the noun class 3 distal demonstrative /wʊ́ʊw/.

Example 63: The glottal stop in Yambeta

mà≠tà	*rheum (dried gunk in eye)*
mà≠tàʔ	*poison for arrows*
mà≠tàk	*joke*
kì≠tí	*widow*
kì≠tìʔ	*epilepsy*
ùn≠nì	*tail*
ùn≠nìʔ	*grave digger*

2.3.1.2 Allophonic and allomorphic realisations

There is no voicing opposition in Yambeta. All stops, with the exception of /ʔ/, have voiced and voiceless variants. All stops are voiceless in phrase-initial and phrase-final position and voiced intervocalically. See Example 64 below.

Example 64: Voiced/voiceless variation of stops in Yambeta

/p,t,k/	→	[b,d,g]	/	V__V	nì≠**b**àɲ	*claw*
					ì≠**d**ɔ̀ŋ	*horn*
					mə̀≠**g**út	*oil*
/p,t,k/	→	[p,t,k]	/	#____	**p**ì≠dà	*saliva*
					tʊ̀≠mìm	*tongues*
					kì≠sùm	*lake, pond*
/p,t,k/	→	[p,t,k]	/	___#	nì≠sɔ̀**p**	*peanut, groundnut*
					ǹ≠sə̀**t**	*duiker*
					j≠ù**k**	*fire*

Following nasals, the bilabial stop is voiced, but both the alveolar and velar stops are voiceless as in Example 65.

Example 65: Stops following a syllabic nasal in Yambeta

/p/	→	[b]	/	N̩___	m̀≠**b**í	pʊ̀≠**b**í	*cutting grass*
					m̀≠**b**ʊ̀n	pʊ̀≠**b**ʊ̀n	*goat*
/t, k/	→	[t, k]	/	N̩___	ǹ≠**t**àt	pʊ̀≠**d**àt	*type of basket*
					ǹ≠**t**ɔ̀ɲ	pù≠**d**ɔ̀ɲ	*fish sp.*
					ŋ̀≠**k**àt	pʊ̀≠**g**àt	*type of drum*
					ŋ̀≠**k**ún	pù≠**g**ún	*tortoise*

In CV-CV(V)(C) reduplicated roots, the stop is voiced in the reduplicated part, but voiceless in the base, as in Example 66.

Example 66: Reduplicated roots in Yambeta

---	---	kì≠bɔ̀-pɔ́ɔ́n	*plant sp.*
nì≠dáán	rock	ì≠dá-táán[66]	*pebble*
ǹ≠tàt	basket	ì≠dà-tát	*small basket*
kì≠dís	wound	ì≠dí-tís	*small wound, scratch*
nì≠gúù	village, country	ì≠gú-kúù	*small village*
---	---	ì≠gɔ́-kɔ́ɔ́	*ankle*

Oral resonants, /l, j/ become voiced obstruents, [d, dʒ] after a nasal as in Example 67.

Example 67: Oral resonants following a nasal in Yambeta.

ònn≠**d**ìgà	pà≠**l**ìgà	*seller(s)*
ǹ≠**d**òm	pù≠**l**òm	*sorcerer(s)*
nì≠**l**ù	ən≠**d**ù	*knee(s)*
nì≠**j**ìŋ	àn≠**dʒ**ìŋ	*raphia palm(s)*
ǹ≠**dʒ**òʔ	pù≠**j**òʔ	*elephant(s)*

The alternation of resonant and voiced obstruent is also evident in reduplicated roots as below:

Example 68: Yambeta oral resonants in reduplicated roots.

ì≠lòn-dòm	*little sorcerer*
kì≠jĭn-dʒím	*fox*

Phillips (1979: 55-6) claims that /w/, like /l/ and /j/, becomes a voiced stop [g] following a nasal. She gives the example below on page 56:

[ŋ̩-gé]	/ŋ̩-wé/	*road*
[pʰù-wé]	/pù-wé/	*roads*

However, the YALICO database and my own data list this word as follows:

ŋgə́	pù≠ŋgə́	*road/roads*

The voiceless fricatives /f/, /s/ and the affricate /tʃ/ do not alter following a nasal as in Example 69.

[66] As seen below, nasals in juxtaposition with alveolar and velar consonants surface as [ʔ], it is possible for at least one of these examples that a nasal is causing the devoicing of the stop:
ì≠dà-táán *pebble* could be interpreted as ì≠dàn-táán or [ìdàʔtáán]. Several others with a CVC root may have a similar reduction of the coda to a glottal stop ì≠dà-tát *small basket* as ì≠dàt-tát or [ìdàʔtát]. This analysis doesn't work for two of the examples given as there is no evidence of either a syllable-final consonant whether nasal or oral. The example of *pebble* above follows the pattern set in Example 68.

Example 69: Fricatives and affricates following a nasal in Yambeta

m̀≠fə́ŋ	pù≠fə́ŋ	*wound*
m̀≠fʷày	pɔ̀≠fʷày	*type of fish*
ǹ≠sə̀t	pù≠sə̀t	*duiker*
ǹ≠sám	pɔ̀≠sám	*nut*
ǹ≠tʃìm	pɔ̀≠tʃìm	*oath*

Noun classes 1, 3 and 6a have a homorganic nasal following a vowel in the prefix. In *Nigii*, however, the VN- noun-class prefixes are realised as Vʔ- preceding alveolar and velar stops, while the stop is realised as voiceless, as is normal following a nasal. In the *Nɛdɛk* dialect, according to Phillips (1979: 51), the nasal of the VN- prefixes is realised before alveolar and velar stops.[67] She gives the example of *head*:

Nigii	Nɛdɛk
[ɔ̀-tɔ̀]	[ɔ̀n-tɔ̀]

The VN- noun-class prefixes are realised as [VN-] before fricatives and resonants, and as [Vʔ-] before alveolar and velar stops. Below in Example 70 are some instances of V(N)- noun-class prefixes before both resonants and stops.

Example 70: Yambeta classes 1, 3 and 6a prefixes

surface realisation	**underlying form**	***gloss***
ɔ̀ndìgà	ɔ̀N≠lìgà	*c1.seller (from **kɔ̀≠lìg-à** sell)*
ɔ̀nnàn	ɔ̀N≠nàn	*c1.grandson*
ùʔtìlə̀ʔ	ɔ̀N≠tìlə̀ʔ	*c1.writer*
ɔ̀ʔkán	ɔ̀N≠kán	*c1.wife*
ùʔtúmə̀ʔ	ɔ̀N≠túmə̀ʔ	*c1.singer (from **kù≠túm**-ə̀ sing)*
ɔ̀fɔ̀m	ɔ̀≠fɔ̀m	*c3.forehead*
ɔ̀mbɔ̀k	ɔ̀N≠pɔ̀k	*c3.hand*
ùbə́ŋ	ɔ̀≠pə́ŋ	*c3.ant sp.*
ùdì	ɔ̀≠tì	*c3.face*
ùndìŋ	ɔ̀N≠lìŋ	*c3.vein, tendon*
ɔ̀ʔtím	ɔ̀N≠tɛ́m	*c3.heart*
ɔ̀ʔtɔ̀	ɔ̀N≠tɔ̀	*c3.head*
ùʔkə́	ɔ̀N≠kə́	*c3.boa constrictor*
ùʔkòs	ɔ̀N≠kòs	*c3.cricket*

[67] In the footnote of p 51, Phillips notes that one informant suggested a "slight pause" between the vowel and the consonant in these cases. She proposes an alternative analysis of doubling the consonant, but since there is no phonetic evidence of a geminate, I suspect that the point of articulation and nasalisation are lost, causing the nasal to surface as a [ʔ].

surface realisation	**underlying form**	***gloss***
àndʒìŋ	àN≠jìŋ	*c6a.raphias*
ə̀ndím	àN≠lím	*c6a.yams*
àʔtɔ́m	àN≠tɔ́m	*c6a.breasts*
àʔtáán	àN≠táán	*c6a.stones*
ə̀ʔkúù	àN≠kúù	*c6a.villages*

There appears to be contrast between voiceless stops, voiced stops and prenasalised stops within the morpheme. For example, in noun class 7, which does not have a nasal in the prefix, there are examples of voiceless stops appearing in root-initial position where there should only be voiced stops. In addition, there are some cases of voiceless stops occurring intervocalically within the noun root. As prenasalised stops may occur in root-initial position, as seen below in Example 71 with the bilabial stops, it is possible that **t** and **k** in intervocalic position are in reality [ˀt] and [ˀk] and are the surface realisations of /ⁿt/ and /ᵑk/ following class 7 and within the noun root. Careful pronunciation does reveal a [ʔ] preceding the stop. There is some justification for this in regarding certain of these words in the *Nɛdɛk* dialect.

Example 71: Apparent contrast in stops in Yambeta

	surface from	**underlying form**	***gloss***
/p/ [b]	kì≠**b**ɔ̀n	kì≠**p**ɔ̀n	*sheaf of raphia leaves*
/ᵐb/ [ᵐb]	kì≠ᵐ**b**ɔ́dàʔ	kì≠ᵐ**b**ɔ́dàʔ	*dried ear of maize*
	kì≠lə̀**b**ùn	kì≠lə̀**p**ùn	*tree sp.*
	kì≠tɔ̀**ᵐb**ɔ́k	kì≠tɔ̀**ᵐb**ɔ́k	*type of hat*
/ⁿt/ [ˀt]	kì≠ˀ**t**ìᵐbəʔ	kì≠**ⁿt**ìᵐbəʔ	*bow (hunting)*
	kì≠**ˀt**ɔ́k	kì≠**ⁿt**ɔ́k[68]	*largeness*
/t/ [d]	kì≠**d**ùn	kì≠**t**ùn	*forest*
	kì≠**d**ɔ̀k	kì≠**t**ɔ̀k	*insult*
/ⁿd/ [ⁿd]	kì≠**ⁿd**ùm	kì≠**ⁿl**ùm	*event*
	kì≠**ⁿd**ɔ̀k	kì≠**ⁿl**ɔ̀k	*traditional dance*
/ⁿt/ [ˀt]	kì≠lóˀ**t**ók	kì≠ló**ⁿt**ók	*type of calabash*
/t/ [d]	kì≠bɔ́**d**ɔ̀m	kì≠bɔ́**t**ɔ̀m	*plant sp.*
/ⁿd/ [ⁿd]	kì≠sì**ⁿd**ìŋ	kì≠sì**ⁿl**ìŋ	*yam*
/ᵑk/ [ˀk]	kì≠ˀ**k**ùɲ	kì≠ᵑ**k**ùɲ	*stump*
	kì≠ˀ**k**ɔ̀n	kì≠ᵑ**k**ɔ̀n	*fish sp.*
/k/ [g]	kì≠**g**ùd	kì≠**k**ùd	*wind*
	kì≠**g**ɔ́k	kì≠**k**ɔ́k	*stool, bench*
/ᵑg/ [ᵑg]	kì≠**ᵑg**ə́ŋ	kì≠**ᵑw**ə́ŋ[69]	*stick, pestle*

[68] In the dialect of Nɛdɛk this word is indeed /kì**ⁿt**ɔ́k/.

	surface from	**underlying form**	***gloss***
	kì≠ᵑ**g**ɔ̀ŋ	kì≠ᵑ**w**ɔ̀ŋ	*spittle, slobber*
/ᵑk/ [ˀk]	ì≠wàˀ**k**ìʔ	ì≠wàᵑ**k**ìʔ	*chimpanzee*
	ì≠báˀ**k**ín	ì≠báᵑ**k**ín[70]	*outbuilding*
/k/ [g]	ì≠bá**g**ín	ì≠bá**k**ín	*type of calabash*

2.3.2 Vowels

This section discusses the vowel inventory of Yambeta (section 2.3.2.1), and various vowel co-occurrences and vowel co-occurrence restrictions (section 2.3.2.2).

2.3.2.1 Yambeta vowel inventory

Yambeta[71] has an inventory of eight contrastive short and long vowels. Long vowels occur only in the first syllable of noun or verb roots. A complex system of vowel harmony regulates the co-occurrences and co-occurrence restrictions of the vowels. The vowels can be divided into two sets, which are mutually exclusive within roots and stems:

Table 13: Yambeta contrastive vowels

[-ATR]						[+ATR]					
ɪ[72]	ɪː			ʊ	ʊː	i	iː			u	uː
				ɔ	ɔː					o	oː
		a	aː					ə	əː		

In the verb system, all eight contrastive vowels are attested in the verb root. While the distinction between /o/ and /ʊ/ is slight, this distinction is emphasised by rounding harmony. Rounding harmony is triggered by non-high (open) round vowels and targets the final vowel /-a/. High round vowels, /u/ and /ʊ/ do not trigger rounding harmony. In the Yambeta verb system, the root vowel generally determines the changes in the final vowel according to ATR and/or rounding harmony, as shown in Example 72 below.

[69] In prenasalisation across morpheme boundries [ⁿd] is clearly the realisation of an underlying /n≠l/. In a like manner, [ᵑg] could be the realisation of /ŋ≠w/. Phillips asserts that this is the case, although her examples of this do not correspond with my data.

[70] In the dialect de Nɛdɛk this word is indeed /ɛ̀báᵑkɛ̀n/.

[71] The vowel inventory is the same in both dialects.

[72] This vowel acoustically has a relatively high F1 and is perceptively closer to a mid vowel than a high vowel (ave. F1/F2: 493/1786). However it is underlyingly /ɪ/.

Example 72: Contrastive vowels in Yambeta CVC verb stems

rt vowel	ATR	round	FV[73]	example	gloss
i	x	---	-ə	kù≠tím-ə̀	*dig*
				kù≠wí:j-ì	*extinguish-CAUS*
ɪ	---	---	-a	kʊ̀≠fɪ̀k-à	*think*
				kʊ̀≠tɪ̂:m-ɪ̀n	*get up*
ə	x	---	-ə	kù≠kə́k-ə̀	*coagulate*
				kù≠də̂:ŋ	*fall*
a	---	---	-a	kʊ̀≠pàs-à	*carve, sharpen*
				kʊ̀≠là:m-ɪ̀	*announce-CAUS*
ɔ	---	x	-ɔ	kʊ̀≠kɔ́l-ɔ̀	*burn*
				kʊ̀≠mɔ́:s-ɪ̀	*narrow-CAUS*
o	x	x	-o	kù≠sóp-ò	*be sweet*
				kù≠lò:d-ì	*show-CAUS*
ʊ	---	---	-a	kʊ̀≠sʊ́m-à	*cut*
				kʊ̀≠jʊ̂:	*flow*
u	x	---	-ə	kù≠mús-ə̀	*fold*
				kù≠sù:l-ì	*lower-CAUS*

In the noun system, the most common root structure is CVC. All eight vowels are attested in CVC noun roots, as in Example 73.

Example 73: Permitted vowels in Yambeta CVC noun roots

i	kì≠pìn	*taro*	ɪ	kɪ̀≠pɪ̀p	*lip*
	kì≠tín	*calabash for water*		kɪ̀≠kɪ̀k	*molar*
i:	ì≠kî:b	*work group*	ɪ:	ɪ̀≠tɪ́:n	*tree squirrel*
ə	ǹ≠sə̀t	*duiker*	a	kɪ̀≠sàk	*bird*
	ì≠kə́t	*cataract*		ŋ̀≠kák	*pangolin, aardvark*
ə:	sə̂:n	*father-in-law*	a:	kɪ̀≠bà:n	*palm whip*
o	ùŋ=kòs	*cricket*	ɔ	ʊ̀ŋ≠kɔ̀t	*nape of neck*
	ì≠sòs	*partridge*		nʊ̀≠sɔ́s	*hot pepper*
o:	nù≠bǒ:	*frog*	ɔ:	kɪ̀≠ɲɔ̌:k	*yam*
u	kì≠pùn	*fracture*	ʊ	kɪ̀≠pʊ̀n	*back*
	ì≠túk	*domesticated animal*		ɪ̀≠tʊ́k	*hernia*
u:	kì≠lùùʔ	*odour*	ʊ:	ʊ̀ŋ≠gʊ̀:	*foot*

While CVCV(C) noun roots do occur, most are reduplicated or compound roots. Only six contrastive vowels have been found in monomorphemic CV_1CV_1(C) roots,

[73] Not all verbs take a FV, in some cases other vowels such as **-i** or **-ɪ** causative suffix may also be found.

the high back vowels /u/ and /ʊ/ are not attested in the data, except in reduplicated or compound roots, as below in Example 74 below.

Example 74: Permitted vowels in monomorphemic CV_1CV_1(C) nouns

i	kì≠ᵑkínìt	*heel*	ɪ	ì≠pìnìn	*hatred*
	kí≠líⁿdìʔ	*shadow*		kì≠sílín	*cricket*
i:	kì≠sì:sȉ	*worm*	ɪ:	ì≠ɲì:ŋɛ̀ʔ	*mockery*
ə	mə̀≠sə́pə̀ʔ	*evening palm wine*	a	ì≠pàkà	*shield*
	ì≠jə́sə́n	*cooking pot*		kì≠jàsáŋ	*basket*
ə:	---	---	a:	kí≠ŋâ:ŋà	*crow*
o	ùm≠pòló	*woven raphia mat*	ɔ	ì≠fɔ̀tɔ́	*yam sp.*
	kì≠lóⁿtók	*calabash*		kí≠lɔ̀tɔ̀k	*toad*
o:	---	---	ɔ:	kì≠lɔ̀:lɔ́	*diarrhea type*
u	---	---	ʊ	---	---
u:	---	---	ʊ:	---	---

2.3.2.2 Vowel co-occurrences

Several factors govern the co-occurrences of vowels in CVCV nouns. These factors include 1) ATR-harmony restrictions and 2) restrictions on V_2, depending on the features of V_1. Each of these vowel co-occurrence restrictions will be discussed in turn in sections Error! Reference source not found. and 2.3.2.2.2 below.

2.3.2.2.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ is always [-ATR] and never found in a [+ATR] environment. In Example 75 below, all ATR vowel co-occurrences in CVCV noun roots are shown.

Example 75: Vowel co-occurrences in Yambeta CVCV(C) noun roots

[-ATR] vowels			**[+ATR] vowels**		
ɪ-ɪ	kì≠sílín	*cricket*	i-i	kì≠ᵑkínìt	*heel*
ɪ:-ɪ	kì≠dí:dí[74]	*sp. of snake*	i:-i	kì≠sì:sí	*intestinal worm*
ɪ-a	mà≠fìkàʔ	*thoughts*	i-ə	í≠tìlə̀	*bitter leaf*
ɪ:-a	ɔ̀ŋg≠wì:nàʔ	*buyer*	i:-ə	---	---
ɪ-ʊ	---	---	i-u	---	---
ɪ-ɔ	---	---	i-o	---	---

[74] Long vowels are less common and many of these examples are clearly reduplicated roots.

[-ATR] vowels			[+ATR] vowels		
a-ɪ	ì≠tàpí	*palm tree sp.*	ə-i	mə̀≠pə́lí	*salt*
a:-ɪ	là:nìʔ	*type of drum*	ə:-i	kə̀:nìʔ	*tomb*
a-a	kì≠jàsáŋ	*basket*	ə-ə	mə̀≠sə́pə̀ʔ	*evening palm wine*
a-ʊ	ŋ̀≠kàᵑwʊ́	*lion*	ə-u	kì≠tə̀ᵑkùn	*caterpillar sp.*
a:-ʊ	ì≠sà:sʊ́	*jigger*	ə:-u	kə̌:wùʔ	*gorilla*
a-ɔ	---	---	ə-o	---	---
ʊ-ɪ	ì≠tʊ́mìn	*plant sp.*	u-i	kì≠lùmìn	*mud*
ʊ:-ɪ	---	---	u:-i	kì≠tù:lìʔ	*brawl*
ʊ-a	kì≠pʊ́ŋàʔ[75]	*living room*	u-ə	ì≠kùtə̀ʔ	*sack*
ʊ:-a	---	---	u:-ə	---	---
ʊ-ʊ	---	---	u-u	---	---
ʊ-ɔ	---	---	u-o	---	---
ɔ-ɪ	ì≠tɔ̀ɔ̀kìʔ	*confidence*	o-i	kì≠kòlìn	*throat*
ɔ:-ɪ	kì≠nɔ̀:ŋìʔ	*foreigner*	o:-i	ŋ≠gò:jí	*childrearing rights*
ɔ-a	---	---	o-ə	---	---
ɔ-ʊ	---	---	o-u	---	---
ɔ-ɔ	ì≠fɔ̀tɔ́	*yam sp.*	o-o	ùm≠pòló	*woven raphia mat*

2.3.2.2.2 Other V_2 co-occurrence restrictions

When V_1 in CV_1CV_2 nouns is a high vowel, V_2 is either a high or open (non-high) vowel. When V_1 is an open round vowel, V_2 is either a high vowel or an identical round vowel. When V_1 is an open non-round vowel, V_2 is either a high, a round or an open vowel. Which high, round or open vowel occurs in V_2 position depends on the ATR value of V_1. The high V_2 is /ɪ/ (with a surface representation of [ɛ]) in [-ATR] noun roots or /i/ in [+ATR] noun roots. The round V_2 is generally either /ʊ/ in [-ATR] noun roots or [u] in [+ATR] roots, except with the open round vowels where the round V_2 is identical to V_1. The open vowel is either /a/ in [-ATR] roots or /ə/ in [+ATR] roots, see Example 76 below.

Example 76: Value of V_2 in Yambeta CVCV noun roots

V_2 in CVCV(C) noun roots	[-ATR]	[+ATR]
High	ɪ	i
Round	ʊ or ɔ	u or o
Open	a	ə

[75] In the YALICO database, most of these vowels are written ɔ-a. For the most part, they fall in the acoustic range of /ʊ/, except that in ten utterances of this word, the first five had F1/F2 averages around /ɔ/ and the second five had F1/F2 averages around /ʊ/. I tend to think that the latter pronunciations are more correct. In addition, since there is rounding harmony in Yambeta triggered by the non-high (open) round vowels, /ɔ/ should cause rounding harmony, and any underlyingly /ɔ-a/ pattern would surface as [ɔ-ɔ].

In summary, the possible combinations of vowels in CVCV(C) noun roots are presented in Table 14 below:

Table 14: Surface CV_1CV_2 combinations permitted in Yambeta

V_1V_2	high	round	open
/i/ /ɪ/	i-i ɪ-ɪ	--- ---	i-ə ɪ-a
/u/ /ʊ/	u-i ʊ-ɪ	--- ---	u-ə ʊ-a
/o/ /ɔ/	o-i ɔ-ɪ	o-o ɔ-ɔ	---[76] ---[77]
/a/ /ə/	a-ɪ ə-i	a-ʊ ə-u	a-a ə-ə

2.3.3 Vowel-harmony processes

Yambeta has a complex system of vowel harmony consisting of two interacting types of harmony: ATR and rounding harmony. Although rounding harmony does not operate as a vowel co-occurrence restriction in roots, both types of vowel harmony cross morpheme boundaries within the phonological word.

2.3.3.1 Pre-stem elements

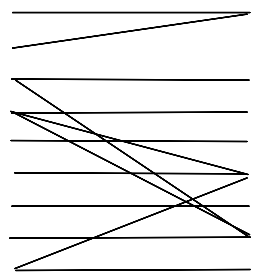
Both nominal and verbal pre-stem elements undergo vowel harmony in Yambeta. These are ATR harmony and rounding harmony which will be discussed in turn below.

ATR harmony in pre-stem elements

Yambeta has a system of fifteen noun classes, not including the infinitive class 15 **kʊ-**. The following double-class genders occur: 1/2, 3/4, 3/6, 5/6a, 7/8, 9/14, 11/13, 19/mʊ and a few examples of 5/6, 5/14, 19/14 and 14/6 are also found in the data. Phillips (1979: 95) identified class 19/mʊ as class 5b/18, but in comparison with other Mbam languages, Phillips' class 5b is identical to class 19 found in the Mbam A60 languages. The plural noun class **mʊ-** is considered in Guthrie (1971: 32) as extraneous and was not assigned a class number. In some literature it is identified as class 18.

[76] Precluded due to rounding harmony; /o-ə/ is realised as /o-o/.
[77] Precluded due to rounding harmony; /ɔ-a/ is realised as /ɔ-ɔ/.

class	**prefixes**	**class**	**prefixes**
1	mʊ- /mu-	2	pa- / pə-
1a	ʊ- / u-		
3	ʊ- / u-	4	N-
5	nɪ- / ni-	6a	aN- / əN-
7	kɪ- / ki-	8	pɪ- / pi-
9	N-	10~14	pʊ- / pu-
11	nʊ- / nu-	13	tʊ- / tu-
14	pʊ- / pu-	6	ma- / mə-
19	ɪ- / i-	mʊ-	mʊ- / mu-



All noun-class prefixes with a vowel undergo ATR harmony, as shown in Example 77. The vowel of the prefix will become a glide before vowel-initial noun roots.

Example 77: ATR harmony of Yambeta noun-class prefixes

class	**noun-class prefix**	**example**	***gloss***
1	ʊ(N) [78]-	ʊ̀ŋ≠kíìt	*woman*
		ùm≠pʷə̂m	*hunter*
2	pà	pà≠kíìt	*women*
		pə̀≠pʷə̂m	*hunters*
3	ʊ(N)-	ʊ̀m≠pɔ̀k	*hand*
		ù≠pə́ŋ	*ant sp.*
5	nɪ-	nɪ̀≠pʊ̀m	*egg*
		nì≠lù	*knee*
6	ma-	mà≠ŋɔ́	*blood*
		mə̀≠ní	*water*
6a	aN-	àm≠pʊ̀m	*eggs*
		ə̀n≠lù	*knees*
7	kɪ-	kɪ̀≠pàŋ	*rooster*
		kì≠tʃút	*mouse sp.*
8	pɪ-	pɪ̀≠pàŋ	*roosters*
		pì≠tʃút	*mice sp.*

[78] N indicates a homorganic nasal which assimilates to the point of articulation of the following consonant. There is also a **mʊ-** class 1 prefix, but its [+ATR] counterpart has not been found.

class	**noun-class prefix**	**example**	***gloss***
11	nʊ-	nʊ̀≠kɔ̀k	*feather*
		nú≠pòŋ	*shrew*
13	tʊ-	tʊ̀≠kɔ̀k	*feathers*
		tú≠pòŋ	*shrews*
14	pʊ-	pʊ̀≠kák	*pangolins, aardvarks*
		pù≠jòʔ	*elephants*
19	ɪ-	ɪ̀≠pàk	*machete*
		ɪ̀≠sòs	*partridge*
pl of 19	mʊ-	mʊ̀≠pàk	*machetes*
		mù≠sòs	*partridges*

The infinitive prefix obligatorily harmonises with a [+ATR] vowel in the verb root: infinitives have a /kʊ-/ (class 15) prefix. As with the noun-class prefixes, it undergoes ATR harmony, see Example 78.

Example 78: ATR harmony of high vowels in Yambeta verb prefixes

kʊ-	kù≠tím-ə̀	*dig*
	kʊ̀≠tít-à	*run*
	kù≠kə́k-ə̀	*coagulate*
	kʊ̀≠tál-à	*see*
	kʊ̀≠tɔ́p-ɔ̀	*touch*
	kù≠sóp-ò	*be sweet, tasty*
	kʊ̀≠tʊ́k-à	*insult*
	kù≠túm-ə̀	*sing*

The reflexive in Yambeta consists of a vowel prefix and a suffix. The prefix vowel **a-** obligatorily harmonises with a [+ATR] vowel in the verb root as in Example 79.

Example 79: ATR harmony of the Reflexive prefix in Yambeta

a-	kʊ̀≠wàs	kʊ̀≠á-wás-íí	*comb/ comb oneself*
	kù≠píə̀n	kù≠ə́-píə́n-íí	*birth/ be born*

Yambeta verbal pre-stem elements undergo ATR harmony. In normal speech, all [-ATR] pre-stem elements will assimilate to a [+ATR] vowel in the verb root. Many verb tenses, however, use an auxiliary + verb structure. The auxiliary, being a separate word, does not assimilate to the verb root. Some examples are shown in Example 80 below.

Example 80: ATR harmony of Yambeta preverbal elements

àà-fìkà			*S/he will think.*
c1.FT1-think			
əə̀-tìlə̀		nùfùù	*S/he will write a letter (this afternoon).*
c1.FT1-write		letter	
àà-mò̀-wáàgìn		nʷádìʔ	*S/he will build him a house.*
c1.FT1-3sIO-build-appl		house	
əə̀-dì-sʲə̀d-ìn		ò̀ʔkɔ̀ɔ̀	*S/he will take our place.*
c1-1pIO-take-appl		place	
àlí	kò̀≠fìkà		*S/he will think (after tomorrow).*
c1.FT2	inf≠think		
àlí	kù≠tìlə̀	nùfùù	*S/he will write a letter (after tomorrow).*
c1.FT2	inf≠write	letter	

Yambeta numeral concord prefixes are invariably [-ATR] and assimilate to the [+ATR] vowel of the numeral roots of *one* and *four*.

Example 81: Yambeta numeral concord prefixes

class	**num. prefix**	**example**	***gloss***
1	ɔ́-	mò̀ò̀d ó≠mòʔ	*one person*
2	pá-	pò̀ò̀d pá≠bàn	*two people*
		pò̀ò̀d pə́≠nìʔ	*four people*
3	ɔ́-	ɔ̀≠tím ó≠mòʔ	*one heart*
4		ǹ≠tím í≠bàn	*two hearts*
		ǹ≠tím í≠nìʔ	*four hearts*
5	ní-	nì≠dáán ní≠mòʔ	*one stone*
6a	á-	àʔ≠táán á≠bàn	*two stones*
		àʔ≠táán ə́≠nìʔ	*four stones*
7	kí-	kì≠tìᵐbəʔ kí≠mòʔ	*one bow*
8	pí-	pì≠tìᵐbəʔ pí≠baǹ	*two bows*
		pì≠tìᵐbəʔ pí≠nìʔ	*four bows*
9	Ń-	ɲ̀≠ɲàm ḿ≠mòʔ	*one animal*
14	pʊ́-	pò̀≠ɲàm pʊ́≠bàn	*two animals*
		pò̀≠ɲàm pú≠nìʔ	*four animals*
11	nʊ́-	nò̀≠gɔk nú≠mòʔ	*one feather*
13	tʊ́-	tò̀≠gɔ̀k tʊ́≠bàn	*two feathers*
		tò̀≠gɔ̀k tú≠nìʔ	*four feathers*
19	í-	í≠gòk í≠mòʔ	*one sugarcane*
mʊ	mʊ́-	mú≠gòk mʊ́≠bàn	*two sugarcanes*
		mú≠gòk mú≠nìʔ	*four sugarcanes*

2.3.3.1.1 Rounding harmony in pre-stem elements

Rounding harmony targets /a/ and is triggered by the non-high (open) round vowels /ɔ/ and /o/. The high round vowels /u/ and /ʊ/ never trigger rounding harmony. Only two noun-class prefixes, classes 2 and 6, have an underlying /a/ and consistently undergo rounding harmony, see Example 82 below.

Example 82: Rounding harmony of /a/ in Yambeta noun-class prefixes

class	**noun-class prefix**	**examples**	***gloss***
2	pa-	pɔ̀≠lɔ́^{n}dɔ́k	*deaf-mutes*
		pò≠lò^{n}dók	*sorcerers*
		pà≠nʊ̀m	*husbands*
		pə̀≠ŋù	*co-wives*
6	ma-	mɔ̀≠^{n}dɔ́ŋ	*problems, affairs*
		mò≠ókìn	*smoke*
		mà≠tʊ̀m	*messages, commissions*
		mə̀≠túk	*nights*
6a	a(N)-	ɔ̀≠tɔ́k	*yams sp.*
		ò≠kój	*plants, grass sp.*
		à≠tʊ́m	*breasts*
		ə̀n≠lùp	*beans*

The reflexive prefix **a-** will also undergo rounding harmony as in Example 83. Examples with /o/ in the verb root were not found in the corpus; it is assumed that the gaps are accidental. In the example below, since the infinitive prefix and the vowel-initial reflexive prefix are in juxtaposition, the high back vowel of the infinitive is completely assimilated as described below in section 2.3.4.2.

Example 83: Rounding harmony of Reflexive prefix in Yambeta

á-	kʊ̀≠kɔ̀m-ìt	kɔ̀≠ɔ́-kɔ́m-ít-íí	*scratch oneself*
	kʊ̀≠tʊ́ŋ-à	kà≠á-tʊ́ŋ-íí	*hang oneself*
	---	kə̀≠ə́-pún-íí	*meet each other*

Verbal pre-stem elements with /a/ undergo rounding harmony as well as ATR harmony.

Example 84: Rounding harmony in Yambeta preverbal morphemes

ɔ̀ɔ́-ŋɔ̀nɔ̀	*S/he laughed.*
c1.P1-laugh	
m^{w}**ǒ**-sópò	*They (foods) were sweet.*
c.*mu*.P1-be sweet	

ɔ̀ɔ̀-ŋɔ̀nɔ̀ c1.FT1-laugh	*S/he will laugh.*
mʷ**ô**-sópò c.*mu*.FT1-be sweet	*They (foods) will be sweet.*
à-lìʔ **ɔ̀**-ŋɔ̀nɔ̀ c1-be PREP-laugh	*S/he is laughing.*
mò-lìʔ **ò**-sópò c.*mu*-be PREP-be.sweet	*They (foods) are sweet.*

2.3.3.2 Vowel harmony in suffixes

Most verb and deverbal noun suffixes undergo vowel harmony. Yambeta, unlike all the other Mbam languages with ATR harmony, does not have dominant suffixes. Discussed in turn in sections 2.3.3.2.1 and 2.3.3.2.2 below are suffixes that undergo ATR harmony and rounding harmony.

2.3.3.2.1 ATR harmony in suffixes

ATR harmony is triggered by a dominant vowel in the root and spreads bidirectionally. All [-ATR] vowels in the phonological word change into their [+ATR] counterpart. A few examples are shown in Example 85 below:

Example 85: ATR harmony of Yambeta verbal suffixes

diminutive	-ɪt	ò≠fɔ́g-ìt		*shake*	
	-it	kù≠típ-ìt		*scratch, claw*	
positional	-ɪm	kò≠tíl-ìm		*stop, stand up*	
	-im	kò≠nɔ́s-ìm		*stoop, bend over*	
		kù≠kə́s-ìm		*sneeze*	
		kù≠út-ìm		*bow*	
reflexive	-íí	kò≠ɔ́-kɔ́m-ít-íí		*scratch oneself*	
	-íí	kə̀≠ə́-píə́n-íí		*be born*	
applicative	-ɪn	kò≠sɔ̀k-ìn		*wash, purify*	
	-in	kù≠súŋ-ìn		*untie, detach*	
separative	-ɪn	kò≠fàɲ	*hang up*	kò≠fàɲ-ìn	*take down*
	-in	kù≠súŋ	*attach*	kù≠súŋ-ìn	*untie, detach*
detransitive	-ɪk	kʷ≠ǎt	*break (TR)*	kʷ≠ǎt-ìk	*break (INTR)*
		kò≠wàk-à	*tear (TR)*	kò≠wàk-ìk	*tear (INTR)*
	-ik	kù≠tùs	*pierce*	kù≠tùs-ìk	*pierce oneself*

		kù≠pún *break (TR)*	kù≠pún-ìk	*break (body part)*
continuous	-an	kò≠fám-àn		*sprinkle, spray*
	-ən	kù≠ləp-ən		*counsel (v)*
continuous	-a	kò≠kót-à		*attach*
(short form)		kò≠fìk-à		*measure (v)*
	-ə	kù≠típ-ə̀		*scratch, claw (v)*
		kù≠mús-ə̀		*fold (v)*

The meaning of the suffix **-ɪn** varies between lexemes. In certain instances, it has a reversive meaning, in others an applicative meaning and in yet others a reciprocal meaning. These lexical differences are illustrated in the examples above.

The causative suffix in Yambeta is not dominant. Rather than triggering ATR harmony, it undergoes ATR harmony. The causative suffix is **-ɪ** for [-ATR] verbs and **–i** for [+ATR] verbs as in Example 86 below.

Example 86: Causative suffix -ɪ/-i in Yambeta

kò≠sák	*dry up*	kò≠sák-**ì**	*cause to dry up*
kò≠óm	*be healed*	kò≠óm-**ì**	*heal someone*
kò≠lɔ̀l-ìt	*catch fire*	kò≠lɔ̀l-ít-**ì**	*set on fire*
kù≠lím	*be deep*	kù≠lím-**ì**	*deepen*
kù≠tə́ə̀ŋ	*fall (v)*	kù≠tə́ə́ŋ-**ì**[79]	*cause to fall*
kù≠tùs	*be dull*	kù≠tùs-**ì**	*make dull*

Most deverbal nouns are formed by adding a noun-class prefix to the verb stem. Any verbal suffix found also undergoes ATR harmony, see Example 87 below.

Example 87: Yambeta deverbal nouns

kò≠páŋ-à	*harvest (v)*	nì≠páŋ-à	*harvest (n)*
kù≠pùk	*harvest groundnuts (v)*	nì≠pùk	*groundnut harvest*
kù≠púə̀m	*hunt (v)*	ùm≠púə̀m	*hunter*
kò≠làm-ì	*govern (v)*	òn≠tàm-ì	*order, command*
kù≠lùn	*be old (v)*	ù≠lùn	*old person*

A few deverbal nouns are formed by adding a noun-class prefix and an applicative suffix to the verb root. Any verbal suffixes present will undergo ATR and rounding harmony where applicable, as in Example 88.

[79] There is a tendency in many Mbam languages for a high tone in word-final position to fall, especially in languages like Yambeta and Yangben which have long vowels and codas. The tone is underlyingly high, and with the addition of the causative suffix, the underlying high tone is discovered.

Example 88: Yambeta deverbal nouns with applicative suffix

kú≠kót-òn	*nurse, care for*	ù≠kót-òn-òn	*nurse, caretaker*
kʊ̀≠sɔ̀k	*wash*	ɔ̀≠sɔ̀k-ìn	*purification rite*

2.3.3.2.2 Rounding harmony in suffixes

Most verb extensions and inflectional suffixes with an /a/ undergo rounding harmony as well as ATR harmony. Like ATR harmony, rounding harmony is bidirectional. Rounding harmony is triggered only by non-high (open) round vowels. The high round vowels /u/ and /ʊ/ do not trigger rounding harmony. A few examples are shown in Example 89 below:

Example 89: Rounding harmony of Yambeta verbal suffixes

short continuous	-a	kʊ̀≠sɔ̀j-ɔ̀	*talk*
		kù≠sóp-ò	*be sweet, tasty*
		kʊ̀≠tʊ́k-à	*insult (v)*
		kù≠tún-ə̀	*pound (v)*
long continuous	-an	kʊ̀≠tɔ́ŋ-ɔ̀n	*call*
		kʊ̀≠tɔ́ŋ-ɔ̀n-ɔ̀n	*call one another*
		kù≠sóp-òn	*be sweet*
		kʊ̀≠nʊ́t-àn	*support*
		kù≠pút-ə̀n	*trip, stumble*

Front vowels are opaque to rounding harmony. Where a suffix or extension with a front vowel occurs, the rounding harmony will be blocked, see Example 90. Since there are no obligatory final vowels in the language, only a few examples were found in the corpus.

Example 90: Opacity of Yambeta front vowels in rounding harmony

kɔ̀≠ɔ̀p-ìn-à	*crush (APPL)*
kù≠kós-ín-ə̀	*cough (CONT)*
kʊ̀≠ʊ̀ⁿd-ìn-ə̀	*detach, release (APPL)*

2.3.4 Hiatus-resolution processes

There are several hiatus-resolution processes in Yambeta. These are glide formation (section 2.3.4.1), vowel assimilation (section 2.3.4.2), hiatus retention (section 2.3.4.3) and consonant insertion (section 2.3.4.4).

2.3.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted across morpheme boundaries. Where V_1V_2 sequences occur, a high vowel in V_1 position becomes a glide. Glide formation occurs between a high vowel in the noun-class prefix and a vowel-initial noun root, as seen in Example 91 below:

Example 91: Prefix-root glide formation in Yambeta

surface from	**underlying form**	***gloss***
kʲìt	kì≠ìt	*tree (generic)*
kʲə̌s	kì≠ə́s	*tree sp.*
kʲùj	kì≠ùj	*maggot*
nʲɔ̀s	nì≠ɔ̀s	*parrot*
nʲǒŋ	nì≠óŋ	*bee*
nʷìt	nʊ̀≠ìt	*stake*
nʷàs	nʊ̀≠às	*chin*
pʷɔ̀s	pʊ̀≠ɔ̀s	*parrots*
pʷǒŋ	pù≠óŋ	*bees*

2.3.4.2 Vowel assimilation

Between the infinitive prefix and a vowel-initial verb prefix or verb root, the high back vowel of the infinitive is completely assimilated as in Example 92.

Example 92: Vowel assimilation in Yambeta CV≠VC verbs

surface form	underlying form	*gloss*
kìíp	kʊ̀≠íp	*steal*
kɛ̀ɛ́sà	kʊ̀≠ísà	*scrape*
kàák	kʊ̀≠ák	*put, place*
kɔ̀ɔ̀p	kʊ̀≠ɔ̀p	*grind, crush*
kòòⁿdìk	kʊ̀≠òⁿd-ìk	*wake up*
kʊ̀ʊ́n	kʊ̀≠ʊ́n	*kill*
kùút	kʊ̀≠út	*bend, fold*
kàáwásɛ́ɛ́	kʊ̀≠á-wás-íí	*comb oneself*
kə̀ə́bíə́níí	kʊ̀≠ə́-píə́n-íí	*be born*

2.3.4.3 Hiatus retention

Identical vowels in juxtaposition are permitted across morpheme boundaries. This is particularly evident between the noun-class prefix and the noun root. Where the vowels are either underlyingly identical or have identical surface realisations due to a vowel-harmony process, both vowels are retained. See Example 93.

Example 93: Yambeta prefix-root hiatus retention

surface form	**underlying form**	***gloss***
nììs	nì≠ìs	*eye*
pə̀ə̀n	pà≠ə̀n	*strangers, visitors*
mààk	mà≠àk	*years*
nɔ̀ɔ̀m	nʊ̀≠ɔ̀m	*river*
tùùt	tʊ̀≠ùt	*pus*

Within the noun or verb stem, a VV structure is permitted either between identical vowels or between a high V_1 and any V_2. According to Phillips (1979) these VV structures are considered disyllabic. The attested VV noun and verb roots are listed in Example 94.

Example 94: VV structure in Yambeta noun and verb stems

VV	example	*gloss*
ii	kì≠jììʔ	*pile (n)*
iə	ùm≠píən	*nephew*
io	nù≠sìòŋ	*goliath frog*
iu	---	---
ɪɪ	ì≠lììŋ	*fish sp.*
ɪa	nò≠ᵑwàsíà	*grass sp. (used in widow rites)*
ɪɔ	pò≠fìɔ̀ŋ	*deformation of feet in "x" shape*
ɪʊ	ì≠líʊ̀t	*chicken's vent*
əə	nì≠sə̀ə̀ní	*wake (for funeral)*
aa	ɔ̀≠fáàn	*wing*
ɔɔ	kì≠kɔ́ɔ̀n	*streak of dried tears*
oo	---	---
ʊɪ	ɔ̀≠tʊ́ìŋ	*ear*
ʊa	pà≠fʊ̀àt	*diarrhea*
ʊɔ	---	---
ʊʊ	kì≠kʊ̀ʊ̀ʔ	*hoof*
ui	kì≠túìn	*nut sp.*
uə	ùm≠púəm	*hunter*
uo	---	---
uu	kì≠tùùliʔ	*brawl*
ii	kù≠nîìk	*dress (v)*
iə	kù≠ŋíən-ə̀	*ask*
io	kù≠sìòt-ò	*hop, skip*
iu	---	---
ɪɪ	kò≠tììs-à	*limp*
ɪa	kò≠síà	*bless*
ɪɔ	kò≠líɔ́ⁿd-ɔ̀n	*act timidly*
ɪʊ	---	---
əə	kù≠tə́ə̀ŋ	*fall*
aa	kò≠wáàk	*build*
ɔɔ	kò≠mɔ́ɔ́s-ì	*rebraid (caus.)*
oo	kù≠lòòt-ì	*show (caus.)*
ʊɪ	kò≠lʊ̀ìk-ì	*announce (caus.)*
ʊa	kò≠kʊ́àn	*marry*
ʊɔ	---	---
ʊʊ	---	---

VV	example	*gloss*
ui	kù≠súìt	*pull*
uə	kù≠pùə́k	*close*
uo	---	---
uu	kù≠sùùl-ì	*lower (caus.)*

2.3.4.4 Consonant insertion

Vowel-initial class 5 nouns which have a plural in class 6a, **a(N)-**, insert a consonant between the nasal of the prefix and the vowel of the root. If the vowel is [-front], this consonant is [g] and the nasal is realised as a velar. If the vowel is [+front], then the inserted consonant is either [b] or [g]. The few examples found in the corpus provide insufficient information to determine if there is a phonological basis for the insertion of [b] over [g] in the context of front vowels. The consonant /n/ does not seem adequate justification especially since [g] is inserted in the context of other alveolar consonants as in Example 95.

Example 95: Consonant insertion between VN- and V-initial nouns

class 5	**class 6a** S.F.	U.F.	***gloss***
n^j≠út	əŋ**g**út	àN≠út	*nose*
n^j≠às	àŋ**g**às	àN≠às	*twin*
nì≠ín	əm**b**ín	àN≠ín	*palm tree*
nì≠ìs	əŋ**g**ìs	àN≠ìs	*eye*
n^j≠ìn	àm**b**ìn	àN≠ìn	*kola*
n^j≠ìŋ	àŋ**g**ìŋ	àN≠ìŋ	*joint*

2.3.5 Tone

Yambeta has a two-tone system underlyingly, high and low. Rising tones and falling tones occur only due to glide formation from syllable mergers. Surface tone is marked on the data in this study.

2.3.5.1 Tone melodies on nouns

High and low tone contrast in monomorphemic noun roots. Two tone melodies are attested in CV and CVC noun roots. Four tone melodies are attested in CVV and CVCV(C) noun roots, see Example 96 below. Noun prefixes usually have a low tone, although there are a few exceptions.

Example 96: Yambeta nominal tone melodies

ì≠pá	≠H	*side, flank*
nò≠pà	≠L	*braid*
ì≠tám	≠H	*type of trap for small animals*
ì≠tàm	≠L	*hat*
mà≠ɲáá	≠H	*sap*
kì≠sáà	≠HL	*tree sp.*
ɔ̀≠làà	≠L	*life*
ɔ̀≠sàá	≠LH	*elder*
ɔ̀≠nɔ́ɔ́n	≠H	*laziness*
kì≠kɔ́ɔ̀n	≠HL	*trace of dried tears on face*
m̀≠pɔ̀ɔ̀n	≠L	*wild cat with grey spotted fur*
kì≠ɲɔ̀ɔ́k	≠LH	*yam sp.*
kì≠jásáŋ	≠H	*corn cob*
kì≠sásàʔ	≠H L	*reprimand, rebuke*
nò≠kàsàʔ	≠L	*kindling*
kì≠jàsáŋ	≠L H	*basket for conservation of dry goods*

2.3.5.2 Tone melodies on verbs

Yambeta verb roots have three underlying tone melodies: L, LH and H. All suffixes are realised with a low tone except in LH verbs in which the first suffix after the verb root will have a H tone unless it is in word-final position. Verbs with a VV root and a H melody will have a surface realisation of HL if in word-final position. It is assumed that verbal suffixes are underlyingly toneless and the melody is a function of the verb root. The verbal tone melodies are illustrated in Example 97 below.

Example 97: Yambeta verbal tone melodies

L	kò≠tàp	L≠L	*be wet*
	kò≠tàp-à	L≠L -L	*be wet (CONT)*
	kò≠tàp-ìn	L≠L -L	*wet oneself*
	kò≠tàp-ì	L≠L -L	*cause to be wet*
	kò≠sɔ̀k	L≠L	*wash*
	kò≠sɔ̀k-ìn	L≠L -L	*wash (APPL)*
	kò≠sɔ̀k-ìn-à	L≠L -L -L	*wash (APPL/CONT)*

L.H	kù≠tìə̀l-ì	L≠L -L	*be slippery*
	kù≠tìə̀l-ík-ə̀n	L≠L -H -L	*slip, slide*
	kù≠tìə̀l-ík-ə̀n-ì	L≠L -H -L -L	*make slippery*
H	kù≠mús	L≠H	*fold*
	kù≠mús-ə̀	L≠H -L	*fold (CONT)*
	kù≠súìt	L≠HL	*pull*
	kù≠súít-ə̀	L≠H L	*pull (CONT)*
	kò≠ɲáŋ-ìn	L≠H -L	*carry*
	kò≠ɲáŋ-ìn-à	L≠H -L -L	*transport*
	kò≠ɲáŋ-ìn-ì	L≠H -L -L	*cause to carry*
	kù≠tə́ə̀ŋ	L≠HL	*fall*
	kù≠tə́ə́ŋ-ì	L≠H -L	*cause to fall, cut down*
	kù≠tə́ə́ŋ-ə̀n-ì	L≠H -L	*cause to fall (CONT)*
	kù≠tə́ə́ŋ-ìn-ì	L≠H -L -L	*cause to fall (APPL)*

In addition to providing lexical contrast, tone also has a grammatical function. Among other things, tone provides the crucial difference between various tenses in verb conjugations. This is, however, beyond the scope of this study.

2.4 Tuki phonological overview

This study is based on *Tutsingo*, the reference dialect. It is based on personal research as well as previous research of several linguists and a wordlist published on the internet[80].

2.4.1 Consonants

This section discusses the consonant inventory of Tuki (section 2.4.1.1), the allophonic and allomorphic realisations of the consonant (section 2.4.1.2), and any distributional restrictions (section 2.4.1.3).

2.4.1.1 Tuki consonant inventory

The consonant system of Tuki consists of 25 contrastive consonants (Essono 1974, Kongne 2004).

[80] The main published sources I have consulted in this study are Essono 1974, 1980, Biloa 1997, and Kongne 2004. The main wordlist used was the Lexique Tuki-Français, published on the Internet by Kongne, Welaze J 2006 (see references for the link). Much of the information and analysis collected from the published and unpublished sources has been checked, and in many cases modified by my own research.

Table 15: Tuki contrastive consonants

		labial	alveolar	palatal	velar	labio-velar
stops	voiceless	p	t	tʃ	k	kp[81]
	voiced	b	d	dʒ	g	gb[82]
prenasalised		ᵐb	ⁿd	ᶮdʒ	ᵑg	ᵑᵐgb
fricatives			s		h	
resonants	nasal	m	n	ɲ	ŋ	
	oral	β	ɾ	j		w

2.4.1.2 Allophonic and allomorphic realisations

The phoneme /h/ is realised as a palatal fricative [ç] in the environment of the vowel /i/, see Example 98.

Example 98: Allophonic realisation of /h/ in Tuki.

	surface from	**underlying form**	***gloss***
/i/	≠çít-ə́	≠hít-á	*coil rope*
/ɪ/	≠híⁿd-á	≠híⁿd-á	*arrange, repair*
/e/	≠hə̀ɾ-ə̀	≠hə̀ɾ-á	*draw, design*
/a/	≠háh-á	≠háh-á	*build*
/ɔ/	≠hɔ̀-hɔ̀ŋg-ɔ̀ɾ-ɔ̀	≠hɔ̀-hɔ̀ŋg-àɾ-à	*be ample*
/ʊ/	≠hʊ́ɾ-á	≠hʊ́ɾ-á	*sweep*
/u/	≠hún-ə́	≠hún-á	*blow*

2.4.1.2.1 Post-nasal hardening and nasal prefix elision

Following gender 9/10 nasal prefixes, fricatives and oral resonants are hardened. Post-nasal hardening also occur in cases of a nominalised verb taking a nasal prefix or in conjugated verbs with a 1s subject concord prefix, **Ǹ≠.** Before voiced fricatives and oral resonants, the nasal prefix is maintained. The nasal prefix is elided before voiceless fricatives, as in Example 99 below.

[81] [kp] is rare in Tuki, only three examples in basic nouns and verbs are found in the corpus: **ʊ̀≠kpá** *utter (incantations)*; **ì≠kpáá** *forest* and **ʊ̀≠kpátá** *black ant sp.*

[82] [gb] and [ᵑᵐgb] are also rare in Tuki. The only examples found in the corpus are: **ì≠ᵑᵐgbə́mə́** *lion*, **ŋm≠gbə́ɾə́** *witchcraft*, **ŋm≠gbì** *pipe (tobacco)*, and **ʊ̀ŋm≠gbɔ̌k-ɔ́ŋ-ɔ́** *calamity*.

Example 99: Hardening of fricatives and oral resonants in Tuki

/β/ → [b] / N≠___

ʊ̀≠βə́t-ìj-ə́	greet (v)	mbə́tìjə́	m≠βə́t-ìj-ə́	*c9.greeting (n)*
ʊ̀-βá≠tɔ́ɾ-ɔ́	listen	mbátɔ́ɾɔ́	m-βá≠tɔ́ɾ-ɔ́	*c9.listening (n)*
ʊ̀≠βàŋg-à	cry, wail	mbàŋgíná	m≠βàŋg-ín-á	*c9.obj. of wailing*
ʊ̀≠βàŋg-à	cry, wail	m̀bàŋgàmʊ́	m̀≠βàŋg-àmʊ́	*1s-wail-*PFV

/s/ → [tʃ] / N≠___

N → ∅ / _____≠$C_{[-Voice]}$

ʊ̀≠sìj-à	insult (v)	tʃìjɔ́	n≠sìj-ɔ́	*c9.insult (n)*
ʊ̀≠síɾ-à	scar (v)	tʃíɾɔ́	n≠síɾ-ɔ́	*c9.scarification*
ʊ̀≠sìm-à	curse (v)	tʃìmɔ̀	n≠sìm-ɔ̀	*c9.curse (n)*
ʊ̀≠sìm-à	curse (v)	tʃìmàmʊ́	ǹ≠sìm-àmʊ́	*1s-curse-*PFV

/j/ → [dʒ] / N≠___

ʊ̀≠jɔ̀ᵐb-ɔ̀	fade, wilt	ndʒɔ̀ᵐbíná	n≠dʒɔ̀ᵐb-ín-á	*c9.kind of wilting*
ʊ̀≠jə̌ɾ-ə̀	learn	ndʒə́ɾíná	n≠dʒə́ɾ-ín-á	*c9.teaching style*
ʊ̀≠jə̌ɾ-ə́	learn	ǹdʒə́ɾámʊ́	ǹ≠dʒə́ɾ-ámʊ́	*1s-learn-*PFV

/h/ → [p] / N≠___

N → ∅ / _____≠$C_{[-Voice]}$

ʊ̀≠hʊ̀r-à	sweep	pʊ́ɾíná	n≠hʊ́ɾ-ín-á	*c9. sweeping style*
ʊ̀≠hʊ́m-á	peal (bark)	pʊ́míná	n≠hʊ́m-ín-á	*c9. pealing style*
ʊ̀≠hʊ̀r-à	sweep	pʊ́ɾámʊ́	ǹ≠hʊ́ɾ-àmʊ́	*1s-sweep-*PFV

/ɾ/ → [d] / N≠___

ʊ̀≠ɾɔ̀n-ɔ̀	growl	ndɔ̀níná	n≠ɾɔ̀n-ín-á	*c9.kind of growl*
ʊ̀≠ɾì-à	swear	ndìná	n≠ɾì-ìn-á	*c9.kind of swearing*
ʊ̀≠ɾíb-á	counsel (v)	ndíbɔ́	n≠ɾíb-ɔ́	*c9.counsel*
ʊ̀≠ɾíb-á	counsel (v)	ǹdíbámʊ́	ǹ≠ɾíb-ámʊ́	*1s-counsel-*PFV

As with voiceless fricatives, nasal prefixes are also elided before voiceless stops. Example 100 below illustrates the elision of the nasal prefix before voiceless stops in verbs conjugated in the first person singular.

Example 100: Elision of nasal prefixes before voiceless stops in Tuki

N	→	∅	/	____≠$C_{[-Voice]}$	
		N	/	____≠$C_{[+Voice]}$	

Verb	*gloss*	conj. verb	underlyingly	*gloss*
ò≠pát-á	*pick (fruit)*	pátámʊ́	Ǹ≠pát-ámʊ́	*1s-pick-PFV*
ò≠bìn-à	*hate*	m̀bìnàmʊ́	Ǹ≠bìn-àmʊ́	*1s-hate-PFV*
ò≠tʊ́m-á	*send*	tʊ́mámʊ́	Ǹ≠tʊ́m-ámʊ́	*1s-send-PFV*
ò≠dáᵑg-á	*disappear*	ǹdáᵑgámʊ́	Ǹ≠dáᵑg-ámʊ́	*1s-disappear-PFV*
ò≠ⁿdə̌ɾ-ə̀	*spoil*	ǹdə̌ɾámʊ́	Ǹ≠ⁿdə̌ɾ-àmʊ́	*1s-spoil-PFV*
ò≠ⁿdʒàm-àn-à	*be.afraid*	ǹdʒàmànà	Ǹ≠ⁿdʒàm-àn-à	*1s-afraid-CONT*
ò≠kʊ́s-ʊ́m-à	*cough*	kʊ́sʊ́màmʊ́	Ǹ≠kʊ́sʊ́m-àmʊ́	*1s-cough-PFV*
ò≠kpá-á	*incantation*	kpáámʊ́	Ǹ≠kpá-ámʊ́	*1s-utter-PFV*
ò≠gɔ̀ɾ-à	*bite, crush*	ŋ̀gɔ̀ɾàmʊ́	Ǹ≠gɔ̀ɾ-àmʊ́	*1s-bite-PFV*

2.4.1.2.2 Failure of nasal-prefix elision

Unlike 9/10 homorganic nasals, 3a/4a nasal prefixes are not "phonetically fused...with the following consonantal segment" (Maho: 1999: 59). While the "phonetically-fused" 9/10 nasals will elide before a voiceless obstruent, the non-"phonetically-fused" 3a nasals do not. Consider the word pairs illustrated in Example 101.

Example 101: Differences in Tuki c3a and 9 homorganic nasal prefixes

surface form	**underlying form**			***gloss***
m̩pə́mə́	m̩≠pə́mə́	→	òm-pə́mə́	*c3a.whitewash*
pə́nə́	N≠pə́nə́			*c9.viper*
n̩tʃʊ̀ᵐbʊ́	n̩≠sʊ̀ᵐb-ʊ́	→	òn≠sʊ̀ᵐb-ʊ́	*c3a.hunt*
tʃʊ́mʊ́	N≠sʊ́m-ʊ́			*c9.news, announcement*
ŋ̩kàná	ŋ̩≠kàná	→	òŋ≠kàná	*c3a.story, proverb*
káná	N≠káná			*c9.crab*

The proto-Bantu proposed 3/4 prefixes are *mù-/*mì-, which could give rise to a process where the prefix vowel was elided between consonants. The remaining /m/ takes on the syllabicity and tone of the vowel, which then, in juxtaposition with the root consonant, assimilates to its point of articulation. This would be in keeping with Janssens' (1992-3: 90-92) hypothesis that the variation in the 3/4 prefixes (and others) comes from the proto-Bantu augment + noun class, *V-CV-. The loss of the prefix vowel in certain conditions is a fairly common occurrence. A further loss of the augment in other cases leaves only the nasal prefix.

2.4.1.3 Restrictions in consonant distribution

Tuki has primarily open syllables; CV, V, and syllabic nasals. There are a few cases of syllables with a nasal coda, CVN. Voiced and voiceless stops contrast in both syllable onsets and intervocalically.

2.4.2 Vowels

This section discusses the vowel inventory of Tuki, and the various vowel co-occurrences and co-occurrence restrictions (section 2.1.2.2). Unlike other Mbam languages, Tuki does not have devoiced vowels in utterance-final position.

2.4.2.1 Vowel inventory

Tuki has an inventory of seven contrastive vowels with a predictable allophone [o][83] which occurs in [+ATR] contexts. ATR and rounding harmony, as well as height dissimilation in the high vowels, regulate the co-occurrences and co-occurrence restrictions of the vowels. The vowels can be divided into two sets which are mutually exclusive within roots and stems:

Table 16: Tuki contrastive vowels

	[-ATR]			[+ATR]	
ɪ[84]		ʊ	i		u
		ɔ			
	a			ə[85]	

In the verb system, all seven contrastive vowels are attested in the verb root. The difference between /ɪ/ and /ə/ is slight and many linguists make no distinction between them. However, in verbs, one is clearly [+ATR] and the other [-ATR].

In many Mbam languages, rounding harmony is triggered by the non-high (open) round vowels /o/ and /ɔ/ and targets the vowel /a/. The high round vowels, /u/ and /ʊ/ do not trigger rounding harmony. In Tuki, the vowel written "**o**" does not trigger

[83] Only one clear counter-example has been found in the corpus [wùsó] [mə̀só] c14/6.*face*. The plural class 6 is **ma-** and generally assimilates to ATR harmony. The [o] in this example is not a predictable allophone but an exceptional evidence for contrast. It may be a remnant of the contrastive /o/, now basically lost in Tuki.

[84] In most of the previous studies, Tuki is analysed as having a seven-vowel inventory, such as /i, e, ɛ, a, ɔ, o, u/ (Biloa 1997) or /i, e, ə, a, ɔ, o, u/ (Hyman 1980, for the dialect Tocenga); or as having a six-vowel inventory /i, e, a, ɔ, o, u/ as in Kongne Welaze (2004) and Essono (1972) --although in Essono (1980) the front mid vowel is identified as an archiphoneme E. I propose a different interpretation of "**e**". As Tuki shows evidence of ATR harmony and the vowel commonly written as "**e**" shows evidence of behaving in some contexts as a [+ATR] vowel and in other contexts as a [-ATR] vowel, I have chosen to reinterpret the [-ATR] vowel as /ɪ/ and the [+ATR] vowel as [e], which, despite its high F2, is most likely underlyingly /ə/. The behaviour of these vowels will be discussed in depth below.

[85] While most seven-vowel systems have either /i, ɪ, ɛ, a, ɔ, ʊ, u/ or /i, e, ɛ, a, ɔ, o, u/ inventories, many Mbam languages have atypical vowel inventories, often with the lack of both /e/and /ɛ/. In such cases /ə/ is often slightly fronted.

rounding harmony, while "**ɔ**" does. As "**o**" is misinterpreted in many Mbam languages as a mid vowel, it is reasonable to conclude that in Tuki as well, it is underlyingly a [-ATR] high vowel /ʊ/.

In the Tuki verb system, it is generally the root vowel that is dominant for either ATR and/or rounding harmony and causes the final vowel to assimilate, as shown in Example 102 below.

Example 102: Contrastive vowels in Tuki CVC verb stems

rt vowel	**ATR**	**round**	**FV**	**example**	***gloss***
i	x	---	-ə	≠hít-ə́	*coil (rope)*
ɪ	---	---	-a	≠tít-á	*draw (water)*
ə	x	---	-ə	≠pə́t-ə́	*seal (door)*
a	---	---	-a	≠pát-á	*pick (fruit)*
ɔ	---	x	-ɔ	≠sɔ́t-ɔ́	*dwell, inhabit*
ʊ	---	---	-a	≠kʊ́t-á	*dry (INTR)*
u	x	---	-ə	≠sús-ə́	*ask, demand*

In the noun system, six of the seven contrastive vowels are found in monomorphemic CV_1CV_1 roots, as in Example 103 below. The [+ATR] vowel /ə/ is not found in CV_1CV_1 noun roots.

Example 103: Permitted vowels in Tuki CV_1CV_1 noun roots

i	ù≠gíní	*firewood*	u	nù≠hùtú	*mongoose*
	ì≠kísí	*piece of meat*		mə̀≠súsú	*armpits*
ɪ[86]	ì≠tíkí	*peanut shell*	ʊ	ʊ̀≠kʊ́sʊ̀	*baboon*
	wʊ̀≠ɾítí	*tree*		ì≠kʊ̀mʊ́	*stump (tree)*
a	ì≠βásá	*cloud*	ɔ	ì≠sɔ́kɔ́	*quiver (n)*
	ì≠támá	*cheek*		ì≠tɔ́ⁿdɔ́	*navel*

2.4.2.2 Vowel co-occurrences

Several factors govern the co-occurrences of vowels in CVCV nouns. These factors include 1) ATR-harmony restrictions, 2) restrictions on V_2, depending on the features of V_1, to either a front, round or open (non-high) vowel, and 3) non-identical high vowels are generally prohibited in the stem. Each of these vowel co-occurrence restrictions will be discussed in turn in sections 2.4.2.2.1 and 2.4.2.2.2 below.

[86] While most sources write these words with **e** rather than /ɪ/, the noun-class prefix is [-ATR] and therefore, the root vowel is not likely the [+ATR] vowel, /e/ or /ə/.

2.4.2.2.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ is always [-ATR] and is never found in a [+ATR] environment. In Example 104 below, all ATR vowel co-occurrences in CVCV noun roots are shown. While [o] may occur in either V_1 or V_2 position in a noun root, it only occurs in the context of /i/. This will be discussed in greater detail below in the section below on V_1V_2 co-occurrences.

Example 104: ATR vowel co-occurrences in Tuki CVCV noun roots

[-ATR] vowels			**[+ATR] vowels**		
ɪ-ɪ	ì≠títí	*bone*	i-i	ù≠gíní	*firewood*
ɪ-a	ò≠tímá	*heart*	i-ə	mə̀≠sínə̀	*tears*
ɪ-ʊ/ɔ	ò≠nímɔ́	*fruit bat*	i-u/o	kító	*hair*
a-ɪ	ò≠háhɪ́	*green mamba*	ə-i	ì≠tə́tí	*rooster*
a-a	ì≠pàná	*hoof*	ə-ə	mù≠sə̀ŋə́	*rings*
a-ʊ/ɔ	ò≠hánʊ́	*machete*	ə-u/o	ì≠kə̀kú	*cola nut*
ʊ-ɪ	ì≠wʊ̀kí[87]	*melon*	u-i	ì≠sútí	*peeling*
ʊ-a	ì≠kʊ̀tá	*ringworm*	u-ə	í≠kútə̀	*fist*
ʊ-ʊ/ɔ	ò≠kʊ́tʊ́[88]	*wife, spouse*	u-u/o	nù≠hùtú	*mongoose*
ɔ-ɪ	ì≠sɔ̀sɪ́	*partridge*			
ɔ-a	---	---			
ɔ-ʊ/ɔ	ì≠sɔ́kɔ́[89]	*quiver*			

2.4.2.2.2 Other V_2 co-occurrence restrictions

Depending on the ATR value of V_1 in CV_1CV_2 nouns, V_2 is either a high, round or open (non-high) vowel. The high V_2 is /ɪ/ in [-ATR] noun roots or /i/ in [+ATR] noun roots. The round V_2 is either [ʊ] or under certain conditions [ɔ] in [-ATR] noun roots or [u] or under certain conditions [o] in [+ATR] roots. The open vowel is either /a/ in [-ATR] roots or /ə/ in [+ATR] roots, see Table 17 below.

[87] Only in the context of the [+ATR] vowel /i/ does [o] occur. It is either the surface realisation of **ʊ-ɪ** triggered by height dissimilation, to surface as [o-i] as discussed below in section 2.4.3.2, or the lowering of /u/ to [o] in the case of the surface realisation of **i-u**, as [i-o].

[88] Mous and Breedveld (1986: 239) has this word as [ùkútû], most other sources as [òkótó].

[89] Noun-class 19 prefix is underlyingly [+ATR], but it is not dominant and does not spread to noun-root vowels.

Table 17: Value of V_2 in Tuki CVCV noun roots

V_2 in CVCV noun roots	**[-ATR]**	**[+ATR]**
high	ɪ	i
round	ʊ (or ɔ)	u (or o)
open	a	ə

With the exception of **u-i**, non-identical high vowels are not found in the same noun root, so **ʊ-ɪ**, **ɪ-ʊ** and **i-u** are disallowed. Tuki resolves the co-occurrence of non-identical high vowels in CVCV stems by height dissimilation, which generally lowers the high, back vowel. However, contrast is lost between **ʊ-ɪ** and **ɔ-ɪ**, if /ʊ/ is lowered to /ɔ/, as occurs elsewhere (see Section 2.4.3.2 below for examples of height dissimilation in verb stems), so rather, /ɪ/ is "raised" to /i/, and its [+ATR] feature then spreads throughout the word. Both [ʊ] and [o] overlap in the same acoustic space, so while underlyingly, it is **ʊ-ɪ**, its [+ATR] surface representation is realised as [o-i]. We therefore find the following possibilities, in Table 18:

Table 18: Surface CV_1CV_2 combinations permitted in Tuki

V1/V2	**i (high)**	**ə (open)**	**u (round)**	**ɪ (high)**	**a (open)**	**ʊ/ɔ (round)**
i	i-i	i-ə	i-u ([i-o])			
e	ə-i	ə-ə	ə-u			
u	u-i	u-e	u-u			
ɪ				ɪ-ɪ	ɪ-a	ɪ-ʊ ([ɪ-ɔ])
a				a-ɪ	a-a	a-ʊ
ɔ				ɔ-ɪ	---[90]	ɔ-ɔ
ʊ				ʊ-ɪ ([o-i])	ʊ-a	ʊ-ʊ

2.4.3 Vowel-harmony processes

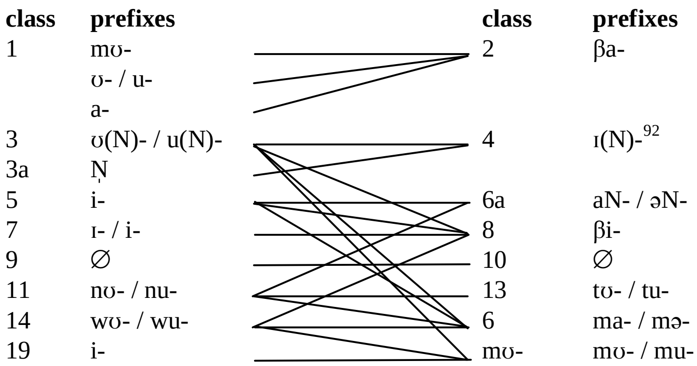
Tuki has two types of vowel harmony, ATR and rounding harmony. In addition there is a height dissimilation that occurs with at least one suffix. Both types of vowel harmony cross morpheme boundaries within the phonological word.

2.4.3.1 Vowel harmony in pre-stem elements

Tuki has a system of sixteen noun classes that combine into eight double-class genders, and two single-class genders. The following double-class genders occur: 1/2, 3/4, 3a/4a,[91] 5/6a, 7/8, 9/10, 11/13, 14/6, and 19/mu(18). The single-class genders are 6 and 3, which is also the infinitive class prefix. A few examples of 3/mu, 3/6, 3/8, 5/6, 5/8, 11/6, 11/6a, 14/8, 14/mu(18) are also found in the data. The plural of class 19 noun is **mʊ-**. This noun class is considered in Guthrie (1971: 32)

[90] The absence of **CɔCa** is likely due to Rounding harmony, so underlying forms surface as [CɔCɔ].
[91] The concords for class 3a are identical to class 4a and also for class 10. The Kongne (2006) database differs from Essono on the concords. Where Essono (1980) has different concords for 3 and 3a and for 4 and 4a, in Kongne's corpus, there is no difference between them.

as extraneous and was not assigned a class number. Essono (1980) and Biloa (1997: 19-21) as well as others, label it as class 18.



Only ATR harmony occurs in Tuki prefixes. Noun-class prefixes fall into two categories, those that are unspecified for ATR, and which will assimilate to the ATR of the word, and those that are specified as either [+ATR], noun classes 5, 8 and 19, or as [-ATR], noun-class 1 prefixes **a-** and **mʊ-**, and noun class 2. Unlike Nen, prefixes specified for ATR are not dominant and do not trigger ATR harmony in the root. Noun classes 9 and 10 consist of a nasal prefix, and thus do not undergo vowel harmony. See Example 105 below. The vowel of the prefix either becomes a glide or elides before vowel-initial noun roots.

Example 105: ATR harmony of Tuki noun-class prefixes

class	**noun-class prefix**	**example**	***gloss***
1	ʊ(ŋ)-	ʊ̀≠nʊ́mʊ́tʊ̀	*husband*
		ù≠tún-ú	*blacksmith*
	a-[93] (invariable)	à≠bʊ̀^{n}dà	*parent*
		à≠wùt-ə̀	*farmer*
	mʊ-	mʊ̀≠tʊ̀	*person*
2	βa- (invariable)	βà≠nʊ́mʊ́tʊ̀	*husbands*
		βà≠tún-ú	*blacksmiths*
		βà≠wùt-ə̀	*farmers*
		βà≠tʊ̀	*persons*

[92] Kongne (2004 : 26) finds one suspect example of a class 4b, mìn-. I have no examples in my databases.
[93] Unlike most noun-class prefixes with a [-ATR] vowel, the 1/2 prefixes with **à-**, **mʊ̀-** and **βà-** do not undergo ATR harmony with a [+ATR] noun root.

class	**noun-class prefix**	**example**	***gloss***
3	ʊ(N)[94]-	ʊ̀ŋ≠gìní	*hill*
		ʊ̀m≠bìnɔ̀	*thigh*
		ù≠gíní	*firewood*
		ùn≠dʒíɾí	*drought, famine*
		ʊ̀≠háhá	*green mamba*
		ù≠hùwə̀	*grass*
4	ɪ(N)-	ɪ̀ŋ≠gìní	*hills*
		ɪ̀m≠bìnɔ̀	*thighs*
		ì≠gíní	*firewood (pl)*
		ɪ̀≠háhá	*green mambas*
		ì≠hùwə̀	*grasses*
5	i-[95] (invariable)	ì≠bání	*breast, teat*
		ì≠bíɾə́	*oil palm*
6a	a(N)[96]-	àm≠bání	*breasts, teats*
		ə̀m≠bíɾə́	*oil palms*
6	ma-	mà≠tíjá	*water*
		mə̀≠sínə̀	*tears*
7	ɪ-	ɪ̀≠kɔ́hí	*shoulder*
		ì≠tə́tí	*rooster*
8	βi- (invariable)	βì≠kɔ́hí	*shoulders*
		βì≠tə́tí	*roosters*
11	nʊ-	nʊ̀≠wʊ́ɾá	*rain*
		nù≠hùtú	*mongoose*
13	tʊ-	tʊ̀≠wʊ́ɾá	*rains*
		tù≠hùtú	*mongooses*
14	wʊ-	wʊ̀≠ɾítí	*tree*
		wù≠sí	*day*

[94] An epenthetic homorganic nasal is optionally inserted both in this class and in certain other V-initial noun-class prefixes.
[95] Noun classes 5, 8 and 19 exceptionally have a [+ATR] prefix. These prefixes do not undergo or trigger ATR harmony in the noun.
[96] Noun class 6a optionally undergoes ATR harmony.

class	**noun-class prefix**	**example**	***gloss***
19	i- (invariable)	ì≠hʊ́ɾá	*broom*
		ì≠dʒìjə̀	*fire*
pl of 19	mʊ-	mʊ̀≠hʊ́ɾá	*brooms*
		mù≠dʒìjə̀	*fires*

Tuki noun class 3 is the infinitive class. Unlike with nouns, many speakers do not harmonise or only optionally harmonise the infinitive class prefix in the context of a [+ATR] vowel in the verb root, see Example 106. In addition, the further away the infinitive class prefix is from the dominant vowel triggering ATR harmony, the less likely it is to undergo ATR harmony.

Example 106: Optional ATR harmony of [-ATR] high vowel of inf. NC3

3	ʊ̀≠sìs-ə̀	~	ù≠sìs-ə̀	*land (v)*
	ʊ̀≠kís-á			*crunch (v)*
	ʊ̀≠pə́t-ə́	~	ù≠pə́t-ə́	*seal (door)*
	ʊ̀≠kàt-à			*judge (v)*
	ʊ̀≠sɔ́t-ɔ́			*live, inhabit*
	ʊ̀≠tʊ́t-á			*pick up, gather*
	ʊ̀≠sús-ə̀	~	ù≠sús-ə́	*ask, request*

Other than the infinitive class prefix, the only other verb pre-stem element that undergoes vowel harmony is the reflexive prefix **βá-**[97], as in Example 107. As with the infinitive prefix, **βá-** *optionally* undergoes vowel harmony.

Example 107: Optional ATR harmony of the reflexive prefix in Tuki

βá-	ʊ̀-βə́≠tíj-ə́	*embrace, hug*
	ʊ̀-βá≠síɾ-á	*tattoo (v)*
	ʊ̀-βə̀≠tə́m-ìn-à	*lie down, sleep*
	ʊ̀-βá≠ɾáᵑg-à	*prevent, refuse*
	ʊ̀-βá≠tɔ́ɾ-ɔ́	*listen*
	ʊ̀-βá≠sʊ́ᵑg-á	*choke*
	ʊ̀-βə́≠hún-ə́	*blow (nose)*

Like Nen, Tuki has [+ATR] numeral prefixes for noun classes 8 and 19, two of the three noun classes that have non-dominant [+ATR] prefix vowels.

Tuki numeral prefixes in general are [-ATR], but do not undergo ATR harmony triggered by a [+ATR] numeral root. Only the numeral prefixes for noun classes 8 and 19 are [+ATR]. Numeral prefix 8 also is dominant and will trigger ATR harmony in the numeral roots **≠βání** *two* and **≠íní** *four*, although not in the other

[97] There is free variation between βá- and wá- in Tuki.

numerals. Similar to Nen, Tuki numbers three and five are [-ATR] but do not assimilate to the [+ATR] numeral prefix.

Since the numeral root **≠mʷə̀sí** *one* is already [+ATR], it is à priori not possible to determine whether the [+ATR] numeral prefix 19 is likewise dominant. However, we must assume this prefix is [+ATR] because numeral prefixes in Tuki do not undergo ATR harmony, and thus the class 19 numeral prefix does not get its [+ATR] from the numeral root. Both class 8 and 19 have clearly [+ATR] prefixes on the noun, although these do not trigger vowel harmony.

Example 108: Tuki [+ATR] dominant numeral prefixes

class	**numeral prefix**	**example**	***gloss***
1	ʊ̀-	mʊ̀≠tʊ̀ ʊ̀≠mʷə̀sí	*one person*
2	βá-	βà≠tʊ̀ βá≠βání	*two people*
		βà≠tʊ̀ βá≠ání	*four people*
3	ʊ́-	ʊ̀≠tímá ʊ́≠mʷə̀sí	*one heart*
4	í-	ì≠tímá í≠βání	*two hearts*
		ì≠tímá í≠íní	*four hearts*
5	nʊ́-	n≠ìsó nʊ́≠mʷə̀sí	*one eye*
6a	á-	èŋg≠ìsó á≠βání	*two eyes*
		əŋg≠ìsó á≠ání	*four eyes*
7	í-	j≠ìrá í≠mʷə̀sí	*one arrow*
8	βí-	bʲ≠ìrá **βí≠βə́ní**	*two arrows*
		bʲ≠ìrá **βí**≠tátʊ́	*three arrows*
		bʲ≠ìrá **βí≠íní**	*four arrows*
		bʲ≠ìrá **βí**≠táánʊ́	*five arrows*
11	nʊ́-	nʷ≠àní nʊ́≠mʷə̀sí	*one leaf*
13	tʊ́-	tʷ≠àní tʊ́≠βání	*two leaves*
		tʷ≠àní tʊ́≠tátʊ́	*three leaves*
		tʷ≠àní tʷ≠íní	*four leaves*
		tʷ≠àní tʊ́≠táánʊ́	*five leaves*
14	wʊ́-	wʊ̀≠rítí wʊ́≠mʷə̀sí	*one tree*
6		mà≠rítí má≠βání	*two trees*
19	i-	j≠ǎ:pánʊ́ **í**≠mʷə̀sí	*one knife*
mʊ	mʊ-	mʷ≠ǎpánʊ́ mʊ́≠βání	*two knives*
		mʷ≠ǎpánʊ́ mʷ≠íní	*four knives*

2.4.3.2 Vowel harmony in suffixes

Many verb suffixes undergo vowel harmony, but some block ATR harmony, and there are two that trigger ATR harmony. Discussed in turn below are suffixes that block and those that undergo ATR harmony, ATR-dominant suffixes **-ij** and **-i**, vowel height dissimilation in certain nominalising suffixes and rounding harmony in suffixes.

2.4.3.2.1 ATR harmony in suffixes

ATR harmony is triggered by a dominant vowel, usually in the root, and spreads bidirectionally. Most [-ATR] vowels in the phonological word change into their [+ATR] counterpart. Certain suffixes like **-an** and **-ɪn** block ATR harmony, and are bolded in Example 109 below.

Example 109: ATR harmony of verbal suffixes in Tuki

diminutive	-ɪt	ʊ̀-βá≠sɪ́ɾ-ɪ̀t-à	*sit down*
		ù≠tʃə̀ᵑg-ít-ə̀	*abandon*
applicative	-ɪn	ʊ̀≠tʊ́m-**ɪ́n**-à	*send*
		ù≠gún-**ɪ́n**-à	*drive away*
separative	-ʊn	ʊ̀≠hát-ʊ́n-à	*subtract*
		ù≠búᵑg-ún-ə̀	*spill, knock over*
??	-ʊm	ʊ̀≠kʊ́s-ʊ́m-à	*cough*
		ù≠hə́ɾ-úm-ə̀	*breathe*
stative	-ɪm	ʊ̀≠βám-ɪ́m-à	*admit (to a wrong)*
		ù≠kə́s-ím-ə̀	*sneeze (v)*
continuous	-an	ʊ̀≠sʊ́ɾ-**án**-à	*look at*
		ʊ̀≠pɪ̀ɾ-ɪ̀s-**àn**-à	*separate, divide*
		ù≠wús-**án**-à	*urinate*
		ù≠kùɾ-ùm-**àn**-à	*bend over*
reciprocal	-an	ʊ̀≠wʊ̀n-à	*kill*
		ʊ̀≠wʊ̀n-**àn**-à	*kill e.o.*
		ù≠dìᵑg-ə̀	*love*
		ù≠dìᵑg-**àn**-à	*love e.o.*

Deverbal nouns are formed in various manners. One method is by adding the applicative suffix and a noun-class prefix to the verb root. The applicative suffix (bolded) in verbs is underlyingly [-ATR] and does not undergo ATR harmony, see Example 110.

Example 110: Tuki deverbal nouns with applicative suffix

≠dʒə̀ᵐb-ə̀	*know*	n≠dʒə̀ᵐb-**ɪ́n**-á	*c9.knowledge, acquaintance*
≠sìt-à	*spread, display*	ì≠sìt-**ɪ́n**-á	*c7.display (n), place to spread*
≠βàᵑg-à	*weep, cry*	m≠bàᵑg-**ɪ́n**-á	*c9.for which one weeps*
≠sɔ̀ᵑg-ɔ̀	*copulate*	mà≠sɔ̀ᵑg-**ɪ̀n**-à	*c6.sexual relations*

Deverbal nous are also formed by adding a nominalising suffix **-ʊ** as well as the noun-class prefix to the verb root, as in Example 111. The nominaliser is non-dominant and undergoes ATR harmony.

Example 111: Nominalising suffix -ʊ in Tuki

verb	***gloss***	**deverbal noun**	***gloss***
≠bàɾ-à	*hoe (v)*	m≠bàɾ-**ʊ́**	*c9.hoed land*
≠sùᵐb-ìj-ə̀	*hunt (v)*	ǹ≠tʃʊ̀ᵐb-**ʊ́**	*c3b.hunt (n)*
≠hə́ɾ-úm-ə̀	*breathe*	ì≠hə́ɾ-**ú**	*c19.tuberculosis*
≠tún-ə́	*smithing*	ù≠tún-**ú**	*c1/2.blacksmith*
≠ɾùn-ə́	*become old*	wù≠ɾùn-**ú**	*c14.old age*

Other deverbal nouns are formed simply by adding a noun-class prefix to a verb. Any verbal suffixes present will undergo ATR harmony with the exception of those suffixes which block ATR harmony, see Example 112.

Example 112: Tuki deverbal nouns with only NC prefix.

≠tít-án-à	*bury*	ì≠tít-án-à	*c5/6a.burial, funeral*
≠tə́h-ân-à	*invite*	tə́h-ân-à[98]	*c9.invitation*
≠púᵐb-j-ə́	*make clean*	m≠púᵐb-án-á	*c3b.cleanliness*
≠bə̌ɾ-àn-à	*praise (v)*	m≠bə̌ɾ-àn-à	*c9.eulogy, praise (n)*
≠kàt-à	*judge (v)*	ŋ≠kàt-à	*c3b.judgement*
≠wə́t-íj-ə́	*greet (v)*	m≠bə́t-íj-ə́	*c9.greeting*
-βá≠tɔ́ɾ-ɔ́	*listen*	m-bá≠tɔ́ɾ-ɔ́	*c9.hearing*
≠sìj-ə̀	*saw (wood)*	ì≠sìj-ə̀	*c19.saw(n)*
≠gíj-ə̀	*support (v)*	ì≠gíj-ə̀	*c7.support (n)*
≠kùs-ə̀	*buy*	ŋ≠kùs-ə̀	*c3b.price*
≠bìn-à	*hate (v)*	ì≠bìn-á	*c5.hatred*
≠dʒáɾ-á	*speak*	n≠dʒáɾ-á	*c9.speech, language*

2.4.3.2.2 ATR-dominant suffixes.

Two suffixes, the [+ATR] causative **-ij**, and the [+ATR] nominaliser **-i** are dominant and trigger ATR harmony. ATR harmony is generally bidirectional and spreads from the causative suffix both to the root and to the final vowel. The agentive suffix, on the other hand, being at the right edge of the word, spreads only to the left, as seen in Example 113.

---

[98] A nasal prefix preceding a voiceless stop is elided in noun class 9/10, see Example 100 in 2.4.1.2 above.

Example 113: ATR Dominant suffixes in Tuki

caus.	-ij	≠sìs-ə̀	*land, lower*	≠sìs-ìj-ə̀	*unload, lower smth*
		≠tíɾ-ím-ìn-à	*be stopped*	≠tíɾ-ím-ìj-ə̀	*stop, correct*
		≠pə́n-ə́[99]	*decorate*	≠pə́n-íj-ə̀	*caus. to decorate*
		≠hàt-ìn-à	*rise up(INTR)*	≠hə̀t-ìj-ə̀	*lift*
		≠sɔ́t-ɔ́	*live, dwell*	≠sót-íj-ə̀	*save, caus. to live*
		≠kʊ́t-á	*dry(INTR)*	≠kút-íj-ə̀	*caus. to dry, dry(TR)*
		≠dʒùm-ə̀	*be wet*	≠dʒùm-ìj-ə̀	*soak*
nom.	-i	≠ìb-ə́	*steal (v)*	ùŋg≠úb-í[100]	*c1.thief*
		≠kə́s-ím-ə̀	*sneeze (v)*	ì≠kə́s-í	*c19.sneeze (n)*
		≠hʲ-á	*burn (INTR)*	ì≠hʲ-ə́n-ì	*c7.burn (n)*
		≠dìᵑg-ə̀	*love (v)*	ì≠dìŋ-í	*c5.love (n)*
		≠ɾùm-ə̀	*squeak (v)*	n≠dùɾ-ùm-ì	*c9.squeak (n)*
		≠sàɾ-à	*split*	ì≠sə̀ɾ-ì	*c7.crevice, part*

2.4.3.2.3 Height dissimilation in nominalising suffix -ʊ

A type of height dissimilation occurs in Tuki. When the nominalising suffix **-ʊ** occurs in the environment of the high front vowels, its vowel is lowered depending on the ATR feature of the high vowel to either /ɔ/ or /o/, see Example 114.

Example 114: Height dissimilation in high front vowels in Tuki

≠sìj-à	*insult (v)*	tʃìj-ɔ́	*c9.insult (n)*
-βá≠síɾ-á	*tattoo (v)*	tʃíɾ-ɔ́	*c9.facial scar(s)*
≠ɾìm-àn-à	*dream (v)*	n≠dìm-ɔ́	*c9.dream (n)*
≠sìm-à	*curse (v)*	tʃìm-ɔ̀	*c9.curse (n)*
≠bín-ə́	*dance (v)*	ì≠bín-ó	*c7.dance, feast*
≠tìᵐb-ə̀	*hold (v)*	ì≠tíᵐb-ó	*c7.walking stick*

[99] In the writing system and the analysis of others, "e" is either [+ATR] and phonetically [ə], or [-ATR] and phonetically [ɪ]. Kongne (2004: 55) gives an exception to this rule with the example, ònèŋgà diminish with its causative form òwánéŋgíjè cause to diminish. Because ònèŋgà takes the [-ATR] infinitive prefix and final vowel, the root vowel "e" would appear to be /ɪ/, therefore [òniŋgà]. However, the [+ATR] counterpart of /ɪ/ is /i/, not "e" (/ə/), the latter of which is the [+ATR] pair of [a]. The following counterpart, also written in the orthography of Kongne, follows the pattern expected of the [-ATR] "e" would appear to be /ɪ/: ònèŋgènà [òniŋginà] be weak ònìŋgìjè [ònìŋgìjè] weaken. If the vowel "e" of ònèŋgà diminish is the [+ATR] vowel /ə/, one would expect this word to be [ònə̀ŋgə̀], with the final vowel undergoing the expected ATR harmony. It would be nice to claim that this is indeed the case, unfortunately, my informants confirmed the orthography of Kongne, in that the final vowel is indeed "a", and that the root vowel of the causative is /ə/ and not /i/. Due to the fact that ònèŋgà diminish and ònèŋgènà [òniŋginà] be weak are almost homonymous, the unusual causative form of diminish may be a way to better distinguish between similar causative forms.

[100] There is a vowel change in the root between the verb form and the nominalised form, possibly triggered by the noun-class prefix vowel.

2.4.3.2.4 Rounding harmony in suffixes

The final vowel -a undergoes both rounding and ATR harmony, but the continuous suffix **-an** will only undergo rounding harmony. Rounding harmony is triggered only by non-high (open) round vowel /ɔ/. The high round vowels /u/ and /ʊ/ (the latter often written as **o** in other studies) do not trigger rounding harmony. A few examples are shown in Example 115 below:

Example 115: Rounding harmony of Tuki verbal suffixes

final vowel	-a	≠sɔ́s-ɔ́	*suck*
		≠sɔ̀k-ɔ̀	*slander*
		≠sʊ̀w-à	*wash (TR) (items)*
		≠kʊ́t-á	*dry*
		≠sús-ə́	*ask, request*
		≠kùs-ə́	*buy*
continuous	-an	≠sɔ́m-ɔ́n-ɔ̀	*accuse*
		≠dʒɔ̀ɾ-ɔ̀	*visit a trap*
		≠dʒɔ̀ɾ-ɔ̀n-ɔ̀	*visit a trap (repetitive per day)*
		≠wús-ə́	*defecate*
		≠wús-án-à	*urinate*
		≠kʊ́t-á	*dry*
		≠kʊ́t-án-à	*dry up, evaporate*

Front vowels are opaque to rounding harmony. Where a suffix or extension with a front vowel occurs, rounding harmony is blocked, see Example 116.

Example 116: Opacity of Tuki front vowels in rounding harmony

caus.	-ij	≠sót-íj-ə̀	*save, caus. to live (from≠sɔ́t-ɔ́ dwell)*
		≠tòᵐb-ìj-ə̀	*appease, pacify (from ≠tɔ̀ᵐb-ɔ̀ calm oneself)*
dim.	-ɪt	≠nɔ̀ᵑg-ìt-à	*fold*
		≠nɔ́ɾ-ít-à	*twist*
??[101]	-ɪj	≠tɔ́ɾ-íj-à	*prepare (to do something)*
applicative	-ɪn	j≠ɔ̀ⁿd-ín-à	*c7/8.bride price*

[101] Biloa (1997: 18), although writing about the Tukombe dialect, identifies only one suffix /-iy/ which he identifies as the causative suffix. He writes "/i/ becomes [e] when the immediately preceding vowel is /a/ or /o/". The problem with this hypothesis is that the causative suffix in Tuki is ATR dominant (as seen in examples above in Section 2.4.3). Rather than state that the causative is sometimes ATR dominant, and sometimes not, I prefer to hypothesise two different suffixes, the causative ATR-dominant **-ij** and a suffix **-ɪj** non-specified for ATR, with a different meaning (not causative):

≠pàɾ-ìj-à	*sting (superficially)*
≠tìᵐb-ìj-à	*leave liquid exposed to the air*

Nen and Maande both have a suffix **-ɪ** *neuter* which may be a cognate of the Tuki suffix **-ɪj**.

2.4.4 Hiatus-resolution processes

There are several hiatus-resolution processes found in Tuki. These are glide formation (section 2.4.4.1), desyllabification of high vowels (section 2.4.4.2), and vowel elision (section 2.4.4.3).

2.4.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted. Where V_1V_2 sequences occur across morpheme boundaries, a high vowel in V_1 position becomes a glide. Glide formation occurs principally between a high vowel in the noun-class prefix and a vowel-initial noun root, as seen in Example 117. Both juxtaposed vowels are retained if they are underlyingly identical.

Example 117: Prefix-root glide formation in Tuki

surface from	**underlying form**	***gloss***
bʷìᵑgò	bʊ̀≠ìᵑgò	*c14.beeswax*
bʷìⁿdá	bʊ̀≠ìⁿdá	*c14.liver*
bʲìbà	βì≠ìbà	*c8.pigeons*
nʷəɾí	nʊ̀≠əɾí	*c11.rope, wire*
bʲàⁿdʒì	bì≠àⁿdʒì	*c8.houses*
nʷàᵑgɔ́	nʊ̀≠àᵑgɔ́	*c11.broom*
nʲɔ̀ɾɔ́	nì≠ɔ̀ɾɔ́	*c5.neck*
bʷɔ̀ɾɔ́	bʊ̀≠ɔ̀ɾɔ́	*c14.tree sp.*
bʲʊ̀ɾá	bì≠ʊ̀ɾá	*c8.skins (fruit)*
bʲùⁿdù	bì≠ùⁿdù	*c8.garbage dumps*

2.4.4.2 Desyllabification of high vowels

The high vowels, /i/, /ɪ/, /u/ and /ʊ/ when they occur as noun-class prefixes before a vowel-initial root desyllabify as /j/ or /w/ even before an identical vowel in the root, as in Example 118.

Example 118: Desyllabification of high vowels in Tuki.

surface from	**underlying form**	***gloss***
jɪ̀ɾá	ɪ̀≠ɪ̀ɾá	*c19.arrow*
jìbà	ì≠ìbà	*c7.pigeon*
wìbə́	ʊ̀≠ìb-ə́	*inf.steal*
wùɾə́	ʊ̀≠ùɾ-ə́	*inf.come*
wʊ̀ná	ʊ̀≠ʊ̀n-á	*inf.kill*
jàⁿdʒì	ì≠àⁿdʒì	*c7.house*
wàtá	ʊ̀≠àt-á	*inf.shell (nuts)*
jʊ̀ɾá	ì≠ʊ̀ɾá	*c7.skin (fruit)*
jùⁿdù	ì≠ùⁿdù	*c7.garbage dump*

2.4.4.3 Vowel elision

In certain instances, especially in noun classes 2, 5 and 6, which have $V_1 \neq V_2$ sequences across morpheme boundaries, the prefix vowel is elided. In Example 119, the elision of the prefix vowel is shown in contrast with glide formation and other hiatus-resolution processes.

Example 119: Vowel elision across morpheme boundaries in Tuki

surface form		**underlying form**		***gloss***
nʲɔ̀ɾɔ́	àᵑgɔ̀ɾɔ́	nì≠ɔ̀ɾɔ́	àᵑg≠ɔ̀ɾɔ́	*c5/6a.neck*
nìsó	ə̀ᵑgìsó/àᵑgìsó[102]	nì≠ìsú	àᵑg≠ìsú	*c5/6a.eye*
nìjó	ə̀ᵑgìjó/àᵑgìjó	nì≠ìjú	àᵑg≠ìjú	*c5/6a.tooth*
---	màtə́já	---	mà≠tə́já	*c6.water*
---	mìnə́	---	mà≠ìnə́	*c6.blood*
bʷìndá	mìⁿdá	bʊ̀≠ìⁿdá	mà≠ìⁿdá	*c14/6.liver(s)*
bʷɔ̀ɾɔ́	mɔ̀ɾɔ́	bʊ̀≠ɔ̀ɾɔ́	mà≠ɔ̀ɾɔ́	*c14/6.tree(s) sp.*
bùɾù	mùɾù	bʊ̀≠ùɾù	mà≠ùɾù	*c14/6.maternity*
ʊ̀kʊ́tʊ́	βàkʊ́tʊ́	ʊ̀≠kʊ́tʊ́	βà≠kʊ́tʊ́	*c1/2.woman(en)*
mʷàná	βàná	mʊ̀≠àná	βà≠àná	*c1/2.child(ren)*
ùᵑgìní	βìní	ùᵑg≠ìní	βà≠ìní	*c1/2.visitor(s)*
nìⁿdə́	tìⁿdə́	nʊ̀≠ìⁿdə́	tʊ̀≠ìⁿdə́	*c11/13.rib(s)*

2.4.5 Tone

Tuki has two register tones, high and low, and two contour tones, rising and falling (Essono 1974: 12). Vowels with contour tones are perceived as fairly long, and should probably be considered bi-moraic (Essono 1980: 20). Surface tone is marked on the data in this study.

2.4.5.1 Tone melodies on nouns

High and low tone contrast in monomorphemic noun roots. Four tone melodies are attested in both CV and CVCV noun roots, see Example 120 below. Noun prefixes usually have a low tone, although there are a few exceptions.

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[102] In /i-u/ sequences there is a height dissimilation of non-identical high vowels. The vowel /u/ is lowered to [o].

Example 120: Nominal tone melodies in Tuki

ì≠kʊ̀	≠L	*c7.copper*
ì≠gʊ̌	≠LH	*c5.elephant grass*
mà≠tʊ́	≠H	*c6.ashes*
í≠sʊ̂	≠HL[103]	*c7.quinqueliba (type of grain)*
ì≠kɔ̀kɔ̀	≠L	*c19.instant (n)*
ì≠kɔ̀ɾɔ́	≠L.H	*c19.jealousy*
ì≠kɔ́ɾɔ́	≠H	*c19.maize*
ì≠kɔ́^{n}dɔ̀	≠H.L	*c7.plantain*

In addition, three other noun-root melodies are minimally attested in the corpus: LH.L, HL.L and HL.H, as in Example 121.

Example 121: Additional nominal melodies in Tuki.

nǒŋgò	≠LH.L	*c9.shrew*
í≠tǒ^{n}dò		*c7.leech*
í≠βǎŋgà		*c7.clod (of earth)*
í≠ndʒâɾà	≠HL.L	*c1.young man*
ì≠bâkà		*c19.type of machete*
ì≠nôní	≠HL.H	*c19.bird*
ì≠sâŋgá		*c19.drying shelf (over cook fire)*

2.4.5.2 Tone melodies on verbs

Four tone melodies are attested in Tuki verbs. There is, however, a neutralisation of contrast between H and HL melodies in CVC-V verb stems.

When a verb suffix is added, however, the distinction between H and HL melodies becomes apparent. In verbs with a H melody, the H tone spreads one slot onto the suffix. In verbs with a HL melody, the L is unattached in verb stems with only a final vowel (with a surface representation identical to verbs with a H melody), but docks to a suffix when present. The H tone still spreads one vowel to the right and causes a falling tone on the suffix. The final vowel is always realised with a low tone when a suffix is present. This is illustrated in Example 122 below, along with all four verb melodies.

[103] The HL melody on monosyllabic noun roots is not so widely attested in the corpus.

Example 122: Verbal tone melodies in Tuki

L	ò≠bì^{n}d-à	L ≠L -L	*close (door)*
	ò≠bì^{n}d-ìn-à	L ≠L -L -L	*close (door)*
	ò≠ɾàh-à	L ≠L -L	*be long*
	ù≠ɾə̀h-ìj-ə̀	L ≠L -L -L	*make long*
	ò≠dʒɔ̀ɾ-ɔ̀	L ≠L -L	*visit traps*
	ò≠dʒɔ̀ɾ-ɔ̀n-ɔ̀	L ≠L -L -L	*visit traps (ITER)*
LH	ò≠jə̌-ə̀	L ≠LH -L	*learn*
	ò≠jə̌ɾ-ìt-à	L ≠LH -L -L	*learn a little*
	ò≠gǔɾ-ə̀	L ≠LH -L	*rub*
	ò≠gǔɾ-ìt-à	L ≠LH -L -L	*rub a little*
H	ù≠núb-ə́	L ≠H -H	*hit, palpitate*
	ù≠núb-át-à	L ≠H -H -L	*hit, strike*
	ò≠kʊ́t-á	L ≠H -H	*dry*
	ò≠kʊ́t-án-à	L ≠H -H -L	*dry up*
	ù≠pə́n-ə́	L ≠H -H	*design, paint*
	ù≠pə́n-íj-ə̀	L ≠H -H -L	*cause to paint*
HL	ò≠wʊ́t-á	L ≠H -H	*pack, attach*
	ò≠wʊ́t-în-à	L ≠H -HL -L	*attach, fasten, bind*
	ò≠mám-á	L ≠H -H	*mix, clasp, unite*
	ò≠mám-în-à	L ≠H -HL -L	*clasp (to protect)*
	ò≠wʊ́^{n}dʒ-á	L ≠H -H	*gather, heap up*
	ò≠wʊ́^{n}dʒ-în-à	L ≠H -HL -L	*gather, heap up (APPL)*

Vowel-initial verb stems also attest all four verb melodies, but the surface representation is different due to the spread to the right of the L of the infinitive prefix.

Example 123: Melodies of Tuki ≠VC verb roots

L	w≠àk-à	≠L -L	*help (v)*
	w≠àk-àn-à	≠L -L -L	*help each other (v)*
LH	w≠ə̌t-úɾ-ə̀	≠LH -H -L	*drag*
	w≠ə̌t-úr-ìt-à	≠LH -H -L -L	*drag (DIM)*
H	w≠ùɾ-ə́	≠L -H	*come*
	w≠ùɾ-ík-ìj-ə́	≠L -H -L -L	*leave, depart*
	w≠àt-á	≠L -H	*shell (peanuts)*
	w≠àt-ít-à	≠L -H -L	*shell (DIM)*
HL	w≠ʊ̀w-á	≠L -H	*hear*
	w≠ʊ̀w-ân-à	≠L -HL -L	*agree*

The reflexive prefix is **βá-**. The H tone of the prefix spreads one place to the right. The rightward spread of the reflexive high tone affects low and LH melody verbs only.

Example 124: Reflexive prefix in Tuki

L	≠dùm-ə̀	*strike with force*	-βə́≠dúm-ə̀	*strike oneself with force*
	≠dìᵑg-ə̀	*love*	-βə́≠díᵑg-ə̀	*love oneself*
LH	≠ⁿdə̌ɾ-ə̀	*spoil*	-βá≠ⁿdə́ɾ-ə̀	*spoil oneself*
	≠jə̌ɾ-ə̀	*learn*	-βá≠jə́ɾ-ə̀	*teach oneself*
H	≠gún-ə́	*chase*	-βá≠gún-ə́	*chase oneself*
	≠wʊ́t-á	*attach*	-βá≠wʊ́t-á	*attach oneself*
	≠tíh-íj-ə̀	*teach, show*	-βə́≠tíh-íj-ə̀	*boast, brag*
HL	ʊ̀≠bíɾ-ân-à	*call*	ʊ̀-βá≠bíɾ-ân-à	*call*

In addition to providing lexical contrast, tone also has a grammatical function. Among other things, tone provides the crucial difference between various tenses in verb conjugations. This is, however, beyond the scope of this study.

2.5 Gunu phonological overview

This study is based on *Gunu Nord*, the reference dialect. It is based on personal research as well as previous research of several linguists and a wordlist published on the internet[104].

2.5.1 Consonants

This section discusses the consonant inventory of Gunu (section 2.5.1.1), and consonant distribution restrictions (section 2.5.1.2).

2.5.1.1 Consonant inventory

The consonant system of Gunu consists of 23 contrastive consonants

[104] The main published sources I have consulted in this study are Robinson 1984, Orwig 1989, Gerhardt 1984 and 1989, Scruggs 1982, and Hyman 2001. The main wordlist used was the Nugunu Provisional Lexicon, published on the Internet (see references for link to the website) and its predecessor by Robinson 1979. Much of the information and analysis collected from these sources has been checked, and in many cases modified by my own research with Sinstimé Crépin, from Ombessa, a speaker of the reference dialect.

Table 19: Gunu contrastive consonants

		labial	alveolar	palatal	velar
stops	voiceless	p	t	tʃ	k
	voiced	b	d		g
prenasalised	voiceless	ᵐp	ⁿt	ⁿtʃ	ᵑk
	voiced	ᵐb	ⁿd		ᵑg
fricatives	voiceless	f	s		h
resonants	nasal	m	n	ɲ	ŋ
	oral		l	j	

2.5.1.2 Restrictions in consonant distribution

Gunu has only open syllables; CV, V, and syllabic nasals. Voiced and voiceless stops contrast in both syllable onsets and intervocalically with the exception of **ᵑk** which hasn't been found in initial position.

2.5.2 Vowels

This section discusses the vowel inventory of Gunu (section 2.5.2.1), and the various vowel co-occurrences and co-occurrence restrictions (section 2.5.2.2). Unlike other Mbam languages, Gunu does not have devoiced vowels in utterance-final position.

2.5.2.1 Vowel inventory

Gunu has an inventory of eight contrastive vowels. A complex system of vowel harmony regulates the co-occurrences and co-occurrence restrictions of the vowels. The vowels can be divided into two sets which are mutually exclusive within roots and stems:

Table 20: Gunu contrastive vowels

	[-ATR]			[+ATR]	
ɪ[105]		ʊ	i		u
		ɔ	e[106]		o
	a				

All eight contrastive vowels are attested in the verb root. While the distinction between /o/ and /ʊ/ is slight, this distinction is emphasised by rounding harmony. Rounding harmony is triggered by non-high (open) round vowels and targets the final vowel /-a/. High round vowels, /u/ and /ʊ/ do not trigger rounding harmony. In

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[105] This vowel acoustically has a relatively high F1 and is perceptibly closer to a mid vowel than a high vowel (ave F1/F2: 444.8/1757.8). However it is underlyingly /ɪ/. In Hyman's feature analysis of the Gunu vowels (2002: 6), it has only the feature front, and not open (which would make it a true mid vowel). Therefore, [ɛ] functions in similar manner to [ɪ] in the Yangben, Mmala and Elip, and differs only by the feature [ATR] from /i/.

[106] Like in many Mbam languages, Gunu has an atypical vowel inventory, lacking both mid front vowels. In the case of Gunu, /ə/ is rather fronted and occupies the vowel space of /e/.

the Gunu verb system, the root vowel generally determines the changes in the final vowel according to ATR and/or rounding harmony, as shown in Example 125 below.

Example 125: Contrastive vowels in Gunu CVC verb stems

rt vowel	**ATR**	**round**	**FV**	**example**	***gloss***
i	x	---	-e	≠dím-è	*dig*
ɪ	---	---	-a	≠dɪ̀n-à	*pound*
e	x	---	-e	≠déb-è	*flow, pour*
a	---	---	-a	≠dáᵐb-à	*trap*
ɔ	---	x	-ɔ	≠dɔ̀ᵐb-ɔ̀	*stop, cease*
o	x	x	-o	≠kóŋ-ò	*remain uncooked*
ʊ	---	---	-a	≠dʊ́ᵐb-à	*pass, transgress*
u	x	---	-e	≠sùg-è	*pull up*

In the noun system, only seven contrastive vowels are found in monomorphemic CV_1CV_1 roots, as in Example 126 below. The [-ATR] vowel **ʊ** is not found in CV_1CV_1 noun roots.

Example 126: Permitted vowels in Gunu CV_1CV_1 noun roots

i	ùn≠tʃílì	*time of famine*	ɪ	ʊ̀≠fínì	*handle (ax)*
	m≠bìmì	*cadaver*		ì≠bìgì	*calabash (water)*
e	ŋ≠gélé	*poison (for fish)*	a	gí≠nàⁿtá	*cricket sp.*
	nì≠hèŋé	*tree sp.*		nʊ̀≠básá	*old machete*
o	bù≠gónó	*tree sp.*	ɔ	ŋ̀≠gɔ̀sɔ̀	*grey parrot*
	ì≠lóⁿtʃò	*sparrow sp.*		gì≠lɔ̀pɔ́	*termite sp.*
u	gì≠lúŋù	*yam sp.*	ʊ	---	---
	gì≠ⁿtʃúŋú	*basket (groundnuts)*		---	---

2.5.2.2 Vowel co-occurrences

Several factors govern the co-occurrences of vowels in CVCV nouns. These factors include 1) ATR-harmony restrictions and 2) restrictions on V_2, depending on the features of V_1, to either a front, round or open (non-high) vowel. Each of these vowel co-occurrence restrictions will be discussed in turn in sections 2.5.2.2.1 and 2.5.2.2.2 below.

2.5.2.2.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ is always [-ATR] and never found in a [+ATR] environment. In Example 127 below, all ATR vowel co-occurrences in CVCV noun roots are shown. An unexplained gap, the lack of ʊ-ʊ co-occurrence is highlighted.

Example 127: ATR vowel co-occurrences in Gunu CVCV noun roots

[-ATR] vowels			[+ATR] vowels		
ɪ-ɪ	gì≠dìⁿdí	*palm tree*	i-i	ǹ≠tʃílì	*edible termite sp.*
ɪ-a	ʊ̀≠dímá	*heart*	i-e	gì≠bílè	*palm nut regime*
ɪ-ɔ	mɔ̀≠gíbɔ̀	*wine*	i-o	ù≠gídó	*tuft of grass*
ɪ-ʊ	---	---	i-u	---	---
a-ɪ	ì≠dání	*stone*	e-i	gì≠lèŋì	*embankment*
a-a	gì≠bàlà	*road*	e-e	ŋ̀≠gélé	*type of poison (for fish)*
a-ɔ	---	---	e-o	---	---
a-ʊ	gì≠sàmɔ́	*fruit*	e-u	ù≠kèlú	*voice, throat*
ɔ-ɪ	ǹ≠dɔ́ŋì	*antelope*	o-i	ì≠nòní	*bird*
ɔ-a	---	---	o-e	---	---
ɔ-ɔ	ì≠dɔ̀ŋɔ̀	*flea*	o-o	u≠hóló	*tree sp.*
ɔ-ʊ	---	---	o-u	---	---
ʊ-ɛ	dʊ̀≠lʊ̀ⁿtʃí	*insect sp.*	u-i	gì≠gúlí	*time, hour*
ʊ-a	nʊ̀≠bʊ́lá	*rain*	u-e	í≠jùkè	*fire*
ʊ-ɔ	---	---	u-o	---	---
ʊ-ʊ	---	---	u-u	gì≠ntʃúŋú	*basket for groundnuts*

2.5.2.2.2 Other V_2 co-occurrence restrictions

In CVCV noun roots, V_2 is either a high, round or open (non-high) vowel. The high V_2 is /ɪ/ (which has a surface representation [ɛ]) in [-ATR] noun roots or /i/ in [+ATR] noun roots. The round V_2 is /ʊ/ with a surface representation [ɔ] in [-ATR] noun roots or [u] or [o] in [+ATR] roots. Round V_2 vowels cannot be of the same height as the V_1 unless identical to V_1. The open vowel is either /a/ in [-ATR] roots or /e/ in [+ATR] roots, see Table 21 below.

Table 21: Value of V_2 in Gunu CVCV noun roots

V_2 in CVCV noun roots	[-ATR]	[+ATR]
high	ɪ	i
round	ʊ	u or o
open	a	e

In [+ATR] noun roots, non-identical mid vowels are not found in the same root, so **o-e** is disallowed. We therefore find the following possibilities:

Table 22: Surface CV_1CV_2 combinations permitted in Gunu

V_1V_2	high	round	open
/i/	i-i	i-o	i-e
/ɪ/	ɪ-ɪ	ɪ-ɔ	ɪ-a
/u/	u-i	u-u	u-e
/ʊ/	ʊ-ɪ	---	ʊ-a
/o/	o-i	o-o	---
/ɔ/	ɔ-ɪ	ɔ-ɔ	---
/e/	e-i	e-u	e-e
/a/	a-ɪ	a-ɔ	a-a

2.5.3 Vowel-harmony processes

Gunu has a complex system of vowel harmony consisting of two interacting types of harmony: ATR and rounding harmony. Although rounding harmony does not operate in vowel co-occurrence restrictions in roots, both types of vowel harmony cross morpheme boundaries within the phonological word.

2.5.3.1 Pre-stem elements

Both nominal and verbal pre-stem elements undergo vowel harmony in Gunu. These are ATR harmony and rounding harmony discussed in turn below.

2.5.3.1.1 ATR harmony in pre-stem elements

Gunu has a system of eighteen noun classes that combine into nine double-class genders, and three single-class genders.

The following double-class genders occur: 1/2, 3/4, 3/6a, 5/6a, 7/8, 9/10, 11/13, 14/6, and 19/mu. The single-class genders are 6, 15 and 16.

class	prefixes	class	prefixes
1	mʊ-	2	ba-
	ʊ- / u-		
3	ʊ(m)- / u(m)-	4	ɪ(m)- / i(m)-
5	ɪ- / i-	6a	a(m)- / e(m)-
5a	nɪ- / ni-		
7	gɪ- / gi-	8	bɪ- / bi-
9	N-	10	N-
11	nʊ- / nu-	13	dʊ- / du-
14	bʊ- / bu-	6	ma- / me-
19	ɪ- / i-	mʊ-	mʊ- / mu-
	hɪ- / hi-		

Noun-class prefixes are underlyingly [-ATR] but have a [+ATR] counterpart when preceding a [+ATR] noun root. Classes 9 and 10 consist of a nasal prefix. All noun-class prefixes with a vowel undergo ATR harmony, as shown in Example 128.

Example 128: ATR harmony of Gunu noun-class prefixes

class	**noun-class prefix**	**example**	***gloss***
1	ʊ(m)-[107]	ʊ̀≠kɔ́dɔ̀	*woman*
		ʊ̀≠gɔ́nɔ́	*elder*
		ùm≠bìénì	*nephew*
		ù≠gúlè	*friend*
	mʊ-[108]	mʊ̀≠ɔ́nɔ́	*child*
		mʊ̀≠tɔ̀	*person*
2	ba-	bà≠kɔ́dɔ̀	*women*
		bà≠áná	*children*
		bà≠gɔ́nɔ́	*elders*
		bè≠bìénì	*nephews*
		bè≠gúlè	*friends*
3	ʊ(m)-	ʊ̀≠dímá	*heart*
		ʊ̀m≠bɔ́gɔ̀	*hand*
		ù≠kúᵐbè	*feather*
		ù≠fínò	*name*
4	ɪ(m)-	ɪ̀≠dímá	*hearts*
		ɪ̀m≠bɔ́gɔ̀	*hands*
		ì≠kúᵐbè	*feathers*
		ì≠fínò	*names*
5	ɪ-	ɪ̀≠dáɲí	*stone*
		ì≠bílè	*oil palm*
	nɪ-	nɪ̀≠báɲà	*place to defecate*
		nì≠hèŋé	*tree sp.*
6a	a(m)-	à≠dáɲí	*stones*
		àm≠báɲà	*places to defecate*
		èm≠bílè	*oil palms*
		è≠hèŋé	*trees sp.*

[107] Before a bilabial stop, an epenthetic /m/ is inserted both in this class and in certain other V-initial noun-class prefixes. Before a vowel-initial root an epenthetic /ŋ/ is inserted.
[108] No examples of a [+ATR] counterpart to **mʊ-** have been found in the corpus. It is assumed that this gap is accidental.

class	**noun-class prefix**	**example**	***gloss***
6	ma-	mà≠sáŋà	*yams sp.*
		mè≠gúdé	*fat, oil*
		mè≠dúgú	*nights*
7	gɪ-	gɪ̀≠dɔ̀ŋɔ̀	*village, country*
		gɪ̀≠jèlí	*worm*
8	bɪ-	bɪ̀≠dɔ̀ŋɔ̀	*villages, countries*
		bɪ̀≠jèlí	*worms*
11	nʊ-	nʊ̀≠bʊ́lá	*rain*
		nù≠fè^{n}dù	*ravine*
13	dʊ-	dʊ̀≠bʊ́lá	*rains*
		dù≠fè^{n}dù	*ravines*
14	bʊ-	bʊ̀≠sáŋà	*yam sp.*
		bù≠dúgú	*night*
15	gʊ-	gʊ̀≠sʊ́gà	*poverty*
		gù≠bélìè	*day before/after*
16	hʊ-	hʊ̀≠ʊ́mà	*place*
		---	---
19	ɪ-	ɪ̀≠sʊ́lá	*hoe*
		ì≠nònɪ́	*bird*
pl of 19	mʊ-	mʊ̀≠sʊ́lá	*hoes*
		mù≠nònɪ́	*birds*

Numeral prefixes in Gunu are underlyingly [-ATR] and undergoes ATR harmony. There are no [+ATR] numeral prefixes in Gunu.

Example 129: Numeral prefixes in Gunu

class	**numeral prefix**	**example**	***gloss***
1	ʊ̀-	mʊ̀≠tʊ̀ ù≠mùè	*one person*
2	bá-	bà≠tʊ̀ bá≠à^{n}dí	*two persons*
		bà≠rʊ̀ bá≠dàdʊ́	*three persons*
3	jʊ́-	ʊ̀≠dímá jú≠mùè	*one heart*
4	ɪ́(h)-	ɪ̀≠dímá ɪ́h≠à^{n}dí	*two hearts*
		ɪ̀≠dímá ɪ́≠dàdʊ́	*three hearts*

class	**numeral prefix**	**example**	***gloss***
5	ní-	ì≠dání ní≠mùè	*one stone*
6a	á(h)-	à≠dání áh≠à^{n}dí	*two stones*
		à≠dání á≠dadʊ́	*three stones*
7	gí-	gì≠dɔ̀ŋɔ̀ gí≠mùè	*one village*
8	bí-	bì≠dɔ̀ŋɔ̀ bí≠à^{n}dí	*two villages*
		bì≠dɔ̀ŋɔ̀ bí≠dàdʊ́	*three villages*
9	Ǹ-	ɲ≠ɲàmà m̀≠mùè	*one animal*
10	í(h)-	ɲ≠ɲàmà íh≠à^{n}dí	*two animals*
		ɲ≠ɲàmà í≠dàdʊ́	*three animals*
11	nʊ́-	nù≠èlí nú≠mùè	*one cord*
13	dʊ́-	dù≠èlí dʊ́≠à^{n}dí	*two cords*
		dù≠èlí dʊ́≠dàdʊ́	*three cords*
14	bʊ́-	bʊ̀≠sàŋà bú≠mùè	*one yam sp.*
6		mà≠sàŋà má≠à^{n}dí	*two yams*
		mà≠sàŋà má≠dàdʊ́	*three yams*
19	hí-	ì≠nòní hí≠mùè	*one bird*
mʊ	mʊ-	mù≠nòní mʊ́≠à^{n}dí	*two birds*
		mù≠nòní mʊ́≠dàdʊ́	*three birds*

Gunu noun class 15 is the infinitive class. As with the other noun-class prefixes with a high vowel, /gʊ̀-/ will undergo ATR harmony, see Example 130.

Example 130: ATR harmony of [-ATR] high vowel of infinitive nc 15

15	gʊ-	gù≠dìd-è	*choose, compare*
		gʊ̀≠dìn-à	*pound (okra)*
		gù≠déb-è	*flow*
		gʊ̀≠dáb-à	*plant (tubers)*
		gʊ̀≠dɔ́s-ɔ̀	*peal*
		gù≠dòg-ò	*burp*
		gʊ̀≠dʊ́s-à	*skin*
		gù≠dùl-è	*accumulate, gather*

Along with the infinitive prefix, Gunu has other verbal pre-stem elements which will also undergo ATR harmony. These include the reflexive, subject concord, and tense markers. The negative, pre-stem adverbs and the indirect object pronouns will block ATR harmony in the pre-stem elements, see Example 131 below:

Example 131: ATR harmony of Gunu preverbal elements

reflx/ reciproc	bá-	gʊ̀-bá≠sìg-à	*insult e.o.*
		gʊ̀-bá≠sʊ̀gà	*wash oneself*
		gù-bé≠dùl-è	*gather together*
		gù-bé≠fúùn-è	*dry oneself*

indirect object	gʊ́	m̀béè gú-dím-ín-é gìbílá 1s.P1 2s-dig-APPL-FV hole	*I dug you a hole.*
	N[109]	à báà tʃʊ̀g-ìn-à gìlà c1 P1 1p.wash-APPL-FV cloth	*S/he washed clothes for us.*
future	gàá	à gàá sʊ̀g-á c1 FT1 wash-FV	*s/he will wash*
		è gèé dím-é c1 FT1 dig-FV	*s/he will dig*
recent past	báà	à báà sʊ̀g-à c1 P1 wash-FV	*s/he washed*
		mè béè déb-è c6 P1 flow-FV	*it (water) flowed*
negative	dì	à dì né dím-è[110] c1 NEG FT2 dig-FV	*s/he did not dig*
		à dì báà sʊ̀g-à c1 NEG P1 wash-FV	*s/he did not wash*
adverb	gɔ̀nɔ́	à ná gɔ̀nɔ́ dím-è c1 FT2 again dig-FV	*s/he will dig again*
		bá dì gɔ̀nɔ́ bá≠sìg-à c2 NEG again REFL-insult-FV	*they will not insult e.o. again*
IO pronouns	mʊ̀	à báà mʊ̀ dím-èn-è gìbílá c1 P1 3sIO dig-CONT-FV	*s/he dug him a hole*
	tʃʊ̀	àa báà tʃʊ̀ dím-èn-è gìbílá c1 P1 1pIO dug-CONT-FV	*s/he dug us a hole*

2.5.3.1.2 Rounding harmony in pre-stem elements

Rounding harmony targets /a/ and is triggered by the non-high (open) round vowels /ɔ/ and /o/. The high round vowels /u/ and /ʊ/ never trigger rounding harmony. Only one noun-class prefix, class 6, with an underlying /a/ consistently undergoes rounding harmony. Another class, 6a, will usually undergo rounding harmony, especially when the root is vowel-initial. However, not all speakers consistently round noun-class 6a prefixes, see Example 132 below. The noun-class 2 prefix undergoes ATR harmony only.

[109] The affricate [tʃ] is the surface realisation of a nasal followed by /s/.

[110] There is some disagreement with the premise that the negative morpheme blocks ATR harmony. Some anonymous notes on Gunu found in the SIL archives summarising ATR harmony indicate that the negative marker may assimilate according to ATR. In this case, the word would be [è dì né dím-è].

Example 132: Rounding harmony of /a/ in Gunu noun-class prefixes

class	noun-class prefix	examples	*gloss*
6	ma-	mɔ̀≠gíbɔ̀	*wine*
		mò≠bínò	*dances*[111]
		mà≠nʊ́mɪ̀	*sperm*
		mè≠gúdé	*fat, oil*
6a	a(N)-	ɔ̀ŋ≠ɔ̀lɔ́ ~ àŋ≠ɔ̀lɔ́	*necks*
		òŋ≠òɲí	*markets*
		òŋ≠ìsò	*eyes*
		à≠gʊ́sà	*groups, troops*
		èm≠búusè	*urinals*

Verbal pre-stem elements with /a/ undergo rounding harmony as well as ATR harmony. In Example 133, the reflexive prefix **bá-** undergoes rounding harmony, and the recent past marker, **báà** optionally undergoes rounding harmony. Rounding occurs especially in rapid speech:

Example 133: Rounding harmony of Gunu preverbal elements

reflexive	bá	bó≠gòòd-ò	*reflx≠meditate-FV*
		bɔ́≠kɔ́k-ɔ̀l-ɔ̀	*reflx≠crawl-DIM-FV*
recent past	báà	à bɔ́ɔ̀ gɔ́l-ɔ̀ c1 P1 take-FV	*s/he took*
		à bóò pòl-ò c1 P1 pierce-FV	*s/he pierced*

The high round vowels /ʊ/ and /u/ do not trigger rounding harmony, neither in the reflexive prefix nor the recent past marker, see Example 134 below.

Example 134: Non-triggering of rounding harmony in Gunu

reflexive	bá	bá-dʊ́s-à	*REFLX-skin, flay*
		bá-tʃʊ̀ʊ̀m-àn-à	*REFLX-chatter-CONT-FV*
recent past	báà	à béè fún-èn-è c1 P1 blow-CONT-FV	*s/he blew*
		à báà sʊ́g-à c1 P1 wash-FV	*s/he washed*
		à báà dʊ́ᵐb-à c1 P1 transgress-FV	*s/he transgressed*

[111] Hyman 2001: 9

2.5.3.2 Vowel harmony in suffixes

Most verb suffixes undergo vowel harmony, but there is one that triggers ATR harmony. Discussed in turn below are suffixes that undergo ATR harmony, ATR dominant suffix **-i**, and rounding harmony in suffixes.

2.5.3.2.1 ATR harmony in suffixes

ATR harmony is triggered by a dominant vowel, usually in the root, and spreads bidirectionally. All [-ATR] vowels in the phonological word change into their [+ATR] counterpart. A few examples are shown in Example 135 below:

Example 135: ATR harmony of Gunu verbal suffixes

intensive	-ɪg	≠gás-ìg-à	*break, fell (tree)*
		≠lìb-ìg-è	*soak*[112]
stative	-ɪm	≠nín-ìm-à	*float (on water)*
		≠tʃék-ìm-è	*sneeze*
continuous	-an	≠ság-àn-à	*spread out (to dry)*
		≠ém-èn-è	*bleed, exit-CONT-FV*
		≠gíd-èn-è	*add-CONT-FV*
diminutive	-ɪd	≠nák-ìd-à	*lick (a little)*
		≠núùn-ìd-è	*glance, look (a little)*
applicative	-ɪn	≠sɔ̀g-ìn-à	*wash-APPL-FV*
		≠dím-ìn-è	*dig-APPL-FV*

Some deverbal nouns are formed by adding the applicative suffix and a noun-class prefix to the verb root. These suffixes also undergo ATR harmony, see Example 136.

Example 136: Gunu deverbal nouns with applicative suffix

≠báɲ-à	*defecate*	gì≠báɲ-ín-á	*anus*
≠dúùg-è	*rest*	gì≠dúúg-íd-én-é	*resting place*
≠bóɲ-ò	*drink*	gì≠bóɲ-ín-ó	*drinking place*

Other deverbal nouns are formed simply by adding a noun-class prefix to a verb. Any verbal suffixes present will undergo ATR harmony, see Example 137.

[112] Example found only in Orwig 1989: 294.

Example 137: Gunu deverbal nouns

≠híl-ìm-à	*breathe*	gì≠híl-ìm-à	*respiration*
≠báɲ-à	*defecate*	nì≠báɲ-à	*latrine*
≠ɔ̀ŋ-ìn-ɔ̀	*request, ask*	gì≠ɔ̀ŋ-ìn-ɔ̀	*fiancée*
≠nèb-ìg-ìn-ì-e	*unite*	m≠bé-nèb-ìg-ìn-ì-è	*union*
≠búùs-è	*urinate*	nì≠búùs-è	*urinal*

2.5.3.2.2 ATR-dominant suffixes.

Two suffixes, the [+ATR] causative **-i**, and the [+ATR] agentive **-i** are dominant and trigger ATR harmony. ATR harmony is generally bidirectional and spreads from the causative suffix both to the root and to the final vowel. The agentive suffix, on the other hand, being at the right edge of the word, spreads only to the left, as seen in Example 138.

Example 138: ATR-dominant suffixes in Gunu

caus.	-i	≠ság-à	*dry (INTR)*	≠ség-ì-è	*dry (TR)*
		≠gɔ̀s-ɔ̀	*descend (INTR)*	≠gòs-ì-ò	*descend (TR)*
		≠ɔ̀b-à	*fall (INTR)*	≠ùb-ì-è	*fell, cause to fall*
		≠fí-ɔ̀	*heat (INTR)*	≠fí-ìg-ì-ò	*heat (TR)*
		≠íŋ-èn-è	*enter*	≠íŋ-èn-ì-è	*cause enter*
		≠fùg-è	*chill (INTR)*	≠fùg-ì-è	*chill (TR)*
		≠dʊ́s-à	*skin (v)*	gì≠dús-í-è	*skin (removed)*
agent.	-i	≠fíf-à	*survey*	ò≠fíf-í	*guardian*
		≠bín-è	*dance*	òm≠bín-í	*dancer*
		≠gɔ́g-ɔ̀	*drive, guide*	ù≠góg-í	*guide, driver*

2.5.3.2.3 Rounding harmony in suffixes

Most verb extensions and inflectional suffixes with an /a/ undergo rounding harmony as well as ATR harmony. Like ATR harmony, rounding harmony is bidirectional. Rounding harmony is triggered only by non-high (open) round vowels. The high round vowels /u/ and /ʊ/ (often written in the literature as **o**) do not trigger rounding harmony. A few examples are shown in Example 139 below:

Example 139: Rounding harmony of Gunu verbal suffixes

final vowel	-a	≠bɔ̀l-ɔ̀	*borrow*
		≠bɔ̀g-ɔ̀	*delight (v)*
		≠hɔ̀n-ɔ̀	*mock, tease*
		≠dòg-ò	*burp*
		≠pòl-ò	*pierce*
		≠kóŋ-ò	*remain uncooked*
		≠bʊ̀l-à	*arrive*
		≠fʊ́^{m}b-àn-à	*sob, cough while drinking*
		≠dùl-è	*accumulate*
continuous	-an	≠gɔ̀s-ɔ̀n-ɔ̀	*descend (CONT)*
		≠dɔ̀g-ɔ̀n-ɔ̀	*boil, heat*
		≠bóɲ-òn-òn-ò	*drink (CONT)*
		≠fʊ́^{m}b-àn-à	*sob, cough while drinking*
		≠fʊ̀f-àn-à	*smell, inhale*
		≠fún-èn-è	*blow*

Front vowels are transparent to rounding harmony. Where a suffix or extension with a front vowel occurs, the rounding will pass through the front vowel to the final vowel, see Example 140.

Example 140: Transparency of front vowels in rounding harmony

applicative	-ɪn	≠gɔ́l-ìn-ɔ̀	*be trapped*
		≠sɔ́m-ìn-ɔ̀	*accuse*
		≠pòl-ìn-ò	*pierce*
intensive	-ɪg	≠sɔ́l-ìg-ɔ̀	*insist*
		≠bóɲ-ìg-ì-o	*cause to drink*

2.5.4 Hiatus-resolution processes

In general, Gunu permits vowel hiatus of both similar and different juxtaposed vowels. Only in the context of the class 5 prefix allomorphs **nɪ-/ni-** is glide formation found to break up juxtaposed vowels, see section 2.1.4.12.5.4.1 below.

2.5.4.1 Glide formation

The class 5 prefix **nɪ-/ni-** preceding a round vowel will trigger glide formation of the prefix vowel. Both the [-ATR] and [+ATR] allomorphs glide, see Example 141.

Example 141: Class 5 prefix-root glide formation in Gunu

surface from	underlying form	gloss
nʲúdé	nì≠údé	*mouth*
nʲòɲí	nì≠òɲí	*market*
nʲɔ́lɔ́	nì≠ɔ́lɔ́	*neck*
nʲàlì	nì≠àlì	*fruit sp.*

Glide formation does not occur when the VCV noun root has an initial front vowel see Example 142.

Example 142: Class 5 prefix-root hiatus retention in Gunu

surface form	underlying form	gloss
nìísò	nì≠ísò	*eye*
nììbà	nì≠ìbà	*fireplace*

2.5.5 Tone

Gunu has a two-tone system underlyingly, high and low. Rising and falling tones are found where there is juxtaposition of two or more dissimilar tones[113]. Juxtaposed dissimilar tones will cause lengthening of the vowel.

2.5.5.1 Tone melodies on nouns

High and low tone contrast in monomorphemic noun roots. Four tone melodies are attested in CVCV noun roots, see Example 143 below. Noun prefixes usually have a low tone, although there are a few exceptions.

Example 143: Gunu nominal tone melodies

ì≠bàdà	≠L.L	*yaws*
ì≠bàŋá	≠L.H	*whitlow (type of infection)*
ì≠báŋà	≠H.L	*tree sp.*
ì≠sámá	≠H.H	*kidney*

2.5.5.2 Tone melodies on verbs

Gunu verb roots divide into three tone-melody groups. Verb roots with both a high or a low lexical melody are found in each of the tone-melody groups.[114] Although this is similar to the three tone classes found in the various other Mbam languages,

[113] Patman 1991: 74

[114] Patman 1991: 78-80. Patman posits an underlying tone (H, L, ø) which functions as a verb-group marker, and which is in addition to the high or the low lexical tone carried by the root. Verbal extensions often cause the verb to shift from one tone class to another, with the exception of group 3 verbs which do not have suffixes.

there are some differences which are beyond the scope of this study. The three verbal tone groups (Patman 1991: 80) are illustrated in Example 144 below[115].

Example 144: Gunu underlying verbal tone melodies

	lexical	**class**	**underlying melody**	**examples**	
group 1	L	L	L-L	bìg-à	*carry*
	H		H-L	fɔ́l-à	*sweep*
group 2	L	ø	L-ø	sìs-è	*descend*
	H		H-ø	díìn-à	*let alone*
group 3	L	H	L-H	màn-à	*finish*
	H		H-H	húm-è[116]	*go out*

In addition to providing lexical contrast, tone also has a grammatical function. Among other things, tone provides the crucial difference between various tenses in verb conjugations. This is, however, beyond the scope of this study.

2.6 Elip phonological overview

The three dialects of Elip, *Nuyambassa*, *Nulamba* and *Nukanya* differ in several ways: the *Nuyambassa* dialect shows contrast between voiced and voiceless alveolar and velar stops in the word root (although the voiceless stops are more limited in their distribution), while the *Nulamba* and *Nukanya* dialects have contrast in voicing only in the velar stops (in the case of *Nukanya*, there are only a few examples of /g/). In addition, *Nulamba* and *Nukanya* differ from each other in the distribution of voiced and voiceless velar consonants, and *Nukanya* differs from both *Nuyambassa* and *Nulamba* in certain vowel-harmony processes. This phonological sketch is based primarily on *Nuyambassa*, the reference dialect[117].

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[115] Although verbal tone analysis is beyond the scope of this study, it does merit further research. While my own analysis of the verbal tone melodies in the Mbam languages is at best superficial, due to the similarities of Gunu and some of the other languages of this study, I have some reservations about Patman's analysis here. Robinson (1999:19) identifies two tone classes for verbs: those which take a high tone melody and those with a low tone melody on the root.

[116] The distinction between Group 3 and the others is seen most clearly when conjugated (Patman 1991:78).

[117] The database, based on a 1,700 word list produced by SIL Africa Area, was begun by Rebecca Prittie, a linguistic intern in Cameroon in 2001. The present author picked up where she left off and checked, corrected, and enlarged the database. It currently is divided into the three dialects. The Nuyambassa database includes approximately 2,000 terms, the Nulamba database approximately 1,000 terms, and the Nukanya database has approximately 800 terms.

Also consulted was an additional database organised by Hinke Leijenhorst. This other database consists of over 6,000 terms compiled in the reference dialect and being edited by a committee of Elip speakers. It includes much of the information found in the other two databases, but the entries are only written orthographically not phonetically. The Elip orthography under-differentiates the vowel system; writing only seven rather than all eight contrastive vowels. For this reason, it is of less use in this present study.

2.6.1 Consonants

This section discusses the consonant inventory of Elip (section 2.6.1.1), and the various adaptations to it due to allophonic and allomorphic realisations (section 2.3.1.22.6.1.2), distribution restrictions (section 2.6.1.3) and final-vowel devoicing (section 2.6.1.4).

2.6.1.1 Consonant inventory

The consonant system of Elip consists of 21 contrastive consonants.

Table 23: Elip contrastive consonants[118]

		labial	alveolar	palatal	velar
stops	voiceless aspirated		t	(tʃ)	k
	voiced	b	d		g
	prenasalised	^{m}b	^{n}d		^{ŋ}k
fricatives	voiceless	f	s		h
	prenasalised	^{ɱ}f ([p^{h}])	^{n}s ([tʃ])		
resonants	nasal	m	n	ɲ	ŋ
	oral		l	j	w

2.6.1.2 Allophonic and allomorphic realisations

Voiceless stops in the *Nuyambassa* dialect are slightly aspirated except for /tʃ/ which already has a delayed release. Voiced consonants in utterance-final position become devoiced, but they are not aspirated. Voiceless consonants are not found in word-final position.

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[118] *Nulamba* and *Nukanya* dialects have 20 contrastive consonants. The voiceless stops are not aspirated. The contrastive consonants are as follows:

		labial	alveolar	palatal	velar
stops	voiceless	---	t	(tʃ)	k
	voiced	b	---		g
	prenasalised	^{m}b	^{n}d		^{ŋ}k
fricatives	voiceless	f	s		h
	prenasalised	^{ɱ}f	^{n}s		
resonants	nasal	m	n	ɲ	ŋ
	oral		l	j	w

Prenasalised fricatives in the *Nulamba* and *Nukanya* dialects occur as a prenasalised affricate [tʃ] or an aspirated stop [pʰ] in the *Nuyambassa* dialect[119]. In addition, morphologically, /f/, /s/ and /h/ undergo alternation when a syllabic nasal prefix precedes them. The labial /f/ following the nasal prefix becomes a strongly aspirated bilabial stop [pʰ] not [pf] as would be expected; the alveolar /s/ becomes an affricate [tʃ] and /h/ changes its place of articulation and like /f/ becomes an aspirated bilabial stop [pʰ]. As the nasal prefix is homorganic, it cannot be the trigger for the change of place of articulation. See Example 145 below.

Example 145: Variations of /f/, /h/ and /s/ between prefix and root

gù≠fìg-è	[gùfìgè]	*be full of weevils*
m̀≠fìg	[m̩̀pʰìg̊]	*weevil*
gù≠híl-è	[gùhílè]	*paint (v)*
m̀≠híl-è	[m̩̀pʰílè]	*paint (n)*
gʊ̀≠sìg-à	[gʊ̀sìgà]	*insult (v)*
ǹ≠sìg	[ǹ̩tʃìg]	*insult (n)*

2.6.1.3 Restrictions in consonant distribution

Elip has both open and closed syllables; CV, CVC, V, VC and syllabic nasals. All consonants except for the voiceless stops (/t/, /tʃ/, /k/), the velar prenasalised stop /ᵑk/, and /w/ are found in syllable-final position. Voiced, voiceless and prenasalised stops contrast in syllable onsets, see Example 146 below.

Example 146: Contrast in alveolar and velar stops in Elip

t/d/ⁿd	gì≠**t**ûn	*fist*
	ò≠**d**ún	*forge*
	gì≠**ⁿd**ʊ́l-áɲ	*giant*
k/g/ᵑk	gí≠**k**àᵐbà	*type of insect*
	ʊ̀≠**g**áⁿdɔ̀	*woman*
	bʊ́≠**ᵑk**ɔ̀ŋâ	*papaya*
	gì≠mú.**k**è	*mute (a)*
	ǹ≠dù.**g**é	*smoke*
	ì≠lʊ́.**ᵑk**án	*herb used for certain skin diseases*

[119] In the Nulamba and Nukanya dialects, they remain fricatives. The table below shows the surface realisations of /ⁿs/ and /ᶬf/ in each of the Elip dialects:

U.F	Nuyambassa	Nulamba/Nukanya	*gloss*
gí≠ⁿ**s**àŋá	[gìⁿ**tʃ**àŋá]	[gìⁿ**s**àŋá]	*sour herb*
U.F	Nuyambassa	Nulamba/Nukanya	*gloss*
gʊ̀≠lìⁿ**s**	[gʊ̀lɛ̀ⁿ**tʃ**]	[gʊ̀lɛ̀ⁿ**s**]	*know*
gì≠ᶬ**f**àᶬm	[gìᵐ**pʰ**àm]	[gìᶬ**f**àm]	*warthog tusk*
gì≠nùᶬ**f**	[gìnùᵐ**pʰ**]	[gìnùᶬ**f**]]	*bad smell*

Consonant-glide sequences, especially when they occur at morpheme boundaries, are formed by the desyllabification of a high vowel (discussed in section 2.6.4.1 below).

2.6.1.4 Final-consonant devoicing

Voiced obstruents devoice in word-final position. This occurs consistently with voiced and prenasalised stops, with the exception of /^{ŋ}k/ which is not found in syllable-final position.

Example 147: Final consonant devoicing in Elip

/b/ → [b̥]	mà≠gíb	[màgɛ́b̥]	*wine*
/d/ → [d̥]	mà≠gúd	[mègúd̥]	*fat*
/g/ → [g̊]	bʊ̀≠dúg	[bùdúg̊]	*night*
/^{m}b/ → [^{m}b̥]	nì≠bì^{m}b	[nìbì^{m}b̥]	*frog sp.*
/^{n}d/ → [^{n}d̥]	nʊ̀≠gʊ̀^{n}d	[nʊ̀gʊ^{n}d̥]	*foot*

2.6.2 Vowels

This section discusses the vowel inventory of Elip (2.6.2.1) and the various adaptations to it due to allophonic realisations (section 2.6.2.2), vowel co-occurrences and vowel co-occurrence restrictions (section 2.6.2.3).

2.6.2.1 Vowel inventory

Elip[120] has an inventory of eight contrastive vowels. A complex system of vowel harmony regulates the co-occurrence and co-occurrence restrictions of the vowels. The vowels can be divided into two sets which are mutually exclusive within roots and stems:

Table 24: Elip contrastive vowels

	[-ATR]			**[+ATR]**	
ɪ		ʊ	i		u
		ɔ	e[121]		o
	a				

In the verb system, all eight contrastive vowels are attested in the verb root in open syllables. There is, however, surface neutralisation of /ɔ/ - /ʊ/ in comparable closed syllables and in word-final position. This phenomenon is most clearly seen in comparing verbs with and without the continuous suffix **-a**, as shown in Example 148 below. In addition it is assumed that a merger of the [–ATR] high vowel /ɪ/ and the [-ATR] mid vowel /ɛ/ has occurred.

[120] The vowel inventory is the same in all three dialects.

[121] Although acoustically this vowel is clearly front, as the [+ATR] counterpart of /a/; it is likely underlyingly /ə/. The tendency to front /ə/ is evident in the other A60 languages as well.

Example 148: Contrastive vowels in Elip CVC verb stems

	inf≠verb-ext.	**inf≠verb root**	**conjugated c1-P1-root**	***gloss***
/i/	gù≠dím-è	gù≠dím	ù-sè≠dím	*dig*
/ɪ/	gʊ̀≠bɪ̀g-à	gʊ̀≠bɛ̀g	ʊ̀-sà≠bɛ̀g	*burn*
/e/	gù≠dén-èn	gù≠dén	ù-sè≠dén	*drip*
/a/	gʊ̀≠bàs-à	gʊ̀≠bàs	ʊ̀-sà≠bàs	*germinate*
/u/	gù≠gús-è	gù≠gús	ù-sè≠gús	*pierce*
/ʊ/	gʊ̀≠bʊ́d-à	gʊ̀≠bɔ́d	ʊ̀-sà≠bɔ́d	*get, obtain*
/o/	gù≠dòg-è	gù≠dòg	ù-sò≠dòg	*burp*
/ɔ/	gʊ̀≠dɔ́b-à	gʊ̀≠dɔ́b	ʊ̀-sɔ̀≠dɔ́b	*knead*

In the noun system, all contrastive vowels are found in monomorphemic CV_1CV_1 roots in Example 149 below. There are, however, few examples of /ʊ/ found in the corpus.

Example 149: Permitted vowels in Elip CV_1CV_1(C) noun roots

/i/	gì≠bílì	*bunch (plantain)*	/ɪ/	ɔ̀≠hɪ́ɲɪ̀	*sun*
	ò≠gʷɪ́ɲɪ̀	*firewood*		m̀≠fɪ́ɲɪ̀	*viper*
/e/	ì≠léⁿdé	*bar-breasted mousebird*	/a/	gì≠lámà	*pot (water)*
	gì≠géŋé	*baked clay pan*		nì≠gádá	*courtyard*
/o/	gì≠dógól	*loins*	/ɔ/	ì≠gɔ́ŋɔ́l	*ankle bone*
	nì≠bóⁿdóŋ	*tranquility*		gì≠bɔ́gɔ́d	*shoe*
/u/	gì≠húŋûl	*lump*	/ʊ/	gìlʊ̀ⁿdʊ́	*cloud*
	mè≠dúbúl	*obesity*			

2.6.2.2 Vowel devoicing/elision in utterance-final position

The high vowels, /i/, /ɪ/, /u/ and /ʊ/, are susceptible to devoicing and/or elision in utterance-final position. This is the same position where voiced obstruents devoice and tone-melody contrast is lost in noun roots.

Utterance-final devoicing/elision is conditioned by the tone melody of the noun. Nouns with a melody ending with a high tone tend towards vowel devoicing. In isolation or utterance-final position, the final vowel of noun roots with L and HL melodies is generally elided.

Only in very careful speech is the presence of the final vowel perceived in utterance-final position. With the H noun-root melody in utterance-final position, the final vowel is usually only devoiced, although it may also elide depending on the speaker. In contrast, the LH melody permits only devoicing, and never elision, of the final vowel. In Table 25 below, **L̥** indicates a devoiced vowel, and **(L̥)** indicates a devoiced vowel that is also susceptible to elision.

Table 25: Elip noun-root melodies and utterance-final vowel devoicing

underlying tone	non-final	utterance-final	vowel devoicing	elision
≠H	≠H	≠H(L̥)	Yes	Yes
≠HL	≠HL	≠L	---	Yes
≠LH	≠LH	≠LL̥	Yes	No
≠L	≠L	≠L	---	Yes

Example 150 below illustrates the tone-melody adaptations and the associated devoicing/elision of the susceptible vowels in utterance-final position.

Example 150: Final-vowel devoicing in Elip

	underlying forms		**final**	**non-final**	***gloss***
/i/	bì≠gʷìdì	L	[bìgʷìd̥]	[bìgʷìdì]	*rubbish*
	gì≠gòdí	LH	[gìgòdì̥]	[gìgòdí]	*law*
/ɪ/	gì≠àⁿtʃɪ̀	L	[gʲàⁿtʃ]	[gʲàⁿtʃɪ̀]	*house*
	gì≠áⁿtʃɪ̀	HL	[gʲàⁿtʃ]	[gʲáⁿtʃɪ̀]	*cockroach*
	gì≠àtʃɪ́	LH	[gʲàⁿtʃɪ̥̀]	[gʲàtʃɪ́]	*refusal*
/u/	gì≠dégú	H	[gìdég̥]~[gìdég̥ù̥]	[gìdégú]	*navel*
	m̀≠mèkʰú	LH	[m̀mègù̥]	[m̀mègú]	*muscle, flesh*
/ʊ/	mʊ̀≠ⁿdʊ̀	L	[mʊ̀ⁿd̥]	[mʊ̀ⁿdʊ̀]	*man*
	gì≠lʊ̀ⁿdʊ́	LH	[gìlʊ̀ⁿd̥ʊ̥̀]	[gìlʊ̀ⁿdʊ́]	*cloud*

In utterance-final position, all low tones fall to some extent. However acoustically, nouns with an underlying ≠L melody fall more sharply than nouns with an underlying ≠LH melody in utterance-final position. From Example 150 above, the underlyingly L noun [gʲàntʃ] *house* has an average fall of 38.13Hz in 0.135225 seconds in utterance-final position, while the underlyingly HL noun [gʲàntʃ] *cockroach* has an average fall of 12.32Hz in 0.18036 seconds[122].

2.6.2.3 Vowel co-occurrences

Several factors govern the co-occurrences of vowels in CVCV nouns. These factors include 1) ATR harmony, 2) high-vowel lowering, and 3) restrictions on V_2, to either a high, round or open (non-high) vowel. Each of these vowel co-occurrence restrictions will be discussed in turn below.

[122]My acoustic data is rather limited and as tonal phenomena are beyond the scope of this study, this data is based on the averages of a few utterances only.

2.6.2.3.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ is always [-ATR] and never found in a [+ATR] environment. In Example 151 below, all ATR vowel co-occurrences in CVCV noun roots are shown.

Example 151: ATR vowel co-occurrences in Elip CVCV(C) noun roots

[-ATR] vowels			**[+ATR] vowels**		
ɪ-ɪ	ɔ̀≠híɲì	*sun*	i-i	gì≠bílì	*bunch (plantain)*
ɪ-a	nì≠hìŋá	*termite sp.*	i-e	m̀≠bínè	*ebony tree*
a-ɪ	nì≠dáɲì	*rock, stone*	e-i	m̀≠bèɲí	*elder sister*
a-a	gì≠lámà	*pot (water)*	e-e	ì≠lé^{n}dè	*bar-breasted mousebird*
a-ʊ	ǹ≠tʃámʊ̀	*stone, pit*	e-u	ǹ≠tʃèlù	*chin*
ʊ-ɪ	---[123]	---	u-i	nì≠gùlì	*family*
ʊ-a	gì≠sʊ́^{m}bà	*adult*	u-e	nì≠gù^{n}dè	*basket*
ʊ-ʊ	gì≠lʊ̀^{n}dʊ́	*cloud*	u-u	gì≠húŋûl	*lump*
ɔ-ɪ	nʊ̀≠gɔ̀lì	*mushroom*	o-i	ì≠nònì	*bird*
ɔ-a	ní≠gɔ̀^{n}dà	*plantain*	o-e	gì≠gógè	*bone*
ɔ-ɔ	gì≠jɔ̀bɔ̀	*stutterer*	o-o	gì≠dógól	*loins*

2.6.2.3.2 High-vowel lowering

The [–ATR] high vowels /ɪ/ and /ʊ/ are lowered to [ɛ] and [ɔ] in closed syllables. This is illustrated by, although not limited to, the deverbal nouns shown in Example 152 below.

Example 152: Word-final lowering in Elip deverbal noun roots

underlying vowel	**surface form**	**example**	***gloss***	**from verb**	
/ɪ/	[ɛ]	[ǹ≠tʃɛ̀g]	*insult*	[gʊ̀≠sìg-à]	*insult (v)*
		[gì≠mɛ̀n]	*neck*	[gʊ̀≠mín-à]	*swallow*
/ʊ/	[ɔ]	[gì≠lɔ́ŋ]	*cadaver*	[gʊ̀≠lʊ́ŋ-à]	*agonise, die*

In CV_1CV_1 noun roots where the vowel is /ɪ/, both vowels will lower to [ɛ] when the noun is in isolation or utterance-final position, see Example 153, below.

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[123] No monomorphemic example has been found, but there are some deverbal noun stem examples:

deverbal noun	*gloss*	from verb	*gloss*
gì≠bʊ́l-íg-a	*slope*	gʊ̀≠bʊ́l-íg	*climb*
m̀≠hʊ́l-ín-à	*baldness*	gʊ̀≠hʊ́l-ín-à	*clean*
nì≠bʊ̀s-ìn	*fish barricade*	gʊ̀≠bʊ̀s-à	*bail, fish*

Example 153: Lowering of /ɪ/ in utterance-final position in Elip

non-final	**utterance-final**	***gloss***
[ɔ̀hí̞ɲì]	[ɔ̀hɛ́ɲɛ̀]	*sun*
[m̩̀pʰí̞ɲì]	[m̩̀pʰɛ́ɲɛ̀]	*viper*

2.6.2.3.3 Other V_2 co-occurrence restrictions

The high vowels, /i/, /ɪ/, /u/ and /ʊ/ in V_1, take only a front or open vowel in V_2. The non-high vowels, /e/, /a/, /o/ and /ɔ/ in V_1 will also take a round vowel in V_2 position. The [-ATR] counterpart of /i/ is /ɪ/. In [-ATR] noun roots, the round V_2 is /ʊ/, and in [+ATR] noun roots, V_2 is underlyingly /u/. When there is /o/ in V_1 position, /u/ is lowered to /o/ in V_2 position. The open vowel is either /a/ in [-ATR] roots or /e/ in [+ATR] roots, see Table 26 below.

Table 26: V_2 in Elip CVCV noun roots

V_2 in CVCV noun roots	[-ATR]	[+ATR]
high	ɪ	i
round	ʊ	u or o
open	a	e

Table 27 below shows the CVCV combinations permitted in Elip noun roots.

Table 27: Surface CV_1CV_2 combinations permitted in Elip

	[-ATR]				**[+ATR]**		
V_1V_2	high	open	round	V_1V_2	high	open	round
ɪ	ɪ-ɪ	ɪ-a	---	i	i-i	i-e	---
a	a-ɪ	a-a	a-ʊ	e	e-i	e-e	e-u
ɔ	ɔ-ɪ	ɔ-a	ɔ-ɔ	o	o-i	o-e	o-o
ʊ	(ʊ-ɪ)[124]	ʊ-a	ʊ-ʊ	u	u-i	u-e	u-u

2.6.3 Vowel-harmony processes

Elip has a complex system of vowel harmony consisting of two interacting types of harmony: ATR and rounding harmony. Although rounding harmony does not operate as vowel co-occurrence restriction in roots, both types of vowel harmony cross morpheme boundaries within the phonological word.

2.6.3.1 Pre-stem elements

Both nominal and verbal pre-stem elements undergo vowel harmony in Elip. These are ATR harmony and rounding harmony discussed in turn below.

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[124] No monomorphemic examples found.

2.6.3.1.1 ATR harmony in pre-stem elements

Elip has a system of eighteen noun classes that combine into eight double-class genders, and three single-class genders.

The following double-class genders occur: 1/2, 3/4, 5/6a, 7/8, 9/10, 11/13, 14/6, and 19/mu. There are a few isolated examples of 11/8, 15/6, and 5/13. The single-class genders are 6, 15 and 17.

class	prefixes	class	prefixes
1	mʊ-	2	ba- /be-
	ʊ- / u-		
	a- / e-		
	∅		
3	ʊ(N)- / u(N)-	4	ɪ(N)- / i(N)-
5	nɪ- / ni-	6a	a(N)- / eN)-
7	gɪ- / gi-	8	bɪ- / bi-
9	N-	10	N-
11	nʊ- / nu-	13	dʊ- / du-
14	bʊ- / bu-	6	ma- / me-
15	gʊ- / gu-		
19	ɪ- / i-	mʊ-	mʊ- / mu-

The vowels in noun-class prefixes are underlyingly [-ATR] but change into [+ATR] when preceding a [+ATR] noun root. With the exception of classes 9 and 10, which consist of a syllabic nasal, most Elip noun classes contain one of three underlying vowels /ɪ/, /ʊ/ and /a/, which will undergo ATR harmony. Noun classes 1 and 3 are different from the others and will be discussed below. The [+ATR] counterpart of /a/ is /e/[125], see Example 154.

Example 154: ATR harmony of Elip noun-class prefixes

class	**noun-class prefix**	**example**	***gloss***
2	ba-	bà≠gá^{n}dʊ́	*women*
		bà≠nìm	*husbands*
		bè≠ébì	*thieves*
		bè≠lìmén	*siblings*

[125] It is assumed that the [+ATR] counterpart of /a/ was originally /ə/, but in the language as it is spoken today, this vowel is acoustically clearly a front vowel. It is assumed that a merger between /e/ and /ə/ has occurred sometime in the past since /e/ is currently the [+ATR] counterpart of both /ɛ/ and /a/.

class	**noun-class prefix**	**example**	***gloss***
4	ɪ(N) [126]-	ì≠sǎ	*rivers*
		ì≠dím	*hearts*
		ì≠dʷá	*heads*
		ìm≠bɔ́g	*hands*
		ì≠gèl	*voices, throats*
		ì≠fín	*debts*
		ì≠hún	*noses*
5	nɪ-	nì≠bánà	*breast, udder*
		nì≠hìɲá	*termite sp.*
		ní≠gɔ̀ⁿdà	*plantain*
		nì≠bèg	*melon*
		nì≠gùⁿdè	*basket for groundnuts*
6	ma-	mà≠gíb	*wine*
		mè≠gúd	*fat, oil*
6a	a(N)-	àm≠bánà	*breasts, udders*
		àm≠bʊ̀sìn	*fish barricade*
		à≠hìɲá	*termite sp.*
		èm≠bèg	*melon*
		è≠gùⁿdè	*basket for groundnuts*
7	gɪ-	gì≠kʰánà	*charcoal*
		gì≠sɔ́ᵐbɔ́l	*hill of "mpinya" termites*
		gì≠gǒgè	*bone*
8	bɪ-	bì≠kʰánà	*charcoals*
		bì≠sɔ́ᵐbɔ́l	*hills of "mpinya" termites*
		bì≠gǒgè	*bones*
11	nʊ-	nʊ̀≠bílà	*birdlime*
		nʊ̀≠gʊ́ⁿd	*foot*
		nù≠néŋʷé	*hevea, rubber tree*
13	dʊ-	dʊ̀≠bílà	*birdlime*
		dʊ≠gʊ́ⁿd	*feet*
		dù≠néŋʷé	*heveas, rubber trees*

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[126] N indicates a homorganic nasal which assimilates to the point of articulation of the following consonant.

class	**noun-class prefix**	**example**	***gloss***
14	bʊ-	bʊ̀≠ɲàm	*animal*
		bɔ̀≠sɔ̀b	*groundnut*
		bù≠dúg	*night*
15	gʊ-	gʊ̀≠nʊ́mà	*illness*
		gù≠nèɲè	*flood, inundation*
17	gʊ-	gʊ̀≠mɔ̀n	*sky*
		gʊ̀≠dàɲì	*savannah, bush*
19	ɪ-	ì≠lɔ̀g	*poison*
		ì≠líŋà	*uterus*
		ì≠nònì	*bird*
pl of 19	mʊ-	mʊ̀≠lɔ̀g̥	*poisons*
		mù≠nònì	*birds*

Numeral prefixes in Elip are underlyingly [-ATR] and undergo ATR harmony. There are no [+ATR] numeral prefixes in Elip.

Example 155: Elip numeral prefixes

class	**num. pfx**	**example**	***gloss***
1	ɔ̀-	mʊ̀≠^{n}dʊ̀ ò≠mòómí	*one person*
2	bá-	bà≠^{n}dʊ̀ bá≠à^{n}dì	*two person*s
		bà≠^{n}dʊ̀ bé≠níhì	*four persons*
3	ɔ́-	ò≠dú ó≠mòòmí	*one ear*
4	í-	ì≠dú íj≠à^{n}dì	*two ears*
		ì≠dú í≠níhì	*four ears*
5	ní-	nì≠sàbà ní≠mòómí	*one groundnut*
6a	á-	à≠sàbà á≠à^{n}dì	*two groundnuts*
		à≠sàbà é≠níhì	*four groundnuts*
7	gí-	gì≠à^{n}sì gí≠ mòómí	*one house*
8	bí-	bì≠à^{n}sì bí≠à^{n}dì	*two houses*
		bì≠à^{n}sì bí≠níhì	*four houses*
9	ì-	m≠fún ì≠ mòómí	*one nose*
10	í-	m≠fún í≠à^{n}dì	*two noses*
		m≠fún í≠níhì	*four noses*
11	nʊ́-	nʊ̀≠tá nú≠ mòómí	*one arrowhead*
13	tʊ́-	tʊ̀≠tá tʊ́≠à^{n}dì	*two arrowheads*
		tʊ̀≠tá tú≠níhì	*four arrowheads*
14	pʊ́-	bʊ̀≠díd bú≠ mòómí	*one tree*
6	má-	mà≠díd má≠à^{n}dì	*two trees*
		mà≠díd mé≠níhì	*four trees*

19	í-	ì≠nòní í≠ mòómí	*one bird*
mu	mʊ́-	mù≠nòní mʊ́≠àⁿdì	*two birds*
		mù≠nòní mú≠níhì	*four birds*

Elip noun class 15 is the infinitive class. As with the other noun-class prefixes with a high vowel, **gʊ-** also undergoes ATR harmony, see Example 156.

Example 156: ATR harmony of Elip infinitive nc 15

15	gʊ-	gù≠fìd-è	*joke, amuse*
		gʊ̀≠sìg-à	*insult*
		gù≠gés-ên	*sneeze*
		gʊ̀≠bàⁿd-à	*hatch, crunch*
		gʊ̀≠gɔ̀ŋ-à	*scratch*
		gù≠hòg-è	*rest*
		gʊ̀≠gʊ̀l-à	*grind*
		gù≠bùŋ-è	*mix*

Noun classes 1 and 3 differ from the other vowel-initial noun classes. The forms of class 1 are **ʊ-**, **a-**, **ɔ-**, **mʊ-** and ∅. All class 1 prefixes undergo ATR harmony. Example 157 below gives examples for each of the possible class 1 prefixes.

Example 157: ATR harmony of noun-class 1 prefixes in Elip

nc 1 prefix	**example**	***gloss***
a-	à≠fàl	*bandit*
	è≠ⁿdìmén	*sibling*
ʊ-	ʊ̀≠gáⁿdʊ́	*woman*
	ùŋ≠ébì[127]	*thief (gʷ≠éb to steal)*
ɔ-	ɔ̀≠gʊ̀ná	*ancestor*
	ɔ̀≠nìm	*husband*
	ɔ̀≠lìᵐb	*sage, wise man*
	ò≠gúl	*friend, comrade*
mʊ-[128]	mʊ̀≠ⁿdʊ̀	*person*
	mʷ≠ɔ̌n	*baby*
	mʊ̀≠ʊ́ŋàjɔ̀	*child*

[127] /ŋ/ is added before vowel-initial noun roots.

[128] In the corpus, no examples of words with a [+ATR] counterpart to the noun-class 1 **mʊ-** have been found.

nc 1 prefix	**example**	***gloss***
∅	sʲé	*father*
	hɔ̌m	*wound*
	gélém	*back, behind*

Class 3 prefixes are always round. The two prefix forms found are **ʊ(N)-** and **ɔ(N)-**. They will both undergo ATR harmony. Example 158 below shows examples for each of the variants of the class 3 prefix.

Example 158: ATR harmony of noun-class 3 prefixes in Elip

nc 3 prefix	**example**	***gloss***
ɔ(N)-	ɔ̀≠híɲì	*sun*
	ɔ̀m≠bɔ́g	*hand*
	ɔ̀≠dʊ́nà	*stake, prop (for plants)*
	ò≠fín	*debt*
	ò≠hólí	*moon*
	ò≠hún	*nose*
	ò≠gʷé	*stream, brook*
ʊ(N)-	ʊ̀m≠bál	*boundary*
	ʊ̀≠hàn	*thigh*
	ù≠gèl	*voice, throat*

In addition to the infinitive prefix, Elip has other verbal pre-stem elements which also undergo ATR harmony. These include the reflexive, negation, subject concord, and tense markers, see Example 159 below

Example 159: ATR harmony of Elip preverbal elements

reflexive	bí-	gʊ̀-bí≠bís-à	*comb oneself*
		gʊ̀-bí≠gɔ́ᵐb-à	*shave oneself*
		gù-bí≠dúᵐb-è	*wash oneself*
negative	dì-	ʊ̀-dì-gà≠hʊ̀l-à	*c1-NEG-FT2≠sweep-CONT*
(pres. & fut.)		ù-dì-é≠dím-è	*c1-NEG-Pr≠dig-CONT*
negative	sá-	dì-sà-sá≠hʊ̀l-à	*1p-P1-NEG≠sweep-CONT*
(past tenses)		dì-mè-sé≠dím-é	*1p-P4-NEG≠dig-CONT*
recent past	sà-	ʊ̀-sà≠hʊ̀l-à	*c1-P1≠sweep-CONT*
		ù-sè≠hún-è	*c1-P1≠vanner-CONT*

2.6.3.1.2 Rounding harmony in pre-stem elements

The three noun-class prefixes which have an underlying /a/ may also undergo rounding harmony in the context of a non-high (open) round vowel (/o/ or /ɔ/) in the noun root, see Example 160 below.

Example 160: Rounding harmony of /a/ in Elip noun-class prefixes

class	noun-class prefix	examples	*gloss*
2	ba-	bɔ̀≠gɔ̂gà	*elders, notables*
		bò≠ló^{n}dì	*traditional healers*
		bà≠gʊ̀nâ	*ancestor, lord*
		bè≠nùgì	*weaver*
6a	a(N)-	ɔ́≠gɔ̀^{n}dà	*plantains*
		ò≠hògè	*shadows*
		à≠sʊ̀gà	*pastures for animals*
		è≠gù^{n}dè	*baskets for peanuts*
6	ma-	mɔ̀≠dɔ́g	*seasonings*
		mò≠gòdì	*thought*
		mà≠gʊ̀l	*cooked palm-nut pulp*
		mè≠gúd	*fat, oil*

Verbal pre-stem elements with /a/ undergo rounding harmony as well as ATR harmony. In Example 161, the recent past, the past tense negative and the 2s subject concord prefixes all undergo both ATR and rounding harmony:

Example 161: Rounding harmony of Elip preverbal elements

negative (past)	sá	ù-mò-só≠dól-è	*c1-P4-neg-tickle-CONT*
		ʊ̀-mɔ́-sɔ́≠sɔ̀s-à	*c1-P0-neg≠smoke-CONT*
		ʊ̀-sɔ̀-sɔ́≠gɔ́l-ɔ̀n	*c1-P1-neg≠take-CONT*
recent past	sà-	ʊ̀-sɔ̀≠sɔ̀s-à	*c1-P1≠smoke-CONT*
		ù-sò≠dól-è	*c1-P1≠tickle-CONT*
subject concord	à-	ò-gǒ≠hòg-è	*2s-FT1≠rest-CONT*
		ɔ̀-gɔ̌≠gɔ́mb-ìd	*2s-FT1≠shave-DIM*

The high round vowels (/ʊ/ and /u/) do not trigger rounding harmony, even when they are lowered in the context of a closed syllable, see Example 162 below.

Example 162: Non-triggering of rounding harmony in Elip

recent past &	sà-	ù-sè≠húg-è	*c1-P1≠cover*
subject concord	à-	à-sà≠sʊ̀g-à	*2s-P1≠wash*
& near future	bá	bá-gà-gɔ̀l	*c2-FT2≠grind*
negative (past)	sá-	ù-mè-sé≠hún-è	*c1-P4-NEG≠thresh*

2.6.3.2 Vowel harmony in suffixes

Most verb and deverbal noun suffixes undergo vowel harmony, but there are two that trigger ATR harmony. Discussed in turn below are suffixes that undergo ATR harmony, ATR dominant suffixes, and rounding harmony in suffixes.

2.6.3.2.1 ATR harmony in suffixes

ATR harmony is triggered by a dominant [+ATR] vowel, usually in the root, and spreads bidirectionally. All [-ATR] vowels in the phonological word change into their [+ATR] counterpart. A few examples are shown in Example 163 below:

Example 163: ATR harmony of Elip verbal suffixes

intensive	-ɪg	gʊ̀-bí≠dɔ́l-íg-ìn	*listen intently*
		gʊ̀≠gás-íg-àn	*break up, detach, split*
		gù≠hùn-ìg-èn	*bury*
separative	-ʊn	gʊ̀≠sáŋ-ʊ́n-à	*deny*
		gù≠hùn-ùn-è	*unearth, dig up*
continuous	-an	gʊ̀≠hám-àn	*flow, leak, run*
		gu≠bùn-èn	*open*
diminutive	-ɪd	gʊ̀≠bɔ́n-ìd	*sharpen, file*
		gù≠búm-ìd	*chase*

Some deverbal nouns are formed by adding the applicative suffix and a noun-class prefix to the verb root. These suffixes also undergo ATR harmony, see Example 164.

Example 164: Elip deverbal nouns with applicative suffix

gù≠nùg-íg	*plug, stop-up*	gì≠nùg-íg-ín	*plug (n), stopper*
gʊ̀≠náᵐb-à	*prepare (food)*	nì≠náᵐb-ín	*kitchen*

Other deverbal nouns are formed by adding an **-a** suffix onto the verb root. This suffix will also undergo ATR harmony, see Example 165.

Example 165: Elip deverbal nouns with -a suffix

gʊ̀≠sɔ́d	*live*	nʊ̀≠sɔ́d-à	*life*
gʊ̀≠síŋ	*despise*	ì≠síŋ-à	*contempt*
gʊ̀≠dɔ́ŋ-ìn	*call*	ɔ̀≠dɔ́ŋ-ín-à	*invitation, summons*
gʷ≠èj-ìd	*choose, pick*	gʲ≠èj-ìd-è	*choice, vote*
gʊ̀≠bìn	*hate*	m≠bìn-à	*hatred*
gù≠bíŋ-ín	*enter*	ò≠bíŋ-ín-é	*entrance*

2.6.3.2.2 ATR-dominant suffixes.

Two suffixes, the [+ATR] causative **-ʲe**, and the [+ATR] agentive **-i** are dominant and trigger ATR harmony. While ATR harmony is generally bidirectional, these dominant suffixes are at the right edge of the word and, as a result, ATR harmony can only spread to the left as seen in Example 166.

Example 166: ATR-dominant suffixes in Elip

causative	-ʲe	gù≠dòg	*be tired*	gù≠dòg-ʲè	*make s.o. tired*
		gò≠sɔ́d	*live*	gù≠sód-ʲè	*save, cause to live*
		gò≠bɔ́l-íg	*climb*	gù≠búl-íg-ʲè	*raise*
		gò≠bàs	*sprout*	gù≠bès-ʲè	*cause to sprout*
		gò≠kìl	*approach*	gù≠kìl-ʲè	*cause to approach*
agentive	-i	gò≠nɔ̀g-à	*weave*	è≠nùg-ì	*weaver*
		gʷ≠àⁿd	*walk*	eŋ≠eⁿd-ì	*walker*
		gò≠lìⁿs	*know*	è≠lìⁿs-ì	*connoisseur*
		gò≠lɔ́g-à	*fish*	ò≠lóg-í	*fisherman*

2.6.3.2.3 Rounding harmony in suffixes

Most verb extensions and inflectional suffixes with an /a/ undergo rounding harmony as well as ATR harmony. Like ATR harmony, rounding harmony is bidirectional. A few examples of suffixes undergoing rounding are shown in Example 167 below:

Example 167: Rounding harmony of Elip verbal suffixes

continuous	-an	gò≠bɔ́n-ɔ̀n	*sharpen*
		gʷ≠òⁿd-òn	*return*
passive[129]	-ab	gò≠gɔ̀g-ɔ̀b-ìd	*crawl*
		gù≠gòg-òb-ìd-ʲè	*make to crawl*
extensive	-al	gò≠dɔ́g-ɔ́l-ìd	*dig shallow*
		gù-bí≠sóg-ól-ìd-ʲè	*pray*

2.6.3.2.4 Failure of rounding harmony

Not all suffixes with /a/ undergo rounding harmony. In *Nuyambassa* and *Nulamba* dialects of Elip, both the **-a** suffix on deverbal nouns and the verb-final vowel **-a** do not undergo rounding harmony, but in the *Nukanya* dialect, both do. In Example 168 below, the presence of the non-high (open) round vowel in the root does not cause the nominal suffix to undergo rounding:

Example 168: Elip deverbal nouns with -a suffix

noun sfx	***Nuyambassa***	***Nukanya***	***gloss***
-a	gʲ≠ɔ̀j-à	nʲ≠ɔ̀j-ɔ̀	*love (from verb gʷɔ̀jìd/kʷɔ̀jìt say)*
	ŋ≠ɔ̀j-ìd-à	kʲ≠ɔ̀j-ìt-ɔ̀	*announcement (verb gʷɔ̀jìd/kʷɔ̀jìt say)*
	gʲ≠ǒb-ʲè	kʲ≠ǒb-ʲò	*swelling (from verb gʷǒbè/kʷǒbò swell)*

[129] This extension is closest formally to the *-ibu nº2194 passive from Guthrie's Comparative Bantu which he considered as missing in Bantu A. The meaning of **-ab** is unclear.

The final vowel is obligatory on certain verbs. Other verbs may occur without any final vowel. With the latter verbs, **-a** carries a continuous-aspect sense and is optional (see in section 2.3.2; Example 72). In *Nuyambassa* and *Nulamba* dialects of Elip, the verb-final vowel (or the continuous-aspect suffix **-a**) undergoes only ATR harmony. In the *Nukanya* dialect, however, **-a** undergoes both ATR and/or rounding harmony. Table 28 below illustrates the surface realisations of **-a** due to vowel harmony constraints between the three dialects of Elip.

Table 28: ATR and rounding harmony in the Elip dialects

		rt V	*Nuyambassa*	*Nulamba*	*Nukanya*	*gloss*
-ATR	+round +open	/ɔ/	gɔ̀≠gɔ́g-à	kɔ̀≠gɔ́g-à	kɔ̀≠kɔ́k-ɔ̀	*pull*
			gɔ̀≠sɔ́s-à	kɔ̀≠sɔ́s-à	kɔ̀≠sɔ́s-ɔ̀	*smoke*
			gɔ̀≠gɔ̀ŋ-à	kɔ̀≠gɔ̀ŋ-à	kɔ̀≠kɔ̀ŋ-ɔ̀	*scratch*
	+round -open	/ʊ/	gʊ̀≠sʊ̀g-à	kʊ̀≠sʊ̀g-à	kʊ̀≠sʊ̀k-à	*wash*
			gʊ̀≠nʊ̀d-à	kʊ̀≠nʊ̀t-à	kʊ̀≠nʊ̀t-à	*vomit*
			gʊ̀≠hʊ́h-à	kʊ̀≠hʊ́h-à	kʊ̀≠hʊ́h-à	*flow*
+ATR	+round +open	/o/	gù≠hòg-è	kù≠hòg-è	kù≠hòg-ò	*rest*
			g^w≠ób-è	k^w≠ób-è	k^w≠ób-ò	*swell*
			g^w≠òj-è	k^w≠òj-è	k^w≠òj-ò	*raise child*
	+round -open	/u/	gù≠k^hùm-è	kù≠kùm-è	kù≠kùm-è	*slap back*
			gù≠hún-è	kù≠hún-è	kù≠hún-è	*blow*
			gù≠búm-è	kù≠búm-è	kù≠búm-è	*hunt*

2.6.4 Hiatus-resolution processes

There are several hiatus-resolution processes found in Elip. These are glide formation (section 2.6.4.1), hiatus retention (section 2.6.4.2), semivowel insertion (section 2.6.4.3) and vowel elision (section 2.6.4.4).

2.6.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted. Where V_1V_2 sequences occur, either within the morpheme or across morpheme boundaries, a high vowel in V_1 position becomes a glide. Glide formation occurs principally between a high vowel in the noun-class prefix and a vowel-initial noun root, as seen in Example 169 below:

Example 169: Prefix-root glide formation in Elip

surface form	**underlying form**	***gloss***
b^{w}ăn	bʊ̀≠án	*tribe*
g^{w}ǐsì	gʊ≠ísì	*earth, ground*
n^{w}ɔ̀^{n}dɛ̀	nʊ̀≠ɔ̀^{n}dì	*frog sp.*
n^{w}òlì	nʊ̀≠òlì	*string*
g^{j}ɔ̀já	gì≠ɔ̀já	*feather, hair*
g^{w}ěbèn	gʊ≠éb-èn	*steal*
g^{w}ǒl	gʊ̀≠ól	*come*

Glide formation also occurs between a CV verb root and a –VC verbal extension, Example 170.

Example 170: CV verb roots with –VC extension(s) in Elip

surface form	**underlying form**	***gloss***
gʊ̀g^{w}à	gʊ̀≠gʊ̀-à	*fall (INTR)*
gʊ̀g^{w}ɛ̀n	gʊ̀≠gʊ̀-ìn	*fall (TR)*
gʊ̀g^{w}ànɛ̀n	gʊ̀≠gʊ̀-àn-ìn	*fall (APPL)*

Glide formation also occurs in nouns derived from verbs. In Example 171 below, the noun is derived from the verb with the [+ATR] causative extension **–i**, and a nominalising suffix **–e**. The high vowel becomes a glide when followed by a vowel.

Example 171: Elip glide-formation in derived nouns

verb	***gloss***	**U.F. of noun**	**S.F. of noun**	***gloss of noun***
gù≠dúmb-è	*wash*	gì≠dúmb-i-e	gìdúmb^{j}é	*bath*
gʊ̀≠dɔ̀g	*finish*	gì≠dòg-i-e	gìdòg^{j}è	*fatigue, tiredness*
gʊ̀≠jɔ̀g-à	*cultivate*	mò≠jòg-i-e	mòjòg^{j}è	*agriculture*
g^{w}≠ób-è	*swell (v)*	g^{j}≠ób-i-e	g^{j}ób^{j}é	*swelling (a)*

2.6.4.2 Hiatus retention

Identical vowels in juxtaposition are permitted. This is particularly evident between the noun-class prefix and the noun root. Where the vowels are either underlyingly identical or have identical surface realisations due to a vowel-harmony process, both vowels are retained. See Example 172.

Example 172: Elip prefix-root hiatus retention

surface form	**underlying form**	***gloss***
nìís	nì≠ís	*eye*
gɪ̀ɪ́là	gɪ̀≠ɪ́l-à	*arrow*
mèéᵐb	mà≠éᵐb	*side (of body)*
máàdà	má≠àd-à	*poison for arrows*
mʊ̀ʊ́ŋàjʊ́	mʊ̀≠ʊ́ŋ-àjʊ́	*child*
mòóɲí	mà≠óɲí	*palaver*
bʊ̀ʊ̀bí	bʊ̀≠ʊ̀bí	*severity*
nùúb	nʊ̀≠úb	*white hair*

2.6.4.3 Semivowel insertion

In preverbal V_1V_2 sequences a semivowel is inserted to break up the vowel sequence. In the examples below, the subject marker **ɪ-** *first person singular* and **ʊ-** *third person singular*, *class 1* and the distant-past tense marker **a-** occur in juxtaposition. A semivowel is inserted between them to break up the illegal sequence, as in Example 173.

Example 173: Semivowel insertion in inflected verbs in Elip

verb	***gloss***	**1s-P4≠verb stem**	**c1-P4≠verb stem**
gʊ̀≠nʊ̀d-à	*vomit*	ɪ̀j-á≠nʊ́d-á	ʊ̀w-á≠nʊ́d-á
gʊ̀≠dɔ́l-à	*twist*	ɪ̀j-ɔ́≠dɔ́l-á	ʊ̀w-ɔ́≠dɔ́l-á
gù≠bùh-è	*tear*	ɪ̀j-é≠búh-é	ùw-é≠búh-é
gù≠hòɲ-è	*fill-up*	ɪ̀j-ó≠hóɲ-é	ùw-ó≠hóɲ-é

2.6.4.4 Vowel elision

In non-utterance-initial position, illegal V_1V_2 sequences which occur across morpheme boundaries and in which V_1 is not a high vowel (underlined in Example 174 below), V_1 is elided. Such vowel elision occurs between verb roots and extensions and between CV- prefixes and VC noun roots.

Example 174: Vowel elision in Elip

gʊ̀≠gà	[gʊ̀gà]	*butcher*
gʊ̀≠gà-ìn	[gʊ̀gɪ̀n]	*butcher-APPL*
mà≠ìᵐbì	[mìᵐbì]	*6.water*

2.6.5 Tone

Elip has a two-tone system underlyingly, high and low. Rising tones and falling tones occur only due to glide formation from syllable mergers. There is a slight lengthening of the vowel due to glide formation in Elip.

In addition, tone melodies undergo a loss of contrast in utterance-final position in connection with vowel devoicing or elision. Noun-melody adaptations and the associated V_2 devoicing/elision is discussed in section 2.6.2.2 above. Surface tone is marked on the data in this study.

2.6.5.1 Tone melodies on nouns

High and low tone contrast in monomorphemic noun roots. Four tone melodies are attested in CVCV noun roots, see Example 175 below. Noun-class prefixes usually have a low tone, although there are a few exceptions.

Example 175: Elip nominal tone melodies

ò≠làᵐbà	≠L.L	*polygamy*
gì≠bàdá	≠L.H	*bag*
gì≠dámà	≠H.L	*okra*
nò≠bálá	≠H.H	*arrival*

2.6.5.2 Tone melodies on verbs

Elip verb roots have three underlying tone melodies: L, HL and H. In verb stems with a H melody, the H spreads one syllable to the right, except onto the final vowel or continuous suffix **-a**. It is assumed that verbal suffixes are underlyingly toneless. The three verbal tone melodies are illustrated in Example 176 below, showing both the H spread on verbal suffixes as well as the failure of H spread onto the final vowel.

Example 176: Elip verbal tone melodies

L	gò≠dàn-à	L ≠L –L	*pound*
	gò≠dàn-ìd	L ≠L –L	*pound (a little)*
HL	gò≠bám-à	L ≠H –L	*talk loudly*
	gò≠bám-ìd	L ≠H –L	*talk loudly (a little)*
H	gò≠gɔ́g-à	L ≠H –L	*drag*
	gò≠gɔ́g-îd	L ≠H –HL	*drag (a little)*

In addition to providing lexical contrast, tone also has a grammatical function. Among other things, tone provides the crucial difference between various tenses in verb conjugations. This is, however, beyond the scope of this study.

2.7 Mmala phonological overview

This study is based on *Nuenyi*, the reference dialect. Three databases are the primary sources of data behind this study[130].

[130] The *Nuenyi* database includes approximately 2,000 terms (based on a 1,700-word list produced by SIL Africa Area). It was begun by Rebecca Prittie, a linguistic intern in Cameroon in 2001. The present author picked up where she left off and checked, corrected, and enlarged the database.

2.7.1 Consonants

This section discusses the consonant inventory of Mmala (section 2.7.1.1), and the various adaptations to it due to allophonic and allomorphic realisations (section 2.7.1.2), distributional restrictions (section 2.7.1.3) and final-consonant devoicing (section 2.7.1.4).

2.7.1.1 Consonant inventory

The consonant system of Mmala consists of 22 contrastive consonants.

Table 29: Mmala contrastive consonants[131]

		labial	alveolar	palatal	velar
stops	voiceless	p	t	tʃ	k
	voiced	b	d		g
	prenasalised	^{m}b	^{n}d		^{ŋ}g
fricatives	voiceless	f	s		h
	prenasalised	^{ɱ}f	^{n}s		
resonants	nasal	m	n	ɲ	ŋ
	oral		l	j	w

2.7.1.2 Allophonic and allomorphic realisations

Voiceless stops in the *Nuenyi* dialect are always aspirated, except for /tʃ/ which already has a delayed release. Voiced stops in utterance-final position become devoiced but are not released. Contrast is therefore maintained in word-final position between the voiced and voiceless consonants.

The *Nukitia* database includes approximately 2,500 terms. It is a merged database combining the handwritten lexicon of about 2,000 words compiled by Kiolé Frederic, a Mmala man from the village of Kedia and keyed in by Noumba Valérie, and my own database of about 1,500 words collected in Kedia and its neighbouring village, Ediolomo. Duplicate entries were combined.

Also consulted was a third database organised by Hinke Leijenhorst. This third database consists of approximately 6,000 terms compiled in the reference dialect and being edited by a committee of Mmala speakers from all five villages. It includes much of the information found in the other two databases, but the entries are written orthographically. The Mmala orthography underdifferentiates the vowel system; writing only seven rather than all nine contrastive vowels. For this reason, it is of less use in this present study.

131 The *Nukitia* dialect of Mmala has 19 contrastive consonants. The voiceless stops, unlike in *Nuenyi*, are not aspirated. The contrastive consonants of *Nukitia* are as follows:

		labial	alveolar	palatal	velar
stops	voiceless	p	t	tʃ	k
	prenasalised	^{m}b	^{n}d		^{ŋ}g
fricatives	voiceless	f	s		h
	prenasalised	^{ɱ}f	^{n}s		
resonants	nasal	m	n	ɲ	ŋ
	oral		l	j	w

The prenasalised fricative /^{n}s/ is realised [^{n}tʃ], as seen in Example 177 below.

Example 177: Realisation of /^{n}s/ in Mmala

gì≠sɛ̀^{n}s	[gɛ̀sɛ̀^{n}tʃ]	*lip*
nʊ̀≠^{n}sòk^{j}ò	[nù^{n}tʃòk^{j}ò]	*red pepper*
gì≠à^{n}sì	[g^{j}à^{n}tʃì]	*house*

In addition, morphologically, /s/ changes to /tʃ/ when preceded by a nasal prefix, see Example 178 below:

Example 178: Realisations of /s/ between Mmala NC prefix and root

gì≠sámʊ̀	[gìsámʊ̀]	*fruit*
àn≠sámʊ̀	[àntʃámʊ̀]	*nut*

2.7.1.3 Restrictions in consonant distribution

Mmala has both open and closed syllables; CV, CVC, V, VC and syllabic nasals. All consonants except for /^{ŋ}g/, /p/, /tʃ/, /h/ and /w/ are found in syllable-final position. Voiced stops and voiceless aspirated stops, contrast in both syllable onsets and codas.

Consonant-glide sequences generally occur at morpheme boundaries and are formed by the desyllabification of a high vowel (discussed in section 2.7.4.1 below). Only a few consonant-glide sequences have been found inside roots, as in Example 179:

Example 179: Consonant-glide sequences in Mmala

nù≠b^{w}è	*white hair*
gì≠s^{w}á	*bowl*
m̀≠b^{w}á	*dog*
àŋ≠k^{w}àɲ	*diastema (gap between teeth)*
ɔ̀≠d^{w}ɔ́	*head*
s^{j}è	*father*
gì≠s^{j}èn	*farm*
mà≠s^{j}à	*side*
ì≠ɲód^{j}ò	*mother*
t^{j}ò	*relative of father*

2.7.1.4 Final-consonant devoicing

Voiced obstruents are devoiced in word-final position. This occurs consistently with voiced and prenasalised stops, with the exception of /^{ŋ}g/ which is not found in syllable-final position.

Example 180: Final-consonant devoicing in Mmala

/b/→[b̥]	[màgέb̥]	*wine*
/d/→[d̥]	[mègùd̥]	*fat*
/g/→[g̊]	[bùdùg̊]	*night*
/ᵐb/→[ᵐb̥]	[nὲbὲᵐb̥]	*frog sp.*
/ⁿd/→[ⁿd̥]	[gὲgɔ́ⁿd̥]	*foot*
/t/→[tʰ]	[nʲǎtʰ]	*buffalo*
/k/→[kʰ]	[gìjὲkʰ]	*rot (n)*

2.7.2 Vowels

This section discusses the vowel inventory of Mmala (section 2.7.2.1) and the various adaptations to it due to allophonic realisations such as utterance-final devoicing (section 2.7.2.2), vowel co-occurrences and co-occurrence restrictions (section 2.7.2.3).

2.7.2.1 Vowel inventory

Mmala[132] has an inventory of nine contrastive vowels. A complex system of vowel harmony regulates the co-occurrences and co-occurrence restrictions of the vowels. The vowels can be divided into two sets which are mutually exclusive within roots and stems:

Table 30: Mmala contrastive vowels

	[-ATR]			[+ATR]	
ɪ		ʊ	i		u
ɛ		ɔ	e		o
	a				

In the verb system, all nine contrastive vowels are attested in the verb root in open syllables. There is, however, surface neutralisation of the [-ATR] high and the [-ATR] mid vowels with /ɪ/ being realised as /ɛ/; and /ʊ/ being realised as /ɔ/ in comparable closed syllables. This phenomenon is most clearly seen in comparing verbs with and without the continuous suffix **-a**, as shown in Example 181 below. The changes in the suffix are described below in section 2.7.3.

[132] The vowel inventory is the same for both Nuenyi and Nukitia dialects.

Example 181: Contrastive vowels in Mmala CVC verb stems

	≠verb-suffix	**≠verb**	***gloss***
/i/	≠dím-è	≠dím	*dig*
/ɪ/	≠jɪ̀k-à	≠jɛ̀k	*rot*
/e/	≠dèg-è	≠dèg	*abound*
/ɛ/	≠bɛ̀g-à	≠bɛ̀g	*burn*
/a/	≠bàn-à	≠bàn	*count, read*
/u/	≠dúm-è	≠dúm	*stab*
/ʊ/	≠gʊ́l-à	≠gɔ́l	*crush, grind*
/o/	≠dòg-ò	≠dòg	*burp*
/ɔ/	≠sɔ́l-ɔ̀	≠sɔ́l	*hoe*

Only seven of the nine contrastive vowels are found in monomorphemic CV_1CV_1 noun roots. The vowels /ɪ/ and /ʊ/ have not been found in CV_1CV_1 roots, as in Example 182 below.

Example 182: Permitted vowels in Mmala CV_1CV_1 noun roots

i	bù≠lìfì	*flower*	ɪ	---	---
	ò≠ŋìnì	*louse*		---	---
u	ò≠kúlù	*evening*	ʊ	---	---
	nì≠lúkù	*bamboo stool*		---	---
e	gì≠bébè	*boundary of field*	ɛ	à≠lɛ̀gɛ̀	*yam sp.*
	ì≠bèŋè	*calabash (for wine)*		ǹ≠sɛ̀gɛ̀	*insult*
o	bò≠kónó	*potato*	ɔ	gì≠lɔ̀ⁿdɔ̀	*fog, cloud*
	òm≠bòkò	*squirrel*		nù≠bɔ̀mɔ̀	*river, stream*
			a	à≠wàgà	*chimpanzee*
				gì≠námà	*bat*

2.7.2.2 Vowel devoicing/deletion utterance-finally

Four vowels, /i/, /ɪ/, /u/ and /ʊ/, are susceptible to devoicing or deletion in utterance-final position. This is the same position where voiced obstruents are devoiced and where tone-melody contrast is lost in noun roots. Devoicing/deletion of these four vowels is interdependent with the utterance-final loss of contrast in the tone melody, as shown below. In Table 31, (L̥) indicates that the vowel may either be devoiced (in which case the tone is low) or deleted (in which case the tone is also deleted)[133].

[133] Native speakers perceive a tone on these devoiced vowels even though this is difficult to show acoustically.

Table 31: Mmala N. root melodies and utterance-final vowel devoicing

underlying tone	non-final	utterance-final	vowel devoicing?
≠H	≠H	≠H(L̥)	Yes
≠HL	≠HL	≠L(L̥)	Yes
≠LH	≠LH	≠LL	No[134]
≠L	≠L	≠L(L̥)[135]	Yes

Example 183 below illustrates the melody adaptations and the associated devoicing/deletion of the vowels /i/, /ɪ/, /u/ and /ʊ/ in utterance-final position.

Example 183: Final-vowel devoicing in Mmala

	underlying forms		**final**	**non-final**	***gloss***
/i/	bì≠gùdì	L	[bìgùd̥]~[bìgùd̥i̥]	[bìgùdì]	*rubbish*
	gì≠dédì	HL	[gìdèd̥]~[gìdèd̥i̥]	[gìdédì]	*rooster*
	ì≠nòní	LH	[ìnònì]	[ìnòní]	*bird*
/ɪ/	gì≠àⁿsì	L	[gʲàⁿtʃ]~[gʲàⁿtʃɪ̥]	[gʲàⁿtʃɪ̀]	*house*
	gì≠àⁿsí	LH	[gʲàⁿtʃɪ̀]	[gʲàⁿtʃɪ́]	*pledge*
/u/	gì≠dégú	H	[gìdég̥]~[gìdég̥u̥]	[gìdégú]	*navel*
	à≠mèkú	LH	[èmèkʰù]	[èmèkʰú]	*muscle, flesh*
/ʊ/	bà≠àⁿdʊ̀	L	[bààⁿd̥]~[bààⁿd̥ʊ̥]	[bààⁿdʊ̀]	*people*
	àn≠sámʊ̀	HL	[àntʃàm]~[àntʃàmʊ̥]	[àntʃámʊ̀]	*grain*
	gì≠sàsʊ́	LH	[gìsàsʊ̀]	[gìsàsʊ́]	*granary*

The remaining five vowels, /ɛ/, /e/, /a/, /o/ and /ɔ/ are never devoiced and their underlying HL and L melodies are realised on the surface in both utterance-final and non-final positions. However, non-devoicing vowels in H and LH underlying melodies are realised as HL and L respectively. Example 184 below illustrates that non-devoicing vowels may occur in melody patterns (i.e. L, HL and H) where there is normally devoicing/deletion of utterance-final vowels.

[134] In utterance-final position, there is a loss of contrast between H.L, L.H, and L.L melodies, all of which have a surface realisation of L. A partial contrast is maintained between the underlying L.H melody and the underlying H.L and L.L melodies due to the failure of vowel devoicing in the case of the former.
[135] In utterance-final position, all low tones fall to some extent. I have not been able to distinguish a clear acoustical difference between underlying ≠L.L and ≠L.H in utterance-final position. However, my acoustical data is limited and tonal phenomena are beyond the scope of this study.

Example 184: Non-devoicing vowels in Mmala

	underlying forms		final	non-final	gloss
/ɛ/	ǹ≠tʃìgɛ̀	L	[ǹtʃɛ̀gɛ̀]	[ǹtʃìgɛ̀]	*insult*
/ɔ/	ɔ̀ŋ≠kʰɔ̀gɔ̀	L	[ɔ̀ŋkʰɔ̀gɔ̀]	[ɔ̀ŋkʰɔ̀gɔ̀]	*wine (gen.)*
/a/	mà≠dígà	HL	[màdígà]	[màdígà]	*water*
	gì≠dɔ́ᵐbá	H	[gɛ̀dɔ́ᵐbà]	[gɛ̀dɔ́ᵐbá]	*sheep*
	gì≠gɔ̀nà	L	[gɛ̀gɔ̀nà]	[gɛ̀gɔ̀nà]	*plant shoot*
/e/	bʊ̀≠gídè	HL	[bùgídè]	[bùgídè]	*grass*
/o/	ɲódʲó	H	[ɲódʲò]	[ɲódʲó]	*mother*

2.7.2.3 Vowel co-occurrences

Several factors govern the co-occurrences of vowels in CVCV nouns. These factors include 1) ATR and height-harmony restrictions and 2) restrictions on V_2, depending on the features of V_1, to either a front, round or open (non-high) vowel. Each of these vowel co-occurrence restrictions will be discussed in turn in sections 2.7.2.3.1, 2.7.2.3.2 and 2.7.2.3.3 below.

2.7.2.3.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. In Mmala, each [-ATR] vowel has a [+ATR] counterpart, as in Table 32.

Table 32: [-ATR]/[+ATR] vowel counterparts in Mmala

[-ATR]	ɪ	ɛ	a	ɔ	ʊ
[+ATR]	i	e	e[136]	o	u

The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ is always [-ATR] and never found in a [+ATR] environment. In Table 33 below, all existing ATR vowel co-occurrences in CVCV noun roots are shown. There are numerous co-occurrence restrictions, which will be discussed in turn below.

Table 33: ATR vowel co-occurrences in Mmala CVCV noun roots

U.F.	[-ATR] vowels		U.F.	[+ATR] vowels	
ɪ-ɪ	---	---	i-i	ò≠ŋìnì	*louse*
ɪ-a	mà≠dígà	*water*	i-e	gì≠gìdè	*ram*
ɪ-ɔ	pù≠jíkɔ̀[137]	*pineapple*	i-o	ò≠ɲídò	*hair*
ɛ-ɪ	nɛ̀≠lɛ̀gɛ̀	*yam sp.*	e-i	gì≠bèbì	*s/he-goat*
ɛ-a	bɛ̀≠sɛ́gà	*taro field*	e-e	ì≠bèŋè	*calabash (for wine)*
ɛ-ʊ	---	---	e-u	è≠mèkù	*flesh*

[136] It is assumed that the [+ATR] counterpart of /a/ was originally /ə/, but in the language as it is spoken today, this vowel is acoustically clearly a front vowel. It is assumed that a merger between /e/ and /ə/ has occurred sometime in the past since /e/ is currently the [+ATR] counterpart of both /ɛ/ and /a/.

[137] The open round vowel /ɔ/ takes an ATR-disharmonic /u/ in affixes which do not undergo height harmony at all, see section 2.7.3.

U.F.	**[-ATR] vowels**		**U.F.**	**[+ATR] vowels**	
---	---	---	u-i	bì≠gùdì	*rubbish*
ʊ-a	m̀≠bʊ̀dà	*catfish sp.*	u-e	gì≠kúᵐbè	*feather*
---	---	---	u-u	nì≠lúkù	*bamboo stool*
ʊ-ɔ	ɔ̀m≠bùlɔ́	*girl*	u-o	ò≠fùlò	*June-Aug. period*

ɔ-ɪ	ɔ̀≠fɔ̀ɲɛ̀	*yellow yam*	o-i	ì≠nònì	*bird*
ɔ-a	---	---	o-e	---	---
ɔ-ɔ	nù≠bɔ̀mɔ̀	*river, stream*	o-o	bò≠kónó	*potato*
a-ɪ	ɛ̀≠pàkì	*age group*			
a-a	à≠wàgà	*chimpanzee*			
a-ʊ	bʊ̀≠ɲánʊ̀	*yam*			

2.7.2.3.2 Height-harmony restrictions

Height harmony generally lowers the surface realisation of the [-ATR] high vowel /ɪ/. When /ɪ/ is found in V_2 position in the noun stem, it will lower to [ɛ] with either of the [-ATR] mid vowels /ɛ/ or /ɔ/. When /ʊ/ is in V_2 position, it will lower to /ɔ/ only following /ɔ/ in the noun root. Elsewhere /ʊ/ goes through other changes which will be discussed below in Section 2.7.3.

In deverbal nouns with a suffix involving either /ɛ/ or /ɔ/, a [-ATR] high V_1 will also be lowered. In Table 34, three of the four possible pairs are illustrated. No example of CɪC-ɔ(C) has been found in the corpus. Verbal suffixes have been found with only the following vowels: /ɪ/ /ɛ/, /ʊ/ or /a/.

Table 34: Height Harmony in Mmala CVCV(C) deverbal nouns

underlying CV_1CV_2	**S.F.**	**example**	***gloss***	**from verb**	
ɪ-ɛ	ɛ-ɛ	n≠tʃɛ̀g-ɛ̀	*insult (n)*	gʊ̀≠sɪ̀g-à	*insult (v)*
ɪ-ɔ	---	---	---	---	---
ʊ-ɛ	ɔ-ɛ	gɛ̀≠gɔ́l-ɛ̀n	*grinding stone*	gʊ̀≠gʊ́l-à	*grind (v)*
ʊ-ɔ	ɔ-ɔ	ɔ̀≠sɔ̀g-ɔ̀	*purification*	gʊ̀≠sʊ̀g-à	*wash (v)*

2.7.2.3.3 Other V_2 restrictions

In CVCV noun roots, V_2 is either high, round or open (non-high)[138]. The round V_2 is /ʊ/ or /ɔ/ in [-ATR] noun roots and /u/ or /o/ in [+ATR] roots. Round V_2 vowels cannot be of the same height as the V_1 unless identical to V_1. The open vowel is either /a/ in [-ATR] roots or /e/, its [+ATR] counterpart, see Table 35 below.

[138] This is similar to what Hyman (2002) found in Gunu, a related language.

Table 35: Value of V_2 in Mmala CVCV noun roots

V_2 in CVCV noun roots	**[-ATR]**	**[+ATR]**
high	ɪ or ɛ	i
round	ʊ or ɔ	u or o
open	a	e

In [+ATR] noun roots, non-identical mid vowels are not found in the same root, so **o-e** is disallowed. We therefore find the following possibilities:

Table 36: Surface CV_1CV_2 combinations permitted in Mmala

$V_1 \backslash V_2$	**high**	**round**	**open**
/i/	i-i	i-o (i-u)	i-e
/ɪ/	---	ɪ-ɔ (ɪ-ʊ)	ɪ-a
/e/	e-i	e-u	e-e
/ɛ/	ɛ-ɛ	---	ɛ-a
/u/	u-i	u-u/u-o	u-e
/ʊ/	---	ʊ-ɔ	ʊ-a
/o/	o-i	o-o	---
/ɔ/	ɔ-ɛ	ɔ-ɔ	---
/a/	a-ɪ	a-ʊ	a-a

The following table shows the permitted CVCV combinations with height harmony affecting the surface forms of the vowels. Examples are shown where they have been found illustrating the underlying form proposed for the surface combinations. Not all possible combinations have been found, and some are thus hypothetical. The illegal CV_1CV_2 combinations are indicated by an asterisk and hypothetical underlying CV_1CV_2 combinations are italicised in Table 37 below. Nouns derived from verbs are listed in the table below in italics.

Table 37: Permitted combinations for Mmala [-ATR] vowels

underlying CV_1CV_2	**S.F.**	**example**	***gloss***
ɪ-ɛ		*ǹ≠tʃɛ̀gɛ̀*	*insult (from gʊ̀sɪ̀gà to insult)*
ɛ-ɪ	ɛ-ɛ	--	---
ɛ-ɛ		nɛ̀≠lɛ̀gɛ̀	*yam sp.*
ɪ-a	ɪ-a	mà≠dígà	*water*
ɪ-ɔ		ɔ̀m≠fɛ́ɲɔ̀	*termite sp. (pl. ìm≠fíɲà)*
*ɛ-ɔ[139]	ɛ-ɔ	---	---
ɛ-ʊ		---	---
ɛ-a	ɛ-a	bɛ̀≠sɛ́gà	*taro field*
ʊ-ɪ	ʊ-ɪ	---	---
ʊ-ɛ		*gɛ̀≠gɔ́lɛ̀n*	*large grinding stone (gʊ̀gʊ̀là to grind)*
ɔ-ɪ	ɔ-ɛ	ɛ̀≠ŋɔ́dɛ́[140]	*machete handle*
ɔ-ɛ		ɔ̀≠fɔ̀ɲɛ̀[141]	*yellow yam*
ʊ-a	ʊ-a	m̀≠bʊ̀dà	*siluridae sp.*
ʊ-ɔ		*ɔ̀≠sɔ̀gɔ̀*	*funeral purification (gʊ̀sʊ̀gà to wash)*
ɔ-ʊ	ɔ-ɔ	---	---
ɔ-ɔ		nù≠bɔ̀mɔ̀	*river, stream*
a-ɪ	a-ɪ	ɛ̀≠pàkì	*age group*
a-a	a-a	à≠wàgà	*chimpanzee*
a-ʊ	a-ʊ	bʊ̀≠ɲánʊ̀	*yam*

2.7.3 Vowel-harmony processes

Mmala has a complex system of vowel harmony consisting of three interacting types of harmony: ATR, height, and rounding harmony. All three types of vowel harmony cross morpheme boundaries within the phonological word.

2.7.3.1 Vowel harmony in prefixes

Both nominal and verbal prefixes are [-ATR]. They have two surface representations depending on whether or not there is a [+ATR] vowel in the stem. In addition to ATR harmony, prefixes are also affected by rounding harmony and height harmony. ATR, height and rounding harmony are discussed in turn below.

2.7.3.1.1 ATR harmony in prefixes

Mmala has a system of seventeen noun classes that combine into ten double-class genders, and two single-class genders.

[139] As mentioned above, round V_2 vowels cannot be of the same height as the V_1 unless identical to V_1.
[140] V_2 here is underlyingly /ɪ/ because it undergoes devoicing. Only the high vowels devoice.
[141] V_2 here is underlyingly /ɛ/. The LL melody will permit devoicing in high vowels, but this vowel does not devoice.

The following double-class genders occur: 1/2, 3/4, 5/6a, 7/8, 9/10, 11/13, 14/6, 19/*mu*, 19/13, 19/4 and a few examples of 5/*mu*. The two single-class genders are 6 and 15.

Class 19 takes one of three plurals. If the noun is diminutive, the plural is in class 13. Many animal species are in class 19 with a class 4 plural, but most of the time the plural of a class 19 noun is **mʊ-**.

class	**prefixes**	**class**	**prefixes**
1	mʊ-	2	ba- /be-
	a- / e-		
	∅		
3	a(N)- / e(N)-	4	ɪ(N)- / i(N)-
5	nɪ- / ni-	6a	a(N)- / eN)-
7	gɪ- / gi-	8	bɪ- / bi-
9	N-	10	ɪN- / iN-
11	nʊ- / nu-	13	dʊ- / du-
14	bʊ- / bu-	6	ma- / me-
19	ɪ- / i-	mu-	mʊ- / mu-

Noun-class prefixes are underlyingly [-ATR] but have a [+ATR] counterpart when preceding a [+ATR] noun root. With the exception of class 9, which consists of a syllabic nasal, all Mmala noun classes contain one of three underlying [-ATR] vowels /ɪ/, /ʊ/ and /a/, see Example 185.

Example 185: ATR harmonisation of Mmala noun-class prefixes

class	**noun-class prefix**	**example**	***gloss***
1	a(N)-/e(N)-	à≠gá^{n}dʊ̀	*woman*
		è≠b^{j}èɲ	*midwife*
2	ba-/be-	bà≠gá^{n}dʊ̀	*women*
		bè≠b^{j}èɲ	*midwives*
3	a(N)-/e(N)-	à≠sà	*river*
		àn≠sàmʊ̀[142]	*nut*
		è≠mèkù	*flesh, muscle*
		è≠g^{w}én	*death, impotence*

[142] The nasal is considered to be part of the prefix in this case as well as in the other examples based on the root form when a different noun class is used:

gì≠s̀amʊ̀	*fruit*	àn≠sàmʊ̀	*nut*
nì≠bánà	*breast, udder*	àm≠bánà	*breasts, udders*
nì≠bùs	*anthill*	èm≠bùs	*anthills*

class	**noun-class prefix**	**example**	***gloss***
4	ɪ(N[143])-/i(N)-	ì≠sà	*rivers*
		ìn≠sàmʊ̀	*nuts*
		ì≠mèkù	*flesh, muscles*
		ì≠ŋídè	*hair*
5	nɪ-/ni-	nì≠bánà	*breast, udder*
		nì≠bùs	*anthill*
		nì≠sélù	*chin*
		nì≠lò^{n}sò	*bean*
6	ma-/me-	mà≠dígà	*water*
		mè≠gùd	*fat, oil*
6a	a(N)-/e(N)-	àm≠bánà	*breasts, udders*
		à≠bɛ̀^{m}b	*edible frogs*
		èm≠bùs	*anthills*
		è≠sélù	*chins*
7	gɪ-/gi-	gì≠námà	*bat sp.*
		gì≠lèŋ	*brook, stream*
8	bɪ-/bi-	bì≠námà	*bats sp.*
		bì≠lèŋ	*brooks, streams*
10	ɪN-/iN-	ìm≠b^{w}á	*dogs*
		ìn≠tʃùb	*hippopotami*
11	nʊ-/nu-	nʊ̀≠làm	*arrow shaft*
		nù≠lèn	*stream*
13	dʊ-/du-	dʊ̀≠làm	*arrow shafts*
		dù≠lèn	*streams*
14	bʊ-/bu-	bʊ̀≠ɲàm	*animal*
		bù≠dùg	*night*
15	gʊ-/gu-	gʊ̀≠gàj	*harvest (peanut, maize)*
		gù≠sín	*cold water*

[143] N indicates a homorganic nasal which assimilates to the point of articulation of the following consonant.

class	**noun-class prefix**	**example**	***gloss***
19	ɪ-/i-	ɪ≠màŋ	*long rainy season*
		ì≠nònì	*bird*
mu	mʊ-/mu-	mʊ̀≠màŋ	*long rainy seasons*
		mù≠nònì	*birds*

Numeral prefixes in Mmala are underlyingly [-ATR] and undergo ATR harmony. There are no [+ATR] numeral prefixes in Mmala.

Example 186: Mmala numeral prefixes

class	**num. pfx**	**example**	***gloss***
1	ɔ̀-	mɔ̀≠^{n}dɔ̀ ò≠mòmù	*one person*
2	bá-	bà≠^{n}dɔ̀ bá≠à^{n}dì	*two person*s
		bà≠^{n}dɔ̀ bé≠nî	*four persons*
3	ɔ́-	ò≠dú ó≠mòmù	*one ear*
4	í-	ì≠dú íj≠à^{n}dì	*two ears*
		ì≠dú í≠nî	*four ears*
5	ní-	nì≠sàbà ní≠mòmù	*one groundnut*
6a	á-	à≠sàbà á≠à^{n}dì	*two groundnuts*
		à≠sàbà é≠nî	*four groundnuts*
7	gí-	gì≠à^{n}sì gí≠mòòmù	*one house*
8	bí-	bì≠à^{n}sì bí≠à^{n}dì	*two houses*
		bì≠à^{n}sì bí≠nî	*four houses*
9	ì-	m≠fún ì≠mòmù	*one nose*
10	í-	ìm≠fún íj≠à^{n}dì	*two noses*
		m≠fún í≠nî	*four noses*
11	nʊ́-	nʊ̀≠tá nú≠mòmù	*one arrowhead*
13	tʊ́-	dʊ̀≠tá dʊ́≠à^{n}dì	*two arrowheads*
		dʊ̀≠tá dú≠nî	*four arrowheads*
14	pʊ́-	bʊ̀≠díd bú≠mòmù	*one tree*
6	má-	mà≠díd má≠à^{n}dì	*two trees*
		mà≠díd mé≠nî	*four trees*
19	í-	ì≠nòní í≠mòmù	*one bird*
mu	mʊ́-	mù≠nòní mʊ́≠à^{n}dì	*two birds*
		mù≠nòní mú≠nî	*four birds*

The Mmala noun class 15 is the infinitive class. As with the other noun-class prefixes with a high vowel, **gʊ-** is also [-ATR] and has two surface representations depending on the ATR value of the stem, see Example 187.

Example 187: ATR harmony of Mmala infinitive nc 15

15	gʊ-/gu-	gù≠gíd-è	*patch*
		gʊ̀≠sìg-à	*insult*
		gù≠dèg-è	*abound*
		gʊ̀≠bɛ̀g-à	*burn*
		gʊ̀≠gál-à	*speak, talk*
		gù≠gɔ́g-ɔ̀[144]	*pull*
		gù≠dòg-ò	*burp*
		gʊ̀≠gʊ́l-à	*crush, grind*
		gù≠dúm-è	*stab*

In addition to the infinitive prefix, Mmala has other verbal prefixes which are underlyingly [-ATR]. These include the reflexive **bí-**, negation **dì-**, subject concord **ʊ-**, and tense markers; P1 **sà-** and P4 **mà-** among others. These verbal prefixes have two surface realisations depending on the ATR value of the verb stem. A few examples are shown below in Example 188:

Example 188: ATR harmony of Mmala preverbal elements

reflexive	bí-	gʊ̀-bí≠fɛ̀g	*spill*
	bí-	gù-bí≠bʲén	*be born*
negation	dɪ-	ǹ-dì-má-sʊ̀g-à 1s-NEG-P1≠wash-CONT	*I did not wash*
	di-	ǹ-dì-mé≠jèl-ì 1s-NEG-P1≠cross-CAUS	*I did not cross*
directional --from reference	na-	dì-mà-ná≠ɲà 1p-P4-DIR-eat-CONT	*we ate there*
	ne-	dì-mè-né≠bìŋ-ìn 1p-P4-DIR-enter-CONT	*we entered there*
directional --towards reference	sɪ-	ʊ̀-sà-sì-ŋ≠àl-ɛ̀n bʷòlì c1-P1-DIR-1sIO≠do-APPL work	*s/he works here for me*
	si-	ù-sè-sì-ŋ≠dím-ìn ɔ̀mbɛ̀l c1-P1-DIR-1sIO≠dig- APPL hole	*s/he dug a hole for me*
subject concord/tense	ʊ-/ sa-	ʊ̀-sà≠fʊ̀l-à c1-P1≠sweep-CONT	*s/he was sweeping*
	u-/ se-	ù-sè≠súŋ-è c1-P1≠attach-CONT	*s/he was tying*

[144] The open round vowel /ɔ/, though clearly a [-ATR] vowel, takes an ATR-disharmonic /u/ in the root or affixes. All other vowels remain, however remain [-ATR].

2.7.3.1.2 Rounding harmony in prefixes

The five noun-class prefixes which have an underlying /a/ also have a round surface realisation in the context of a non-high (open) round-vowel (/o/ or /ɔ/) in the noun root. Rounding harmony co-occurs with ATR harmony, see Example 189 below.

Example 189: Rounding harmony of /a/ in Mmala noun-class prefixes

class	**noun-class prefix**	**examples**	***gloss***
1	a(N)-	ɔ̀m≠búlɔ̀	*girl*
		òŋ≠ó^{n}d-ì	*buyer*
		à≠nʊ́mà^{n}dɔ̀	*male, man*
		è≠dùmèb	*envoy*
2	ba-	bɔ̀≠kɔ̀nɔ́-kɔ̀n	*crazy persons*
		bò≠t^{j}ò	*relatives of father*
		bà≠nʊ́mà^{n}dɔ̀	*males, men*
		bè≠dùmèb	*envoys*
3	a(N)-	ɔ̀ŋ≠kɔ̀gɔ̀	*wine (gen)*
		òm≠bòkò	*squirrel*
		à≠wàgà	*chimpanzee*
		è≠mèkú	*flesh*
6a	a-	ɔ́≠gɔ̀^{n}dɔ̀	*plantains*
		ò≠lò^{n}só	*beans*
		à≠mʊ̀^{n}dɛ̀	*stomach, belly*
		è≠lùkù	*bamboo stool*
6	ma-	mɔ̀≠fɔ̀^{ɱ}f	*marrow*
		mò≠ɲòn	*burial*
		mà≠nɔ̀ŋ (/mà≠nʊ̀ŋ/)	*blood*
		mè≠gùd	*fat, oil*

Within classes 1 and 3, certain nouns have a round prefix vowel which is not caused by rounding harmony. The examples in Example 190 below are remnants of the original proto-Bantu **mʊ*- prefixes found in both classes; they are not formed by rounding harmony as with the other cases of /o-/ or /ɔ-/ in noun-class prefixes.

Example 190: Round vowels in Mmala noun classes 1 and 3

class	**noun-class prefix**	**examples**	***gloss***
1	ɔ-	ɔ̀≠nɛ̀m	*husband*
	*mʊ-	ò≠lì^{n}tʃ-ì	*expert*
3	ɔ(N)-	ɔ̀≠dìm	*heart*
	*mʊ-	ɔ̀m≠bɛ̀l	*hole*
		ɔ̀≠fín	*name*
		ò≠ŋìnì	*louse*
		ò≠kìd	*grass*
		ɔ̀n≠dɔ̀nɔ̀	*commerce, riches*
		òm≠fùlò	*cool season (July-Aug)*

Verb prefixes with /a/ have a round surface realisation which co-occurs with ATR harmony. In Example 191, the recent past **sa-**, the negative **na-** and the 2s subject concord **a-**, all undergo both ATR and rounding harmony.

Example 191: Rounding harmony of Mmala preverbal elements

subject/ tense	a-/ sa-	<u>ɔ̀</u>-<u>sɔ̀</u>≠sɔ̀g-ɔ̀[145] 2s-P1≠probe-CONT		*You probed (the sack).*
		<u>ò</u>-<u>sò</u>≠bòk-ò 2s-P1≠bark-CONT		*You barked.*
directional	na-	ʊ̀-sɔ̀-<u>nɔ̀</u>-ŋ-ɔ̀nd-ɛ̀n c1-P1-DIR-1sIO-buy-APPL	gìlà clothes	*S/he went to buy me clothes.*
		ù-sò-<u>nò</u>-ŋ-od-in-ìn c1-P1-DIR-1sIO-fill-CONT-APPL	gìgàd sack	*S/he went to fill me the sack.*

The high round vowels, /ʊ/ and /u/ are not dominant for rounding harmony, even when they are lowered in the context of a closed syllable. The vowel /a/ in the prefixes, therefore, is not rounded, see Example 192 below.

[145] Preceding /ɔ/, the infinitive prefix gʊ- and all preverbal markers with /ʊ/ are idiosyncratically realised in their [+ATR] form. The reason for this will be discussed in Chapter 4, Section 4.4.4.

Example 192: Non-dominant round vowels in Mmala

subject concord/	a-/	à-sà≠fɔ́l-à	*you sweep*
recent past	sa-	2s-P1≠sweep-FV	
		è-sè≠fúg-è	*you cover*
		2s-P1≠cover-FV	
subject concord/	bá-	bá-gà≠gɔ̀l	*they grind*
near future	ga-	c2-F2≠grind	
		bé-gè≠dúk-è	*they rest*
directional	na-	ʊ̀-mà-nà≠sʊg-à	*s/he went there to wash*
		c1-P4-DIR≠wash-FV	
		ù-mè-nè≠gùl-è	*s/he went to hoe*
		c1-P4-DIR≠hoe-FV	

2.7.3.1.3 Height harmony in prefixes

The open (non-high) vowels /ɛ/ and /ɔ/[146] are dominant for height harmony. Prefixes with a [-ATR] high vowel /ɪ/[147] have a lowered surface realisation where a height-dominant vowel is in the noun stem, as below in Example 193.

Example 193: Height harmony in Mmala noun-class prefixes

class	class prefix	example	*gloss*
4	ɪ(N)-	ɪ̀≠dìm	*hearts*
		ɪ̀≠ŋʊ́d	*machete handles*
		ɛ̀≠mɛ̀^{n}dɛ̀	*fences*
		ɛ̀m≠bɔ́g	*hands*
5	nɪ-	nɪ̀≠gʊ̀b	*salt*
		nɛ̀≠bɛ̀^{m}b	*edible frog*
		nɛ́≠gɔ̀^{n}dɔ̀	*plantain*
7	gɪ-	gɪ̀≠gʊ́^{n}d	*foot*
		gɪ̀≠sàs	*chest*
		gɛ̀≠dɔ̀ŋ	*village*
		gɛ̀≠sɛ̀g	*monkey*
8	bɪ-	bɪ̀≠gʊ̀^{n}d	*feet*
		bɪ̀≠sàs	*chests*
		bɛ̀≠dɔ̀ŋ	*villages*

[146] As will be seen in Chapter 4, the feature open is not sufficient to explain height harmony in Mmala. The vowel /a/, also an open vowel, does not generally participate in height harmony.

[147] The high back vowel /ʊ/ is lowered elsewhere, see section 2.7.3.2, but in the prefixes, only /ɪ/ is lowered. In this particular case, vowel-height harmony in Mmala is asymmetric.

class	class prefix	example	*gloss*
		bɛ̀≠sɛ̀g	*monkeys*
10	ɪN-	ìn≠tʃʊ̀m	*news*
		ɛ̀m≠bɔ̀ŋ	*toad sp.*
		ɛ̀m≠bɛ̀s	*cane rats*
19	ɪ-	**ɛ̀≠jɔ̀m**	*forest*
		ɛ̀≠lɛ̀mɛ̀	*vision, dream*

In nouns with **Cʊ**-prefixes and the infinitive prefix **gʊ-,** the prefix vowel /ʊ/ is lowered by height harmony only in the environment of the lowered form of /ʊ/ and not in the environment of the open front vowel /ɛ/. The open round vowel /ɔ/ takes an ATR-disharmonic /u/ in affixes which do not undergo height harmony at all, see Example 194.

Example 194: Failure of vowel-height harmony in *Cʊ-* NC prefixes

11	nʊ-	**nɔ̀≠bɔ̀g** (from gʊ̀bʊ̀gà)	*prophecy*
		nʊ̀≠mà^{n}dɛ̀	*wild cat*
		nʊ̀≠bɛ̀l^{j}à	*spring*
		nù≠bɔ̀mɔ́	*river, stream*
13	dʊ-	**dɔ̀≠bɔ̀g** (from gʊ̀bʊ̀gà)	*prophecies*
		dʊ̀≠mà^{n}dɛ̀	*wild cats*
		dʊ̀≠bɛ̀l^{j}à	*springs*
		dù≠bɔ̀mɔ́	*rivers, streams*
14	bʊ-	bʊ̀≠dîd	*tree*
		bù≠lɔ̀g	*meat*

In verbs, the infinitive prefix is optionally lowered when the root vowel is /ʊ/, as in Example 195. In these cases, even in open syllables, /ʊ/ in both the root and the prefix are lowered depending on the speaker[148]. In addition, all **Cʊ**-prefixes undergo an ATR disharmony when the [-ATR] open round vowel /ɔ/ is the root vowel; they surface as the [+ATR] /u/.

[148] The most robust height harmony takes place between the verb root and certain verb suffixes. This will be discussed in section 2.7.3.2.4 below.

Example 195: Variation of Mmala infinitive prefix

underlying /ʊ/ in root				**underlying /ɔ/ in root**	
gò≠sʊ̀g-à	~	gɔ̀≠sɔ̀g-à	*wash*	gù≠sɔ̀g-ɔ̀	*probe*
gò≠fʊ́l-à	~	gɔ̀≠fɔ́l-à	*sweep*	gù≠sɔ̀s-ɔ̀	*suck, smoke*
gò≠dɔ́m	~	gɔ̀≠dɔ́m	*send something*	gù≠dɔ́m	*eat first fruits*
gò≠gɔ́l	~	gɔ̀≠gɔ́l	*crush, grind*	gù≠gɔ́l	*take*

A height-dominant suffix, **-ɛn**, or a height-dominant root vowel such as /ɔ/ lowers certain types of verb prefixes. In Example 196, the height-dominant vowels are underlined, and the target vowels are bolded.

Example 196: Height harmony in Mmala prefixes

reflexive	bí-	ʊ̀-sà-b**ɛ́**≠d**ɔ́**g-<u>ɛ̀n</u>[149] c1-P1-REFL≠load-APPL	*S/he put her load on her head.*
negative	dɪ-	ǹ-d**ɛ̀**-mɔ́-gʷ≠<u>ɔ̀n</u>-ɔ̀[150] 1s-NEG-P0-2sIO-laugh-FV	*I am not laughing at you.*

2.7.3.2 Vowel harmony in suffixes

Most verb and deverbal noun suffixes are underlyingly [-ATR], but there are some that are [+ATR]. Discussed in turn below are suffixes that undergo ATR harmony, ATR dominant suffixes, rounding harmony, height harmony, and height dominant suffixes.

2.7.3.2.1 ATR harmony in suffixes

A [+ATR] dominant vowel, usually in the root, spreads bidirectionally. All [–ATR] vowels in the phonological word change to their [+ATR] counterparts. A few examples are shown in Example 197 below.

Example 197: ATR harmony of Mmala verbal suffixes

final vowel	-a	≠sìg-à	*insult*
		≠sìg-è	*saw*
intensive	-ɪg	≠máɲ-íg-àn	*govern, dominate*
		≠díl-íg-èn	*transport*
separative	-ʊn	-bí≠làŋ-ʊ̀n-à	*undress (s.o.)-CONT*
		≠òl-ùn-ìn	*unwrap-for s.o.*
continuous	-an	≠dʊ̀ᵐb-àn	*flow*
		≠tùl-èn	*dull*

[149] The applicative suffix **-ɛn** has a height-dominant vowel. This is discussed more fully in the sections 2.7.3.2 below.

[150] The P0 pre-stem marker is underlyingly **má-**, it is rounded due to a round vowel in the verb root.

applicative	-ɪn	≠fʷág-ɛ̀n	*build-APPL*
		≠gúf-ìn	*work (field)-APPL*
diminutive	-ɪd	≠dáᵐb-ɛ̀d	*trap-DIM*
		≠dím-ìd	*dig-DIM*

2.7.3.2.2 ATR-dominant suffixes.

The [+ATR] causative **-i** is dominant. While ATR harmony is generally bidirectional, the causative suffix is at the right edge of the word and, as a result, ATR harmony can only spread to the left. The ATR-dominant vowel is underlined in Example 198 below:

Example 198: ATR Dominant causative extension -i in Mmala

causative	-i	≠dín-ìd	*run*	≠dín-ìd-ì̲	*make run, frighten*
		≠dád-ɛ̀d	*sing*	≠déd-ìd-ì̲	*cause to sing*

The [+ATR] agentive suffix **-i**, like the causative suffix on verbs, is dominant. While ATR harmony is generally bidirectional, the agentive suffix is at the right edge of the word, so that ATR spreads only right-to-left. In Example 199 the ATR-dominant suffix is underlined.

Example 199: ATR-Dominant agentive suffix -i in deverbal nouns

gɔ̀≠nɔ̀g-à	*weave*	è≠nùg-ì̲	*weaver*
gɔ̀≠éb	*steal*	èŋ≠éb-ì̲	*robber*
gɔ̀≠fáf-à	*watch*	é≠féf-ì̲	*spy*

2.7.3.2.3 Rounding harmony in suffixes

Most verb extensions and inflectional suffixes with an /a/ have a round surface realisation co-occurring with ATR harmony. Like ATR harmony, rounding harmony is bidirectional. Only open round vowels are dominant for rounding harmony; high round vowels are not dominant for rounding harmony but are transparent. Any subsequent suffixes will be rounded, as shown in Example 200 below:

Example 200: Rounding harmony in Mmala verbal suffixes

separative	-ʊn	≠ǎd-ʊ́n-à	*settle a dispute*
		≠làŋ-ʊ̀n-à	*weed (v)*
	-ʊm	≠ěl-úm-è	*breathe*
continuous	-an	≠sɔ́s-**ɔ̀**n	*smoke (v)*
		≠f^{w}òg-**ò**n	*cool (v)*
		≠dʊ̀mb-àn	*flow (v)*
		≠tùl-èn	*dull (v)*

2.7.3.2.4 Height harmony in suffixes

Verb extensions and suffixes with a [-ATR] open vowel, /ɛ/ or /ɔ/, are height dominant. Height harmony spreads bidirectionally between root and affixes and between suffix and root. In Example 201 below, the detranstiviser suffix **-ɪg** (bolded) is lowered by a height-dominant root vowel, /ɛ/ or /ɔ/ (underlined).

Example 201: Height harmony spread left to right in Mmala

detransitive	-ɪg	≠mà^{n}d-à	*heap up (TR)*	≠mà^{n}d-ìg-àn	*heap up (INTR)*
		≠à^{m}b-àn	*dry (TR)*	≠à^{m}b-ìg-àn	*dry (INTR)*
		≠sɛ̀ŋ-àn	*spoil (TR)*	≠sɛ̀ŋ-**ɛ̀**g-àn	*spoil (INTR)*
		≠gɔ́s-àn	*heap (TR)*	≠gɔ́s-**ɛ̀**g-àn	*heap (INTR)*

2.7.3.2.5 Height-dominant suffixes

Certain suffixes, in particular the diminutive suffix **-ɛd**, and the applicative suffix **-ɛn** (underlined) are dominant and will lower a [-ATR] high vowel in the root. All [-ATR] high vowels (bolded) will lower until blocked by the low vowel /a/, which is opaque to height harmony, see Example 202. No clear cases of the [-ATR] open round vowel [ɔ] in the verb extensions lowering [-ATR] high vowels have been found in the data.

Example 202: Height-dominant suffixes in Mmala

DIM	ʊ̀-sà≠sɪ̀g-à	*c1-P1-insult*	ʊ̀-sà≠s**ɛ̀**g-ɛ̀d	*c1-P1≠insult*
	ʊ̀-sà≠fʊ̀l-à	*c1-P1-sweep*	ʊ̀-sà≠f**ɔ̀**l-ɛ̀d	*c1-P1≠sweep*
APPL	ʊ̀-sà≠bʊ́g-à	*c1-P1-divine*	ʊ̀-sà-m≠b**ɔ́**g-ɛ̂n	*c1-P1-1sIO≠divine*
	ʊ̀-sà≠nʊ̀g-à	*c1-P1-braid*	ʊ̀-sà-d**ɛ́**≠n**ɔ̀**g-ɛ̀n	*c1-P1-1pIO≠braid*

2.7.3.2.6 Suffixes in deverbal nouns

Deverbal noun suffixes, either carried over from the verb form or used to derive the noun, will lower [-ATR] high vowels. The applicative suffix **-ɛn** (underlined) lowers the [-ATR] high vowels (bolded) in deverbal nouns, see Example 203.

Example 203: Lowering of root vowels by /-ɛn/ in deverbal nouns

gò≠fól-à	*sweep*	gɛ̀≠fɔ́l-ɛ̀n	*broom*
gò≠mìn-à	*swallow*	nɛ̀≠mɛ̀n-ɛ̀n	*œsophagus*

2.7.4 Hiatus-resolution processes

There are several hiatus-resolution processes found in Mmala. Glide formation (section 2.7.4.1), hiatus retention (section 2.7.4.2) and semivowel insertion (section 2.7.4.3) are lexical processes. Vowel elision (section 2.7.4.4) is a postlexical process.

2.7.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted. Where V_1V_2 sequences occur, a high vowel in V_1 position becomes a glide. Glide formation occurs principally between a high vowel in the noun-class prefix and a vowel-initial noun root, as seen in Example 204 below:

Example 204: Prefix-root glide formation in Mmala

surface form	**underlying form**	***gloss***
b^{w}ìlò	bò≠ìlò	*large black monkey sp.*
b^{w}ěg̊	bò≠ég	*porcupine*
n^{w}ɔ̀^{n}dɛ̀	nò≠ɔ̀^{n}dɛ̀	*frog sp.*
n^{w}òlì	nò≠òlì	*string*
g^{j}ǒ^{m}b	gì≠ó^{m}b	*weeding stick*
g^{w}ěb	gò≠éb	*steal*
g^{w}ɛ̌l	gò≠ɛ́l	*ripen*

Glide formation also occurs between a CV verb root and a –VC verbal suffix, as in Example 205, below.

Example 205: CV verb roots with –VC extension(s) in Mmala

surface form	**underlying form**	***gloss***
gùdú	gù≠dú	*sell*
gùd^{w}énèn	gù≠dú-èn-èn[151]	*sell (CONT)*
gùd^{w}énìn	gù≠dú-èn-ìn	*sell (CONT/APPL)*

2.7.4.2 Hiatus retention

Juxtaposed vowels, which are identical, either underlyingly or due to ATR, rounding or height harmony, are permitted. This is particularly evident between the noun-class prefix and the noun root. In Example 206(a), the prefix vowel and the root vowel are identical due to ATR harmony; in Example 206(b), the prefix vowel and the root

[151] When a high vowel with a high tone desyllabifies, the H tone spreads right to the next available vowel. In the cases illustrated here, the following vowel is in a verbal suffix which is considered to be underlyingly toneless.

vowel are identical due to rounding harmony, and in Example 206(c), the prefix vowel and root vowel are the same due to height harmony.

Example 206: Prefix-root hiatus retention in Mmala

	surface form	**underlying form**	***gloss***
a)	nìís	nì≠ís	*eye*
	gììnd	gì≠ìnd	*garbage dump*
	gùúl	gʊ̀≠úl	*come*
	mèég	mà≠ég	*porcupines*
	mààɲɛ̀	mà≠àɲɛ̀	*fetishes*
b)	mɔ̀ɔ́n	mà≠ɔ́n	*baby*
	ɔ̀ɔ̀ɲ	à≠ɔ̀ɲ	*sun*
	òól	à≠ól	*moon*
c)	gɛ̀ɛ̀ɲ	gì≠ɛ̀ɲ	*hill*
	gɛ̀ɛ̀ᶬf	gì≠ɛ̀ᶬf	*hide (animal)*
	gɔ̀ɔ̀ŋɔ̀	gʊ̀≠ɔ̀ŋ-ɔ̀	*attach, sew*

In addition, hiatus is retained between a CV verb root and a –VC verbal suffix where the vowels are either underlyingly identical or have identical surface realisations, see Example 207, below.

Example 207: Root-suffix hiatus retention in Mmala

surface form	underlying form	*gloss*
gùdúún	gʊ̀≠dú-ʊn	*sell (APPL)*
gùfùùg	gʊ̀≠fù-ʊg	*close*

2.7.4.3 Semivowel insertion

In a word-initial V_1V_2 sequence, a semivowel is inserted to break up the illegal vowel sequence. The choice of the semivowel is contingent on whether the V_1 is a front or a round vowel; see Example 208 for nouns and Example 209 for verbs:

Example 208: Semivowel between noun-class prefix and noun root

c3 noun	**c4 noun**	***gloss***
ɔ̀≠ɔ́n	ɛ̀j≠ɔ́n	*machete, cutlass*
ò≠ól	ìj≠ól	*moon, month*
à≠áⁿd	ìj≠áⁿd	*shaft (of spear)*

In preverbal elements also, a semivowel is inserted between V_1V_2 sequences to break up the vowel sequence. In the examples below, the subject marker **ɪ-** *first person singular* and **ʊ-** *third person singular* and the distant-past tense marker **a-** occur in juxtaposition. A semivowel is inserted between them to break up the illegal sequence.

Example 209: Semivowel insertion in inflected verbs in Mmala

verb	*gloss*	1s-P4≠verb stem	c1/3s-P4≠verb stem
gù≠fùg-èn	*close*	ìj-è≠fùg-èn	ùw-è≠fùg-èn
gò̀≠làf-à	*tear*	ìj-à≠làf-à	ò̀w-à≠làf-à
gʷ≠òd	*pour*	ìj-ò≠òd	ùw-ò≠òd
gʷ≠ɔ̆n-ɔ̀	*kill*	ìj-ɔ̀≠ɔ́n-ɔ̀	ò̀w-ɔ̀≠ɔ́n-ɔ̀

2.7.4.4 Vowel elision

In non-utterance-initial position, illegal V_1V_2 sequences which occur across morpheme boundaries and which do not include a high vowel in V_1 position will undergo elision. If both vowels are non-high, the first vowel will elide (as in Example 210(a)). In the case of a CV verb root with the diminutive suffix, **–ɪd**, it is the high suffix vowel (V_2) which elides, not the root vowel, in Example 210(b) below. Elided vowels are underlined.

Example 210: Vowel elision in Mmala CV verb roots w/ –VC extension

	base form	U.F.	S.F.	*gloss*
(a)	gò̀≠fá	gò̀≠f<u>á</u>-ɛ̀n	gò̀fɛ́n	*give (APPL)*
	gò̀≠dá	gò̀≠d<u>á</u>-ɛ̀n	gò̀dɛ́n	*shell (APPL)*
(b)	gò̀-bí≠sɔ́	gò̀-bí≠sɔ́-<u>ì</u>d-ìd	gò̀bísɔ́dɛ̀d	*spiritually protect self (DIM)*
	gò̀≠fá	gò̀≠fá-<u>ì</u>d-ìd	gò̀fádìd	*give (DIM)*

2.7.5 Tone

Mmala has a two-tone system underlyingly, high and low. Rising tones and falling tones which occur on short syllables are due to glide formation from syllable mergers. There is a slight lengthening of the vowel due to glide formation in Mmala.

In addition, tone melodies undergo a loss of contrast in utterance-final position in connection with vowel devoicing or elision. Noun-melody adaptations and the associated V_2 devoicing/elision is discussed in Section 2.7.2.2 above. Surface tone is marked on the data in this study.

2.7.5.1 Tone melodies on nouns

High and low tone contrast in monosyllabic noun roots. In CV and CVC noun roots, only two tone melodies are attested. In CVCV noun roots, four tone melodies are attested, see Example 211 below. Noun prefixes usually have a low tone, although there are a few exceptions.

Example 211: Mmala nominal tone melodies

gɛ̀≠sɔ̀	≠L	*drizzle*
gɛ̀≠sɔ́	≠H	*pond*
gì≠sàs	≠L	*chest*
gì≠sás	≠H	*carp sp.*
nì≠bànà	≠L	*footstep*
gì≠fàná	≠LH	*hoof*
nì≠bánà	≠HL	*udders, breasts*
gì≠ᵐbádá	≠H	*bottom*

2.7.5.2 Tone melodies on verbs

Mmala verb roots have three possible underlying tone melodies: L, HL and H. In verb stems with a H melody, the H spreads one syllable to the right. The exception is with the final vowel or the continuous suffix **-a,** to which H does not spread. It is assumed that verbal suffixes are underlyingly toneless, and the verb melody maps onto the entire verb stem. The three verbal tone melodies are illustrated in Example 212 below, showing both the H spread on verb suffixes as well as the failure of H spread onto the final vowel.

Example 212: Mmala verbal tone melodies

L	gò≠bàŋ-à	L ≠L- L	*cry*
	gò≠bàŋ-ìd-ìd	L ≠L- L -L	*cry (a little)*
HL	gò-gás-à	L ≠H –L	*pick (fruit)*
	gò-gás-ìd-ìd	L ≠H –L –L	*pick (a little)*
H	gò≠dád-à	L ≠H –L	*crow (rooster)*
	gò≠dád-íd-ìd	L ≠H –H –L	*crow (a little)*

In addition to providing lexical contrast, tone also has a grammatical function. Among other things, tone provides the crucial difference between various tenses in verb conjugations. This is, however, beyond the scope of this study.

2.8 Yangben phonological overview

Yangben[152] is spoken in three villages of the Yangben Canton, Yangben village, Omende and Batanga. While there are slight differences in the speech of individuals

[152] The language is known by various names. The local populations refer to their language as the speech of ___ village; or Nukalɔŋɛ: speech of Kalɔŋ (Yangben) village; Numende: speech of Omende village; and Nutaŋa: speech of Batanga village. They have recently given a more inclusive name to the speech varieties of these three villages: Nuasuɛ: “our language”. In the literature however, it is either known as Yangben or Kalɔŋ (Nukalɔŋɛ).

from the three villages, these differences are too slight to be considered as dialectal differences[153].

2.8.1 Consonants

This section discusses the consonant inventory of Yangben (section 2.8.1.1), the various adaptations to it due to allomorphic realisations (section 2.8.1.2), distribution restrictions (section 2.8.1.3) and final-vowel devoicing (section 2.8.1.4).

2.8.1.1 Consonant inventory

The consonant system of Yangben consists of 18 contrastive consonants, of which two, /h/ and /ᵑg/, are found only in borrowed words and in certain ideophones.

Table 38: Yangben contrastive consonants

		labial	alveolar	palatal	velar
stops	voiceless	p	t		k
	prenasalised	ᵐb	ⁿd		(ᵑg)
fricatives	voiceless	f	s		(h)
	prenasalised	ᶬf	ⁿs		
resonants	nasal	m	n	ɲ	ŋ
	oral		l	j	w

2.8.1.2 Allophonic and allomorphic realisations

Voiceless labial stops become voiced when immediately following a nasal. This is illustrated by the variation of the root-initial consonants in Example 213 below.

Example 213: Voicing of voiceless labial stops following a nasal

kù≠pàŋ-à	*cry, weep (v)*	àm≠bàŋ-ɔ́	*c3.crying*
ì≠pʷà-pʷà	*c19.puppy*	m̀≠bʷà	*c9.dog*
nì≠pàná	*c5.foot (sg)*	àm≠bàná	*c6a.feet (pl)*
		m̀≠bàl-pál-ɛ̀	*c9.pain*

153 The Yangben database includes approximately 2,000 terms (based on a 1,700-word list produced by SIL Africa Area). It was begun by Rebecca Prittie, a linguistic intern in Cameroon in 2001. The Prittie database also included terms from Elip and two dialects of Mmala. The present author picked up where she left off and checked, corrected, and enlarged the database. In addition, Swadesh 200-word lists were collected in the villages of Omende and Batanga for comparison with the larger Yangben (Kalɔŋ) village database.
Also consulted was another database organised by Hinke Leijenhorst. This database consists of approximately 3,500 terms compiled in the reference dialect and being edited by a committee of Yangben speakers from all three villages. It includes much of the information found in the first database, but the entries, currently, are written orthographically. The Yangben orthography underdifferentiates the vowel system, writing only seven rather than all nine contrastive vowels. For this reason, it is of less use in this present study.

Where a nasal prefix is in juxtaposition with the velar stop, a homorganic nasal (N), and the /k/ merge to become [ŋ]. This is illustrated by comparing the variation of the root-initial consonants in Example 214 below.

Example 214: Velar-consonant variation following a nasal in Yangben

word	***gloss***	**UF**	**SF**	***gloss***
pù≠kòlí	*c14.vine (specific)*	àN≠kòlí	òŋòlí	*c3.vine (generic)*
pù≠kìlí	*c14.path (type)*	N≠kìlí	ŋìlí	*c9.path*
kù≠kèt-ì	*measure, weigh (v)*	N≠kèt-ì-è	ŋètʲè[154]	*c9.measure, plan*
nɔ̀≠kál	*c11.language, speech*	N≠kál	ŋál	*c9.argument, dispute*

2.8.1.3 Restrictions in consonant distribution

Yangben has both open and closed syllables; CV, CVC, V, and VC. All consonants except for /ᵑg/, /h/ and /w/ are found in syllable-final position. Consonant-glide sequences, especially when they occur at morpheme boundaries, are formed by the desyllabification of a high vowel (discussed in section 2.8.4.1 below).

2.8.1.4 Final-consonant devoicing

Prenasalised obstruents are devoiced in word-final position, with the exception of /ᵑg/ which is not found in syllable-final position, see Example 215, below.

Example 215: Final-consonant devoicing in Yangben

/ᵐb/→[ᵐb̥]	kì≠sɔ́ᵐb	[kìsɔ́ᵐb̥]	*row for planting*
/ⁿd/→[ⁿd̥]	kì≠kɔ́ⁿd	[kìkɔ́ⁿd̥]	*foot*

2.8.2 Vowels

This section discusses the vowel inventory of Yangben (section 2.8.2.1), the various adaptations to it due to allophonic realisations such as utterance-final devoicing/elision (section 2.8.2.2), vowel co-occurrences, including co-occurrence restrictions (section 2.8.2.3).

2.8.2.1 Vowel inventory

Yangben has an inventory of nine contrastive short and long vowels. Long vowels occur only in the first syllable of noun or verb roots. A complex system of vowel harmony regulates the co-occurrences and co-occurrence restrictions of the vowels. The vowels can be divided into two sets which are mutually exclusive within roots and stems:

[154] Deverbal nouns often take an additional suffix **-a**, see Example 240 in Section 2.8.4.1 below.

Table 39: Yangben contrastive vowels

[-ATR]							[+ATR]			
ɪ	ɪ:			ʊ	ʊ:	i	i:		u	u:
ɛ	ɛ:			ɔ	ɔ:	e	e:		o	o:
		a	a:							

In the verb system, all nine contrastive short and long vowels are attested in the verb root in open syllables. There is, however, surface neutralisation of /ɛ/ - /ɪ/ and /ɔ/ - /ʊ/ in comparable closed syllables. This neutralisation of contrast is most clearly seen in comparing verbs with and without the continuous suffix **-a** or **-an**, as shown below. The changes in the affixes are described below in section 2.8.3.

Example 216: Contrastive vowels in Yangben CVC verb stems

	inf≠verb-affix	**inf≠verb root**	***gloss***
/i/	kù≠tím-è	kù≠tìm	*dig*
/i:/	kù≠tí:n-è	kù≠tî:n	*flee in fear*
/ɪ/	kʊ̀≠jɪ̀k-à	kʊ̀≠jɛ̀k	*rot*
/ɪ:/	kʊ́≠jɪ́:l-à	kʊ̀≠jɛ̂:l	*(be) slimy (food)*
/e/	kù≠sèl-èn	kù≠sèl	*descend*
/e:/	kù-té:ɲ-ì	kù≠tê:n	*(make) drip*
/ɛ/	kʊ̀≠fɛ̀k-ɛ̀	kʊ̀≠fɛ̀k	*measure*
/ɛ:/	kʊ̀≠nɛ̀:n-ɛ̀n	kʊ̀≠nɛ̀:n	*abandon, let fall*
/a/	kʊ̀≠fát-à	kʊ̀≠fàt	*husk (corn); shell*
/a:/	kʊ̀≠fá:t-à	kʊ̀≠fâ:t	*carve, sharpen*
/u/	kù≠tùn-è	kù≠tùn	*back up (rear first)*
/u:/	kù≠tú:n-è	kù≠tû:n	*crush*
/ʊ/	kʊ̀≠kʊ́t-à	kʊ̀≠kɔ̀t	*fasten, bind*
/ʊ:/	kʊ̀≠pʊ́:k-à	kʊ̀≠pɔ̂:k	*cook meat (wrapped in leaves)*
/o/	kù-pí≠kóf-ò	kù-pí≠kòf	*devour*
/o:/	kù≠fó:k-òn	kù≠fô:k	*advance, go ahead*
/ɔ/	kʊ̀≠sɔ́k-ɔ̀	kʊ̀≠sɔ̀k	*extract*
/ɔ:/	kʊ̀≠sɔ́:k-ɔ̀	kʊ̀≠sɔ̂:k	*grow (of plants)*

In the noun system, however, only seven contrastive long and short vowels (excluding ɪ, ɪ: ʊ or ʊ:) are found in monomorphemic CV_1CV_1 roots, as in Example 217 below.

Example 217: Permitted vowels in Yangben CV_1CV_1 noun roots

[i]	è≠ŋìní	*chicken flea*	[u]	è≠súpù	*palm-nut pulp*
[iː]	kì≠píːpì	*pus*	[uː]	è≠túːtúk	*broom*
[e]	kì≠tèŋé	*water hole*	[o]	kì≠fòŋó	*bottomless pit*
[eː]	ì≠téːnè	*son-in-law*	[oː]	kí≠wóːɲò	*connective tissue*
[ɛ]	mɛ̀≠pɛ́nɛ̀	*milk*	[ɔ]	ì≠kɔ́tɔ́	*pipe*
[ɛː]	kì≠sɛ́ːpɛ̀n	*melon, squash*	[ɔː]	kì≠tɔ́ːkɔ̀	*wound*
[a]	kì≠kànà	*charcoal, embers*			
[aː]	kì≠ɲáːŋà	*grass sp.*			

2.8.2.2 Vowel devoicing/elision utterance finally

The four high vowels, /i/, /ɪ/, /u/ and /ʊ/, are susceptible to devoicing or elision in utterance-final position. This is the same position where prenasalised obstruents are also devoiced. Devoicing/deletion of these four vowels is interdependent with the utterance-final loss of contrast in the tone melody, as shown below. Only nouns with a L≠L.H tone melody do not undergo devoicing of the susceptible high vowels. Table 40 below summarises the vowel devoicing/elision patterns and the ≠CVCV tone melody of the noun. (L) indicates that the vowel may either be devoiced (in which case the tone is low) or elided (in which case the low tone is also elided).

Table 40: Yangben noun melodies and utterance-final vowel devoicing

underlying tone	non-final	utterance-final	vowel devoicing
L≠H	L≠H.H	H≠↓H.(L)	Yes
L≠HL	L≠H.L	L≠H.(L)	Yes
L≠LH	L≠L.H	L≠L.H	No
L≠L	L≠L.L	L≠L.(L)	Yes

The Example 218 below illustrates the devoicing/elision of the susceptible vowels in utterance-final position.

Example 218: Final-vowel devoicing in Yangben

	underlying forms		final	non-final	*gloss*
/i/	kì≠tólí	H	[kí↓tól]~[kí↓tólḭ̥]	[kìtólí]	*ant*
	kì≠tòlí	LH	[kìtòlí]	[kìtòlí]	*musical form*
/ɪ/	kʲ≠àⁿsì	L	[kʲàⁿs]~[kʲàⁿsɪ̥̀]	[kʲàⁿsì]	*house*
	kʲ≠ǎⁿsì	HL	[kʲǎⁿs]~[kʲǎⁿsɪ̥̀]	[kʲǎⁿsì]	*mutter, growl*
	kʲ≠àⁿsí	LH	[kʲàⁿsí]	[kʲàⁿsí]	*challenge*

	underlying forms		final	non-final	*gloss*
/u/	kì≠tékù	HL	[kìték]~[kìtékù̥]	[kìtékù]	*navel*
	è≠mèkú	LH	[èmèkú]	[èmèkú]	*muscle, flesh*
/ʊ/	à≠káːⁿdʊ̀	HL	[àkáːⁿd]~[àkáːⁿdʊ̥̀]	[àkáːⁿdʊ̀]	*woman*
	kì≠tɛ̀kʊ́	LH	[kìtɛ̀kʊ́]	[kìtɛ̀kʊ́]	*gift of forgiveness*

The non-high vowels are not devoiced in utterance-final position. Example 219 below shows that the non-devoicing vowels may occur in tone-melody patterns that normally trigger devoicing/elision of utterance-final vowels.

Example 219: Non-devoicing vowels in Yangben

	underlying forms		final	non-final	*gloss*
/ɛ/	kì≠tɛ̀lɛ̀	L	[kìtɛ̀lɛ̀]	[kìtɛ̀lɛ̀]	*palm bamboo*
/ɔ/	ì≠kɔ́tɔ́	H	[ìkɔ́tɔ́]	[ìkɔ́tɔ́]	*pipe*
/a/	à≠sànà	L	[àsànà]	[àsànà]	*shrimp*
/e/	kì≠kújè	HL	[kìkújè]	[kìkújè]	*plant, sp.*
/o/	ì≠tópò	HL	[ìtópò]	[ìtópò]	*flank (body)*

2.8.2.3 Vowel co-occurrences

Several factors govern the co-occurrences of vowels in CVCV nouns. These factors include 1) three types of vowel harmony (ATR, rounding and fronting) and 2) restrictions on V_2, depending on the features of V_1 to either a front, round or open (non-high) vowel. Each of these vowel co-occurrence restrictions will be discussed in turn below. In addition, long vowels only occur in V_1 position.

2.8.2.3.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ is always [-ATR] and is never found in a [+ATR] environment. In Example 220 below, all ATR vowel co-occurrences in CVCV noun roots found in the corpus are shown. Those gaps that are due to either fronting or rounding harmony are indicated as such. As there are fewer long vowels found, some combinations are unattested. These gaps (in shaded cells below) may be accidental. Gaps in unshaded boxes are not considered accidental and are addressed in the sections following.

Example 220: ATR vowel co-occurrences in Yangben CVCV noun roots

[-ATR] vowels			[+ATR] vowels		
ɪ-ɛ	ǹ≠sìnɛ́	*worm*	i-i	nì≠kìlí	*ritual place*
ɪ-ʊ	---	---	i-u	kì≠íkú	*sweat*
ɪ-a	m̀≠bíkà	*complaint*	i-e	kì≠pìɲé	*termite trap*
ɪ-ɔ	kì≠ᵐbìlɔ̀	*tadpole*	i-o	---	---

[-ATR] vowels			**[+ATR] vowels**		
ɪː-ɛ	nì≠pìːᵐbʲɛ̀	*goliath frog*	iː-i	kì≠píːpì	*pus*
ɪː-ʊ	---	---	iː-u	---	---
ɪː-a	---	---	iː-e	èm≠fíːɲé	*termite sp.*
ɪː-ɔ	ɔ̀≠síːⁿdʲɔ̀	*leech*	iː-o	---	---
ɛ-ɛ	kì≠sɛ̀kɛ̀	*sandy earth*	e-i	kì≠kèɲí	*clam*
ɛ-ʊ	ɛ̀≠tɛ̀nʊ́	*shame*	e-u	è≠mèkú	*flesh*
ɛ-a	---	---*(fronting)*	e-e	kì≠tèŋé	*waterhole*
ɛ-ɔ	---	---	e-o	---	---
ɛː-ɛ	kì≠pɛ́ːsɛ̀	*twins*	eː-i	è≠lèːⁿdí	*s.o. who smooths*
ɛː-ʊ	---	---	eː-u	---	---
ɛː-a	---	---*(fronting)*	eː-e	ì≠téːnè	*son-in-law*
ɛː-ɔ	---	---	eː-o	---	---
ʊ-ɛ	m̀≠bʊ̀ŋɛ̀	*manioc*	u-i	ì≠mùⁿdí	*gizzard*
ʊ-ʊ	---	---	u-u	è≠súpù	*palm-nut pulp*
ʊ-a	ì≠kʊ́pà	*loincloth*	u-e	kì≠kújè	*plant sp., fan*
ʊ-ɔ	ì≠sʊ̀ⁿdɔ́	*gazelle*	u-o	---	---
ʊː-ɛ	kì≠tʊ́ːᵐbɛ̀	*sheep*	uː-i	è≠túːsì	*merchant*
ʊː-ʊ	---	---	uː-u	è≠túːtúk	*broom*
ʊː-a	---	---	uː-e	kì≠lǔːmè	*story, tale*
ʊː-ɔ	---	---	uː-o	---	---
ɔ-ɪ	pɔ̀≠kɔ̀ŋí	*cherry tree*	o-i	ì≠nòní	*bird*
ɔ-ʊ	---	---	o-u	---	---
ɔ-a	---	--*(rounding)*	o-e	pò≠tʲǒŋé	*yam sp.*
ɔ-ɔ	ì≠kɔ́tɔ́	*pipe*	o-o	ì≠tópò	*side (of body)*
ɔː-ɪ	---	---	oː-i	jǒːtí	*mother*
ɔː-ʊ	---	---	oː-u	---	---
ɔː-a	---	--*(rounding)*	oː-e	nú≠kǒːŋé	*grass sp.*
ɔː-ɔ	kì≠tɔ́ːkɔ̀	*wound*	oː-o	kì≠kóːkó	*bone*
a-ɪ	kì≠kákì	*crust, scab*			
a-ʊ	àn≠sàmʊ́	*fruit*			
a-a	kì≠kànà	*charcoal*			
aː-ɪ	à≠wàːkì	*chimpanzee*			
aː-ʊ	à≠káːⁿdʊ̀	*woman*			
aː-a	kì≠ɲáːŋà	*grass sp.*			

2.8.2.3.2 Fronting and rounding-harmony restrictions

Fronting and rounding harmony preclude /a/ in V_2 position following the open vowels /ɛ/ and /ɔ/. In polymorphemic contexts, the low vowel /a/ is rounded to /o/ in [+ATR] words, or /ɔ/ in [-ATR] words, where an open round vowel is in the root and is fronted to /e/ in [+ATR] words, or /ɛ/ in [-ATR] words where a open front vowel is in the root. As the [+ATR] counterpart of /a/ is /e/[155], and thus already a front vowel, fronting harmony is neutralised in [+ATR] words. Vowel-harmony processes are discussed below in Section 2.8.3.

2.8.2.3.3 Other V_2 co-occurrence restrictions

In CVCV noun roots, V_2 is either high, round or open (non-high)[156]. High [-ATR] vowels in V_1 position do not co-occur with high vowels in V_2 position. In such cases, /ɪ/ and /ʊ/ in V_2 position lower to /ɛ/ and /ɔ/. /ɪ/ will also lower to /ɛ/ following /ɛ/ in V_1 position and /ʊ/ will lower to /ɔ/ following /ɔ/ in V_1 position. This co-occurrence restriction explains the gaps **CɪCɪ** and **CʊCʊ** in CVCV noun roots, which surface as **CɪCɛ** and **CʊCɔ**. Likewise, **CɪCʊ** surfaces as **CɪCɔ** and **CʊCɪ** surfaces as **CʊCɛ**. The open vowel is either [a] in [-ATR] roots or [e] in [+ATR] roots, see Table 41 below.

Table 41: Value of V_2 in Yangben CVCV noun roots

V_2 in CVCV noun roots	[-ATR]	[+ATR]
High	ɪ or ɛ	i
Round	ʊ or ɔ	u or o
Open	a	e

In [-ATR] noun roots, the open vowels /ɛ/ and /ɔ/ in V_1 position trigger fronting or rounding harmony respectively, targeting /a/ in V_2 position. As a result, C**ɛCa** is realised as **CɛCɛ**, and **CɔCa** is realised as **CɔCɔ**. We therefore find the following possibilities:

[155] It is assumed that the [+ATR] counterpart of /a/ was originally /ə/, but in the language as it is spoken today, this vowel is acoustically a front vowel. It is assumed that a merger between /e/ and /ə/ has occurred sometime in the past since /e/ is currently the [+ATR] counterpart of both /ɛ/ and /a/.

[156] This is similar to what Hyman (2002) found in Gunu, a related language.

Table 42: Surface CV_1CV_2 combinations permitted in Yangben

$V_1 \backslash V_2$:	high	round	open
/i/	i-i	i-u	i-e
/ɪ/	ɪ-ɛ	ɪ-ɔ	ɪ-a
/e/	e-i	e-u	e-e
/ɛ/	ɛ-ɛ	ɛ-ʊ	---[157]
/u/	u-i	u-u	u-e
/ʊ/	ʊ-ɛ	ʊ-ɔ	ʊ-a
/o/	o-i	o-o	o-e
/ɔ/	ɔ-ɪ	ɔ-ɔ	---[158]
/a/	a-ɪ	a-ʊ	a-a

2.8.2.3.4 Distributional restrictions of long vowels

Long vowels are more restricted in their distribution than short vowels. Long vowels are found only in the first syllable of a root, and not all CV:CV combinations possible are attested. Table 43 below shows the CV:CV combinations found in the corpus.

Table 43: Surface $CV{:}_1CV_2$ combinations permitted in Yangben

V_1V_2	high	round	open
/i:/	i:-i	---	i:-e
/ɪ:/	ɪ:-ɛ	ɪ:-ɔ	---
/e:/	e:-i	---	e:-e
/ɛ:/	ɛ:-ɛ	---	---
/u:/	u:-i	u:-u	u:-e
/ʊ:/	ʊ:-ɛ	---	---
/o:/	o:-i	o:-o	o:-e
/ɔ/:	---	ɔ:-ɔ	---
/a:/	a:-ɪ	a:-ʊ	a:-a

The following table shows the permitted CVCV combinations with both fronting and rounding harmony and lowering of high vowels after a high V_1. Not all the examples come from monomorphemic noun roots. In some examples, the surface representation of the underlying CVCV form is best illustrated by a deverbal noun (italicised). In these circumstances, the verbal form is given in the gloss. Not all possible combinations have been found, and some are thus hypothetical. A dagger (†) marks the unattested CV_1CV_2 surface forms in Table 44 below.

[157] Precluded due to front harmony, realised as /ɛ-ɛ/.
[158] Precluded due to round harmony, realised as /ɔ-ɔ/.

Table 44: Permitted combinations for Yangben [-ATR] vowels

underlying CV_1CV_2	**S.F.**	**example**	***gloss***
ɪ-ɪ→ɪ-ɛ	ɪ-ɛ	*n≠sɪ̀k-ɛ́*	*insult (n) (from kʊ̀sɪ̀kàn to insult)*
ɪ-a	ɪ-a	m̀≠bíkà	*complaint (n)*
ɪ-ʊ→ ɪ-ɔ	ɪ-ɔ	kì≠ᵐbìlɔ̀	*tadpole*
ɪ:-ɪ→ɪ:-ɛ	ɪ:-ɛ	nì≠pì:ᵐbʲɛ̀	*goliath frog*
ɪ:-a	†ɪ:-a	---	---
ɪ:-ʊ→ ɪ-ɔ	ɪ-ɔ	ɔ̀≠sí:ⁿdʲɔ	*leech*
ɛ-ɪ→ ɛ-ɛ	ɛ-ɛ	kì≠sìkɛ̀l	*season, time*
ɛ-a→ɛ-ɛ		kì≠sɛ̀kɛ̀	*sandy earth*
ɛ-ʊ	ɛ-ʊ	*kì≠tɛ̀k-ʊ́*	*gift (from kʊ̀tɛ̀k to pardon)*
ɛ:-ɪ→ɛ:-ɛ	ɛ:-ɛ	---	*--- (lowering of high V_2)*
ɛ:-a→ɛ:-ɛ		kì≠pɛ́:sɛ̀	*twins*[159]
ɛ:-ʊ	†ɛ:-ʊ	---	---
ʊ-ɪ→ʊ-ɛ	ʊ-ɛ	m̀≠bʊ̀ŋɛ̀	*manioc*
ʊ-a	ʊ-a	ì≠kʊ́pà	*loin cloth*
ʊ-ʊ→ʊ-ɔ	ʊ-ɔ	*kì≠fʊ̀n-ɔ̀*	*sacrifice (from kʊ̀fʊ̀nà to sacrifice)*
ʊ:-ɪ→ʊ:-ɛ	ʊ:-ɛ	kì≠tʊ́:ᵐbɛ̀	*sheep*
ʊ:-a	†ʊ:-a	---	---
ʊ:-ʊ→ʊ:-ɔ	†ʊ:-ɔ	---	*--- (lowering of high V_2)*
ɔ-ɪ	ɔ-ɪ	pɔ̀≠kɔ̀ŋí	*cherry tree*
ɔ-a	ɔ-ɔ	---	*--- (rounding harmony)*
ɔ-ʊ→ ɔ-ɔ		ì≠kɔ́tɔ́	*pipe*
ɔ:-ɪ	†ɔ:-ɪ	---	---
ɔ:-a	ɔ:-ɔ	---	*--- (rounding harmony)*
ɔ:-ʊ→ɔ:-ɔ		kì≠tɔ́:kɔ̀	*wound*
a-ɪ	a-ɪ	kì≠kákɪ̥̀	*crust, scab*
a-a	a-a	kì≠kànà	*charcoal*
a-ʊ	a-ɔ	*àm≠bàŋ-ʊ́*	*mourning (from kʊ̀pàŋà to cry)*
a:-ɪ	a:-ɪ	à≠wà:kì	*chimpanzee*
a:-a	a:-a	kì≠ɲá:ŋà	*grass sp.*
a:-ʊ	a:-ɔ	à≠ká:ⁿdʊ̀	*woman*

[159] Without deverbal nouns and their corresponding verb, it is difficult to determine the underlying form. Since the noun root in the neighbouring language, Mmala, is ≠básà, I am favouring the lower vowel option.

2.8.3 Vowel-harmony processes

Yangben has a complex system of vowel harmony consisting of three interacting types of harmony: ATR, rounding and fronting harmony. All three types of vowel harmony cross morpheme boundaries within the phonological word.

2.8.3.1 Pre-stem elements

Both nominal and verbal pre-stem elements undergo vowel harmony in Yangben. These are ATR harmony, rounding harmony and fronting harmony discussed in turn below.

ATR harmony in pre-stem elements

Yangben has a system of seventeen noun classes that combine into nine double-class genders, and two single-class genders.

The following double-class genders occur: 1/2, 3/4, 5/6a, 7/8, 9/10, 11/13, 14/6, 19/mu, and 19/13. The single-class genders are 6 and 15.

Class 19 takes one of two plurals. If the noun is diminutive, the plural is in class 13, but most of the time the plural of a class 19 noun is **mʊ-**.

class	prefixes	class	prefixes
1	mʊ- a- / e- ∅	2	pa- /pe-
3	a(N)- / e(N)-	4	ɪ(N)- / i(N)-
5	nɪ- / ni-	6a	a(N)- / eN)-
7	kɪ- / ki-	8	pɪ- / pi-
9	N-	10	ɪN- / iN-
11	nʊ- / nu-	13	tʊ- / tu-
14	pʊ- / pu-	6	ma- / me-
19	ɪ- / i-	13 mʊ-	tʊ- / tu- mʊ- / mu-

Noun-class prefixes are underlyingly [-ATR] but have a [+ATR] counterpart when preceding a [+ATR] noun root. With the exception of class 9, which consists of a nasal, all Yangben noun classes contain one of three underlying vowels /ɪ/, /ʊ/ and /a/ and will undergo ATR harmony. The [+ATR] counterpart of /a/ is /e/[160], see Example 221.

[160] It is assumed that the [+ATR] counterpart of /a/ was originally /ə/, but in the language as it is spoken today, this vowel is acoustically clearly a front vowel. It is assumed that a merger between /e/ and /ə/ has occurred sometime in the past since /e/ is currently the [+ATR] counterpart of both /ɛ/ and /a/.

Example 221: ATR harmony of Yangben noun-class prefixes

class	**noun-class prefix**	**example**	***gloss***
1	a(N)-	à≠káⁿdɔ̀	*woman*
		è≠fùŋ	*chief*
2	pa-	pà≠káⁿdɔ̀	*women*
		pè≠fùŋ	*chiefs*
3	a(N)-	à≠sǎː	*river*
		è≠súɲ	*tsetse fly*
4	ɪ(N) [161]-	ɪ̀≠tím	*hearts*
		ì≠mèkú	*flesh, muscles*
5	nɪ-	nɪ̀≠táɲ	*rock, grinding stone*
		nì≠sèlú	*chin*
6a	a(N)-	à≠tàɲ	*rocks, grinding stones*
		è≠kìlí	*ritual places*
6	ma-	mà≠sɔ̀k (ʊ)	*salt*
		mè≠kút	*fat, oil*
7	kɪ-	kɪ̀≠kàsá	*fish scale*
		kì≠ŋúlè	*owl*
8	pɪ-	pɪ̀≠kàsá	*fish scales*
		pì≠ŋúlè	*owls*
10	ɪN-	ɪ̀m≠bɛ́s	*cane rats*
		ìn≠súp	*hippopotami*
11	nʊ-	nʊ̀≠kàl	*language, speech*
		nù≠kòl	*hawk*
13	tʊ-	tʊ̀≠kàl	*languages, speeches*
		tù≠kòl	*hawks*
14	pʊ-	pʊ̀≠ɲàm	*animal*
		pù≠túk	*night*

[161] N indicates a homorganic nasal which assimilates to the point of articulation of the following consonant.

class	**noun-class prefix**	**example**	***gloss***
15	kʊ-	kʊ̀≠sɔ̀t	*life*
		kù≠mèɲ	*knowledge*
19	ɪ-	ɪ̀≠lɔ̀ŋ	*horn*
		ɪ̀≠nòní	*bird*
pl of 19	mʊ-	mʊ̀≠lɔ̀ŋ	*horns*
		mù≠nòní	*birds*

Numeral prefixes in Yangben are underlyingly [-ATR] and undergo ATR harmony. There are no [+ATR] numeral prefixes in Yangben.

Example 222: Yangben numeral prefixes

class	**num. pfx**	**example**	***gloss***
1	ɔ̀-	mɔ̀≠ɔ̀ⁿdɔ̀ ò≠mòómí	*one person*
2	pá-	pɛ̀≠ɛ̀ⁿdɔ̀ pá≠àⁿdí	*two persons*
		pɛ̀≠ɛ̀ⁿdɔ̀ pé≠nì	*four persons*
3	ɔ́-	ɔ̀≠tím ó≠mòómí	*one heart*
4	í-	ɪ̀≠tím íj≠àⁿdí[162]	*two hearts*
		ɪ̀≠tím í≠nì	*four hearts*
5	ní-	nì≠kɛɛ́ ní≠mòómí	*one egg*
6a	á-	ɛ̀≠kɛɛ́ á≠àⁿdí	*two eggs*
		ɛ̀≠kɛɛ́ é≠nì	*four eggs*
7	kí-	kì≠àⁿs kí≠mòómí	*one house*
8	pí-	pì≠ans pí≠àⁿdí	*two houses*
		pì≠ans pé≠nì	*four houses*
9	ì-	m≠fún ì≠mòómí	*one nose*
10	í-	ìm≠fún íj≠àⁿdí	*two noses*
		ìm≠fún í≠nì	*four noses*
11	nʊ́-	nʊ̀≠kɔ́ŋ nú≠mòómí	*one swallow (bird)*
13	tʊ́-	tʊ̀≠kɔ́ŋ tʊ́≠àⁿdí	*two swallows*
		tʊ̀≠kɔ́ŋ tú≠nì	*four swallows*
14	pʊ́-	pʊ̀≠tɛ́ pú≠mòómí	*one tree*
6	má-	ma≠tɛ́ má≠àⁿdí	*two trees*
		ma≠tɛ́ mé≠nì	*four trees*
19	í-	ɪ̀≠noní í≠mòómí	*one bird*
mu	mʊ́-	mù≠noní mʊ́≠àⁿdí	*two birds*
		mù≠noní mú≠nì	*four birds*

Yangben noun class 15 is the infinitive class. As with the other noun-class prefixes with a [-ATR] high vowel, **kʊ-** undergoes ATR harmony, Example 223.

[162] síj≠àⁿdí is also used in noun class 4, depending on the context.

Example 223: Harmonisation of [-ATR] high vowel of infinitive nc 15

15	kʊ-	kù≠sìk-è	*saw (wood)*
		kʊ̀≠sík-à	*bite*
		kù≠sèl-èn	*land, descend*
		kʊ̀≠sɛ́k-ɛ̀	*plaster, sharpen*
		kʊ̀≠sák-à	*shake*
		kʊ̀≠sɔ́k-ɔ̀	*extract*
		kù≠fók-ò	*drive, lead*
		kʊ̀≠sʊ̀k-à	*bathe*
		kù≠súk-è	*fail, miss*

Certain classes 1 and 3 nouns have a round prefix vowel which is not caused by rounding harmony. The instances in Example 224 below are possibly remnants of the original proto-Bantu **mʊ-* prefixes found in both classes as they are not formed by rounding harmony as with the other cases of /o-/ or /ɔ-/ in noun-class prefixes.

Example 224: Round vowels in Yangben noun classes 1 and 3

class	**noun-class prefix**	**examples**	***gloss***
1	ɔ- (*mʊ-)	ɔ̀≠nɛ̀m	*husband*
3	ɔ(N)-	ɔ̀≠tím	*heart*
	(*mʊ-)	ɔ̀m≠bɛ́l	*hole*
		ɔ̀≠kɛ́l	*mountain*
		ɔ̀≠kɛ̀n	*tail*
		ɔ̀≠mì^{n}dɛ́	*fence*
		òn≠dé	*grass sp.*

While generally the noun-class 3 prefix is **a(N)- / e(N)-**, it will undergo rounding or fronting harmony (see below). However, in a couple of class 3 nouns with a round root vowel /ɔ/, the noun-class prefix is the open front vowel /ɛ/ rather than the expected round vowel, thus undergoing *fronting* rather than rounding harmony. In these cases the [ɔ] of the noun root of the singular form is the result of the assimilation of /ʊ/ and /ɛ/ in juxtaposition, as can be seen in the plural class 4 forms. If the underlying vowel is an open front vowel /ɛ/, the prefix vowel undergoes fronting harmony, as in Example 225 below.

Example 225: Apparent failure of rounding harmony in nc 3 prefixes

class 3	class 4	*gloss*
ɛ̀≠tɔ̀	ì≠t^{w}ɛ̀	*head(s)*
ɛ̀≠sɔ̌	ì≠s^{w}ɛ́	*penis(es)*

In addition to the infinitive prefix, Yangben has other pre-stem elements which also undergo ATR harmony. These include subject concord, reflexive, negative, and tense markers. A few examples are shown below in Example 226:

Example 226: Harmonisation of Yangben preverbal elements

reflexive	pí-	kʊ̀-pí≠fɛ̀k-ɛ̀	*measure oneself*
		kù-pí≠kìl-èn	*shake oneself*
negation/	tì-	ʊ̀-tì-má≠sʊ̀k-à	*c1-NEG-P0≠wash-CONT*
tense		ù-tì-mé≠kìt-è	*c1-NEG-P0≠strike-CONT*
subject concord/	ʊ-	ù-sʲè≠sìk-ìt	*c1-P1≠saw-DIM*
tense	sʲà-	ʊ̀-sʲà≠sìk-ɛ̀t	*c1-P1≠insult-DIM*

2.8.3.1.1 Rounding harmony in pre-stem elements

The five noun-class prefixes which have an underlying /a/ undergo rounding harmony in the context of a open round vowel, /o/ or /ɔ/ in the noun root, see Example 227.

Example 227: Rounding harmony in Yangben noun-class prefixes

class	**noun-class prefix**	**examples**	***gloss***
1	a(N)-	ɔ̀m≠bɔ̀l	*daughter*
		ò≠lókí	*fisherman*
		à≠káⁿdʊ̀	*woman*
		é≠túɲ	*blacksmith*
2	pa-	pɔ̀≠pɔ̀l	*daughters*
		pò≠lókí	*fishermen*
		pà≠káⁿdʊ̀	*women*
		pé≠túɲ	*blacksmiths*
6a	a(N)-	ɔ̀≠kɔ̀t	*napes of necks*
		ò≠kòj	*hatreds*
		à≠nʊ̀k	*wicker works*
		è≠kùl	*families*
6	ma-	mɔ̀≠fɔ̀ᵐfɛ̀	*marrow*
		mò≠ɲǒː	*cemetery*
		mà≠nʊ́ŋ	*blood*
		mè≠kút	*fat, oil*

Verbal pre-stem elements with /a/ will undergo rounding harmony as well as ATR harmony. Some examples, including tense markers, and the 2s subject-concord prefix, are shown in Example 228 below.

Example 228: Rounding harmony of Yangben preverbal elements

subject concord/tense	a-	ɔ̀-sʲɔ̀≠tɔ́s-ɛ̀t	*2s-P1≠polish-DIM*
	sʲà-	ò-sʲò≠pós-ìt	*2s-P1≠bark-DIM*
	mà-	ɔ̀-mɔ̀≠kɔ̀t-ɔ̀	*2s- P4≠work-CONT*
		ò-mò≠fók-ò	*2s- P4≠lead-CONT*
directional	nʲà-	ʊ̀-mɔ́-nʲɔ̀-kɔ́l nsùnú	*c1-P0-DIR≠take clothes*
		ù-mó-nʲò-sòl-ò	*c1-P0-DIR≠pour_libation-FV*

The high round vowels /ʊ/ and /u/ do not trigger rounding harmony, see Example 229 below.

Example 229: Non-triggering of rounding harmony in Yangben

subject concord/tense	a-	à-sʲà≠sʊ̀k-à	*2s-P1≠bathe-CONT*
	sʲà-	è-sʲè≠súk-è	*2s-P1≠fail-CONT*
	mà-	à-mà≠là:ⁿd-à	*2s-P4≠crawl-FV*
		è-mè≠tíːn-e	*2s-P4≠flee-FV*
directional	nʲà-	ʊ̀-má-nʲà-ɲân	*c1-P0-DIR≠eat*
		ù-mé-nʲè-tiɲ-ì	*c1-P0-DIR≠show-CAUS*

2.8.3.1.2 Fronting harmony in pre-stem elements

The five noun-class prefixes which have an underlying vowel /a/ undergo fronting harmony in the context of a open front vowel, /ɛ/ or /e/, as in Example 230 below. Due to a loss of contrast between the vowel /ə/, which was the [+ATR] counterpart of /a/, and /e/ which is the [+ATR] counterpart of /ɛ/, the contrast between [+ATR, -front] and [+ATR, +front] vowels is lost.

Example 230: Fronting harmony of /a/ in Yangben noun-class prefixes

class	**noun-class prefix**	**examples**	***gloss***
1	a(N)-	ɛ̀≠nʊ́mɛ̀ⁿdɔ́	*man, male*
		è≠pʲéɲí	*midwife*
2	pa-	pɛ̀≠nʊ́mɛ̀ⁿdɔ́	*men, males*
		pè≠pʲéɲí	*midwives*
3	a(N)-	ɛ̀m≠bɛ̀sɛ̀	*maize*
		è≠mèkú	*flesh, muscle*
6a	a(N)-	ɛ̀m≠bɛ́:nɛ̀	*breast, udder*
		è≠sèlú	*chin*

class	**noun-class prefix**	**examples**	***gloss***
6	ma-	mὲ≠pɛ́:nὲ	*milk*
		mè≠té	*sap (tree)*

Verbal pre-stem elements with /a/ also undergo fronting harmony. Some examples, including tense markers, and the 2s subject concord prefix, are shown in Example 231 below.

Example 231: Fronting harmony in Yangben preverbal elements

subject	à-	è-sʲè≠fén-it	*2s-P1≠despise-DIM*
concord/tense	sʲà-	ὲ-sʲὲ≠sɛ́k-ὲt	*2s-P1≠sharpen-DIM*
	mà-	ù-mè≠fén-è	*c1-P4≠disdain-FV*
		ʊ̀-mὲ≠tὲn-ὲ	*c1-P4≠pound-FV*
directional	nʲà-	ʊ̀-mɛ́-nʲὲ≠fὲk-ὲ	*c1-P0-DIR-measure-FV*
		ù-mé-nʲè≠séˑk-ì	*c1-P0-DIR-haggle-CAUS*

The high front vowels (/ɪ/ and /i/) do not trigger fronting harmony, even when they are lowered in the context of a closed syllable, see Example 232 below.

Example 232: Non-triggering of fronting harmony in Yangben

subject	à-	à-sʲà-sìk-ìt	*c1-P1-insult-DIM*
concord/tense	sʲà-	è-sʲè-sìk-ìt[163]	*c1-P1-saw-DIM*
		ʊ̀-sʲà-pὲk	*c1-P1-burn*
		ʊ̀-sʲà-pìk-à	*c1-P1-burn-CONT*

2.8.3.2 Vowel harmony in suffixes

Most verb and deverbal noun suffixes undergo vowel harmony, but there are two suffixes which trigger ATR harmony. Discussed in turn below are suffixes that undergo ATR harmony, ATR dominant suffixes, rounding harmony in suffixes and fronting harmony.

2.8.3.2.1 ATR harmony in suffixes

ATR harmony is triggered by a dominant vowel, usually in the root, and spreads bidirectionally. All [-ATR] vowels in the phonological word assimilate to their

[163] I make the assumption that [e] in the above case is due to ATR harmony and not fronting harmony. The high back vowels /u/ and /ʊ/ do not trigger rounding harmony, likewise the high front vowels /i/ and /ɪ/ do not trigger fronting harmony.

[+ATR] counterpart. These include the final vowel[164], various extensions and aspectual suffixes. A few examples are shown in Example 233 below:

Example 233: Harmonisation of verbal suffixes in Yangben

intensive	-ɪk	kʊ-pí≠tɔ́l-ìk-ɛ̀n	*listen*
		kù≠tít-ìk-ìn	*jostle*
separative	-ʊn	kʊ̀≠pàl-ʊ̀n-à	*strain, filter (food)*
		kù≠tún-ùn-è	*contradict*
continuous	-an	kʊ̀≠pál-àn	*pull up (weeds)*
		kù≠kíːk-èn	*touch*
diminutive	-ɪt	kʊ̀≠sʊ̀k-ɛ̀t	*wash*
		kù≠fúk-ìt	*blow*
final vowel	-à	kʊ̀≠fát-à	*husk, shell*
		kù≠fúk-è	*blow*

Some deverbal nouns are formed by adding an instrumental suffix **-ʊ** or an applicative suffix **-ɪn**. These suffixes assimilate to the [+ATR] root vowel. When these suffixes are [-ATR], the instrumental **-ʊ** will lower following a high vowel, as is seen in Example 234 below.

Example 234: Yangben deverbal nouns with applicative suffix

kʊ̀≠tɛ̀k	*forgive*	kɪ̀≠tɛ̀k-ʊ́	*gift (for forgiveness)*
kʊ̀≠tɔ̀nd-ɛ̀n	*hammer (v)*	í≠tɔ̀nd-ìn-ɔ̀	*wood pecker*
kʊ̀-pí≠nàn	*mistake (v)*	kɪ̀-pí≠nàn-ʊ́	*mistake (n)*
kʊ̀≠pàŋ-à	*cry (v)*	àm≠bàŋ-ʊ́	*tears, crying*
kù≠lùn	*age (v)*	kì≠lùn-ú	*old person (n)*
kù≠pʲén	*give birth*	kì≠pʲén-ín	*instrument to help birth*
kʊ̀≠pàl	*uproot (to)*	nɪ̀≠pál-ín	*things uprooted*

2.8.3.2.2 ATR-dominant suffixes

Two suffixes, the [+ATR] causative **-i**, and the [+ATR] agentive **-i** are dominant and trigger ATR harmony. These dominant suffixes occur only at the right edge of the word, so ATR harmony, while generally bidirectional, can only spread to the left as seen in Example 235.

[164] The final vowel is obligatory on certain verbs only. Others may occur without any final vowel. With the second class of verbs, the vowel **-a** carries a continuous-aspect meaning and is optional, see section 2.8.2.1, Example 216.

Example 235: ATR-dominant causative extension -i in Yangben

causative	-i	kù≠sùk	*miss, stop*	kù≠súk-ì	*cause to stop*
		kʊ̀≠fʊ́l-à	*flow*	kù≠fúl-ì	*cause to flow*
		kʊ̀≠sɔ́ːk-ɔ̀	*grow*	kù≠sóːk-ì	*germinate*
		kʊ̀≠pàl	*uproot*	kù≠pèl-ì	*cause uproot*
		kʊ̀≠kɛ́t-ìk	*blink*	kù≠két-ìk-èɲ-ì	*cause to blink*
		kʊ̀≠jìk-à	*boil*	kù≠jìk-ì	*boil over*
agentive	-i	kʊ̀≠tát-à	*do sorcery*	è≠tét-ì	*sorcerer/esse*
		kʷ≠ěp-è	*steal*	èŋ≠ép-ì	*robber*
		kʊ̀≠fɛ́:f-ɛ̀	*watch*	è≠fé:f-ì	*sentry*
		kʊ̀≠lɔ́k-ɔ̀	*fish*	ò≠lók-ì	*fisherman*
		kʊ̀≠sʊ̀l-à	*drink(spoon)*	è≠sùl-ì	*drinker*

2.8.3.2.3 Rounding harmony in suffixes

Most verb extensions and inflectional suffixes with an /a/ will undergo rounding harmony as well as ATR harmony. Like ATR harmony, rounding harmony is bidirectional. A few examples of suffixes undergoing rounding harmony are shown in Example 236 below:

Example 236: Rounding harmony of Yangben verbal suffixes

final vowel	-a	kʊ̀≠pɔ́k-ɔ̀	*organise*
		kù≠fók-ò	*drive, conduct*
continuous	-an	kʊ̀≠sɔ́t-ɔ̀n	*live*
		kù≠jò:s-òn	*regard*

2.8.3.2.4 Fronting harmony in suffixes

Most verb extensions and inflectional suffixes with an /a/ will also undergo fronting harmony as well as ATR and rounding harmony. Like rounding harmony, fronting harmony is bidirectional. A few examples of suffixes undergoing fronting are shown in Example 237 below:

Example 237: Fronting harmony of Yangben verbal suffixes

final vowel	-a	kʊ̀≠fɛ́:f-ɛ̀	*spy, watch intently*
		kù≠fén-è	*despise*
continuous	-an	kʊ̀≠fɛ̀l-ɛ̀n	*lock (w/ key)*
		kù≠fén-èn	*despise*

2.8.4 Hiatus-resolution processes

A couple of hiatus-resolution processes are found in Yangben: glide formation (section 2.8.4.1), and hiatus retention (section 2.8.4.2).

2.8.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted. Where V_1V_2 sequences occur, either within the morpheme or across morpheme boundaries, a high vowel in V_1 position becomes a glide. Glide formation occurs principally when a high vowel in the noun-class prefix and a vowel-initial noun root are in juxtaposition, as seen in Example 238 below:

Example 238: Prefix-root glide formation in Yangben

surface form	**underlying form**	***gloss***
jìk	ì≠ìk	*c19.fire*
pʷěk	pò≠ék	*c14.porcupine*
kʲɛ̀ⁿs	kì≠ɛ̀ⁿs	*c7.hole*
kʲɛ̀j	kì≠ɛ̀j	*c7.spirit*
nʲɛ̀ⁿd	nì≠ɛ̀ⁿd	*c5.channel*
nʲànà	nì≠ànà	*c5.nest, cocoon*
kʲɔ̀p	kì≠ɔ̀p	*c7.pile, group*
kʷěpè	kò≠ép-è	*inf.steal*
kʷɛ̀kɛ̀	kò≠ɛ̀k-ɛ̀	*inf.look for*
nʷɛ̀j	nò≠ɛ̀j	*c11.iron*
kòpʲák	kò-pí≠àk	*inf.put on, wear*
nʷɔ̌l	nò≠ɔ́l	*c11.body*
kʷòl	kò≠òl	*inf.come, come from*
pʷǒk	pò≠ók	*c14.honey*

Glide formation my also occur when a CV verb root and a –VC verbal extension are in juxtaposition, as in Example 239.

Example 239: CV verb roots with –VC extension(s) in Yangben

kùtù	kù≠tú	*sell*
kùtʷénèn	kù≠tú-en-en[165]	*sell (CONT)*
kòkʷà	kò≠kò-a	*fall*
kòkʷànɛ̀n	kò≠kò-an-ɛn	*fall (HAB)*

[165] When a high vowel with a high tone desyllabifies, the H tone spreads right to the next available vowel. In the cases illustrated here, the following vowel is in a verbal suffix which is considered to be underlyingly toneless.

Glide formation also occurs in nouns derived from verbs. When the causative suffix **-i** is followed by the nominalising suffix **-a**[166], the high vowel becomes a glide, as seen in Example 240.

Example 240: Glide-formation in Yangben deverbal nouns

kù≠kól-ì	*welcome (v)*	kìkólʲò	*welcome (n)*
kù≠téˑk-ì	*announce (v)*	kìtéˑkʲè	*announcement*
kù≠núk-ì	*change, modify (v)*	kìnúkʲè	*exchange (of goods) (n)*

2.8.4.2 Hiatus retention

Juxtaposed vowels which are identical either underlyingly or due to ATR, rounding or fronting harmony are permitted. This is particularly evident between the noun-class prefix and the noun root. In Example 241 (a), the prefix vowel and the root vowel are identical due to ATR harmony; in Example 241 (b), the prefix vowel and the root vowel are identical due to rounding harmony, and in Example 241 (c), the prefix and root vowels are the same due to fronting harmony.

Example 241: Yangben prefix-root hiatus retention

	surface form	**underlying form**	***gloss***
(a)	kì:né	kì≠ìné	*c7.filth (on body)*
	nìít	nì≠ít	*c5.mouth*
	kììl	kì≠ìl	*c7.small stream*
	nììp	nì≠ìp	*c5.cooking stone*
	kǐ:là	kì≠ílà	*c7.arrow*
	nʊ̀ʊ̀ŋ	nʊ̀≠ʊ̀ŋ	*c11. soldier ant*
(b)	òól	à≠ól	*c3.moon*
	òókì	à≠ókì	*c3.bee*
	ɔ̀ɔ̀pì	à≠ɔ̀pì	*c3.green mamba*
(c)	mě:nè	mà≠énè	*c6.brain*
	ɛ̀ɛ̀n	à≠ɛ̀n	*c3.thigh*
	ɛ̀ɛ̀jɛ́	à≠ɛ̀jɛ́	*c3.bush fire*

In addition, hiatus retention also occurs between CV verb root and a –VC verbal suffix where the juxtaposed vowels are either underlyingly identical or have identical surface realisations, see Example 242, below.

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[166] The nominalising suffix **-a** may undergo all vowel-harmony adaptations. It takes its [+ATR] counterpart **-e** in the following examples or its [+ATR, +round] counterpart **-o** in Example 240.

Example 242: Root-suffix hiatus retention in Yangben

surface form	**underlying form**	***gloss***
kùkùùsì	kʊ̀≠kʊ̀-ʊs-ì	*cause to fall*
kʊ̀kɔ̀ɔ̀n	kʊ̀≠kɔ̀-ən	*fall into*
kʊ̀fààn	kʊ̀≠fà-an	*give (CONT)*
kùɲòòn	kʊ̀≠ɲò-on	*bury (APPL)*

2.8.5 Tone

Yangben has a two-tone system underlyingly, high and low. Rising tones and falling tones which occur on short syllables are due to glide formation from syllable mergers. There is a slight lengthening of the vowel due to glide formation in Yangben. Surface tone is marked on the data in this study.

2.8.5.1 Tone melodies on nouns

High and low tone contrast in monosyllabic noun roots. In CVC noun roots, only two tone melodies are attested. In CVCV noun roots, four tone melodies are attested, see Example 243 below. Noun prefixes generally have a low tone, although there are a few exceptions.

Example 243: Yangben nominal tone melodies

kì≠kɔ̀l	≠L	*ringworm*
kì≠kɔ́l	≠H	*nasal mucus*
nʊ̀≠kɔ̀mɔ̀	≠L	*tree sp.*
nʊ̀≠pɔ̀tɔ́	≠LH	*wasp*
nʊ̀≠pɔ́nɔ̀	≠HL	*(a) file*
ì≠kɔ́tɔ́	≠H	*pipe*

2.8.5.2 Tone melodies on verbs

Yangben verb roots have three possible underlying tone melodies: L, HL, and H; the H melody is the least common. With the exception of the final vowel or continuous suffix **-a** in verb stems with a H melody, the H spreads one syllable to the right and is downstepped[167]. It is assumed that verbal suffixes are underlyingly toneless. The three verbal tone melodies are illustrated in Example 244 below.

[167] There is no immediately obvious reason for this downstepped high, further research is needed.

Example 244: Yangben verbal tone melodies

	U.F.	**S.F.**	**melody**	***gloss***
L	kò≠tàŋ-ìm-ìt	kòtàŋìmìt	L≠L-L-L	*straddle*
	kù≠fèk-ès-ì	kùfèkèsì	L≠L-L-L	*try smth*
	kù≠kèːk-èn-ì	kùkèːkènì	L≠L-L-L	*cause to stutter*
HL	kò≠tɔ́l-ìm-ìt	kòtɔ́lìmìt	L≠H-L-L	*bend*
	kù≠fúk-ès-ì	kùfúkèsì	L≠H-L-L	*cause to blow*
	kù≠síːt-èn-ì	kùsíːtènì	L≠H-L-L	*stir-up (fire, emotions)*
H	kò≠ɛ́j-ím-ìt	kʷɛ̌↓jímìt	L≠H-↓H-L	*lean against*
	kù≠sék-és-ì	kùsé↓késì	L≠H-↓H-L	*cause to dry up*
	kù≠péːⁿd-én-ì	kùpéː↓ⁿdénì	L≠H-↓H-L	*spy on to capture*

In closed syllables, a high tone on a short syllable is realised as a low tone, and a high tone on a long syllable is realised as a falling tone, see Example 245 below.

Example 245: Short/long syllable verb-tone adaptations in isolation

kù≠tím-è	kù≠tìm	*dig*
kù≠tíːn-è	kù≠tîːn	*flee in fear*
kò≠fát-à	kò≠fàt	*husk (corn); shell*
kò≠fáːt-à	kò≠fâːt	*carve, sharpen*
kò≠kɔ́t-à	kò≠kɔ̀t	*fasten, bind*
kò≠pɔ́ːk-à	kò≠pɔ̂ːk	*cook meat (wrapped in leaves)*
kò≠sɔ́k-ɔ̀	kò≠sɔ̀k	*extract*
kò≠sɔ́ːk-ɔ̀	kò≠sɔ̂ːk	*grow (of plants)*

In addition to providing lexical contrast, tone also has a grammatical function. Among other things, tone provides the crucial difference between various tenses in verb conjugations. This is, however, beyond the scope of this study.

2.9 Mbure phonological overview

Mbure (also known as Mbola, Mbule, or Dumbule) is spoken in the village of Mbola in the Yangben Canton. It appears to have no dialectal variations.[168]

2.9.1 Consonants

This section discusses the consonant inventory of Mbure (section 2.9.1.1), the various adaptations to it due to allophonic and allomorphic realisations (section

[168] The Mbure database includes over 600 terms, most with example sentences and recordings collected over two short visits to the village in June 2007 and February 2009 and a week work session in Yaoundé July 2010 with Kibindé Babouet, a village elder and traditional healer from Mbola-Cade, and Inengué Gilbert, a farmer from Mbola-Kidjo. Also consulted are two other wordlists: Scruggs (1982) and the wordlist used by Boone (1992) for his survey of Mbure.

2.9.1.2), distribution restrictions (section 2.9.1.3) and final-consonant devoicing (section 2.9.1.4).

2.9.1.1 Consonant inventory

The consonant system of Mbure consists of 20 contrastive consonants. Two consonants, /tʃ/ and /l/ have very limited distributions.

Table 45: Mbure contrastive consonants

		labial	alveolar	palatal	velar
stops	oral	p	t	tʃ	k
	prenasalised	ᵐb	ⁿd	ⁿdʒ	ᵑg
fricatives	voiceless	f	s		h
	prenasalised	ᶬf [ᵐpʰ]	ⁿs [ⁿtʃ]		
resonants	nasal	m	n	ɲ	ŋ
	oral		ɾ	j	w
	lateral		l		

2.9.1.2 Allophonic and allomorphic realisations

Mbure has both oral and prenasalised stops and fricatives. Oral obstruents are non-contrastive and predictable in their voicing according to their position in the syllable. The bilabial stop is slightly voiced in all syllable positions except utterance-final. The alveolar and velar stops are voiceless in C_1 position of the root and in word- or utterance-final position. They are voiced in C_2 position and in suffixes. The alveolar stop is voiced in prefixes while the velar stop never is, see Example 246:

Example 246: Stops in morpheme-initial and final position in Mbure

position		**phonetic**	**underlying form**	***gloss***
prefix	/p/	pʰùkʰùm	pù≠kùm	*baobab*
		pʰìhó	pì≠hó	*beehives*
	/t/	tʰùbóɾ	tù≠póɾ	*rains*
		tʷɔ̌ɾ	tɔ̀≠ɔ́ɾ	*body*
	/k/	kìsàs	kì≠sàs	*chest*
		kɔ̀màɲ	kɔ̀≠màɲ	*to know*
root-initial position	/p/	kìbàpʰ	kì≠pàp	*wing*
		kɔ̀bɛ̀k	kɔ̀≠pɛ̀k	*burn*
		kʰùbʰítʰìbʰínì	kù≠pít-ìp-ín-ì	*be dirty*
	/t/	ǹtɔ́	ǹ≠tɔ́	*cinders*
		pʰìté	pì≠té	*saliva*
	/k/	ŋ̀káⁿd̥ʰ	ŋ̀≠káⁿd	*woman*
		nìkàɾ	nì≠kàɾ	*hand, arm*

position		**phonetic**	**underlying form**	***gloss***
word-final position	/p/	màkɛ̀pʰ	mà≠kɛ̀p	*wine, alcohol*
		kìdʒɔ̀pʰ	kì≠ⁿdʒɔ̀p	*hyena*
	/t/	sétʰ	sét	*duiker*
		nìítʰ	nì≠ít	*mouth*
	/k/	tákʰ	ták	*catfish sp.*
		nìtékʰ	nì≠ték	*navel*

2.9.1.2.1 Word-final aspiration

Aspirated consonants are non-contrastive. In final position, aspiration on consonants may be an indication of the loss of a vowel. In neighbouring languages, cognates of the Mbure words often have a vowel or devoiced vowel where Mbure has an aspirated consonant, as seen in Example 247.

Example 247: Word-final aspiration in Mbure

Mbure	***gloss***	**cognate**	**language**
kʰì≠ìᵐb̥ʰ	*pond (spring, lake)*	kì≠ìᵐbi̥	Yangben
kì≠bàːb̥ʰ	*wing*	kì≠pàpɔ́	Yangben
		kì≠pàbá	Baca
mì≠ìᵐb̥ʰ	*water*	mì≠ᵐbi̥	Elip
nì≠néᵐb̥ʰ	*tongue*	kì≠lèᵐbi̥	Yangben
kì≠ɾɔ́ːⁿd̥ʰ	*cloud (fog)*	kì≠lɔ̀ⁿdɔ́	Yangben
kò≠tɛ́ⁿd̥ʰ	*smooth*	kò≠lɛ̀ⁿd-ɛ̀	Yangben
mù≠ùⁿd̥ʰ	*person*	mò≠ⁿdɔ̥̀	Elip
nì≠bóⁿd̥ʰ	*stomach*	m̀≠pʰùⁿtʃú	Baca
		nì≠pùⁿdí	Yangben
núᵐbètʰ	*man*	ɛ̀≠nɔ́mɛ̀ⁿdɔ́	Yangben
		à≠nɛ́ᵐbɛɾɛ̀	Baca
ŋ̀≠káⁿd̥ʰ	*woman*	à≠káⁿdɔ̥̀	Yangben
tʃàⁿtʰ	*house*	kʲ≠àⁿsɛ̥̀	Yangben
mò≠bàⁿd̥ʰ	*two*	pʷ≠àⁿdí	Yangben
àkʰ	*here*	àkì	Yangben
m̀≠mèːkʰ	*flesh*	è≠mèkú	Yangben
ɲ≠ǒkʰ	*smoke*	ò≠ɲòkì	Yangben

In other positions, a high [+ATR] vowel will trigger aspiration or spirantisation on the preceding consonant. The vowel itself is sometimes reduced to aspiration or spirantisation on the consonant, Example 248.

Example 248: Spirantisation preceding a high vowel in Mbure

surface forms			**underlying form**	***gloss***
k^{h}ùt^{h}ùɾ	~	k^{h}t^{h}ùɾ	kù≠tùɾ	*dull (v)*
k^{h}ìp^{h}ùg-è	~	k^{h}p^{h}ùgè	kì≠pùk-à	*close*
k^{h}ùp^{h}ít^{h}-íp^{h}-ín-ì	~	k^{h}p^{h}ít^{h}p^{h}ínì	kù≠pít-íp-ín-ì	*make dirty*
ǹt^{h}ú			ǹ≠tú	*ear*
jòt^{h}ìnè	~	jòt^{h}nè	j≠òtìnè	*star*

The affricate [tʃ] is limited in distribution. Only a handful of words have been found in the corpus. For most words, the affricate [tʃ] has a couple of sources.

1) In word-initial position, it is caused by the desyllabification of the noun-class 7 prefix /kì/ before a dissimilar root-initial vowel. This is discussed in section 2.9.4.1 below.
2) As in the other A60 languages, the fricative /s/ following a nasal becomes [-continuant]:

/s/	→	[tʃ]	/	N̩-_____

surface form		**underlying form**		***gloss***
nìsóló	ȉtʃóló	nì≠sóló	ìn≠sóló	*yam sp.*

3) Most of the remaining words in the corpus with [tʃ] are in the environment of /ɪ/ and have cognates in the other languages with either a velar stop /g/, /k/ or fricative /h/:

gloss	**Mbure**	**Yangben**	**Baca**	**Mmala**	**Elip**	**Gunu**
hoe	kì≠**tʃ**ɛ́nɛ́	--	--	gɛ̀≠**g**ɛ̀ŋà	gí≠**g**ìŋà	--
egg	kì≠**tʃ**ɛ̌ː	nì≠**k**ɛ̌ː	ǹ≠**h**ɛ̀kɛ́	nì≠**k^{h}**à	nì≠**g**àh	ɛ̀≠**g**ɛ́ɛ̀

The last word with the affricate [tʃ] has a cognate with /t/ in the other languages. It is interesting to note that with this word, there is an indication of aspiration or spirantisation in some of the other varieties:

/t/	→	[t^{h}]	/	_____/i/	(Mmala, Elip)
/t/	→	[tʃ]	/	_____/i/	(Baca, Mbure)

gloss	Mbure	Yangben	Baca	Mmala	Elip
six	mʊ̀≠**tʃ**í^{n}dât	má≠**t**í^{n}dàt	mʊ̀≠**tʃ**í^{n}dát	bá≠**t^{h}**í^{n}dàd̥ʊ̥̀	bʊ́≠**t^{h}**í^{n}dàd̥

2.9.1.2.2 Intervocalic lenition

In intervocalic position in nouns and verbs, oral stops are voiced and sometimes weakened to voiced continuants, see Example 249 below.

Example 249: Intervocalic voicing and lenition in Mbure

surface forms			**underlying form**	***gloss***
dʒèbá	~	dʒèβá	≠dʒèpá	*go, leave*
kɔ̀bɔ̀t	~	kɔ̀bɔ̀dà	kɔ̀≠pɔ̀t-à	*exit*
kʰìtôːt	~	kʰìtôːdà	kì≠tôːt-à	*throw*
kʷăk	~	kʷăgà ~ kʷăɣà	kù≠ák-à	*put, pour*
kùbèk	~	kùbègà ~ kùbèɣà	kù≠pèk-à	*to burn*
kí≠kɔ́gɔ̀	~	kí≠kɔ́ɣɔ̀	kí≠kɔ́kɔ̀	*bark (tree)*
ɲàgà	~	ɲàɣà	ɲàkà	*cattle*
kʰùlíᵐbʰìgè	~	kùlíᵐbìɣè	kù≠líᵐb-ìg-à	*sit, be seated*

Consonant clusters in Mbure are the result of vowel elision. Both consonants will agree in voicing unless C_1 is a stop and C_2 is nasal. Two stops in a cluster are both voiceless. A stop following a nasal or a resonant is voiced, except for /s/.[169] In Example 250 below the CC cluster is underlined.

Example 250: Consonant clusters in Mbure

cluster types	**surface form**	**underlying form**	***gloss***
CC	tɔ́kpà	tɔ́k-ìp-à	*hunting barrier*
	kʰìbʰíkpènè	kì≠pík-ìp-èn-è	*besmear oil*
	mátɔ̀ktà	má≠tɔ̀k-ɔ̀t-à	*boil, bubble (water)*
CR	m̀bègɾè	m̀≠pèk-ìɾ-à	*load, burden*
	pògɾò	pòk-ìɾ-ò	*braggarts*
	kìkábɾì	kì≠kápìɾì[170]	*horse*
CN	táknɛ̀	tákànɛ̀[171]	*uncle*
	kìkápnà	kì≠káp-àn-à	*catch in air*
	kìmɔ̀kmà	kì≠mɔ̀k-ìm-à[172]	*deaf-mute*
NC/RC	pʰìbámgà	pì≠pám-ìg-à	*growl (n)*
	màhénbìt	mà≠hén-ìp-ìt	*lean*
	màmánbìt	mà≠mán-ìp-ìt	*stoop, bend over*
	mákánbɛ̀nɛ̀	má≠kán-ìp-ɛ̀nɛ̀	*lie down*
	kʰìkʰùmsìnì	kì≠kùm-ìs-ìn-ì	*bring up (a child)*
	màbòɾd	mà≠pòt-it	*break (INTR)*

[169] A similar phenomenon occurs in Basaá (Hyman: 2003b:257), a neighbouring language.
[170] Cognates of this word are found in Yangben [kìkàpìlɛ́], and Mmala [gìkàpɛ̀lɛ̀].
[171] Cognates of this word are found in Baca [tágáɲɛ́], and Elip [idágàɲá].
[172] Cognates of this word are found in Yangben [kìmùkè], Baca [kìmúmà] and Elip [gìmúke].

cluster types	**surface form**	**underlying form**	***gloss***
NR	kʰìsíŋ̲ɾ̲è	kì≠síŋ-ìɾ-à	*rub*
	kìtàŋ̲ɾ̲ì	kì≠tàŋ-ìɾ-ì	*say*
	kéŋ̲ɾ̲ì	kì≠eŋ-ìɾ-ì	*ankle*
	sìŋ̲ɾ̲è	≠sìŋ-ìɾ-à	*pet, caress (v)*
NN	àlómnà	à≠lóm-àn-à	*bless*
	kʰìnómnè	kì≠nóm-nè	*serpent*
	sómnà	≠som-àn-à	*accuse*

2.9.1.2.3 Post-nasal hardening of fricatives

The fricatives become hardened when preceded by a nasal prefix. When following a nasal prefix, /s/ becomes [tʃ] and /f/ becomes [pʰ], see Example 251 below:

Example 251: Post-nasal hardening in Mbure

surface form	**underlying form**	***gloss***
m̀pʰɛ̏	ŋ̀≠fɛ̀ɲ[173]	*puff adder*
m̀pʰû̏	ŋ̀≠fûn	*nose*
ȉtʃàm	ìn≠sàm	*nuts*
ȉtʃóló (nìsóló, sg)	ìn≠sóló	*yams sp.*

2.9.1.3 Restrictions in consonant distribution

Mbure has both open and closed syllables; CV, CVC, V, VC and syllabic nasals. All consonants except for /ᵑɡ/ and /w/ are found in syllable-final position.[174] Gaps are considered to be accidental. Consonant-glide sequences, especially when they occur at morpheme boundaries, are formed by the desyllabification of a high vowel (discussed in section 2.9.4.1 below).

There are only a few instances of prenasalised obstruents occurring in morpheme-initial position. These examples cannot be considered as post-nasal hardening after a nasal prefix as these noun-class prefixes are not known to have nasals.

[173] Compare the Mbure terms for *puff adder* and *nose* with cognates in the following language:

puff adder	p≠fɛ́n	Baca	m̀≠pʰɛ́ɲ / ɱ≠fɛ́ɲ	Elip
	ɱ≠fɛ̀ɲ	Yangben, Mmaala	ɛ̀≠hɛ́ɲɛ̀	Maande
nose	p≠fûn	Baca	ò≠hún	Elip
	ŋ̀≠fùn	Yangben	ŋ̀≠fún	Mmaala

[174] This is particularly true for the first syllable of a noun or verb stem.

ᵐb	kìᵐbàᵐbà	kì≠ᵐbà-ᵐbà	*c7.agama lizard*
	pàᵐbó	pà≠ᵐbó	*c2.young girls*
ⁿd	pʊ̀ⁿdɔ́ⁿd̥	pʊ̀≠ⁿdɔ́ⁿd	*c14.small*
ⁿs	kĩ̀tʃáŋà	kì≠ⁿsáŋà	*c7.monkey*
	kĩ̀tʃɛ̌ː	kì≠ⁿsɛ̌ː	*c7.egg*
ⁿj	nĩ̀dʒèɾì	nì≠ⁿjèɾì	*c5.beard*
	pũ̀dʒú	pù≠ⁿjú	*c14.yesterday*

2.9.1.4 Final-consonant devoicing

Prenasalised obstruents are devoiced in word-final position, with the exception of /ᵑg/ which is not found in syllable-final position.

Example 252: Final-consonant devoicing in Mbure.

/ᵐb/→[ᵐb̥]	mà≠ìᵐb	[mììᵐb̥ʰ]	*water*
	nì≠néᵐb	[nìnéᵐb̥ʰ]	*tongue*
/ⁿd/→[ⁿd̥]	kì≠ɾɔ́ːⁿd	[kìɾɔ́ːⁿd̥ʰ]	*cloud*
	ŋ̀≠káⁿd	[ŋ̀káⁿd̥ʰ]	*woman*

2.9.2 Vowels

This section discusses the vowel inventory (section 2.9.2.1), and the various adaptations to it due to allophonic and allomorphic realisations (section 2.9.2.2) and vowel co-occurrences and co-occurrence restrictions (section 2.9.2.3).

2.9.2.1 Vowel inventory

Mbure has an inventory of nine contrastive vowels for verbs and seven contrastive vowels for nouns. The vowel inventory seems to be in the process of reducing to a seven-vowel system.[175] The language has a weak vowel-harmony system, which affects vowel co-occurrences and co-occurrence restrictions. The vowels can be divided into two sets which are mutually exclusive within roots and stems, with the exception of /a/ which occurs with [+ATR] vowels in some contexts:

Table 46: Mbure contrastive vowels

	[-ATR]			**[+ATR]**	
ɪ		ʊ	i		u
ɛ		ɔ	e		o
	a			(a)	

[175] The Mbure vowels proved difficult to determine. The acoustic space between /i/, /ɪ/ and /e/, and /u/, /ʊ/ and /o/ is very small. However, the acoustic space between /ɪ/ and /e/ is smaller than between /i/ and /ɪ/. This is also true for the back vowels: /ʊ/ is acoustically closer to /o/ than it is to /u/.

In the verb system, nine contrastive vowels are attested in the verb root as seen in Example 253 below. The changes in the affix are described below in section 2.9.3.2.

Example 253: Contrastive vowels in Mbure CVC verb stems

	phonetic surface form	**underlying form**	***gloss***
i	≠tʰíbè	≠típ-à	*pierce*
ɪ	≠mɪ́ɲà	≠mɪ́ɲ-à	*drink*
e	≠pélà	≠pél-à	*call*
ɛ	≠sɛ́ɾà	≠sɛ́ɾ-à	*flow*
a	≠sáɾà	≠sáɾ-à	*chop*
ɔ	≠sɔ́dà	≠sɔ́t-à	*live*
o	≠sògà	≠sòk-à	*wash*
ʊ	≠pʊ́hà	≠pʊ́h-à	*bark (dog)*
u	≠pʰùgè	≠pùk-à	*close*

In the noun system, however, only seven contrastive vowels are found in monosyllabic noun roots, and only six are found in monomorphemic CV_1CV_1 roots, as in Example 254 below. The [-ATR] high vowels [ɪ] and [ʊ] are more restricted in their distribution and occur only in the context of other [-ATR] vowels.

Example 254: Permitted vowels in Mbure CV_1CV_1 and CVC noun roots

i	kʰì≠tíⁿdì	*log for sitting*	u	---	---
	m̀≠pìt	*bottom*		nì≠ɲúk	*teat, breast*
ɪ	---	---	ʊ	---	---
	---	---		---	---
e	ì≠téᵐbé	*correct*	o	ì≠kòŋò	*ridge*
	sét	*duiker*		tók	*calf*
ɛ	kì≠tʃɛ́nɛ́	*old hoe*	ɔ	kì≠kɔ́kɔ̀	*bark (tree)*
	kì≠sɛ̀k	*liver*		tɔ̀k	*stomach*
a	kì≠tʃáŋà	*monkey*			
	ták	*catfish*			

2.9.2.2 Allophonic and allomorphic variations

Mbure has several allophonic and allomorphic variations. Discussed here is /a/ in [+ATR] environments, nasalised vowels and vowel lenthening.

2.9.2.2.1 /a/ in [+ATR] environments

The vowel /a/, unlike in most of the other Mbam languages, does occur in the environment of [+ATR] vowels, in V_2 position of nouns or in the suffix of verb stems. When it occurs in a noun root or verb stem with a non-high vowel, it does not change its phonetic quality in the [+ATR] environment. When /a/ occurs as a final vowel in verb roots with high [+ATR] vowels, however, its [+ATR] counterpart /e/ occurs.[176]

2.9.2.2.2 Nasalised vowels

Nasalised vowels are not contrastive, but are the result of a nasal environment. The principal cause of vowel nasalisation is the synchronic elision of an underlying nasal consonant in word-final position, see Example 255 below. The elision of the final nasal also lengthens of the resulting nasalised vowel.

Example 255: ≠(C)Ṽ correspondences with neighbouring languages

gloss	**Mbure**			**Yangben**	**Baca**
throat	m̀≠mĩ́:	~	m̀≠mĩ́n	kì≠mɛ̀n	---[177]
knee	ŋ̀≠kẽ̂ː	~	ŋ̀≠kẽ̂n	à≠kɛ́n	---
thigh	m̀≠bɛ̃́:	~	m̀≠bɛ̃́n	---	à≠fɛ̀n
sole (foot)	m̀≠bã̀	~	m̀≠bã̀n	m≠baná	---
child	mɔ̃̀≠ɔ̃́	~	mɔ̃̀≠ɔ̃́n	mʊ̀≠ʊ́n	mʊ̀≠ʊ́n
bird	ǹ≠nõ̀:	~	ǹ≠nõ̀n	ì≠nòní	fì≠nòɲó
goat	m̀≠bũ̀:	~	m̀≠bũ̀n	m̀≠bùɲ	m̀≠bûɲ

Nasalised vowels are also found in the environment of a prenasalised consonant in syllable-final position and in classes 10 or 6a prefixes, ɪN-. Sometimes the nasal consonant is still present, sometimes it is not. Before bilabials, the nasal is most often present, before coronals and velars, it is often less perceptible, see Example 256.

Example 256: Nasalised vowels in Mbure

	surface form	**underlying form**	***gloss***
before prenasalised consonant	nìpʰĩ̀ⁿtʃ	nì≠fìⁿs	*c5.testicle*
	nìnẽ́ᵐb̥ʰ	nì≠néᵐb	*c5.tongue*
	ŋ̀kɛ̃̀ⁿd̥	ŋ̀≠kɛ̀ⁿd	*c9.voyage*
	ŋ̀kã́ⁿd̥ʰ	ŋ̀≠káⁿd	*c1.woman*
	ŋ̀kɔ̃̀ⁿd̥	ŋ̀≠kɔ̀ⁿd	*c9.foot*
	pʰùmõ̀ⁿd̥	pʊ̀≠mòⁿd	*c14.panther*
	mũ̀ũ̀d̥	mʊ̀≠ìⁿd[178]	*c1.person*
ɪN-prefix	ĩ̀mbã̂:	ìm≠pân	*c10.knees*
	ĩ̀mpʰùtʰ	ìm≠fùt	*c10.grasses*
	ĩ̀tékʰ	ìn≠ték	*c6a.navels*
	ĩ̀tʃóló	ìn≠sóló	*c6a.yams sp.*
	ĩ̀kóɾ	ìŋ≠kóɾ	*c6a.rats*

---

[176] Yangben, the language adjacent to Mbure also has /e/ as the [+ATR] counterpart of /a/.
[177] The dashed lines indicate that the corresponding word is not a cognate.
[178] See Example 266 in Section 2.9.4.3 for discussion of this underlying form.

2.9.2.2.3 Vowel lengthening

Long vowels occur in two contexts: bimorphemic and monomorphemic. Bimorphemic long vowels are the result of a CV prefix preceding a VC root where the juxtaposed vowels are identical, see section 2.9.4.2 below.

Monomorphemic long vowels occur in either CV:C or CV: syllables. In the case of monomorphemic long vowels in CV:C nouns, every attested example has an aspirated consonant in final position. Based on the similarity of this language with other Mbam languages, it is assumed that this aspiration is either a voiceless vowel or marks the loss of a voiceless vowel. In the second hypothesis, one could argue that the loss of the final vowel is compensated by the lengthening of the remaining vowel. This also applies to the numeral, three, see Example 257.

Example 257: Vowel lengthening in Mbure

gloss	**Mbure**	**Yangben**	**Baca**
flesh	m̀≠mèːkʰ	è≠mèkú[179]	à≠mèké
wing	kì≠bàːpʰ	kì≠pàpɔ́	kì≠pàpá
cloud (fog)	kì≠ɾɔ́ːⁿd̥ʰ	kì≠lɔ̀ⁿdɔ́	kì≠lɔ̀ⁿdɔ́
three	≠táːtʰ	≠tátɔ̥̀	≠tát

Monomorphemic long vowels also seem to often occur as compensatory lengthening with nasalised vowels due to the loss of the nasal consonant, as in section 2.9.2.2.2 above. Compensatory lengthening due to the loss of a segment may also explain the lengthening of vowels in words for *egg* and *river,* although for the latter, no evidence is found for this in any of the Mbam languages.

gloss	**Mbure**	**Yangben**	**Baca**
egg	kì≠tʃɛ̃ː	nì≠kɛ̌ː	ǹ≠hɛ̀gɛ́
river	sǎː	à≠sǎː	à≠sǎː

In one case, that of the conjunction *when*, the vowel lengthening may be due to vowel assimilation of a semivowel-vowel (SV) sequence.

gloss	**Mbure**	**Yangben**	**Baca**
when	nǐːk	níːk	nʲɛ̀k

2.9.2.3 Vowel co-occurrences

Mbure noun roots are predominantly monosyllabic, although some are disyllabic. Of the 369 nouns in the database, 221 nouns (60%) have monosyllabic roots, 22 nouns (6%) have complex (reduplicated or compound) stems. Only 126 nouns (34%) have disyllabic roots. As a result of the low percentage of disyllabic roots, only a few CVCV(C) vowel co-occurrences have been found in the data used for this study.

[179] In Yangben, the final vowel is not elided or devoiced when the melody is LH, see Section 2.8.2.2 above for details.

Despite the limited CVCV(C) noun root inventory, certain factors governing the co-occurrences of vowels in disyllabic noun roots can be found.

2.9.2.3.1 ATR-harmony restrictions

Mbure nouns have a weak vowel harmony, in that [-ATR] V_1 will necessitate a [-ATR] V_2 and a [-ATR] vowel in the noun-class prefix where applicable. A [-ATR] V_2 occurs with a [+ATR] V_1 except in the case of /u/ and /i/ which will assimilate to the tongue-root value of /a/. In Table 47 below, all ATR vowel co-occurrences in CVCV noun roots found in the corpus are shown.

Table 47: ATR vowel co-occurrences in Mbure CVCV noun roots

i-i	ǹ≠tʰíⁿdʒí	*stem, stalk*	ɔ-ɪ	---	---
i-e	m̀≠bínè	*darkness*	ɔ-ɛ	nì≠kɔ̀ⁿdɛ̀	*plantain*
ɪ-a	kì≠tíⁿdà	*heel*	ɔ-a	kì≠sɔ́hà	*bone*
i-o	---	---	ɔ-ɔ	kì≠kɔ́kɔ̀	*bark (tree)*
i-u	---	---	ɔ-ʊ	---	---
e-i	nì≠ⁿdʒèɾì	*beard*	o-i	ŋ̀≠kónì	*adult*
e-e	kʰì≠jènè	*oil*	o-e	ɾònè	*groundnut*
e-a	---	---	o-a	---	---
e-o	---	---	o-o	mù≠sónò	*frog*
e-u	---	---	o-u	---	---
ɛ-ɪ	---	---	u-i	--	---
ɛ-ɛ	kì≠ⁿtʃɛ́nɛ́	*old hoe*	u-e	nì≠kʰúbè	*banana*
ɛ-a	tʃ≠ɛ́là	*arrow*	ʊ-a	ì≠kʊ́nà	*bean*
ɛ-ɔ	---	---	u-o	---	---
ɛ-ʊ	---	---	u-u	---	---
a-ɪ	ŋ̀≠káhì	*cord for snare*			
a-ɛ	ì≠kàmɛ̀	*birdlime*			
a-a	kì≠tàŋà	*cricket*			
a-ɔ	---	---			
a-o	---	---			
a-ʊ	---	---			

2.9.2.3.2 Other V_2 co-occurrence restrictions

In CVCV noun roots, all vowels are found in the V_2 position except /u/ and /ʊ/. In general, a non-round V_1 will have either a high or open [non-high] vowel V_2. Where the V_1 is a open round vowel /o/ or /ɔ/, the V_2 will be an open or an identical round vowel. Where V_1 is a open front vowel /e/ or /ɛ/, V_2 will be an open or an identical front vowel. There are a couple of exceptions to these rules: 1) The vowel /e/ has only two combinations, /e-i/ and /e-e/. The contrast between the open V_2 and the front V_2 is neutralised. In similar fashion, the vowel /ɛ/ has only two combinations, /ɛ-a/ and /ɛ-ɛ/. The contrast between the high V_2 and the front V_2 is neutralised. 2) the vowels /u/ and /ʊ/ do not take a high or an open V_2. Table 48 below lists the permitted combinations of vowels in CV_1CV_2 nouns.

Table 48: Surface CV_1CV_2 combinations permitted in Mbure

V1/V2	high	open	front/round	high	open	front/round
i	i-i	i-e	---			
e	e-i	(e-e)	e-e			
o	o-i	o-e	o-o			
u	---	u-e	---			
ɪ				---	ɪ-a	---
ɛ				(ɛ-ɛ)	ɛ-a	ɛ-ɛ
a				a-ɪ	a-a	a-ɛ
ɔ				ɔ-ɛ	ɔ-a	ɔ-ɔ
ʊ				---	ʊ-a	---

2.9.3 Vowel-harmony processes

Mbure has a simplified system of ATR vowel harmony, which occurs both within the morpheme and across morpheme boundaries. It is much less robust than the ATR harmony in the neighbouring languages.

2.9.3.1 ATR harmony in pre-stem elements

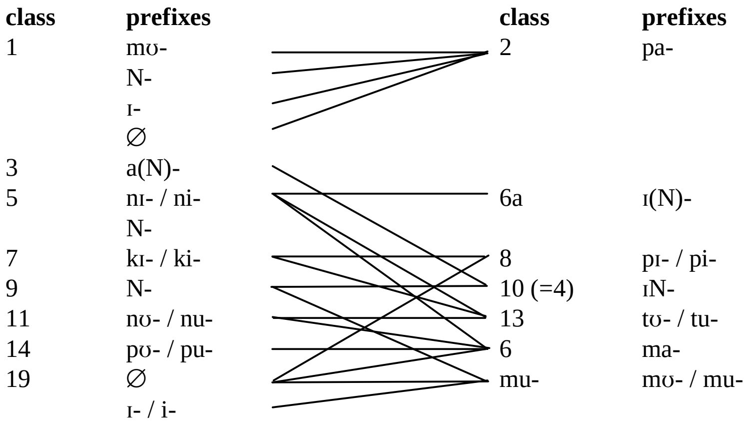
Both nominal and verbal prefixes undergo ATR harmony. Other verbal pre-stem elements do not.

Mbure has a system of fifteen noun classes that combine into fifteen double-class genders, and two single-class genders.

The following double-class genders occur: 1/2, 3[180]/4(=10), 5/6, 5/6a, 5/13, 7/8, 9/10(=4), 14/6, 19/mu. A few examples of 7/13, 9/mu, 11/6, 11/13, 19/6 and 19/8 have also been found. The single-class gender is 6, with some cases found also in class 8.

[180] Scruggs (1982:68) indicates that Mbure (Mbola) does not have classes 3 and 4. While I agree that class 4 is merged with class 10, there does not seem to be a complete merger of class 3 with class 9. A handful of nouns have concords more like what one would expect of class 3 nouns, as in the examples below:

ǹtáp ú pũ̏bṹ *branch assoc. tree*
c3.branch c3 c14.tree
ǹtí dʒì pũ̏bṹ *stump assoc. tree*
c9.stump c9 c14.tree



Noun-class prefixes are underlyingly [-ATR] but have a [+ATR] counterpart when preceding a [+ATR] noun root. With the exception of classes 3 and 9, which consist of a nasal, all Mbure noun-class prefixes contain one of three underlying vowels /ɪ/, /ʊ/ and /a/, which all, except /a/, and the noun-class prefix **mʊ-** will undergo ATR harmony. The vowel /a/ occurs with [+ATR] vowels without change, see

Table 49

Table 49: Harmonisation of Mbure [-ATR] high-vowel N. class prefixes

class	**noun-class prefix**	**example**	***gloss***
1	ɪ-	ì≠tát	*sorcerer*
		ì≠ᵐbó	*young girl*
2	pa-	pà≠tát	*sorcerers*
		pà≠ᵐbó	*young girls*
5	nɪ-	nì≠kàɾ	*hand*
		nì≠píɾ	*oil palm*
6a	ì(N)-	ì̃≠kàɾ	*hands*
		ì̃m≠bíɾ	*oil palms*
	ìŋg-	ì̃ŋg≠ɔ̀ŋ	*spears*
		ì̃ŋg≠òl	*fishing lines*
6	ma-	mà≠náŋ	*blood*
		mà≠hébìt	*breath*
		mà≠kólò	*works*

class	**noun-class prefix**	**example**	***gloss***
7	kɪ-	kì≠páp	*wing*
		kì≠ɾóbó	*toad*
8	pɪ-	pì≠páp	*wings*
		pì≠ɾóbó	*toads*
10	ɪN-	ìn≠táp	*branches*
		ìm≠fɛ̀n	*puff adders*
		ìŋ≠kúm	*boa constrictors*
11	nʊ-	nù≠úɲè	*hair (sg)*
13	tʊ-	tʊ̀≠nà	*intestines (pl)*
		tù≠úɲè	*hair (pl)*
14	pʊ-	pʊ̀≠ⁿtʃá	*savanna (uncultivated)*
		pù≠kólò	*work*
19	ɪ-	ɪ̀≠kʊ́nà	*bean*
		ɪ̀≠nê	*vagina*
pl of 19	mʊ-	mʊ̀≠kɛ̀ŋ	*hoes (n)*
		mù≠sét	*duikers*

Verbs in Mbure have one of three noun-class prefixes. Although the most common is class 15, **kʊ-**, there are also verbs in class 7, **kɪ-,** and class 6, **ma-**. According to Maho (1999: 51), a possible set of noun classes for proto-Bantu (based on the works of Meinhof, Meeussen, Welmers and Hinnebusch) suggests that ***mà-*** (class 6) could be a plural of class 15, among others. Class 7 and 15 noun-class prefixes will undergo ATR harmony, but class 6 does not, see Example 258.

Example 258: Mbure infinitive class prefixes

NC 15 (kʊ-)	***gloss***	**NC 6 (ma-)**	***gloss***	**NC 7 (kì-)**	***gloss***
kʊ̀≠pàn-à	*count*	mà≠míɲ-à	*drink*	kì≠pèk-à	*burn*
kù≠péb-à	*sleep*	mà≠bút-è	*strike*	kì≠pùk-è	*shut*
kù≠pím-è	*swell*	mà≠kàŋ-à	*attach*	kì≠hòⁿd-à	*lie (v)*
kù≠pín-è	*dance (v)*	mà≠kón-ì	*be ripe*	kì≠kɔ́ᵐb-à	*scratch*
kʊ̀≠kʊ́ŋ-à	*hunt*	mà≠kʊ́k-ât	*pull*	kì≠tôːt-à	*throw*
kù≠fúŋ-è	*blow*	mà≠kʊ̀w-à	*fall*	kì≠kàk-à	*butcher*
kù≠hór	*be sharp*	mà≠tíb-ì	*pierce*	kì≠nɔ̂m-à	*bite*
kʊ̀≠kɛ́b-à	*dig*	mà≠ník-è	*bathe*		
kʊ̀≠kɔ́t-à	*take*				

Mbure numeral concord prefixes are invariably [-ATR]. Prefixes with high vowels will assimilate to ATR harmony of the numeral root (shaded in Example 259 below). Prefixes containing the vowel /a/ do not harmonise.

Example 259: Mbure numeral prefixes

class	**num. prefix**	**example**	***gloss***
1	mʊ-	mʊ́≠ɔ̀ⁿt mɪ̀≠mʷɪ̀	*one person*
2	pa-	pɛ́≠ɛ̀ⁿt pá≠pàⁿd	*two persons*
		pɛ́≠ɛ̀nt pá≠tát	*three persons*
		pɛ́≠ɛ̀nt pá≠ɲɛ̋	*four persons*
		pɛ́≠ɛ̀nt pá≠tâːn	*five persons*
3	a-	ǹtím mʷɪ̀	*one heart*
4	∅	ǹtím pàⁿd	*two hearts*
		ǹtím ɲɛ̋	*four hearts*
5	nɪ-	nɪ̀í nɪ́≠mʷɪ̀	*one eye*
6a	N-	ìŋgí ḿ≠pàⁿd	*two eyes*
		ìŋgí ɲ́≠ɲɛ̋	*four eyes*
7	kɪ-	kɪ̀páp kɪ́≠mʷɪ̀	*one wing*
8	pɪ-	pɪ̀páp pɪ́≠pàⁿd	*two wings*
		pɪ̀páp pí≠ɲɛ̋	*four wings*
9	-ɪ	m̀pɛ̀n ɪ̀≠mʷɪ̀	*one viper*
10	N-	ìmpɛ̀n ḿ≠pàⁿd	*two vipers*
	-ɪ	ìmpɛ̀n í≠ɲɛ̋	*four vipers*
11	nɪ-	nʷà nɪ́≠mʷɪ̀	*one chin*
13	tɪ-	tʷà tɪ́≠pàⁿd	*two chins*
		tʷà tí≠ɲɛ̋	*four chins*
14	pʊ-	pʷɔ̌s pʊ́≠ mʷɪ̀	*one day*
6	ma-	mʷɔ̌s má≠pàⁿd	*two days*
		mʷɔ̌s má≠ɲɛ̋	*four days*
19	ɪ-	jɪ̀≠ɪ̀k ɪ́≠mʷɪ̀	*one fire*
pl	mʊ-	mʷɪ̀k mʊ́≠pàⁿd	*two fires*
		mʷɪ̀k mú≠ɲɛ̋	*four fires*

Pre-stem verbal elements in Mbure[181] are not subject to vowel harmony, even when it concerns the high vowels, see Example 260. These pre-stem verbal elements therefore must be considered as separate grammatical words.

[181] Mbure is exceptional among the Mbam languages in that most often, the reflexive is a suffix -(V)b, propably a reflex of the proto-Bantu passive extension, as in the following verbs:

kì≠bík-p-èn-è	*besmear (ointment) on oneself*
má≠kán-b-èn-è	*lie down*
kì≠kóg-òb-èn-è	*crawl*

Only one example in the corpus has been found which has a prefix similar to the reflexive prefix of the other languages, but it has a L(ow) tone rather than the expected H(igh). It is possible that this is a borrowed word: bì≠sóg-ìɾ-ìn-ì *pray*

Example 260: Non-harmonising Mbure preverbal elements

sub. concord	à	à sìŋɾè	*c1 caress*
		à ɾɛ́bà mɔ̀	*c1 advise 3s*
	ìn	ìn fùké pɛ̀n	*1s harvest yams*
		ìn kàhà m̀bòt	*1s scatter seed*
	ù	ù té^{m}bà	*2s PRES-rise up*
		ù táŋà ìɲàm	*2s feed animals*
tense	à	w-à tè^{m}bà	*2s-P2 rise up*
	má	ù-má táŋà ìɲàm	*2s-P1 feed animals*
	à ́	m-à té^{m}bà	*1s-FT rise up*

2.9.3.2 Vowel harmony in suffixes

Most verb suffixes undergo vowel harmony, but there are two suffixes which trigger ATR harmony. Discussed in turn below suffixes that undergo ATR harmony, the rounding of the final vowel, and the [+ATR]-dominant suffix.

ATR harmony in verb suffixes

Most verb extensions and inflectional suffixes undergo ATR harmony. Extensions and inflectional suffixes with a high [-ATR] vowel will undergo ATR harmony. However, extensions and suffixes with /a/ only undergo ATR harmony in the environment of /i/ or /u/. In addition, the vowel /a/ blocks ATR harmony. A few examples are shown in Example 261 below:

Example 261: Harmonisation of verbal suffixes

final vowel	-a	≠kòw-à	*fall*
		≠kón-à	*show*
		≠púh-è	*bubble over*
		≠tíb-è	*pierce*
intensive	-ɪk	≠sàn-ìk	*divorce*
		≠mɛ̀t-íɾ-ík-ì	*accompany*
		≠pòɾd-ìk	*break (INTR)*
		≠nìd-ìk-ì	*push*
reversive	-ʊk	≠táp-òk-à	*ford (a river)*
		≠hɔ̀^{m}b-òk	*annoy, disturb*
		≠tùɾ-ùk	*leave to marry (woman)*
diminutive	-ɪt	≠ǎh-ìt	*yawn*
		≠tɔ́ŋ-ìt	*sing*
		≠hò^{n}d-ìt	*lie (v)*
		≠pím-ìt	*inflate*

continuous	-an	≠ɛ̌n-àn-ì	*see*
		≠màt-ìk-àn-ì	*divide, separate*

In cases where the verb root is [+ATR] and a verbal suffix with a high vowel is interposed and harmonises, [ATR] harmony will continue to spread even to changing the final vowel /a/.

Example 262: Mbure final vowel after suffix in [+ATR] environment

applicative	-ɪn	≠hò^{n}d-à	*lie*
		≠hò^{n}d-ìn-è	*deceive*

2.9.3.2.1 Rounding harmony in suffixes

Mbure has only traces of rounding harmony. Only a handful of words show any tendency towards rounding harmony and those only in noun roots (Section 2.9.2.3) and verb stems. Predominantly it is the final vowel that is rounded when the verb root contains either /o/ or /ɔ/, but only four cases have been found in the corpus. Why these particular words should have a rounded final vowel and other verbs with /o/ and /ɔ/ do not, is not clear. One possibility is, that with the shifting vowel system and the indications that the vowel inventory is losing contrast in the high vowels, /ʊ/ is being reanalysed as [o] or [ɔ], see Example 263 below.

Example 263: Rounding harmony in Mbure final vowels

	surface form	**underlying form**	***gloss***
-a	≠ǒb-ò	≠ǒp-à	*steal, rob*
	≠ǒɾ-ò	≠ǒɾ-à	*come*
	≠bʲǒn-ò	≠pʲǒn-à	*give birth*
	≠ɔ́g-ɔ́	≠ɔ́g-á	*save*
	≠sòg-à	≠sʊ̀k-à	*bathe*
	≠sɔ́h-à	≠sʊ́h-à	*smoke*
	≠ɔ̌n-à	≠ʊ̌n-à	*kill*

2.9.3.2.2 The ATR-dominant suffix

The [+ATR] causative suffix **–i** is [+ATR]-dominant and triggers ATR harmony throughout the entire verb stem. All [-ATR] vowels are targeted, including /a/. Since the ATR-dominant suffixes usually occur at the end of the word, this suffix-triggered ATR harmony is only known to spread to the left. The bolding in Example 264 shows the [-ATR] root-vowel alternations.

Example 264: ATR dominant causative extension -i in Mbure

causative	-i	---	---	≠ǐt-ì	*give*[182]
		≠pél-à	*call s.o.*	≠pél-ég-ì	*cause to call s.o.*
		≠**sɛ̀ɾ**-à	*descend*	≠s**è**ɾ-ì	*lower*
		≠p**à**ŋ-à	*weep*	≠p**è**ŋ-s-ìn-ì	*cause to weep*
		≠t**ɔ́**ŋ-à	*sing*	≠t**ó**ŋ-s-ì	*cause to sing*
		≠ɔ̀ⁿd	*return*	≠òⁿd-ì	*cause to return*
		≠t**ʊ̀**ɾ	*be dull*	≠t**ù**ɾ-s-ì	*dull (TR)*
		≠lúm	*be calm*	≠lúm-s-ì	*calm (TR)*

2.9.4 Hiatus-resolution processes

There are several hiatus-resolution processes found in Mbure. Glide formation including the palatalisation of noun-class 7 prefix **kɪ-** before a vowel-initial root is discussed in section 2.9.4.1, hiatus retention in section 2.9.4.2 and vowel assimilation in section 2.9.4.3.

2.9.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted. Where V_1V_2 sequences occur, either within the morpheme or across morpheme boundaries, a high vowel in V_1 position becomes a glide. Glide formation occurs principally between a high vowel in the noun-class prefix and a vowel-initial noun root, as seen in Table 50 below:

Table 50: Prefix-root glide formation in Mbure

surface form	underlying form	*gloss*
mʷìk	mʊ̀≠ìk	*cmu.fires*
nʷàs	nʊ̀≠às	*c11.chin*
pʷǎkʰ	pʊ̀≠ák	*c14.year*
tʷɔ̏̌	tʊ̀≠ɔ̀n	*c13.laughs*
pʷɔ̌s	pʊ̀≠ɔ́s	*c14.day*
pʲàn	pɪ̀≠àn	*c8.hornbills*
nʲòmá	nɪ̀≠òmá	*c5.stream*
nʲɔ̀kʰ	nɪ̀≠ɔ̀kʰ	*c5.bee*
kʷǐdì	kʊ̀≠ít-ì	*c15.give*
kʷɛ̀ⁿdà	kʊ̀≠ɛ̀ⁿd-à	*c15.walk*
kʷǎk	kʊ̀≠ák	*c15.put, pour*
kʷǒp	kʊ̀≠óp	*c15.rob, steal*
kʷɔ̌p	kʊ̀≠ɔ́p	*c15.hear*

[182] Clear cases of a causative construction with a verb-root vowel /i/ and /ɪ/ have not been found in the corpus. It is assumed that gaps are accidental and that in a larger corpus, such examples would be found.

When the noun-class 7 prefix **kɪ-** occurs with VC noun roots, the resulting glide palatalises the velar consonant, see Example 265. The prefix is realised as [tʃ] unless the root vowel is /i/ or /ɪ/.

Example 265: Palatalisation of noun-class 7 prefix kɪ- in Mbure

surface form		**underlying form**		***gloss***
kìkás	pìkás	kì≠kás	pì≠kás	*leaf(s)*
kììpʰ	pììpʰ	kì≠ìp	pì≠ìp	*forest(s)*
tʃàn	pʲàn	kì≠àn	pì≠àn	*hornbill(s)*
tʃěs	pʲěs	kì≠és	pì≠és	*taro*
tʃɔ̀há	pʲɔ̀há	kì≠ɔ̀há	pì≠ɔ̀há	*feather*

Unlike many of the other Mbam languages, very few CV verb roots have been attested. Only one example[183] has been found, and while it seems likely that glide formation also occurs between a CV verb root and a suffix, the one example is inadequate to determine it: [bʲǎ] *have, possess* which can perhaps be analysed as **≠pì-á**.[184]

2.9.4.2 Hiatus retention

Identical vowels in juxtaposition are permitted. This is particularly evident between the noun-class prefix and the noun root. Where the vowels are either underlyingly identical or have identical surface realisations due to ATR harmony, both vowels are retained, see Table 51.

Table 51: Prefix-root hiatus retention in Mbure

surface form	**underlying form**	***gloss***
nìís	nì≠ís	*c5.eye*
nìítʰ	nì≠ít	*c5.mouth*
kìíɲɛ̀	kì≠íɲɛ̀	*c7.hair (sg)*
jììkʰ	jì≠ìk	*c19.fire*
nùúɲɛ̀	nò≠úɲɛ̀	*c11.hair*
mèés	mà≠és	*c6.armpits*

2.9.4.3 Vowel assimilation

Vowel assimilation occurs in V_1V_2 sequences across morpheme boundaries, as is seen between CV noun-class prefixes and a vowel-initial noun root, see Example 266:

[183] The low number of CV verb roots is very likely due to the limitations of the database.
[184] It cannot be analysed as ≠pì-á because the high [+ATR] vowels cause the final vowel to surface as /e/. If the vowel were /i/, the word would have the surface form [pʲe] rather than [bʲa].

Example 266: Assimilation of the prefix vowel and the VC noun root

surface form		**underlying form**		***gloss***
mɔ̏ɔ̋	pȁa̋	mò≠án	pà≠án	*c1/2.baby(s)*
mȕȕt	pɛ̏ɛ̏t	mò≠ìⁿd	pà≠ìⁿd	*c1/2.person(s)*
mììᵐp		mà≠ìᵐp		*c6.water*
pùùp	pò≠òp	---	---	*c14.theft*
nɔ̌ɾ	tʷɔ̌ɾ	nì≠ɔ́ɾ	tò≠ɔ́ɾ	*c5/13.body(ies)*

2.9.5 Tone

Mbure has a two-tone system underlyingly, high and low. Contour melodies are caused by glide formation from syllable mergers and by the historical reduction from disyllabic to monosyllable roots.

Unlike in some of the other Mbam languages, there is no indication of a loss of contrast of tone melodies in utterance-final position in connection with vowel devoicing or elision. It is interesting to note that Mbure has a dearth of CVCV noun roots (caused by a complete elision of the V_2). Surface tone is marked on the data in this study.

2.9.5.1 Tone melodies on nouns

Only high and low melodies are found in short syllable CV or CVC (monomoraic) noun roots. However, in bimoraic noun roots, CṼ: (CVN), CVⁿC and CVCV noun roots, all four tone melodies are attested, see Example 267 below. Noun prefixes usually have a low tone, although there are a few exceptions.

Example 267: Mbure nominal tone melodies

nì≠wà	≠L	*river*
nì≠má	≠H	*clay*
kì≠sàs	≠L	*chest*
kì≠kás	≠H	*leaf*
ǹ≠nȍː	≠L	*bird*
mɔ̌ː	≠LH	*baby*
nì≠kőː	≠H	*stone*
m̀≠fȗː	≠HL	*nose*

pù≠mò^{n}d	≠L	*panther*
nì≠pǒ^{n}d	≠LH	*stomach*
kì≠tó^{m}b	≠H	*caterpillar*
---[185]	≠HL	---
ì≠kàmɛ̀	≠L.L	*bird lime*
n≠tʃɛ̀mɛ́	≠L.H	*morning*
pì≠kɛ́ɲɛ̀	≠H.L	*charcoal*
kì≠tʃɛ́nɛ́	≠H.H	*used hoe*

2.9.5.2 Tone melodies on verbs

All four possible underlying tone melodies have been found for Mbure verb roots: L, HL H and LH. In verb stems which contain two or more suffixes, and a H melody, the H spreads to the right to the penultimate syllable. It is assumed that verbal suffixes are underlyingly toneless. The verbal tone melodies are illustrated in Example 268 below.

Example 268: Mbure verbal tone melodies

L	≠pòd-à	≠L –L	*flow*
	≠pìg-ìk-à	≠L –L –L	*think*
HL	≠tóŋ-à	≠H –L	*blow (horn)*
	≠tíh-ìk-ì	≠H –L –L	*approach*
	≠sók-ìɾ-ìn-ì	≠H –L –L –L	*pray*
H	≠kóɲ-á	≠H –H	*be dry*
	≠pít-íp-ín-ì	≠H –H –H –L	*be dirty*
LH	≠fàh-á	≠L –H	*grill*
	≠bì^{n}d-ɛ́	≠L –H	*follow behind*
	≠^{n}jèb-án-ì	≠L –H –L	*go, leave*
	≠mɛ̀t-íɾ-ík-ì	≠L –H –H –L	*accompany someone*

In addition to providing lexical contrast, tone also has a grammatical function. Among other things, tone provides the crucial difference between various tenses in verb conjugations. This is, however, beyond the scope of this study.

2.10 Baca phonological overview

Baca is spoken in the village of Bongo. It has three dialects, *Baca*, spoken in the quarters of Ganok, Nkos, Buyatolo, Buyabikɛl, Buyabatug and Buyamboy; *Kélendé* spoken in the quarters of Kélendé Mbat and Kélendé Mɔma; and *Nibieg* spoken in

[185] HL tone with a CV^{n}C syllable structure has not been found in the corpus. It is assumed that this gap is accidental and examples would be found in a larger corpus.

the quarter of the same name. This study is based on personal research on the main dialect spoken in Ganok quarter[186].

2.10.1 Consonants

This section discusses the consonant inventory of Baca (section 2.10.1.1), the various adaptations to it due to allophonic and allomorphic realisations (section 2.10.1.2) and distribution restrictions (section 2.10.1.3).

2.10.1.1 Consonant inventory

The consonant system of Baca consists of 18 contrastive consonants.

Table 52: Baca contrastive consonants

		labial	alveolar	palatal	velar
stops	voiceless	p	t		k
	prenasalised	ᵐb	ⁿd		ᵑg
fricatives	voiceless	f	s		h
	prenasalised	ᶬf	ⁿs		
resonants	nasal	m	n	ɲ	ŋ
	oral		l	j	w

2.10.1.2 Allophonic and allomorphic realisations

Baca has both oral and prenasalised stops and fricatives. Oral stops are voiceless in morpheme-initial and word-final positions, see Example 269.

Example 269: Voiceless stops in morpheme-initial and final position

		surface form	**underlying form**	***gloss***
prefix	/p/	pòsɔ́	pò≠sɔ́	*tree*
		pòmóhò	pò≠móhò	*one (1)*
	/t/	tònɔ̀t	tò≠nɔ̀t	*vomit*
		tòpàl	tò≠pàl	*gonorrhea*
	/k/	kùpìt	kù≠pìt	*word*
		kìkóh	kì≠kóh	*bone*

[186] The Baca database includes over 750 terms, most with example sentences collected over two short visits to the village in June 2007 and February 2009 and a week workshop in Yaoundé with a team of Baca speakers. The data includes recordings of a large percentage of the items collected, and in the case of verbs, including sentences or conjugations. Also consulted are two M.A. theses in linguistics from the University of Yaoundé I: Abessolo Eto Roger (1990) and Sebineni Alphonsine Flore (2008), which includes a list of 250 terms in the annex. In addition, two other wordlists were consulted: Guarisma and Paulian (1986) and Scruggs (1982).

		surface form	**underlying form**	***gloss***
root-initial position	/p/	kìpàpá	kì≠pàpá	*wing*
		màpɛ́nɛ̀	mà≠pɛ́nɛ̀	*milk*
		kʊ̀pɛ́k	kʊ̀≠pɛ́k	*burn*
	/t/	àtɔ̂	à≠tɔ̂	*cinders*
		pìtɛ́	pì≠tɛ́	*saliva*
		kʊ̀tɛ́mà	kʊ̀≠tɛ́m-à	*weed*
	/k/	àkɑ́ɑ̃́ⁿd̥	à≠kááⁿd	*woman*
		fìkòló	fì≠kòló	*mushroom*
word-final position	/p/	ɜ̀ŋíp	àŋ≠íp	*thief*
		fʲɔ̌p	fì≠ɔ́p	*hoe*
		kùlùp	kʊ̀≠lùp	*be wet*
	/t/	nìít	nì≠ít	*mouth*
		kʊ̀sɔ̂t	kʊ̀≠sɔ̂t	*live*
	/k/	kìtɛ́k	kì≠tɛ́k	*navel*
		màsɔ̀k	mà≠sɔ̀k	*salt*
		pùtúk	pʊ̀≠túk	*night*

2.10.1.2.1 Intervocalic lenition

In morpheme-internal position in nouns or in stem-internal position in verbs, oral stops weaken into voiced continuants, see Example 270, below.

Example 270: Intervocalic lenition in Baca

surface form	**underlying form**	***gloss***
kùlúβɜ̀	kʊ̀≠lúp-à	*be wet*[187]
pʊ̀sɔ̀βɔ́	pʊ̀≠sɔ̀pɔ́	*groundnut*
kʊ̀lɔ́βà	kʊ̀≠lɔ́p-à	*get angry*
kù≠téɲíβìt	kù≠téɲ-íb-ìt	*stand up*
kùpóɾɜ̀n	kù≠pót-àn	*exit*
kùlíɾɜ̀	kʊ̀≠lít-à	*be heavy*
ɜ̀mbùɾɜ̀	àm≠bùtà	*small-head mud fish*
ɜ̀mèɣé	à≠mèké	*flesh*
ŋ̍hɛ̀ɣɛ́	ǹ≠hɛ̀kɛ́	*egg*
kʊ̀sɔ̀ɣà	kʊ̀≠sɔ̀k-à	*wash*

[187] The fact that [b] or [β] are allophones of /p/ is seen when comparing [kùlùp] *be wet* found in Example 269 above with this form which has a verbal suffix.

2.10.1.2.2 Post-nasal hardening and voicing

Stops and fricatives are hardened following a nasal. Stops become voiced, and fricatives become affricates. This is most evident across morpheme boundaries either between a prefix and root or in reduplicated roots, as in Example 271.

Example 271: Pos-nasal hardening in Baca

	S.F.	**U.F.**	***gloss***
Stops	àmbɔ̂k	àN≠pɔ̂k	*c3.hand*
	àŋgàŋá	àN≠kàŋá	*c3.root*[188]
	àŋgɛ̏ⁿd̥	àN≠kɛ̀ⁿd	*c3.market*
	àmbáná	àm≠páná	*c6a.soles of feet*[189]
	àmbʲɛ́nɛ̀	àm≠píɛ́nɛ̀	*c6a.breasts*
	àmbȕtʃú	àm≠pùⁿsú	*c6a.stomachs*
	mbʷâ	N≠pʷâ	*c9.dog*
	ndêj	N≠têj	*c9.slobber*
	ŋgấⁿd̥	N≠káⁿd	*c9.monkey*
	àŋgúngùn	àN≠kún-kùn	*c1.leper (from* ***ŋ̀≠kún*** *leprosy)*[190]
Fricatives	ȁpfóɲ	àN≠fóɲ	*c3.wind*
	ȁpfʲɔ̂́ᵐb̥	àN≠fíɔ́ᵐb	*c3.tail*
	ȁtʃàmɔ́	àN≠sàmɔ́	*c3.fruit*
	ȁtʃɛ́m	àN≠sɛ́m	*c3.heart*
	pfûn	N≠fûn	*c9.nose*
	tʃèné	N≠sèné	*c9.worm*

2.10.1.2.3 Failure of post-nasal hardening

The noun-class 5 prefix surfaces as a homorganic syllabic nasal before a consonant-initial noun root. Unlike noun-class 9 homorganic nasals, noun-class 5 nasal prefix is not "phonetically fused ... with the following consonantal segment" (Maho: 1999: 59). While noun-class 9 prefixes will cause hardening of the following consonant, noun-class 5 prefixes do not, as illustrated in the word pairs of Example 272.

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[188] No examples of noun class 3 VN- prefix preceding /t/ is found in the corpus.

[189] Noun-class 6a VN- prefix occurs only before bilabial stops in the corpus.

[190] See section below for an explanation why this word does not undergo post-nasal hardening.

Example 272: Differences in Baca nc 5 and nc 9 nasal prefixes

surface form	**underlying form**			***gloss***
[m̩̀pȕtʃú]	m̩̀≠pùⁿsú	→	nì≠pùⁿsú	*c5.stomach*
[mbű̂ⁿtʃà]	N≠púⁿsà			*c9.fishing net*
[ǹ̩táɲ]	ǹ̩≠táɲ	→	nì≠táɲ	*c5.stone*
[ndêj]	N≠têj			*c9.slobber*
[ŋ̩̀kɔ̏ⁿdɛ̀]	ŋ̩̀≠kɔ̀ⁿdɛ̀	→	nì≠kɔ̀ⁿdɛ̀	*c5.plantain*
[ŋgấⁿd̥]	N≠káⁿd			*c9.monkey*
[m̩̀fɛ̋tʃ]	m̩̀≠fɛ́ⁿs	→	nì≠fɛ́ⁿs	*c5.mongoose sp.*
[pfɛ́n]	N≠fɛ́n			*c9.viper*
[ǹ̩síl]	ǹ̩≠síl	→	nì≠síl	*c5.termite mound*[191]
[tʃés]	N≠sés			*c9.duiker*

The noun-class 5 prefix, although its surface representation is a homorganic nasal, is underlyingly **nɪ-**[192], as can be seen when it occurs before a vowel-initial noun as in Example 273. Noun-class 5 prefix seems to have gone through a process where the prefix vowel was elided between consonants. The remaining /n/ takes on the syllabicity and tone of the elided vowel which then, in juxtaposition with the root consonant, assimilates to its point of articulation.

Example 273: Noun-class 5 prefix on Baca vowel-initial nouns.

surface form	**underlying form**	***gloss***
nìít	nì≠ít	*mouth*[193]
nʲòɲò	nì≠òɲò	*market*
nʲɔ̀ŋɔ́	nì≠ɔ̀ŋɔ́	*spear*
nʲàs	nì≠às	*yawn (n)*

2.10.1.2.4 Prenasalised obstruents

With the exception of /ᶬf/, prenasalised obstruents are found in morpheme-initial, internal or final positions, see Example 274.

Example 274: Prenasalised consonants in Baca

	surface form	**underlying form**	***gloss***
ᵐb	[kìᵐbílà]	kì≠ᵐbílà	*idiot, imbecile*
	[hɛ̏ᵐbɛ́]	hɛ̀ᵐbɛ́	*fish*

[191] Compare with [ȁtʃĩl] c3.termite sp.

[192] Noun-class 5 prefix in most of the Mbam A40/A60 languages is **nɪ-**. In contrast with Baca, which loses the prefix vowel, in Tuki and Gunu, it is the /n/ that is lost before consonant-initial noun roots.

[193] Gaps are considered accidental.

	surface form	**underlying form**	***gloss***
	[mì̀ì̀ᵐb̥]	mì≠ìᵐb	*water*
ⁿd	[kìⁿdómɜ̂n]	kì≠ⁿdómân	*young man*
	[ŋ̩kɔ̀̀ⁿdɛ̀]	nì≠kɔ̀ⁿdɛ̀	*plantain*
	[ŋgá́ⁿd̥]	ŋ≠káⁿd	*monkey*
ᵑg	[kì̀ᵑgùmɜ́]	kì≠ᵑgùmá	*porcupine*
	[kìlèᵑgɜ̀]	kì≠lèᵑgà	*fishing line*
	---	---	---
ⁿs	[kì̀tʃáŋàt]	kì≠ⁿsáŋàt	*monkey sp.*
	[mbú́ⁿtʃɜ̀]	m≠púⁿsà	*fishing net*
	[kʲà̀ⁿtʃ]	kì≠àⁿs	*house*

It is unclear, however, whether /ᶬf/ can be considered a contrastive consonant. Only one example has been found in the corpus within a morpheme. It is possible that this was a noun-class 9 noun which has kept the nasal while adding a noun-class 2 plural, see Example 275.

Example 275: Possible interpretations of ᶬf in Baca

ᶬf	[pfàgá]/[pàpfàgá]	ᶬfàgá/pà≠ᶬfàgá	*lion(s)*
		ɱ̀≠fàgá/pà-ɱ≠fàgá	

Prenasalised consonants are devoiced in word-final position, with the exception of /ᵑg/ which has not been found in syllable-final position; see Example 276.

Example 276: Final-consonant devoicing in Baca

	surface form	**underlying form**	***gloss***
/ᵐb/→[ᵐb̥]	kùsɔ́́ᵐb̥	kʊ̀≠sɔ́ᵐb	*chop, cut*
	mì̀ì̀ᵐb̥	mì≠ìᵐb	*water*
/ⁿd/→[ⁿd̥]	àká́á́ⁿd̥	à≠kááⁿd	*woman*
	ŋ̀kɔ́́ⁿd̥	ŋ̀≠kɔ́ⁿd	*foot*

2.10.1.3 Restrictions in consonant distribution

Baca has both open and closed syllables; CV, CVC, V and VC. All consonants except for /ᵑg/ and /w/ are found in syllable-final position. These gaps are considered to be accidental. Consonant-glide sequences, especially when they occur at morpheme boundaries, are formed by the desyllabification of a high vowel (discussed in section 2.10.4.1 below).

2.10.2 Vowels

This section discusses the vowel inventory of Baca (section 2.10.2.1), the various adaptations to it due to allophonic and allomorphic realisations (section 2.10.2.2), vowel lengthening (section 2.10.2.3) and vowel co-occurrences and co-occurrence restrictions (section 2.10.2.4).

2.10.2.1 Vowel inventory

Baca has an inventory of nine contrastive vowels. A system of vowel harmony regulates the co-occurrences and co-occurrence restrictions of the vowels. The vowels can be divided into two sets, which are mutually exclusive within roots and stems:

Table 53: Baca contrastive vowels

	[-ATR]			[+ATR]	
ɪ		ʊ	i		u
ɛ		ɔ	e		o
	a				

In the verb system, all contrastive vowels are attested in the verb root as seen in Example 277 below:

Example 277: Contrastive vowels in Baca CVC verb stems

	surface form	**underlying form**	***gloss***
/i/	kùpínɜ̀	kʊ̀≠pín-à	*hunt*
/ɪ/	kʊ̀lɪ́gà	kʊ̀≠lɪ́g-à	*lick*
/e/	kùmènɜ̀	kʊ̀≠mèn-à	*swallow*
/ɛ/	kʊ̀pɛ́kà	kʊ̀≠pɛ́k-à	*burn*
/a/	kʊ̀fàkà	kʊ̀≠fàk-à	*put, pour*
/ɔ/	kʊ̀sɔ́sà	kʊ̀≠sɔ́s-à	*smoke, suck*
/o/	kùsóbɜ̀	kʊ̀≠sób-à	*suck*
/ʊ/	kʊ̀fʊ́nà	kʊ̀≠fʊ́n-à	*blow*
/u/	kùkúsɜ̀	kʊ̀≠kús-à	*pierce*

In the noun system, eight of the nine contrastive vowels are found in monomorphemic CV_1CV_1 roots, as in Example 278 below.

Example 278: Permitted vowels in Baca CV_1CV_1 noun roots

/i/	ŋ≠gìlí	*path*	/u/	m̀≠pùⁿsú	*stomach*
	mù≠ɲíhì	*four*		kì≠tùᵐbú	*water snake sp.*
/ɪ/	---	---	/ʊ/	àŋ≠gʊ̀lʊ́	*cord*
	---	---		kì≠lʊ̀nʊ́	*old person*
/e/	kélém	*back*	/o/	fì≠kòló	*mushroom*
	tʃèné	*worm*		fì≠nòɲó	*bird*
/ɛ/	mà≠pɛ́nɛ̀	*milk*	/ɔ/	pɔ̀≠sɔ̀bɔ́	*groundnuts*
	ǹ̩≠hɛ́tɛ́	*hearth stone*		kì≠lɔ̀ⁿdɔ́	*fog, cloud*
/a/	àŋ≠gàŋá	*root*			
	kì≠pàpá	*wing*			

2.10.2.2 The allophone of /a/ in [+ATR] environments

The vowel /a/, unlike in most of the other Mbam languages, does occur in the environment of [+ATR] vowels. In a [+ATR] environment, /a/ is realised as [ɜ][194]. The [+ATR] allophone [ɜ] is illustrated by comparing pairs of verbs with /a/ with the dominant causative suffix **-i**, as in Example 279 below.

Example 279: The allophone of /a/ in Baca causative constructions

[kʊ̀pájà]	*heat*	[kùpɜ́jísì]	/kù≠páj-ís-ì/	*cause to heat*
[kʊ̀kɛ́gà]	*guard*	[kùkégésɜ̀ɲì]	/kù≠kég-és-àn-ì/	*cause to guard*
[kʊ̀hɔ̀:nà]	*sweep*	[kùhò:nɜ̀ɲì]	/kù≠hɔ̀:n-àn-ì/	*cause to sweep*

The allophone [ɜ] is also found in other [+ATR] contexts in both nouns (Example 280 below) and in verbs (in Example 279 above).

Example 280: Allophone of /a/ in Baca nouns

surface form	**underlying form**	***gloss***
mèèsìnɜ̀	mà≠èsìnà	*tears*
fìjégɜ́	fì≠jégá	*doe*
nʷěhíɲɜ̀	nʊ̀≠éhíɲà	*hair (of head)*
mbòⁿdɜ́	m≠bòⁿdá	*drinking gourd*

When the vowel /a/ is in V_1 position in noun roots, no [+ATR] vowel is permitted in the V_2 position (see also Example 285 below). There is only one counter-example. Baca has one trisyllabic noun stem in which /a/ surfaces as [-ATR] and blocks ATR

[194] While in most of the Mbam languages the central [+ATR] counterpart to /a/ is /ə/, this vowel in Baca has a substantially higher F1 (F1 570, F2 1411) whereas in Nen, Yambeta and Maande, the F1 of /ə/ hovers around 400. In addition /ə/ is contrastive in the above-mentioned languages; it is not contrastive in Baca.

harmony. In Example 281, the [+ATR] vowels are bolded and the vowel /a/ is underlined.

Example 281: /a/ blocking ATR harmony in Baca nouns

surface form	***gloss***
k**ìsí**sájɛ̀	*course sand*

2.10.2.3 Long vowels

Long vowels are contrastive and occur in either the first syllable of the noun root or in the verb root. Long vowels are found for eight of the nine contrastive short vowels in noun or verb roots. Some examples in both nouns and verbs are listed in Example 282.

Example 282: Monomorphemic long vowels in Baca nouns and verbs

	noun	***gloss***	**verb**	***gloss***
iː	ʧĩːk	*calabash type*	---	---
ɪː	---	---	kʊ̀≠fíːm-à	*breathe*
eː	---	---	---	---
ɛː	ŋ̀≠kɛ́ː^{n}d	*otter sp.*	kʊ̀≠sɛ́ːŋ-à	*jump*
aː	à≠káː^{n}d	*woman*	kʊ̀≠ɲàː	*defecate*
oː	jòːs	*mother*	kù≠hóːn	*fill (v)*
ɔː	hɔ́ːm	*forest*	kʊ̀≠hɔ̀ːn-à	*sweep*
ʊː	m̩̀≠pʊ̀ː^{n}dɛ̀	*family*	kʊ̀≠kʊ̀ːɾ-à	*hit (w/ hand)*
uː	---	---	kù≠túːn-à	*spit (v)*

In some cases, long vowels found in monomorphemic contexts vary freely with desyllabified vowel-vowel sequences. Where both vowels in the sequence are front, or both are non-front, there is a tendency for vowels to assimilate, see section 2.10.4.3 below.

Example 283: VV versus SV in Baca noun roots

kì≠sɛ̌ːn	~	kì≠sʲɛ̌n	*name*
kù≠sêːn	~	kù≠sʲên	*to be cold*
m̩̀≠pɛ́ːnɛ̀	~	m̀≠pʲɛ́nɛ̀	*breast*
kʊ̀≠hɔ́ːn	~	kʊ̀≠hʷán	*to drink*

However, there are instances of long vowels that are not contrastive but predictable. There are bimorphemic VV sequences where the vowels in the sequence are identical due hiatus-resolution processes, and therefore are not underlyingly long vowels. Usually these bimorphemic long vowels occur between a noun-class-prefix and a VCV root or between a CV verb root and a -VC verb extension. See Example 284 below:

Example 284: Baca bimorphemic VV sequences

surface form	**underlying form**	***gloss***
mɪ̀ɪ̀ᵐb̥	mà≠ìᵐb	*water*
nìít	nì≠ít	*mouth*
mɔ̀ɔ́jàh	mʊ̀≠ɔ́jàh	*fat, oil*
mɔ̀ɔ́n	mʊ̀≠ɔ́n	*baby*
kʊ̀pʊ́ʊ́n	kʊ̀≠pʊ́-ʊn	*open*
kʊ̀pʊ̀ʊ̀k	kʊ̀≠pʊ̀-ʊk	*close*

2.10.2.4 Vowel co-occurrences

Baca noun roots have one or two syllables; one-syllable noun roots predominate. Of the 406 nouns in the database, 211 nouns (52%) have monosyllabic roots, 48 nouns (12%) have complex (reduplicated or compound) stems. Only 145 nouns (36%) have disyllabic roots[195]. As a result of the low percentage of disyllabic roots, only a few CVCV(C) vowel co-occurrences have been found in the data used for this study.

Despite the limited CVCV(C) noun-root inventory, certain factors governing the co-occurrences of vowels in disyllabic noun roots can be found. These include ATR harmony and co-occurrence restrictions on V_2, depending on the features of V_1. Each of these vowel co-occurrence restrictions will be discussed in turn below.

2.10.2.4.1 ATR-harmony restrictions

ATR harmony requires that both vowels in the noun root agree in tongue-root position. The [-ATR] vowels never occur in the same root with [+ATR] vowels. The vowel /a/ has an allophone [ɜ] which occurs in a [+ATR] environment. In Example 285 below, all ATR vowel co-occurrences in CVCV noun roots are shown.

[195] Sebineni's (2008) database for Baca has 221 (monomorphemic and polymorphemic) nouns, of which 135 (61%) nouns have monosyllable roots.

Example 285: Vowel co-occurrences in Baca CVCV(C) noun roots

[-ATR] vowels			[+ATR] vowels		
ɪ-ɪ	---	---	i-i	ŋ≠gìlí	*path*
ɪ-ɛ	kì≠pɔ́líkὲ	*mountain*[196]	i-e	ⁿsíᵐbè	*cobra sp.*
ɪ-a	à≠ⁿdìmán	*sibling*	i-a	---	---
ɪ-ɔ	---	---	i-o	---	---
ɪ-ʊ	---	---	i-u	---	---
ɛ-ɪ	ŋ≠gὲnìn	*pupil (eye)*	e-i	ŋ̩≠kèlí	*path*
ɛ-ɛ	kì≠kὲŋὲ	*old hoe*	e-e	à≠mèké	*flesh*
ɛ-a	kì≠lέbà	*toad*	e-a	kì≠séŋà	*monkey*
ɛ-ɔ	---	---	e-o	---	---
ɛ-ʊ	---	---	e-u	---	---
ɔ-ɪ	ǹ̩≠sɔ̀gín	*wrist*	o-i	kù≠óbìk	*pain (n)*
ɔ-ɛ	ŋ̩̀≠kɔ́ⁿdὲ	*plantain*	o-e	ⁿsòóŋè	*son-in-law*
ɔ-a	kì≠tɔ́gà	*wound*	o-a	kì≠gòlà	*crow*
ɔ-ɔ	pɔ̀≠sɔ̀bɔ́	*groundnut*	o-o	fì≠nòŋó	*bird*
ɔ-ʊ	---	---	o-u	---	---
ʊ-ɪ	---	---	u-i	àn≠sùlín	*round muscle (leg/arm)*
ʊ-ɛ	ŋ≠gʊ̀gέ	*black fish sp.*	u-e	---	---
ʊ-a	kì≠ⁿgʊ̀má	*porcupine*	u-a	---	---
ʊ-ɔ	---	---	u-o	---	---
ʊ-ʊ	àŋ≠gʊ̀lʊ́	*cord*	u-u	m̩̀≠pùⁿsú	*stomach*
a-ɪ	m≠básín	*flea*	a-i	---	---
a-ɛ	à≠hábὲ	*serpent sp.*	a-e	---	---
a-a	kì≠pàbá	*wing*	a-o	---	---
a-ɔ	---	---	a-u	---	---
a-ʊ	---	---			

2.10.2.4.2 Other V_2 co-occurrence restrictions

In CVCV noun roots, all vowels occur in V_2 position, but not in all V_1V_2 combinations. A round V_2 only occurs with an identical V_1. In addition, two other restrictions occur: 1) The high [+ATR] vowels limit V_2 vowels further: /i/ has only a high or front V_2; /u/ has only high and round V_2. 2) The [-ATR] high vowels lack a high V_2. Table 54 below lists the permitted combinations of vowels in CV_1CV_2(C) nouns.

[196] Although this is a trisyllabic word, its cognates are fairly widespread in the region.

Table 54: Surface CV_1CV_2 combinations permitted in Baca

V_1V_2	high	front	open	round
/i/	i-i	i-e	---	---
/ɪ/	---	ɪ-ɛ	ɪ-a	---
/e/	e-i	e-e	e-a	---
/ɛ/	ɛ-ɪ	ɛ-ɛ	ɛ-a	---
/a/	a-ɪ	a-ɛ	a-a	---
/ɔ/	ɔ-ɪ	ɔ-ɛ	ɔ-a	ɔ-ɔ
/o/	o-i	o-e	o-a	o-o
/ʊ/	---	ʊ-ɛ	ʊ-a	ʊ-ʊ
/u/	u-i	---	---	u-u

2.10.3 Vowel-harmony processes

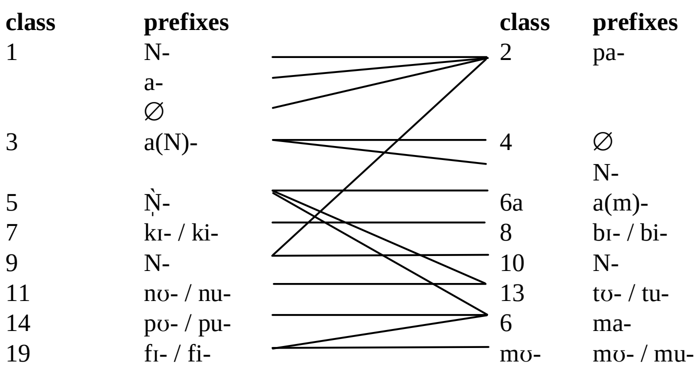
Baca has only ATR harmony, which occurs both within the morpheme and across morpheme boundaries.

2.10.3.1 ATR harmony in pre-stem elements

Both nominal and verbal prefixes undergo ATR harmony in Baca. Other verbal pre-stem elements do not.

Baca has a system of seventeen noun classes that combine into twelve double-class genders, and two single-class genders.

The following double-class genders occur: 1/2, 3/4, 5/6a, 5/13, 7/8, 9/10, 11/13, 14/6, 19/mu. The single-class genders are 6 and 15. A few examples of 5/6, 9/2 and 19/6 have also been found.



Noun-class prefixes are underlyingly [-ATR] but have a [+ATR] counterpart when preceding a [+ATR] noun root. With the exception of classes 9 and 10, which consist of a nasal, all Baca noun classes contain one of three underlying vowels /ɪ/, /ʊ/ and /a/ and will undergo ATR harmony. The [+ATR] counterpart of /a/ is [ɜ], which is not contrastive. In Example 286 below, both surface and underlying forms are given for the examples.

Example 286: ATR harmony of Baca noun-class prefixes

class	**noun-class prefix**	**example**		***gloss***
1	a(N)-	àkã́ã́ⁿd̥	à≠kááⁿd	*woman*
		ɜ̀kùl	à≠kùl	*concubine*
		ɜ̀ŋíp	àŋ≠íp	*thief*
	pa-	pàkáⁿd̥	pà≠káⁿd	*women*
2		pɜ̀kùl	pà≠kùl	*concubines*
3	a(m)-	àfán	à≠fán	*squirrel*
		ɜ̀mèɣé	à≠mèké	*flesh, muscle*
		àmbɔ̂k	àm≠pɔ̂k	*hand*
		ɜ̀mbʷélɜ̀	àm≠pʷélà	*edible frog sp.*
4	∅	fán	fán	*squirrels*
		mèɣé	mèké	*flesh, muscles*
	N-[197]	mbɔ̂k	N≠pɔ̂k	*hands*
		mbʷélɜ̀	N≠pʷélà	*edible frogs*
		pfʲɔ́ᵐb̥	N≠fíɔ́ᵐb	*tails*
		tʃɛ́m	N≠sɛ́m	*hearts*
		ŋgàŋá	N≠kàŋá	*roots*
5	Ǹ̩-[198]	m̩̀pʲɛ́nɛ̀	Ǹ̩≠píɛ́nɛ̀	*breast, udder*
		m̩̀pũ̏tʃú	Ǹ̩≠púⁿsú	*stomach*
		ǹ̩táɲ	Ǹ̩≠táɲ	*stone*
		ŋ̩̀hɛ́ɾɛ́	Ǹ̩≠hɛ́tɛ́	*hearth stone*
		ŋ̩̀kɔ̃̏ⁿdɛ̀	Ǹ̩≠kɔ̀ⁿdɛ̀	*plantain*
6a	a(N)-	àmbʲɛ́nɛ̀	àm≠píɛ́nɛ̀	*breasts, udders*
		ɜ̀mbúⁿsú	àm≠púⁿsú	*stomachs*
		àtáɲ	à≠táɲ	*stones*
		àhɛ́ɾɛ́	à≠hɛ́tɛ́	*hearth stones*
		àkɔ̀ⁿdɛ̀	à≠kɔ̀ⁿdɛ̀	*plantains*
6	ma-	màtáɲ	mà≠táɲ	*blood*
		mɜ̀jèⁿtʃ	mà≠jèⁿs	*urine*

---

[197] N indicates a homorganic nasal which assimilates to the point of articulation of the following consonant.

[198] Noun class 5 is underlying **nɪ-**, but before a consonant-initial noun root, the vowel is elided and the nasal assimilates to the root consonant's point of articulation. The tone of the elided vowel links to the nasal.

class	**noun-class prefix**	**example**		***gloss***
7	kɪ-	kìpàpá	kì≠pàpá	*wing*
		kìgòlɜ̀	kì≠kòlà	*crow*
8	pɪ-	pìpàpá	pì≠pàpá	*wings*
		pìgòlɜ̀	pì≠kòlà	*crows*
11	nʊ-	nʊ̀nà	nʊ̀≠nà	*intestine*
		nùkúɲ	nʊ̀≠kúɲ	*firewood*[199]
13	tʊ-	tʊ̀nà	tʊ̀≠nà	*intestines*
		tùkúɲ	tʊ̀≠kúɲ	*firewood (pl)*
14	pʊ-	pʊ̀sɔ̀bɔ́	pʊ̀≠sɔ̀pɔ́	*groundnut*
		pùtúk	pʊ̀≠túk	*night*
15	kʊ-	kʊ̀sɔ́t	kʊ̀≠sɔ́t	*life*
		kùpìt	kʊ̀≠pìt	*word*
19	fɪ-	fìpán	fì≠pán	*hot pepper*
		fìnɔ̀ɲó	fì≠nɔ̀ɲó	*bird*
pl of 19	mʊ-	mʊ̀pán	mʊ̀≠pán	*hot peppers*
		mùnɔ̀ɲó	mʊ̀≠nɔ̀ɲó	*birds*

As with the other noun-class prefixes with a [-ATR] high vowel, **kʊ-** will undergo ATR harmony, as in Example 287 below.

Example 287: Harmonisation of [-ATR] high vowel of infinitive nc 15

15	kʊ-	inf≠verb root	*gloss*
		kù≠pín	*hunt*
		kʊ̀≠lít	*be heavy*
		kù≠méj	*know*
		kʊ̀≠fɛ́f	*blow nose*
		kʊ̀≠fàk	*put, pour*
		kʊ̀≠sɔ̀k	*attach*
		kù≠pót	*exit (v)*
		kʊ̀≠lʊ̀p	*be wet*
		kù≠kús	*pierce*

[199] The noun-class prefix varies according to speaker, some place it in noun class 5, ŋ̩kúɲ, others in noun class 11 as illustrated here. In either case, the plural is always in noun class 13.

With the exception of the reflexive prefix, which may occur between the infinitive nc 15 prefix and the verb stem, the pre-stem verbal elements in Baca do not undergo vowel harmony, see Example 288.

Example 288: Verb prefix pí- and non-harmonising preverbal elements

reflexive	pí-	[kò-pí≠táj-ân]	*groan with pain*
		[kù-pí≠túɾ-úl-ɜ̀]	*crawl*
subect concord	ji	[jí tɛ̄g-à]	*c1-pres. draw (water)*
		[jí tūūn-ɜ̀ bìtɛ́]	*c1-pres. spit (saliva)*
	a	[à tɔ́ɾ-à]	*2s-past.rec. sell*
		[à sémb-ì]	*2s-past.rec. throw*
tense	kɛ-	[kɛ̀ fʲɛ̀ɾ-à]	*c1-fut pour (into small container)*
		[kɛ̀ hòɾ-ɜ̀]	*c1-fut throw away*

Baca numeral concord prefixes are invariably [-ATR] and do not assimilate to ATR harmony of the numeral root.

Example 289: Baca numeral prefixes

class	**num. prefix**	**example**	***gloss***
1	a-	mʊ́≠ònt à≠mʊ́hɔ̀	*one person*
2	pa-	pɛ́≠ɛ̀nt pá≠ántʃì	*two persons*
		pɛ́≠ɛ̀nt pá≠tát	*three persons*
		pɛ́≠ɛ̀nt pá≠ɲíhì	*four persons*
		pɛ́≠ɛ̀nt pá≠tâːn	*five persons*
3	a-	à≠tʃɛ́m á≠mʊ́hɔ̀	*one heart*
4	∅	tʃɛ́m áⁿtʃì	*two hearts*
		tʃɛ́m tát	*three hearts*
		tʃɛ́m ɲíhì	*four hearts*
		tʃɛ́m tâːn	*five hearts*
5	nɪ-	ǹ≠táɲ mʊ́hɔ̀	*one stone*
6a	ma-	à≠táɲ ántʃì	*two stones*
		à≠táɲ tát	*three stones*
		à≠táɲ ɲíhì	*four stones*
		à≠táɲ tâːn	*five stones*
7	a-	kì≠pàpá kí≠mʊ́hɔ̀	*one wing*
8	bɪ-	pì≠pàpá pʲ≠ántʃì	*two wings*
		pì≠pàpá pí≠tát	*three wings*
		pì≠pàpá pí≠ɲíhì	*four wings*
		pì≠pàpá pí≠tâːn	*five wings*

class	**num. prefix**	**example**	***gloss***
9	N-	ŋgɔ̀ɔ́ mʊ́hʊ̀	*one chicken*
10	N-	ŋgɔ̀ɔ́ ántʃì	*two chickens*
		ŋgɔ̀ɔ́ tát	*three chickens*
		ŋgɔ̀ɔ́ ɲíhì	*four chickens*
		ŋgɔ̀ɔ́ tâːn	*five chickens*
11	nʊ-	nʷ≠ɔ̌l nʊ́≠mʊ́hʊ̀	*one body*
13	tʊ-	tʷ≠ɔ̌l tʷ≠ántʃì	*two bodies*
		tʷ≠ɔ̌l tʊ́≠tát	*three bodies*
		tʷ≠ɔ̌l tʊ́≠ɲíhì	*four bodies*
		tʷ≠ɔ̌l tʊ́≠tâːn	*five bodies*
14	pʊ-	pʊ̀≠túk pʊ́≠mʊ́hʊ̀	*one night*
6	ma-	mà≠túk má̋≠ántʃì	*two nights*
		mà≠túk má≠tát	*three nights*
		mà≠túk má≠ɲíhì	*four nights*
		mà≠túk ma≠tâːn	*five nights*
19	fɪ-	fɪ̀≠nòɲó fɪ́≠mʊ́hʊ̀	*one bird*
pl	mʊ-	mʊ̀≠nòɲó mʷ≠ántʃì	*two birds*
		mʊ̀≠nòɲó mʊ́≠tát	*three birds*
		mʊ̀≠nòɲó mʊ́≠ɲíhì	*four birds*
		mʊ̀≠nòɲó mʊ́≠tâːn	*five birds*

2.10.3.2 Vowel harmony in suffixes

Most verb and deverbal noun suffixes undergo vowel harmony, but there are two suffixes which trigger ATR harmony. Discussed in turn below are suffixes that undergo ATR harmony, suffixes that are ATR dominant, and complete vowel assimilation that affects certain verbal extensions.

2.10.3.2.1 ATR harmony in suffixes.

ATR harmony is triggered by a dominant vowel, usually in the root and spreads bidirectionally. All [-ATR] vowels in the phonological word change into their [+ATR] counterparts. These include the final vowel [200], various extensions and aspectual suffixes. A few instances are shown in Example 290 below.

Example 290: ATR harmony of Baca verbal suffixes

final vowel	-a	[kʊ̀≠fʊ́n-à]	*blow*
		[kù≠púɾ-ɜ̀]	*lie (v)*
continuous	-an	[kʊ̀≠kɔ́l-ân]	*take*
		[kù≠kól-ɜ̀n]	*receive*

[200] The final vowel is obligatory on certain verbs only. Others may occur without any final vowel. With the second class of verbs, **-a** carries a continuous aspect meaning and is optional.

diminutive	-ɪt	[kʊ̀≠fʊ́n-ɪ̀t]	*blow (a little)*
		[kù≠púɾ-ɪ̀t]	*lie (a little)*
intensive	-ɪk	[kʊ̀≠fɛ̀j-ɪ̀k-àn]	*wake up (CONT)*
		[kù≠fúɲ-ík-ìn]	*aggravate an affair*
passive	-ɪp	kʊ̀≠jɔ́l-íb-ìt	*squat*
		kù≠téɲ-íb-ìt	*stand up*

2.10.3.2.2 ATR-dominant suffixes

The [+ATR] causative suffixes **–i** and **-isi** are ATR-dominant and trigger ATR harmony throughout the entire verb stem. All [-ATR] vowels are targeted, including /a/; however, the [+ATR] variant of /a/ is the non-contrastive [ɜ][201]. Since the [+ATR]-dominant suffixes usually occur at the end of the word, this suffix-triggered ATR harmony is only known to spread to the left, see Example 291.

Example 291: ATR-dominant causative extensions -ì / -ìsì in Baca

-ìsì	[kʊ̀≠fʷák-à]	*build*	[kù≠fʷɜ́k-ìsì]	*cause to build*
	[kʊ̀≠pàl-à]	*be hot*	[kù≠pɜ̀l-ìsì]	*heat*
	[kʊ̀≠tɛ́g-à]	*draw water*	[kù≠tég-ìsì]	*cause to draw*
	---	---	[kù≠léⁿd-ísì]	*smooth (v)*
	[kù≠pín-ɜ̀]	*dance*	[kù≠pín-ìsì]	*cause to dance*
-i	[kù≠kíb-ɜ̀]	*dig*	[kù≠kíb-ì]	*cause to dig*
	[kʊ̀≠líg-à]	*lick*	[kù≠líg-ì]	*cause to lick*
	[kù≠séᵐb̥]	*throw*	[kù≠séᵐb-ì]	*cause to throw*
	[kʊ̀≠kɛ́g-à]	*guard*	[kù≠kég-és-ɜ̀ɲ-ì]	*cause to guard*
	[kʊ̀-bí≠jɛ́g-ɛ́l-à]	*learn*	[kù≠jég-él-ɜ̀ɲ-ì]	*teach*
	[kʊ̀≠hɔ̀ɔ̀n-à]	*sweep*	[kù≠hòòn-ɜ̀ɲ-ì]	*cause to sweep*
	[kù≠hóón]	*fill (v)*	[kù≠hóón-ìg-ì]	*cause to fill*
	[kù≠hóɾ-ɜ̀]	*throw out*	[kù≠hóɾ-ɜ̀ɲ-ì]	*cause to throw out*
	[kʊ̀≠kʊ̀ʊ̀ɾ-à]	*strike*	[kù≠kùùɾ-ɜ̀ɲ-ì]	*cause to strike*
	[kù≠túún-ɜ̀]	*spit*	[kù≠túún-ús-ɜ̀ɲ-ì]	*cause to spit*

2.10.3.2.3 Other vowel-assimilation processes in verbal extensions

The vowels of certain verb extensions will undergo complete assimilation to the root vowel. This is most clearly seen for the extensive -Vl in Example 292, in which the extension vowel assimilates completely to the vowel of the verb root. Examples have been found for all but the [-ATR] high vowels /ɪ/ and /ʊ/. For other

[201] [ɜ] never occurs in the root unless it is the result of ATR assimilation from an ATR-dominant suffix.

extensions[202], such as the separative, only verbs with round root vowels have been found.

Example 292: Assimilation of certain Baca verbal extensions

extensive	-al	[kù≠tʃɪ́g-**ɪ́l**-ɜ̀]	*have nausea*
		---	---
		[kù-bí≠kég-**èl**-ɜ̀]	*turn head*
		[kʊ̀≠tʃɛ̀ᵐb-**ɛ̀l**-à]	*limp*
		[kʊ̀≠pág-**ál**-à]	*twist*
		[kʊ̀≠kɔ̀g-**ɔ̀l**-à]	*gnaw*
		[kù≠tòŋ-**òl**-ɜ̀]	*stagger*
		---	---
		[kù-bí≠túɾ-**úl**-ɜ̀]	*crawl*
separative	-ʊk	[kʷ≠ǒb-**óg**-àn]	*suffer*
		[kʊ̀-pí≠tɔ́l-**ɔ́g**-àn]	*listen*
		[kù≠sùl-**ùg**-ɜ̀n]	*startle, surprise*
		[kʊ̀≠pʊ̀-**ʊ̀k**]	*close (door)*

2.10.4 Hiatus-resolution processes

There are several hiatus-resolution processes found in Baca. Glide formation is discussed in section 2.10.4.1, hiatus retention in section 2.10.4.2 and vowel assimilation in section 2.10.4.3.

2.10.4.1 Glide formation

Non-identical vowels in juxtaposition are not permitted. Where V_1V_2 sequences occur across morpheme boundaries, a high vowel in V_1 position becomes a glide. Glide formation occurs principally between a high vowel in the noun-class prefix and a vowel-initial noun root, as seen in Example 293 below:

Example 293: Prefix-root glide formation in Baca

surface form	**underlying form**	***gloss***
kʲèmín	kì≠èmín	*c7.calabash (5 litres) for wine*
fʲɛ̌ɾɛ̀	fì≠ɛ́ɾɛ̀	*c19.small venomous snake sp.*
kʲȁ̃tʃ	kì≠àⁿs	*c7.house*
nʲòɲò	nì≠òɲò	*c5.market*
fʲɔ̌p	fì≠ɔ́p	*c19.hoe*
kʲǔp	kì≠úp	*c7.house mouse*
mʷǎjà	mʊ̀≠ájà	*c1.child*
pʷǎɲ	pʊ̀≠áɲ	*c14.meat*
nʷɔ̌l	nʊ̀≠ɔ́l	*c11.body*

---

[202] These extensions are unproductive and only a limited number are found in the corpus. It is assumed that with a larger corpus, the gaps would be filled.

surface form	**underlying form**	***gloss***
tʷěhíɲɜ̀	tʊ̀≠éhíɲà	*c13.hair*
kʷǐp	kʊ̀≠íp	*steal (v)*
kʷèjɜ̀	kʊ̀≠èj-à	*chose, pick (v)*
kʷɛ̏ⁿdà	kʊ̀≠ɛ̀ⁿd-à	*walk (v)*
kʷǒᵐb̥	kʊ̀≠ǒᵐb	*throw away (v)*
kʷɔ̀jà	kʊ̀≠ɔ̀j-à	*want, desire (v)*

Glide formation occurs also between a CV verb root and a –VC verbal suffix, as in Example 294, below.

Example 294: CV verb roots with –VC extension(s) in Baca

surface form	**underlying form**	***gloss***
kʊ̀nʷà	kʊ̀≠nʊ̀-à	*fall*
kʊ̀nʷànà	kʊ̀≠nʊ̀-àn-à	*fall (CONT)*

2.10.4.2 Hiatus retention

Juxtaposed vowels which are identical vowels either underlyingly or due to ATR harmony are permitted. This is particularly evident between the noun-class prefix and the noun root. Where the vowels are either underlyingly identical or have identical surface realisations due to a vowel-harmony process, both vowels are retained, see Example 295.

Example 295: Prefix-root hiatus retention in Baca

surface form	**underlying form**	***gloss***
fìík	fì≠ík	*c9.fire*
kììᵐb̥	kì≠ìᵐb	*c7.lake (spring, pond)*
nììj	nì≠îj	*c5.tooth*
nììs	nì≠îs	*c5.eye*
kùús	kʊ̀≠ús	*c15.earth, soil*
pàán	pà≠án	*c2.babies*
nìít	nì≠ít	*c5.mouth*

In addition, hiatus is retained between a CV verb root and a –VC verbal suffix where the vowels are either underlyingly identical or have identical surface realisations, see Example 296, below.

Example 296: Root-suffix hiatus retention in Baca

surface form	**underlying form**	***gloss***
kʊ̀pʊ́ʊ́n	kʊ̀≠pʊ́-ʊn	*open*
kʊ̀pʊ̀ʊ̀k	kʊ̀≠pʊ̀-ʊk	*close*

2.10.4.3 Vowel assimilation

Where V_1V_2 sequences occur within the morpheme, vowel assimilation may vary with glide formation. Vowel assimilation typically occurs between two front vowels or two non-front vowels. In Example 297 below, two front vowels and two non-front vowels may coalesce, especially in rapid speech.

Example 297: Vowel assimilation in Baca

surface forms			**underlying form**	***gloss***
kùsêːn	~	kùsʲên	kʊ̀≠síèn	*to be cold*
kìsɛ̌ːn	~	kìsʲɛ̌n	kì≠sìɛ́n	*name*
kʊ̀hɔ́ːn	~	kʊ̀hʷán	kʊ̀≠hʊ́án	*to drink*
ʊ̀kúːs	~	ʊ̀kʷós	ʊ̀≠kúós	*beneath*

In addition, vowel assimilation is found in V_1V_2 sequences that occur across morpheme boundaries, as is seen between CV noun-class prefixes and a vowel-initial noun root in Example 298.

Example 298: Vowel assimilation across morpheme boundaries in Baca

		surface form	**underlying form**	***gloss***
6	ma-	mɔ̀ɔ́jàh	mà≠ɔ́jàh	*oil, fat*
		mɔ̀ɔ́s	mà≠ɔ́s	*days*
		mììᵐb̥	mà≠ìᵐb	*water*
1	mʊ-	mɔ̀ɔ́n	mʊ̀≠án	*baby*
		múùⁿd̥	mʊ̀≠ùⁿd	*person*

Where a non-front and a front vowel are in juxtaposition, vowel assimilation does not occur, as in the case in Example 299. No occurrences of a front vowel and a non-front vowel in juxtaposition have been found.

Example 299: Failure of vowel assimilation in Baca

surface form	**underlying form**	***gloss***
kʊ̀sʷɛ́ɾà	kʊ̀≠sʷɛ́t-à	*to whip*
ɜ̀tʷě	à≠tʷě	*head*

2.10.5 Tone

Baca has a two-tone system underlyingly, high and low. Contour tones are caused by glide formation from syllable mergers and by the historical reduction from disyllabic to monosyllabic roots.

Unlike in some of the other Mbam languages, there is no indication of a loss of contrast of tone melodies in utterance-final position in connection with vowel devoicing or elision. It is interesting to note that Baca has a dearth of CVCV noun roots (caused by a complete elision of the V_2), and a higher percentage of contour tones on monosyllabic roots (due to the loss of the final root syllable). Surface tone is marked on the data in this study.

2.10.5.1 Tone melodies on nouns

High, low, rising and falling melodies contrast in monosyllabic noun roots. In CV, CVC and CVCV noun roots, all four tone melodies are attested, see Example 300 below. Noun prefixes usually have a low tone, although there are a few exceptions.

Example 300: Baca nominal tone melodies

àm≠fɛ̀n	≠L	*thigh*
àn≠sɛ́m	≠H	*heart*
kì≠sɛ̂l	≠HL	*flea*
kì≠sʲɛ̌n	≠LH	*name*
tò≠ɲà	≠L	*intestines*
ǹ̩≠sɛ́	≠H	*orphan*
mà≠ɲâ	≠HL	*food*
à≠sǎ	≠LH	*river*
kì≠kɛ̀ŋɛ̀	≠L.L	*old hoe*
ǹ̩≠hɛ̀gɛ́	≠L.H	*egg*
m̩̀≠pʲɛ́nɛ̀	≠H.L	*udders, breasts*
tò≠nɔ́mɛ̀	≠H.L	*right (hand)*
ǹ≠hɛ́tɛ́	≠H.H	*hearth stone*

2.10.5.2 Tone melodies on verbs

Baca verb roots have three possible underlying tone melodies: L, HL and H. There is contrast between these tone melodies in verb roots with 1) no suffix, 2) the continuous suffix **-an**, or 3) two suffixes. However, where there is only one suffix (other than **-an**), contrast between the HL and H melodies is lost.

In verb stems with two suffixes and a H melody, the H spreads one syllable to the right. It is assumed that verbal suffixes are underlyingly toneless. In verb stems with **-an**, the H melody spreads, causing a falling tone on the suffix. For all other single-suffix verb stems, the contrast is lost, and the suffix surfaces with a L tone.

The three verbal tone melodies are illustrated in Example 301 below, showing both the H spread with verbs of two suffixes and those with the continuous suffix **-an**, as well as the failure of H spread with verbs of only one other suffix. Due to the small size of this database, it is not clear why verbs with a only one suffix do not have a three-way contrast[203]. Not all verb forms were found.

Example 301: Baca verbal tone melodies

L	kò≠hɔ̀n	L ≠L	*laugh*
	kò≠hɔ̀n-à	L ≠L –L	*laugh (CONT)*
	kò≠fàf-àn	L ≠L –L	*palpitate (heart)*
	kò≠hɔ̀n-ìt	L ≠L –L	*laugh (DIM)*
	kù≠nìᵐb-ìk-ìn	L ≠L –L –L	*be seated*
	kù≠pèl-ìs-ì	L ≠L –L –L	*cause to heat*
HL	kò≠nɔ̂m	L ≠HL	*bite*
	kò≠sɔ̂t	L ≠HL	*live*
	kò≠ɲág-ìt	L ≠H –L	*swim*
	kò≠nɔ́m-à	L ≠H –L	*bite (CONT)*
	kò≠sɔ́t-àn	L ≠H –L	*live*
	kù≠fúɲ-ìk-ìn	L ≠H –L –L	*bury*
	kù≠fʷék-ìs-ì	L ≠H –L –L	*lodge, cause to build*
H	kò≠sɔ́ᵐb	L ≠H	*chop*
	kò≠kɔ́l	L ≠H	*take*
	kò≠sɔ́ᵐb-à	L ≠H –L	*chop (CONT)*
	kò≠kɔ́l-ân	L ≠H –HL	*take*
	kò-pí≠táj-ân	L (H)≠H –HL	*groan with pain*
	kù≠fúɲ-ík-ìn	L ≠H –H –L	*fan flames*
	kù≠léⁿd-ís-ì	L ≠H –H –L	*to make slippery*

In addition to providing lexical contrast, tone also has a grammatical function. Among other things, tone provides the crucial difference between various tenses in verb conjugations. This is, however, beyond the scope of this study.

2.11 Acoustic analysis of the Mbam vowel systems

Several of the Mbam languages in this study have been previously analysed as having seven contrastive vowels (i, e, ɛ, a, ɔ, o, u) and ATR harmony. This study argues that all these languages with the exception of Tuki have either eight contrastive vowels with [-ATR] high vowels /ɪ/ and /ʊ/ rather than mid vowels /e/ and /o/, or nine contrastive vowels. In this section, we will look at some of the acoustic considerations of the vowels in connection with their behaviour in the vowel system, and in particular ATR harmony. The acoustic evidence in this section is meant as a back up for the phonological evidence given in the previous sections, not as crucial to it.

[203] In Elip, the **-a** and **-an** suffixes always take a low tone, while other suffixes do not. It seems a similar thing occurs with the **-a** suffix in Baca.

There is a correlation between certain acoustic properties, in particular the F1 value of vowels, and ATR harmony (Starwalt 2008, Casali 2003, 2008, 2012). We will first look at what others have said on this topic (section 2.11.1), and how it applies to the study of the acoustic characteristics of the vowels of the Mbam languages in section 2.11.2.

2.11.1 Acoustic considerations in ATR harmony

While the F1 formant[204] is the primary acoustic correlate of tongue height, it is also a strong indicator of expansion (lowering F1) or constriction (raising F1) of the pharyngeal cavity (Casali 2008: 508). [+ATR] vowels tend to have a lower F1 formant than their [-ATR] counterparts, so for example [i] has a lower F1 than [ɪ], and [u] has a lower F1 than [ʊ], etc. It is a simple anatomic fact that the pushing or pulling of the tongue root automatically affects the tongue height as well. For this reason there is a tendency for high tongue position to also correspond with an advanced tongue root.

As tongue height also affects F1, the higher tongue position correlates with lower F1, so that a high vowel, [i] or [u] will have a lower F1 than a mid vowel [e] or [o]. Since both tongue height and the expansion/constriction of the pharyngeal cavity affect F1, this contributes to some challenging problems in identifying vowels in auditory discrimination.

The [+ATR] high vowels [i] and [u] obligatorily have the lowest F1 by virtue of both a high tongue-body position and expanded pharyngeal cavity, and the [-ATR] non-high vowels [ɛ] and [ɔ] necessarily have the highest F1 by virtue of both a lower tongue-body position and a constricted pharyngeal cavity. The positions of the [+ATR] non-high vowels [e] and [o] and the [-ATR] high vowels [ɪ] and [ʊ], however, are much harder to place between these extremes.

The [+ATR] non-high vowels [e] and [o] may have a lower F1 by virtue of an expanded pharyngeal cavity, the [-ATR] high vowels [ɪ] and [ʊ] may have a lower F1 by virtue of a higher tongue-body position. The question is, according to Casali (2008: 508):

> "If we start with the F1 value of [ɛ] as a baseline, will the lowering relative to this baseline of F1 in [ɪ] due to tongue body raising be greater or less than the lowering of F1 of [e] due to pharyngeal cavity expansion?"

[204] Formants are concentrations of resonance around certain frequencies in the human speech wave. The lowest frequency concentration on a spectrogram is referred to as Formant 1, and each subsequent concentration is labeled Formant 2, etc. While Formant 1 correlates to the height of a vowel, Formant 2 correlates to frontness or backness of a vowel.

Depending on the answer, it is possible that there are languages (or individual speakers) where [ɪ] and/or [ʊ] may have a higher F1 than [e] and/or [o]. In most of the Mbam languages, [ɪ] and [ʊ] have a higher F1 than [e] and [o]. This is the case in Yangben, Mmala, Nen, Maande, Yambeta, Gunu and Tuki. Interestingly, Bancel (1999: 3) noticed that in Nen, *all* of the [+ATR] vowels have lower F1 than any of the [-ATR] vowels. A similar phenomenon is true for the many of the other Mbam languages mentioned here.

There are languages where [ɪ] and [ʊ] have a lower F1 than [e] and [o], such as Elip and Baca. It is also possible that there are languages where the F1 values of these two sets of vowels are very similar (Casali 2008: 508). Mbure is such a language.

It can, therefore, be very difficult to distinguish between the [-ATR] high vowels and the [+ATR] mid vowels. Field linguists often have experienced difficulty in hearing and correctly transcribing the differences between high [-ATR] vowels and mid [+ATR] vowels. Casali (2008: 509) further states that

> "Not infrequently, these vowels have been mistranscribed as either mid [+ATR] vowels [e] and [o] or high [+ATR] vowels [i] and [u]. Partly in consequence, a good number of African languages with phonemic high [-ATR] vowels have at one time or another been analysed incorrectly as having fewer vowel phonemes than they actually have."

Dugast in her *Grammaire du tunen* (1971: 33) indicates that it is difficult to distinguish between /o/ and /u/ as well as between /o/ and /ɔ/. This study argues that Nen, as well as several other Mbam languages, has been incorrectly analysed as having fewer contrastive vowels than it actually has.

If high [-ATR] and mid [+ATR] vowels cannot be consistently distinguished by their F1 values, are they in fact phonetically distinct? Casali (2008: 509) notes that some languages are described as "distinguishing high [-ATR] and mid [+ATR] vowels underlyingly (e.g. in terms of their phonological behaviour in the harmony system) but as having only mid [+ATR] vowels phonetically." Although there are some differences, this is basically how Hyman (2002) analyses Gunu. Hyman identifies seven surface vowels for Gunu. The vowel /o/ however is in certain contexts [-ATR] and in other [+ATR]. Hyman considered the [+ATR] vowel [o] to be derived (and thus predictable), and the [-ATR] vowel [o][205] to be contrastive. There are some problems with this analysis as there are clear cases in Gunu where the [+ATR] vowel [o] must also be considered contrastive. Furthermore, the [+ATR] "o" is audibly and phonetically different from the [-ATR] "o".

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[205] Hyman does give an alternative symbol to his [-ATR] /o/, an archiphoneme U which can be interpreted as /ʊ/ (Hyman 2001: 155).

2.11.2 Acoustic analysis of the vowels of the Mbam languages

In this section, we take into account the acoustic characteristics of the vowels of each of the Mbam languages, and how they function in the phonology of each language, in particular their role in vowel harmony.

The acoustic data used is of varying qualities. The best was collect in collaboration with Coleen Anderson Starwalt the end of 2004 for her thesis. Using my databases, we selected a representative collection of nouns and verbs, the latter including one conjugated form. She recorded three men and two women each from the Elip, Mmala and Yangben language groups directly onto the hard drive of her Sony Vaio PCG-GR250P laptop computer using a Shure SM58 dynamic microphone. While later she decided not to include this data in her thesis, she left with me the raw data from our recording sessions on a compact disc for my own use. I accessed the recordings using a variety of programmes, initially using Speech Analyzer 2.7 and 3.0.1 and latter PRAAT 5.2.03. For each person, ten tokens of 10-20 words for each vowel was recorded per language. This data is the foundation of my acoustic analysis of the Mbam languages.

In 2007 I collected Swadesh 200-word lists for Mbure and Baca during visits to their respective villages of Mbola and Bongo. Two to five tokens for each word was recorded in each location directly onto the hard drive of my Dell Latitude D630 laptop computer using the internal microphone. Later in 2009 and 2011 for Mbure, I recorded five to ten tokens of and additional 480 words of an 1,800-word list in Yaounde with two of the three men involved in the 2007 recordings. In 2010 I recorded five to ten tokens of an additional 352 words for Baca also in Yaounde with three men.

The acoustic data for Gunu (2009) involves the recording of one man and approximately ten tokens of thirty-two words selected specifically to study the acoustic properties of the back vowels. For the remaining four languages, Nen, Yambeta, Maande and Tuki, I selected between 120 and 212 words and some sentences specifically focusing on the acoustic properties of all of the vowels. The data for these latter four languages, and to a lesser extent, Gunu, was specifically aimed at identifying the acoustic properties of their vowels. This data was recorded directly onto the hard drive of my Dell Latitude D630 and later of my Lenovo T510 ThinkPad laptop computer with internal microphones using Audacity 1.3 (Beta) software.

language	**dates**	**subjects**	**# of words**	**# of tokens**
Nen	2010	4 men	120 words	7-10
Yambeta	2010	3 men	165 words	7-10
Maande	2010-2011	2 men	132 words	7-10
Tuki	2011	4 men, 3 women	212 words	7-10

The discussion of the acoustic characteristics of the ten Mbam languages is presented below in the same order as the basic phonological sketches earlier in this chapter. The discussion these languages is in conjunction to what has been previously written about them and in light of the acoustic data collected as indicated above.

2.11.2.1 Nen

With the exception of Bancel's study, most previous studies of Nen vowels identify seven contrastive vowels which occur in one or the other of two mutually exclusive sets. Mous (2003: 285-6) states that there is a variation of pronunciation "of the vowel that acts as the recessive counterpart of the high round vowel and that in some dialects, notably that of Bancel's informants and that of Ndokbassabem, "this vowel is realised as different from the dominant mid-round vowel ***o***." In his own data, there is a complete neutralisation of these two vowels. In Table 55 below, the vowel systems of these studies are referenced with the symbols used for each vowel and the phonetic transcription as I interpret them below.

Table 55: Nen vowel sets based on previous studies.

Study	[+ATR]	[-ATR]
Dugast (1971)[206]	i, e, ɛ, ə, a, u, o, ɔ	
Stewart et al. (1979)	i, e, ạ, o, u	e, e̱, a, o̱, o
	[i, e, ə, o, u]	[e, ɛ, a, ɔ, ʊ]
De Blois (1981)	i, (e),[207] ạ, o, u	(e), e̱, a, o̱, o
	[i, (e), ə, o, u]	[(e), ɛ, a, ɔ, o]
Van der Hulst et al. (1986)	i, A, o, u	ɛ/(e), a, O, o
	[i, ə, o, u]	[ɛ, a, ɔ, o]
Bancel (1999)	i, ə, ɷ, u	ɛ, a, ɔ, o
	[i, ə, o, u]	[ɛ, a, ɔ, ʊ][208]
Mous (2003)[209]	i, ə, o, u	ɛ, a, ɔ, o

[206] Dugast did not group the Nen vowels into [+/-ATR] sets.

[207] In my data, [e] has only been found adjacent to a nasal as an allophone of /i/. In other contexts where Dugast or De Blois have [e], I have [ə]. However, depending on the speaker, in some words, [ə] has a rather high F2, making it verge towards the same acoustic space where [e] would be. In addition, in several of the Mbam languages, /ə/ has migrated and is currently realised as [e].

[208] I differ with Mous (2003: 286) on the phonetic transcription of Bancel's vowels *ɷ* and *o*. Mous transliterates Bancel's **ɷ** as **ʊ**, but since it is clearly [+ATR] in both Bancel's own studies as well as Mous', and functions as the [+ATR] counterpart of **ɔ** (Bancel 1999: 4), while this deviates from how others use the old IPA **ɷ** (see Denis Creissel's description of Tswana in Hombert and Hyman's *Bantu Historical Linguistics*, where **ɷ** is used for [ʊ]), it reflects how *Bancel* used it. Bancel (1999: 4) atypically lists the [+ATR] back vowels as **u** and **ɷ,** and the [-ATR] back vowels as **o** and **ɔ**. This being the case, Mous' (2003: 286) examples should have Bancel and Ndokbassabem: as **ù-kòl** 'create', **ʊ-kòl** 'go and buy medicine'.

[209] Mous worked mainly with Emmanuel Bakui in Some, the Catholic mission which is at the Yaoundé side of Ndikinimeki. Emmanuel Bakui is originally from the *Alinga* dialect spoken in Nituku village, but he is perfectly bilingual in *Tɔbɔ́ányɛ*, the reference dialect which he uses in connection with the Church,

In my own research, recording the speech of three speakers from three different villages of the reference dialect, all three have o/ʊ distinction in verbs. In Table 56 below, the average F1/F2 frequencies[210] of the back vowels /u/, /ʊ/, /o/ and /ɔ/ of three men from different villages in the reference dialect area are given. Note that there is a large acoustic distance in F1 between /o/ and /ʊ/ averaging more than 100 Hz and that in each of the speakers listed, the [+ATR] mid vowel /o/ has a *lower* F1 than the [-ATR] high vowel /ʊ/.

Table 56: F1/F2 frequencies of Nen back vowels

Name	**village**	**back vowels**		
		ave.	**F1**	**F2**
Loumou Benoît	Ndɛkalɛnd	/u/	279	810
		/o/	368	1034
		/ʊ/	480	1059
		/ɔ/	544	1112
Maniben Jean Paul	Ndikmeluk	/u/	326	701
		/o/	394	841
		/ʊ/	546	1000
		/ɔ/	600	1061
Mongele Daniel	Nebolen	/u/	383	720
		/o/	467	823
		/ʊ/	551	1090
		/ɔ/	606	1141

The average F1/F2 frequencies of the eight contrastive vowels in Nen are illustrated in Figure 4 below.

since it is the variety everyone can understand. Dr. Mous' field work in Ndikinimeki focused on word order in Nen, not the acoustic characteristics of the vowels.

[210] Formant measures were taken using the spectogram (with formants) and spectrum displays of SIL's Speech Analyzer software programme. Measurements were generally taken at a steady-state portion near the centre of the vowel. However, where hiatus-resolution processes occur causing a diphthong (generally the case of CV-prefix with a VC root), a point nearer the end of the vowel was generally selected.

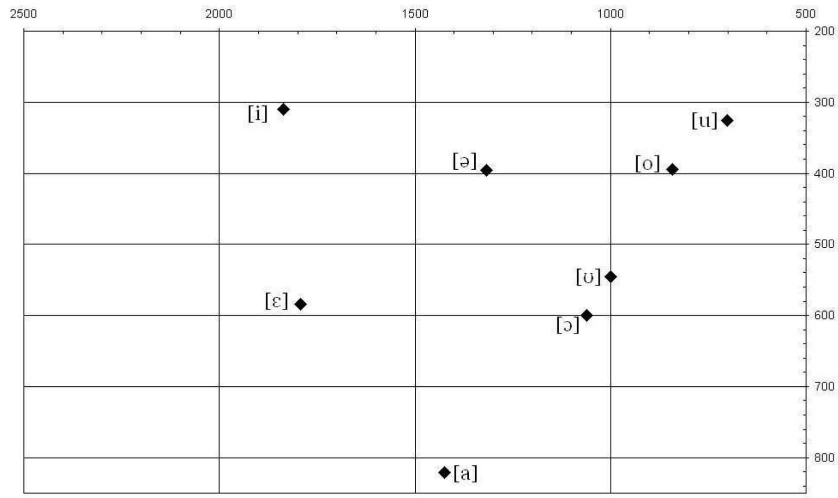

Figure 4: Averages of Nen vowels

2.11.2.2 Maande

All previous studies of Maande identify seven contrastive vowels (i, ə, ɛ, a, ɔ, o, u). Taylor (1990) departs slightly from Scruggs' (1982) analysis by adding the feature ATR replacing Scruggs' feature "low". Taylor correctly identifies and analyses the ATR vowel harmony present in Maande, but notes that there are some unexplained features. One example that Taylor (1990: 5) notes is the fact that certain [-ATR] words may exceptionally have a noun-class prefix with the [+ATR] form. She states: "It is not clear why the prefixes are + or – ATR in these words.

In addition, Taylor (1990: 7) notes that some verbs with a root vowel /ɔ/ take a final vowel /ɔ/ and others take a final vowel /a/. She was not able to determine any reason why certain verbs took one form and others another, and summarises that the choice of the final vowel is not predictable from the root vowel.

In addition to the variation in the final vowel, these two groups of verbs also act differently when the causative suffix /-i/ is added. For those verbs with an /ɔ-a/ structure, the causative suffix changes the root vowel to /u/. For those verbs with a /ɔ-ɔ/ structure the root vowel changes the root vowel to /o/.

Example 302: Variation of "ɔ" with causative suffix /-i/ (Taylor 1990)

ɔ̀≠lɔ̀l-à	*to burn*	ò≠lùl-ì	*to cause to burn*
ɔ̀≠fɔ̀l-ɔ̀	*to borrow*	ò≠fòl-ì	*to cause to borrow*
ɔ̀≠kɔ́t-à	*to dry (INTR)*	ò≠kút-ì	*to dry (TR)*
ɔ̀≠kɔ̀t-ɔ̀	*to refuse, to miss*	ò≠kòt-ì	*to cause to miss*

With the similarity of Maande with the other Mbam languages, notably Nen, the question is whether a different analysis could resolve these problems. In earlier seven-vowel analyses of several Mbam languages, there is a back vowel that varies according to ATR harmony (Gunu, Elip, Nen, etc). In the case of Maande, this back vowel varies in whether it triggers rounding harmony, not on its ATR features. The Maande "**ɔ**" is always [–ATR]. However, based on acoustic data, there is a difference in F1/F2 frequencies between "**ɔ**" (or /ɔ/) in verbs with a rounded final vowel and "**ɔ**" (or /ʊ/) in verbs with a non-rounded final vowel, the latter having a distinctly lower F1 and a slightly lower F2 than the former. While in the other languages, previous analyses "merged" /ʊ/ with /o/, in Maande, /ʊ/ is "merged" with /ɔ/, so rather than an ATR problem, it becomes a height problem, as rounding harmony is triggered only by non-high or open vowels. The average F1/F2 frequencies of the eight contrastive vowels in Maande are illustrated below.

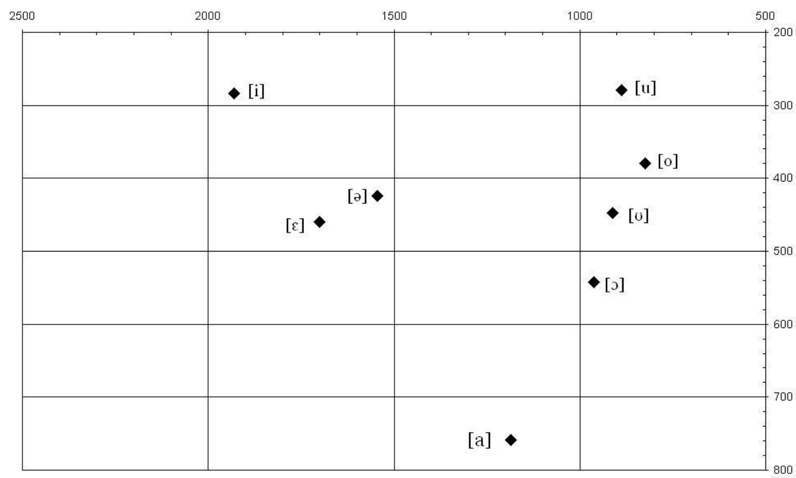

Figure 5: Averages of Maande vowels

2.11.2.3 Yambeta

Phillip's 1979 *The initial standardization of the Yambɛta language* identifies seven contrastive vowels: /i, e, ɛ, a, ɔ, o, u/ and the operation of vowel harmony, although she defines the motivation as that of vowel height rather than ATR. In addition to these seven vowels, Phillips also identifies an allophonic variant of /a/, [ə] which occurs in the environment of high vowels.

Based on the YALICO wordlist (unpublished, of which I have the 2009 version), Phillips' analysis of [ə] is inadequate. There is evidence that [ə] is contrastive and not merely a [+ATR] allophone of /a/. It is found in both noun and verb roots as the only vowel. In addition it is found in minimal root pairs with /a/.

As with many other Mbam languages, the vowel **o** causes particular problems. Phillips (1979: 89) points out that generally, when **o** is in the noun root, a "low vowel prefix" is required, but that there are "rare instances" where "**o**" "appears to act like a high vowel, requiring a high vowel prefix."[211] However, these same words are transcribed differently and even inconsistently in the YALICO lexicon. Based on recordings of these words (as well as other nouns and verbs), the average F1/F2 of the roots transcribed as **o** in Phillips (1979: 89) reveal three vowel heights. In Example 303 below, the F1/F2 averages are for the root vowel (in bold).

Example 303: Noun-class prefix variations with /o/ (Phillips 1979: 89)

Phillips	**YALICO**	**Boyd**	**F1/F2 ave.**	***gloss***
/kɛ̀-tóó/	/kidóó/	[kɛ̀d**ʊ́**:]	448/833[212]	*bamboo bed*
/tò-ñók/	/tònyók/~/tɔ̀nyɔ́k/	[tɔ̀ɲ**ɔ́**k]	522/1035	*joy*
/kì-tók/	/kidok/	[kìd**ó**k]	406.5/849.4	*navel*
/mù-sós/	/mùsós/~/mɔ̀sɔ́s/	[mɔ̀s**ɔ́**s]	518.5/962.3	*peppers*

A comparison of the back vowels of the words listed in Example 303 above with the F1/F2 averages[213] of the back vowels of other nouns shows that the vowel "o" in "kìtók", corresponds to the average of [o], the vowel "o" in "kɛ̀tóó" corresponds to the average of [ʊ], and that the vowel "o" in "mùsós" and the second "o" in "tòñók" correspond most closely to the average of [ɔ]; see Figure 6 below. In addition, as the noun-class markers harmonise according to the ATR value of the root, both "tò-ñók" and "mù-sós", despite Phillips' transcriptions, are in the same acoustic space, and are both the [-ATR] version of the prefixes, [tɔ̀-] and [mɔ̀-], respectively.

[211] Phillips recognises the following pairs in the prefix vowels: i/ɛ, u/o and probably o/ɔ (1979: 91, also in footnote) which depend on the root vowel.

[212] Acoustic samples for these words were given by Bolioki Leonard-Albert and compared with the averages of his other tokens.

[213] Acoustic data was collected from two speakers of the reference dialect *Nigii* and one of a secondary dialect *Nɛdɛk*. No appreciable difference between these two dialects was found concerning the vowel system.

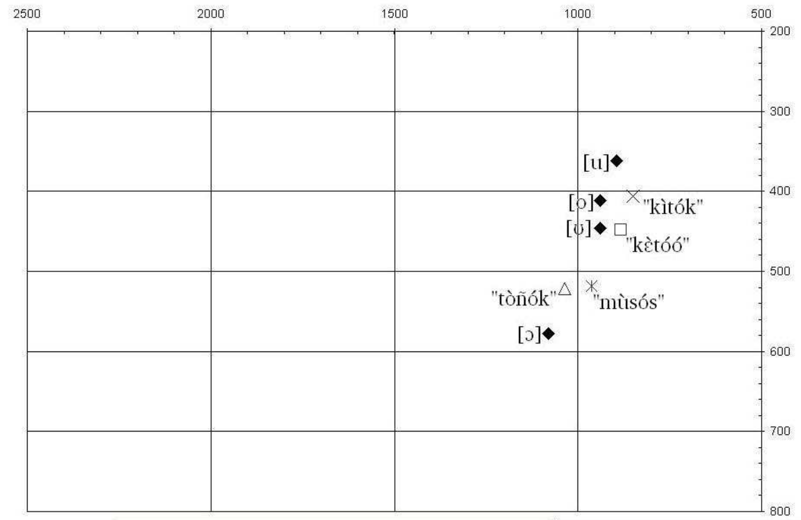

Figure 6: F1/F2 ave. in nouns with words in "o" (Phillips 1979: 89)

In addition, many Yambeta speakers are unsure of how to write **o** in certain contexts. In the YALICO database of approximately 2,000 words, there are multiple occasions where the same word was entered twice with different spellings.

Data showed that the inconsistently written back vowel "o/ɔ" was acoustically distinct from words with either /o/ with a [+ATR] prefix or /ɔ/. In addition to the acoustic data, there is phonological data which distinguishes four levels of back vowels. In verbs, the vowels /u/ and /o/ are clearly [+ATR] and the vowels /ʊ/ and /ɔ/ are [–ATR]. In addition, the vowels /o/ and /ɔ/ are open (non-high) vowels and trigger rounding in the final vowel **–a**, see Example 304 below.

Example 304: Phonological rational for 4 back vowel heights

Underlying form	**surface from**	***gloss***
kʊ̀≠súb-à	kù≠súb-ə̀	*pour*
kʊ̀≠kʊ́d-à	kʊ̀≠kʊ́d-à	*attach, tie*
kʊ̀≠sób-à	kù≠sób-ò	*be sweet*
kʊ̀≠kɔ́d-à	kʊ̀≠kɔ́d-ɔ̀	*cackle (v)*

The average F1/F2 frequencies of the eight contrastive vowels in Yambeta are illustrated below.

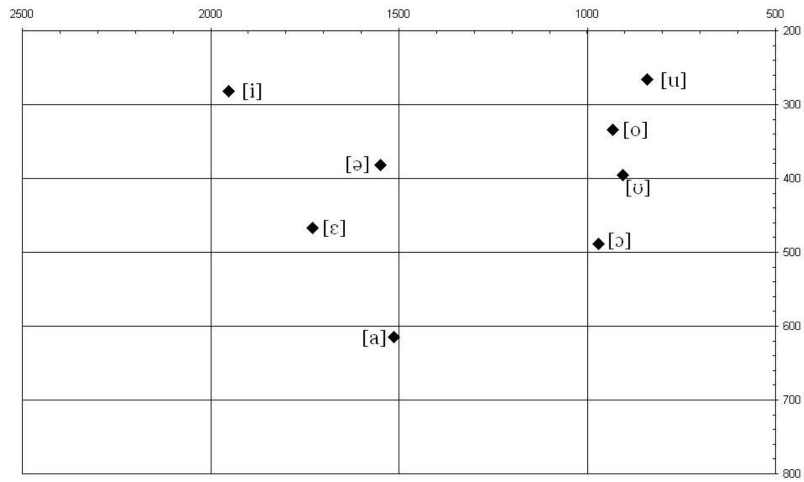

Figure 7: Averages of Yambeta vowels

2.11.2.4 Tuki

Hyman's (1980) article on Tuki (dialect *Tocenga*) noun classes identifies seven contrastive vowels: /i, e, ə, a, ɔ, o, u/, with the note that /e/ is pronounced [ɛ] before a NC cluster.

Huey and Mbongué's (1995) data from their 1994 survey includes a 120-item ALCAM wordlist [214] collected in all seven (identified) dialect regions for lexicostatistic analysis. In all the wordlists found, the surveyors used both [e] and [ɛ] in their transcriptions. No attempt was made to identify which vowels are contrastive, as this was beyond the scope of the survey.

Biloa's (1997) study is on certain grammatical aspects of Tuki (dialect *Tukombe*) following a Generative Grammar approach, specifically Chomsky's Theory of Principles and Parameters. It has little bearing on this present study, except that Biloa (1997: 11) identifies seven "surface contrastive vowels": /i, e, ɛ, a, u, o, ɔ/, although he does say that in general, /ɛ/ is "assimilated to /e/ and /ɔ/ (…) is reduced to (…) /o/ in the orthography." Kongne Welaze identifies six contrastive vowels following Essono (1974). In addition, he identifies variation with some affixes which he identifies as vowel harmony (2004: 44, 60-1).

While ATR vowel harmony is less robust in Tuki than in many of the neighbouring languages, it is attested and as a result, the previous analyses of the Tuki vowels are inadequate. Based on the unpublished database of Kongne Welaze (2006), the

[214] These wordlists are unfortunately not included in Huey and Mbongué's 1995 report. I was, however, able to find and scan their old WordSurv printouts and the original handwritten ALCAM wordlists.

vowels **o** and **e** clearly show [–ATR] tendencies,[215] and should, as a result, be considered as [-ATR] high vowels /ɪ/ and /ʊ/ rather than [+ATR] mid vowels /e/ and /o/. In certain cases, especially in verbs, **e** does show [+ATR] attributes and may occur as the [+ATR] counterpart of /a/, for example, in the causative.

In nouns, the vowels **o** and **e** are [-ATR] high vowels /ʊ/ and /ɪ/ and take [-ATR] noun-class prefixes.[216] Example 305 compares nouns with **o** and **e** found in Kongne (2006) and Essono (1980) with my own data. Kongne, in particular, is aware of the vowel harmony in prefixes, and as a result consistently has [-ATR] prefixes with **o** and **e**.

Example 305: [-ATR] Noun-class prefixes on nouns with "o" and "e"

N. class	Kongne (2006)	Essono (1980)	Boyd	*gloss*
3	òŋ[gòɾó	o-ŋgoɾó[217]	ʊ̀ŋ≠gʊ̀ɾʊ́	*foot*
	ò[hé	o-hé	ʊ̀≠hí	*moon, month*
	ù[hùwè	o-hue[218]	ù≠hùwè	*grass*
	ù[gíní	o-gíní	ù≠gíní	*firewood*
7	è[wóɾó	i-wóɾó	ì≠wʊ́ɾʊ́	*tam-tam*
	è[tété	e-tété	ì≠títí	*bone*
	ì[hí	i-hí	ì≠hí	*debt*
	ì[ɲú	i-nyó	ì≠ɲú	*yam*

Verbs labelled in Kongne (2006) as having **o** and in some cases **e** are clearly [-ATR] high vowels /ʊ/ and /ɪ/ and change into their [+ATR] counterparts /u/ and /i/ when the causative suffix is added. As with other languages, Tuki has [+/-ATR] vowel pairs: ɪ/i, a/e, ʊ/u, ɔ/[o]; in the case of the last pair, [o] is not contrastive but only occurs in [+ATR] contexts. In Example 306, the causative suffix **-ij** will cause [-ATR] verb-root vowels to assimilate to their [+ATR] counterpart. Kongne's (2006) **o** /ʊ/ and **e** /ɪ/ assimilate to /u/ and /i/ when the causative suffix is added. Where /e/ actually occurs, it does not assimilate to /i/ being already a [+ATR] vowel.

[215] An exception to this is when [o] occurs in a CVCV noun root with a [+ATR] vowel /i/. In these cases only, is the noun-class prefix [+ATR] as in: ì≠wòkí *nc7.melon*.

[216] Not all Tuki prefixes assimilate to the ATR value of the root vowel. Certain noun-class prefixes are either invariably [-ATR] as in the case of noun class 2 prefix, **βà-** or are invariably [+ATR] as in the case of noun class 8 prefix **βì-**. Noun classes, 3, 4, 5, 6, 7, 11, 13, 14 and *mu* (18 in Essono 1980) will undergo ATR harmony, and class 6a optionally. Noun classes, 1, 2, 8 and 19 do not undergo ATR harmony.

[217] Essono (1980) interprets these differently than either Kongne or me.

[218] "Le préfixe nominal n'accuse ici qu'une seule forme : o̲ parfois réalisée [u] et même [ɔ]" (Essono 1980: 25).

Example 306: “o” and “e” in verbs with their form in the causative.

Kongne	Boyd	*gloss*	Causative	*gloss*
≠g**ó**n-á	≠gón-á	*grow up*	≠gún-íj-è	*make grow*
≠n**è**ᵑg-èn-à	≠nìᵑg-ìn-à	*be soft*	≠nìᵑg-ìɾ-ìj-è	*soften*
---	≠pén-é	*paint*	≠pén-íj-è	*cause to paint*
≠ràh-à	≠ràh-à	*be long*	≠ɾèh-j-è	*make long*
≠tɔ̀ᵐb-ɔ̀	≠tɔ̀ᵐb-ɔ̀	*calm o.s.*	≠tòᵐb-j-è	*appease*

Since /e/ and /ɪ/ as well as /o/ and /ʊ/ often overlap in acoustic space in 9-vowel languages, it is reasonable to consider the [-ATR] vowels, “**e**” and “**o**”, as /ɪ/ and /ʊ/ and the [+ATR] **e** as /e/. The [+ATR] vowel **o** is not contrastive, and is only found in [+ATR] contexts. The averages of these contrastive and non-contrastive vowels found in Tuki are shown in Figure 8 below. The non-contrastive [o] is indicated by the symbol ◇.

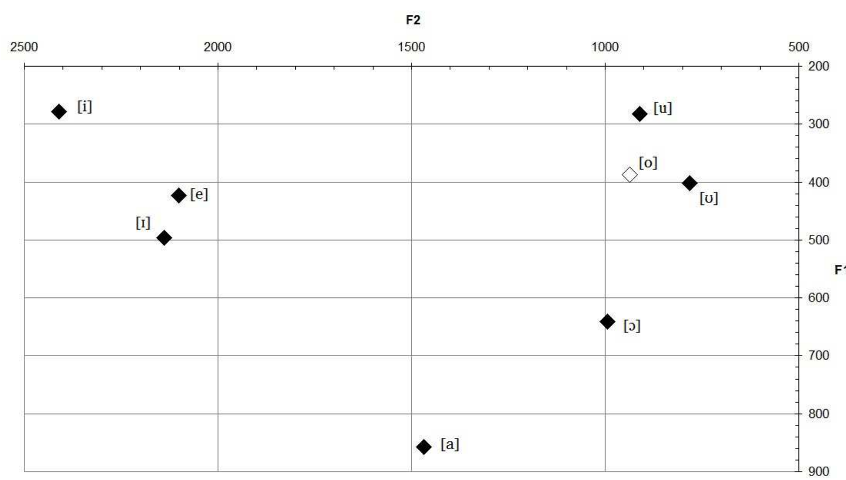

Figure 8: Averages of Tuki vowels

2.11.2.5 Gunu

All previous phonological studies of Gunu have identified seven contrastive vowels (i, e, ɛ, a, ɔ, o, u), although due to the complexities of the vowel-harmony system, there have been difficulties in analysing the vowels. Both Robinson (1984) and Hyman (2002) propose three series or sets of vowels, although they differ in how they divide them. Robinson (1984) divides the Gunu vowels into three series: “série fermée” ([+ATR]): **i**, **e**, **u**; “série ouverte” ([-ATR]): **ɛ**, **a**, **ɔ**, and “mi-fermée”: **o** (1984: 55). Hyman divides the vowels into three sets: set 1: **i**, **e**, **u**; set 2: **ɛ**, **o**, **a**, and set 3: **ɔ**.

Hyman separates **ɔ** from the other two sets because of how it triggers rounding harmony. According to Hyman, only **ɔ** triggers rounding harmony (as well as its ATR-derived counterpart, [o]), but the other round vowels (/u/ and /o/) will not.

The vowel **o** merits a closer look. While Hyman identifies an underlying **o** (i.e. /ʊ/) as [-ATR] and a derived [o] as the [+ATR] counterpart of /ɔ/, there are some exceptions to this analysis. There are some instances of **o** that are underlyingly [+ATR], and that are not explainable as being derived from /ɔ/ due to ATR harmony. Robinson (1984: 56) noted that in CVCV noun roots CoCi and CoCo nouns must be in the "série fermée" while CoCa was clearly in the "série ouverte". While the [+ATR] status of **o** may be conditioned in the context of CoCi and CiCo noun roots, due to the [+ATR] feature of /i/, the same cannot be said for CoCo noun roots, since /o/ is often [-ATR] in many environments. Quilis et al., on the other hand, estimate that /o/ is always in the "série fermée" (Quilis 1990: 347) and the words that Robinson identifies as belonging to the "série ouverte" such as *gónà* 'planter' (Quilis 1990: 348 c.f. GULICO 2003: 14) should actually be /ɔ/ rather than /o/.

With only a few exceptions, CoCo nouns have neither a clearly [+ATR] root vowel or a palatal consonant,[219] but must nevertheless be considered as [+ATR] due to its [+ATR] noun-class prefix,[220] as may be seen in Example 307 below.

Example 307: CoCo noun roots

nù≠hóògò	*full moon*
bù≠gónó	*tree sp.*
gí≠kòdóò	*prune sp.*
gì≠móⁿdó	*leopard*
gì≠góló	*type of drum*
ù≠hóló	*tree sp.*
ì≠lóⁿtʃò	*sparrow sp.*

In comparing the Gunu vowel system with the vowel systems of some of its neighbouring languages, another hypothesis is that Gunu, like Elip (see section 1.6.5.2 below), has eight underlying vowels rather than the seven vowels attributed to it up to now. To test this hypothesis, acoustic data was collected and the

[219] According to Hyman (2002: 7, see footnote), palatal consonants also seem to carry a feature ATR. While Casali (2008: 504) states that "…consonants appear, as far as descriptive sources are revealing, to play little or no role in the (ATR) harmony system" Chacha and Odden (1998: 144-5) show that in Kikuria, palatal consonants trigger vowel raising (although height rather than ATR is the harmony proposed for Kikuria). I have some doubts, however about whether palatal consonants play a role in Gunu vowel harmony in view of numerous instances of /j/ (and other palatal consonants) occurring with [-ATR] vowels, as well as a minimal pair, found in the language: **≠òj-à** [ʊ̀jà](v*) dire (say)* and **≠òj-ò** [òjò] (v) *aider (help)* (GULICO 2003: 21).

[220] In Gunu, as with the Central Yambassa variants, the noun-class marker harmonises according to the tongue-root feature of the root. Gunu noun-prefix vowels have the following +ATR/-ATR pairs i-/ɛ(ɪ)-, u-/ʊ-, e-/a-. There are no [+ATR] dominant prefixes in Gunu.

measurements confirm eight surface vowels[221] rather than the seven posited by Quilis et al. (1990) and Hyman (2002). As with other Yambassa and Mbam languages, there is a four-way contrast of back vowels, and grouping these vowels according to their ATR feature[222] reveals a difference in F1/F2 frequencies between the [+ATR] **o** and the [-ATR] **o**. This difference in F1/F2 frequencies is similar to the difference found between /o/ and /ʊ/ in other languages of the region. Gunu, therefore, clearly has eight contrastive vowels with both affix harmony and root-internal [ATR] agreement. The F1/F2 frequencies of the eight contrastive vowels of Gunu, are illustrated in Figure 9 below.

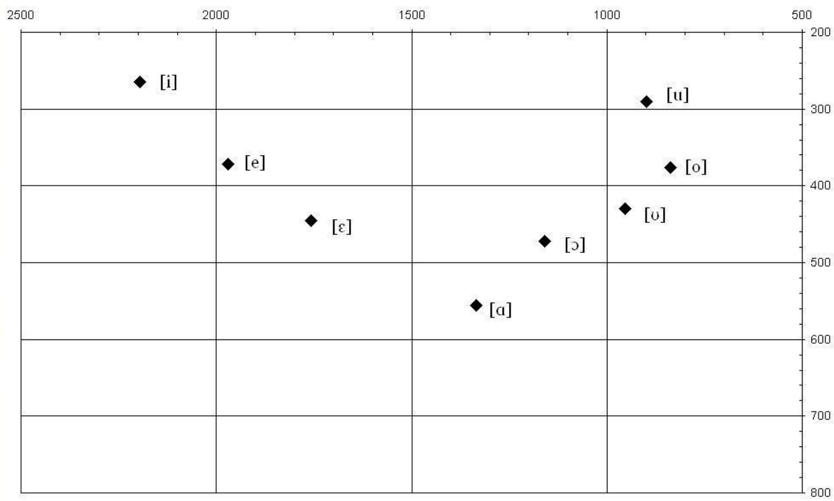

Figure 9: Averages of Gunu vowels

2.11.2.6 Elip

Along with Yangben and Mmala, Paulian (1986: 243-279) identifies seven vowels (i, e, ɛ, a, ɔ, o, u) for Elip. Acoustic research done with Coleen Anderson Starwalt for Elip shows nine surface vowels; although unlike Yangben and Mmala, only eight are contrastive. The [-ATR] mid front vowel, [ɛ] is an allophone of /ɪ/ occurring in the utterance-final position. The average F1/F2 frequencies of nine vowels of Elip are illustrated below. The non-contrastive [ɛ] is indicated by ◇ in Figure 10 below.

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[221] Hyman (2002: 13) states, "The argument against positing the fully specified vowels /I/ and /U/ is one of abstractness: How would speakers “know” that they have underlying [-ATR] high vowels, which they never hear?" The acoustic evidence leads to the conclusion that speakers do in fact "hear" the [-ATR] high vowel /ʊ/. Anecdotal evidence also supports this.

[222] If the back vowels are grouped according to the seven vowels posited elsewhere, so that all **o**’s are grouped together (ex. C**o**C-a verbs with C**o**C-o verbs) similar results to Hyman (2002) are attested. By grouping all verbs written as **o** in published sources, regardless of their ATR feature, I found an average F1/F2 of 406/865 for **o**, whereas Hyman (2002: 2) has F1/F2 for short **o** as 386/1095 and for “long **o** (VV sequence) as 400/1040.

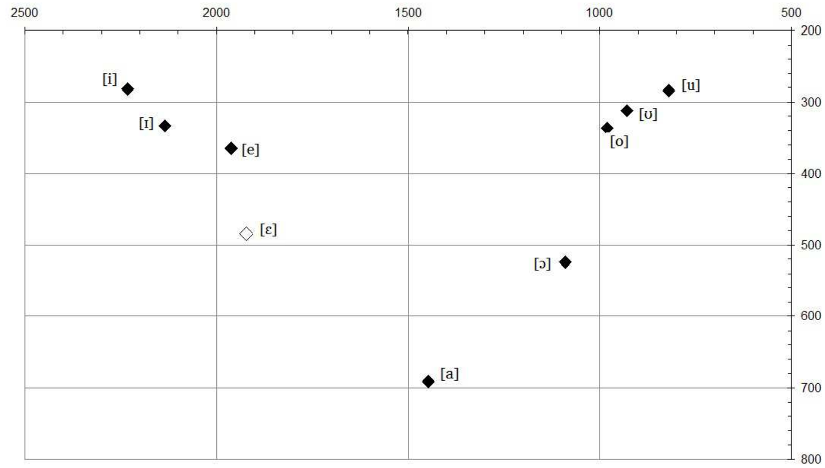

Figure 10: Averages of Elip vowels

2.11.2.7 Mmala

As with Yangben, Paulian (1986: 243-279) identifies seven vowels (i, e, ɛ, a, ɔ, o, u) for Mmala. Acoustic research done with Coleen Anderson Starwalt for Mmala, like for Yangben, clearly shows nine vowels. The average F1/F2 frequencies of the nine vowels of Mmala are illustrated in Figure 11 below.

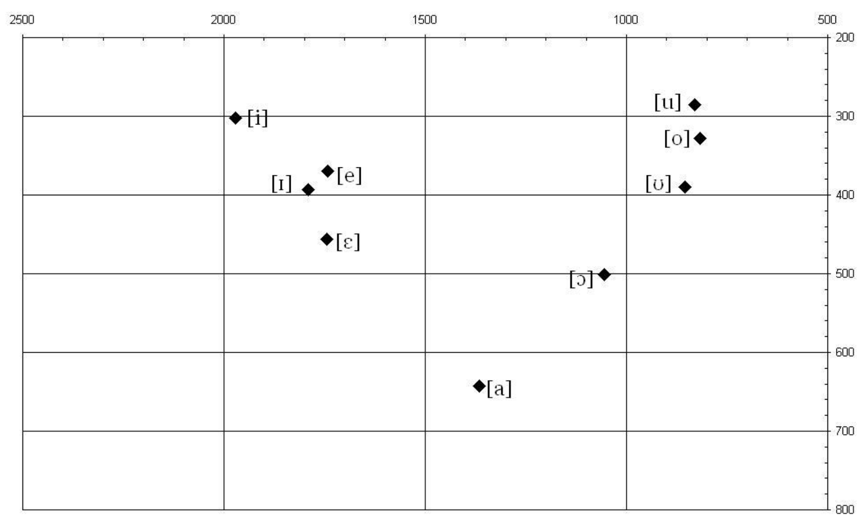

Figure 11: Averages of Mmala vowels

2.11.2.8 Yangben

The most important literature for this study is Hyman's 2003 article: “"Abstract" vowel Harmony in Kàlɔ̀ŋ:[223] A system driven account”. Hyman's data and descriptive analysis are based on Paulian's 2001 3,000-entry lexicon: Lexique kàlɔ̀ŋ-français[224] to which I do not have access. In two works concerning Yangben, Paulian (1986: 243-279) and Guarisma & Paulian (1986: 93-176) identify seven vowels (i, e, ɛ, a, ɔ, o, u) for all of the Central Yambassa languages, including Yangben. Hyman identifies the same seven surface vowels, but due to the phonological behaviour of the vowels in the harmony system, Hyman identifies two additional underlying vowels which he calls “abstract” vowels. These “abstract” vowels /I/ and /U/ are realised on the surface as /i, u/ in open syllables and as /ɛ, ɔ/ in closed syllables (Hyman 2003: 6). Acoustic research[225] done with Coleen Anderson Starwalt in Yangben, however, clearly shows nine surface vowels. Hyman's “abstract” vowels have a surface as well as underlying reality. The average F1/F2 frequencies of nine surface vowels of Yangben are illustrated in Figure 12 below.

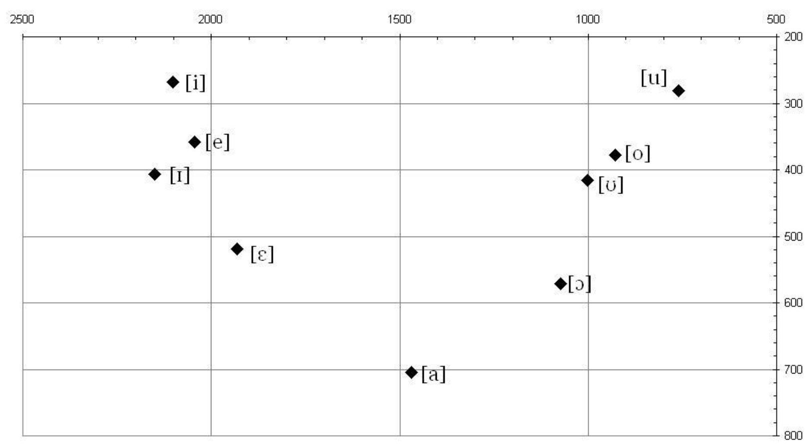

Figure 12: Averages of Yangben vowels

The main difference between the research of this study and that of Hyman is this difference in the Yangben vowel inventory. Whereas Hyman posits a 7/9-vowel system with seven surface vowels and two additional underlying vowels, this study finds a full-fledged 9-vowel system.

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[223] Kàlɔ̀ŋ is an alternate name for Yangben.

[224] Referred to by Hyman (2003: 2) in footnote.

[225] The data selected for recording came from my own lexicons. Anderson Starwalt recorded five speakers (3 men and 2 women). Each word was uttered a minimum of ten times. Each vowel is based on more than one word; including both nouns and verbs. The analysis is my own work, so any errors of analysis are mine alone.

2.11.2.9 Mbure

Identifying the Mbure vowels has proved rather difficult. Nine surface vowels have been identified acoustically. The vowels [ɪ] and [ʊ] are, however, limited in distribution with only a few examples found in noun or verb roots. The acoustic space for both F1 and F2 between [i], [ɪ] and [e]; and [u], [ʊ] and [o] is very small, so much so, that there is reason to question if there really is ATR contrast in both the high and mid vowels or whether it might be more realistic to posit contrast in only the high or mid vowels. If there is only contrast in one set, either the high or the mid vowels, the question then is whether we are dealing with a 7-vowel (type 1) system with /i, ɪ, ɛ, a, ɔ, ʊ, u/, or a 7-vowel (type 2) system with /i, e, ɛ, a, ɔ, o, u/.

In favour of a type (2) vowel system is native speaker intuition. None of the naive native speakers questioned heard a distinction between [i] and [ɪ] or between [u] and [ʊ]. In addition, they consistently differentiate not only between [i] and [e], but also between [ɪ] and [e] and between [u] and [o] as well as [ʊ] and [o]. Figure 13, below shows the averages of nouns with the surface vowels [i] (triangle), [ɪ] (diamond) and [e] (square). In Figure 13 below, the circle indicates the vowels that native speakers perceived as “**i**”.

As with the front vowels, native speakers consistently differentiate not only between [u] and [o], but also between [ʊ] and [o], although both F1 and F2 of [ʊ] (diamond) are very close to [o] (square). No distinction is perceived, however, between [u] (triangle) and [ʊ] (diamond) which have greater acoustic spacing. In Figure 14, below, the circle indicates the vowels that native speakers perceived as “**u**”.

Identifying [u] and [ʊ] as /u/; and [i] and [ɪ] as /i/ fits both native speaker intuition and Scruggs’ (1983) and Boone's (1992b) findings.[226] However positing a seven-vowel type (2) system with /i, e, ɛ, a, ɔ, o, u/ has its problems.

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[226] Not that I consider their findings definitive in consideration that the other Mbam languages have also been classified as seven-vowel type 2 languages and are clearly not.

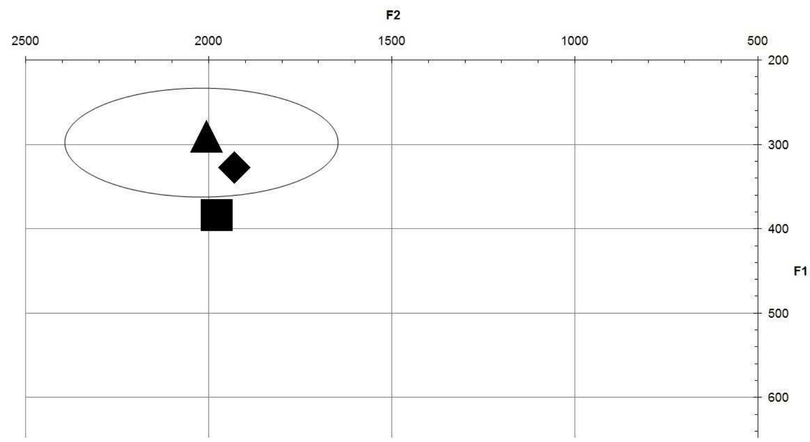


Figure 13: Averages of Mbure nouns with[i], [ɪ] and [e].

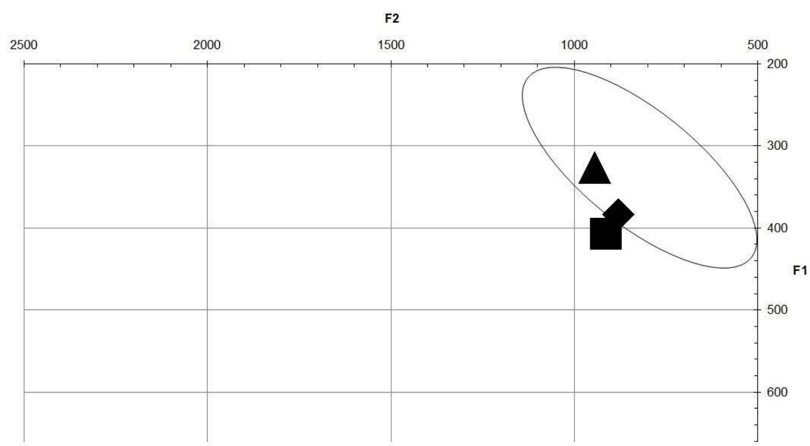


Figure 14: Averages of Mbure verbs with[u], [ʊ] and [o].

Mbure shows evidence of having at least some [+ATR] dominance. Casali (2003, 2008) and Starwalt (2008) show that [+ATR] dominance is exceedingly rare in seven-vowel type (2) ([i, e, ɛ, a, ɔ, o, u]) vowel systems. Is Mbure then an exception to the rule?

Considering that F1 values of high [-ATR] and mid [+ATR] vowels have been shown to overlap quite heavily in languages with 9-vowel systems, including some of the languages in this study, the other possibilities would be to posit Mbure either as a type (1) 7-vowel system with contrast in the high vowels, /i, ɪ, ɛ, a, ɔ, ʊ, u/, or as a 9-vowel language. In the case of the former, although naive native speakers hear a difference between [ɪ] and [e] and between [ʊ] and [o], they would be considered as underlyingly the same. Then /e/ ([ɛ]) found in [+ATR] environments would be considered allophonic. The disadvantage (other than the above-mentioned naive native speaker intuition) is that, there are only a handful of verb roots with [e] and [o] which clearly have [+ATR] and/or [+round] harmony active. As a result of these considerations, positing a 7-vowel system of either type is problematic and Mbure should probably be considered as a 9-vowel language.

While examples of /ɪ/ and /ʊ/ are less robustly attested in noun and verb roots, where they do occur, they are clearly considered distinct from nouns and verbs with /e/ and /o/. In Example 308, /i/ and /u/ generally pattern with the [+ATR] final vowel /e/, while /ɪ/ and /ʊ/ pattern with the [-ATR] final vowel /a/ in verbs.

Example 308: Attested root vowels in Mbure nouns and verbs

	Verb	***gloss***	**noun**	***gloss***	**noun**	***gloss***
i	≠tíb-è	*pierce*	m̀≠bínè	*darkness*	kì≠tì	*crowd*
ɪ	≠híɾ-ìb-à	*breathe*	---	---	sì	*land*
e	≠pél-à	*call*	ì≠téᵐbé	*be correct (n)*	sét	*duiker*
ɛ	≠sɛ́ɾ-à	*flow*	kì≠tʃɛ́nɛ́	*old hoe*	tɛ̂	*father*
a	≠sáɾ-à	*chop*	kì≠tʃáŋà	*monkey*	ták	*catfish*
ɔ	≠sɔ́d-à	*live*	ì≠sɔ̀nà	*broom*	tɔ̀k	*stomach*
o	≠sòg-à	*wash*	ì≠kòŋò	*ridge*	tók	*calf*
ʊ	≠kʊ́g-àt	*pull*	ì≠kʊ́nà	*bean*	mà≠ɲʊ́k	*milk*
u	≠pùg-è	*close*	núᵐbètʰ	*man*	sú	*fish*

Figure 15 shows the average F1/F2 frequencies of nine contrastive vowels of Mbure. The vowel /e/ has a lowered non-contrastive form [ɛ][227] occurring in word-final position. It is acoustically very similar to /ɛ/ and its average is indicated by the open diamond in the figure below.

[227] Another hypothesis is that this is a fronted [+ATR] counterpar of /a/. A high F2 of this vowel is not uncommon among [+ATR] central vowels in Mbam languages many of which have "migrated". I suspect this [+ATR] vowel is underlyingly the [+ATR] counterpart of /a/ and similar to the Baca [ɜ].

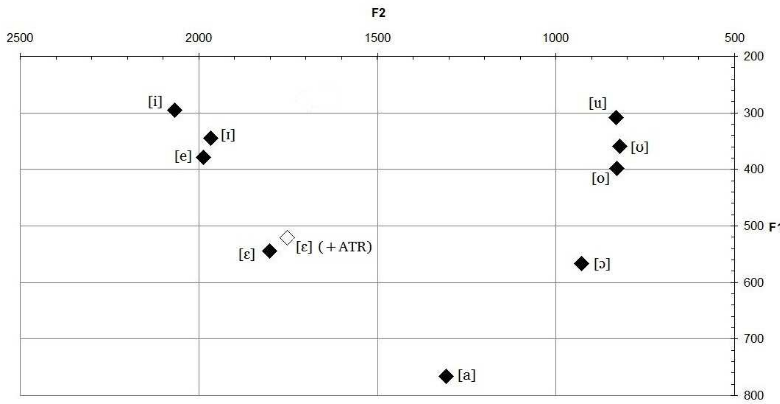


Figure 15: Averages of Mbure vowels

2.11.2.10 Baca

Both Abessolo and Sebineni identify only seven vowels (i, e, ɛ, a, ɔ, o, u) for Baca. Acoustic research show ten surface vowels; though only nine are contrastive, as shown in Figure 16 below. The non-contrastive [ɜ] is indicated by the symbol ◇.

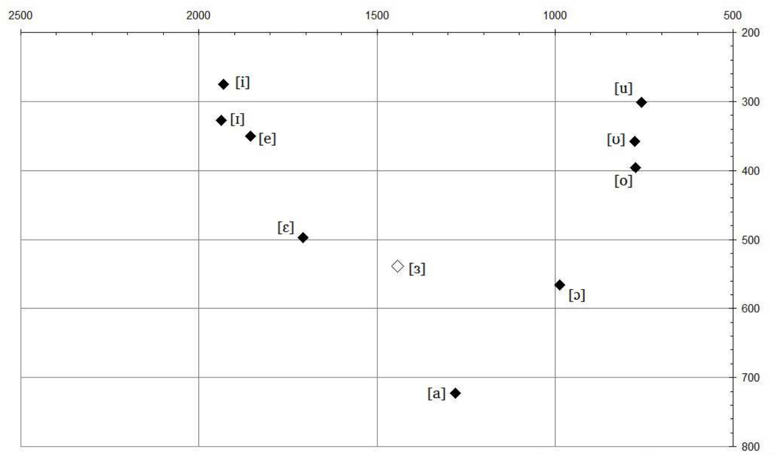


Figure 16: Averages of Baca vowels

The tenth vowel, [ɜ] is a predictable [+ATR] allophone of /a/ and only occurs in [+ATR] words. This vowel has a substantially higher F1 than in the other Mbam languages with a central [+ATR] counterpart to /a/.

2.11.2.11 Summary

Many of the Mbam languages have been previously analysed as having seven surface vowels, although in some cases eight or nine underlying vowels are posited.

The acoustic evidence, however, is reasonably clear that there are in fact more surface vowels than previously thought. Previous studies often struggled to understand why certain vowels behaved oddly in the vowel-harmony system, and missed some interesting features of vowel harmony as a result. Through the study of the vowels and vowel harmony of the Mbam languages, I hope to shed light on the character of vowel harmony specifically and on phonology in general.

2.12 Conclusions

ATR harmony is found in all ten Mbam languages. The differences between them lie in the number of underlying and surface vowels, and the scope of the ATR harmony.

The Mbam languages most likely once had ten contrastive vowels. They currently have seven, eight, or nine contrastive vowels, with traces of additional underlying vowels as evident in their vowel-harmony systems.

Tuki and Mbure have the most restrictive tongue-root harmony, essentially limited to the noun or verb stem and some noun-class prefixes and verbal suffixes. Yangben and Mmala have the most extensive ATR harmony, which encompasses all pre-stem morphemes in the verb unit and certain grammatical elements connected with the noun, such as the associative marker, conjunctions and prepositions.

In addition to ATR harmony, the Mbam languages also have various other vowel-harmony processes which interact with ATR harmony. The most common of these additional harmonies is rounding harmony that targets /a/ in the context of a non-high round vowel. The flipside of rounding harmony is fronting harmony, which occurs only in Yangben and is triggered by non-high front vowels. The last type of vowel harmony found is height harmony, which targets the [-ATR] high vowels.

Based on the data presented in this chapter for each of these languages, we will consider in greater detail the vowel inventories and the vowel-harmony systems in subsequent chapters.

3
Dominance, directionality and domain of Mbam vowel harmony

The Mbam languages provide insight into the question of ATR dominance in vowel harmony. While root- (or stem-) controlled vowel harmony is the more common analysis, due to the presence of [+ATR]-dominant suffixes, and a few [+ATR]-dominant prefixes, the vowel harmony of the Mbam languages is clearly dominant-recessive rather than root- (or stem-) controlled. Baković (2000) discusses residual stem-control and cyclic vowel harmony to describe why otherwise dominant ATR harmony seems to have directional tendencies in some languages. Directional tendencies in Mbam languages, such as Tuki (which has [+ATR]-dominant prefixes) and Mbure, however, can be explained without evoking a residual stem-control that applies only to some Mbam languages but not in others. The question of the differences in vowel-harmony spread can be explained through a discussion on directionality in vowel-harmony spread and the domain of vowel harmony.

The differences in the domain of vowel harmony reflect differences in the Mbam languages of what is a phonological word. The phonological designation of the word is important to the general Bantu issue of how verbs historically became so agglutinative.

In this chapter, we will discuss the issues of ATR dominance (section 3.1), directionality in vowel harmony (section 3.2) and the domain of vowel harmony (section 3.3).

3.1 [+ATR] dominance

Vowel harmony has generally been considered as either "root- (or stem-) controlled" or "dominant-recessive". In the former, the harmonic feature (for example, ATR) of the root or stem vowel determines the ATR value of any affix vowels.

In dominant-recessive languages, one tongue-root feature (advanced or retracted) is considered dominant. Any dominant-featured morpheme, whether the root or an affix, determines the tongue-root feature of all the recessive vowels in the domain (often the phonological word). While most languages studied have dominant ATR harmony, there are some languages, Yoruba being the most studied, and the Bantu C languages (Leitch 1996), which have retracted tongue root (RTR) harmony.

While there is much discussion favouring both "root-controlled" and "dominant-recessive" analyses, the "dominant-recessive" approach fits the Mbam languages better. Due to the presence of [+ATR]-dominant suffixes and of a few [+ATR] prefixes (in Nen and Tuki), which will cause [ATR] assimilation even of root vowels, dominant-recessive harmony is the most useful analysis for the description of the ATR harmony of the Mbam languages. Even in a language like Yambeta, which does not have [+ATR]-dominant affixes, the same general principle of assimilation to [+ATR] vowels is seemingly at work in all of the languages. To consider Yambeta therefore as root- or stem-controlled and the others as dominant-recessive is introducing a false dichotomy between languages which show strikingly similar vowel-harmony patterns. But if all the Mbam languages are dominant-recessive, what role is there then for root- or stem-control? What are the defining properties of a root- or stem-controlled language and how can we be sure such languages do in fact exist? This study cannot answer these questions which require reference to languages outside of the Mbam.

ATR harmony generally affects more than roots, it also occurs between affixes and roots. ATR harmony occurring in roots is sometimes called *static vowel harmony* (see various works of Kutsch Lojenga), and involves V_1-V_2 co-occurrences and co-occurrence restrictions within roots. *Dynamic vowel harmony* on the other hand involves ATR changes across morpheme boundaries. The Mbam languages generally have both *static* and *dynamic* vowel harmony.

3.2 Directionality in vowel harmony

Directionality is a relevant topic in vowel harmony because, unlike assimilation, vowel harmony is not local, and unlike umlaut, it is iterative, spreading sometimes rather far from the triggering vowel (whether in the root or in a dominant affix). How vowel harmony spreads, its domain and its direction, therefore, are essential topics in any discussion about vowel harmony. In this section, we will look at the directionality of vowel harmony and consider what various writers have said about directionality and discuss these analyses in light of the vowel harmony in the Mbam languages.

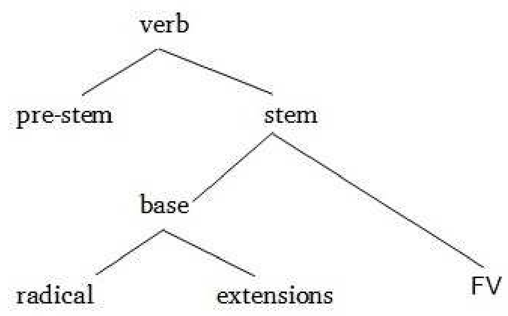
3.2.1 Overview of vowel-harmony directionality in the literature

Halle and Vergnaud (1981: 1) identify two types of harmony processes: *directional*, where the harmony features propagate in one direction only, and *dominant*, where the harmony features propagate in both directions. Later works make further precisions such as differing between root- or stem-controlled vowel harmony and dominant-recessive vowel harmony both of which can in principle be bidirectional.

Baković (2000: 7) claims "... that the 'direction' of vowel harmony is entirely dependent on the morphological structure of the language." In those languages like Yoruba which have strictly prefixing morphology, vowel harmony spreads leftward from the root towards the prefix. In languages with both prefixes and suffixes, vowel harmony spreads both leftward and rightward from the root to the affixes.

Vowel harmony is stronger between root and suffixes than between prefixes and the root. In Tuki (and in certain contexts in Mbure), the final vowel **-a** will harmonise with a [+ATR]-dominant vowel in the verb root, but prefixes with /a/ will not. Meeussen and others consider that suffixes (particularly derivational suffixes) are more closely bound to the root than prefixes, as illustrated in Figure 17 for Bantu, and that "this root + suffix stem domain is shown to be the locus of phonological activity in proto-Bantu" (Hyman 2008: 1), hence vowel harmony triggered by either a root or suffix vowel (stem) will spread throughout the root + suffix domain.

Figure 17: Meeussen (1967) Structure of the Bantu verb



In a couple of articles, Hyman discusses directionality in vowel harmony and other phonological and morphological processes. Like Baković, Hyman (2002) considers vowel harmony to be predominantly root- or stem-controlled. However, Hyman also notes that this is only part of the picture. Post-lexical vowel harmony, such as is found in Nez Perce (Hyman 2002: 17), is anticipatory (right to left), and is not dependent on the morphological structure of the language. He summarises phonological processes, including vowel harmony (Hyman 2008: 322-323), as follows:

Figure 18: Summary of phonological processes Hyman (2008: 322)

a When a process is root-controlled, either prefixes or suffixes may be affected.

b There is an anticipatory bias which should:
   - i make prefixes better targets for reduction, fusion, and loss than suffixes
   - ii make suffixes better triggers for harmony and other phonological processes.

Hyman (2008: 322) goes on to say that "the implication of the above is that when segments interact across identical constituent types (word-word, stem-stem, root-root, and affix-affix), the effect should be anticipatory. To test such claims, a full discussion of directional possibilities must include cases of multiple prefixation and suffixation..."

Given a typical Bantu verb with multiple prefixes and suffixes:

[P1 - P2 - R - S1 - S2]$_{word}$

Where P=prefix, R=root and S=suffix, Hyman (2008: 323, 2005: 14-15 and 2002: 15) charts the more “widely attested processes[...] (✓) includ[ing] anticipatory and root-control harmony.” The VH target/trigger possibilities are attested in Table 57.

Table 57: VH target/trigger + directional possibilities of forms with two prefixes and/or suffixes (Hyman 2002: 15, 2005: 14, 2008: 322)

left to right	right to left	left to right	right to left
a. local VH		d. non-local VH -affix+rt transparency	
P1 > P2 ?	P2 > P1 ✓	P1 > S1 ?	S1 > P1 ?
P2 > R ?	R > P2 ✓	P1 > S2 ?	S2 > P1 ?
R > S1 ✓	S1 > R ✓	P2 > S2 ?	S2 > P2 ?
S1 > S2 ?	S2 > S1 ✓		
b. non-local VH -affix transparency		e. root-root compound VH	
P1 > R ?	R > P1 ✓	R1 > R2 ✓	R2 > R1 ✓
R > S2 ✓	S2 > R ✓		
c. non-local VH -root transparency		f. root-internal VH (also within P&S)	
P2 > S1 ?	S1 > P2 ?	[V > V]R ✓	[V < V]R ✓

Coming from his root-control position, Hyman (2008: 322-323) wonders whether the unattested, or less attested, prefix-controlled processes are due to

> “... a condition on prefixes as triggers, roots as targets, or both. Specifically, can a prefix initiate vowel harmony onto prefixes to its right or left? If the parameters are root-control and anticipatory assimilation, then the checks vs. question marks in [Table 57] indicate the following: (i) *P2 can harmonize P1, but P1 cannot harmonize P2 (or R)*; (ii) *S2 can harmonize S1, and S1 can harmonize R, but S1 cannot harmonize S2*” (my italics).

While a couple of Mbam languages do have [+ATR]-dominant prefixes, these occur only in closed paradigms such as numerals and display several exceptional patterns. These particular cases are better considered as exceptions rather than rule governed. This said, as we will see below, there is evidence that certain of Hyman's (2002, 2005, 2008) questionable categories are found in the vowel-harmony processes of the Mbam languages.

3.2.2 Directionality and prefix-/suffix-controlled vowel harmony in the Mbam languages

Hyman's (2005: 14-15, 2008: 322-323) parameters of root-control and anticipatory assimilation lead to two assumptions mentioned above which will be addressed in this section in light of the various vowel-harmony processes of the Mbam languages: 1) *"P2 can harmonise P1, but P1 cannot harmonise P2 (or R)*"; and 2) *"S2 can harmonise S1, and S1 can harmonise R, but S1 cannot harmonise S2"*.

3.2.2.1 "P2 can harmonise P1, but P1 cannot harmonise P2 (or R)"

Hyman (2005, 2008) claims that vowel harmony tends to be anticipatory, and puts forward a hypothesis that in a word with two (or more) prefixes the right-hand prefix may trigger vowel harmony to the left, but that the left-hand prefix will not trigger vowel harmony to the prefix to its right or to the root (progressive vowel harmony). In similar fashion, Hyman indicates that a prefix will not trigger vowel harmony on a root vowel.

While not strictly prefixes, Maande preverbal morphemes do show clear anticipatory (right-left) directionality in ATR harmony. Unlike what is normal in Common Bantu, Maande does not have a series of prefixes to a verb root. Rather, these morphemes are clitic-like elements before the verb. Certain adverbs and the indirect-object pronouns are phonological words which may occur between the subject-tense morphemes and the verb stem. They will trigger anticipatory ATR harmony only. This supports Hyman's hypothesis that P2 can harmonise P1, but not vice versa. In Example 309 below, the [+ATR]-dominant adverb is underlined, and the clitics to the left which undergo ATR harmony are bolded.

Example 309: Anticipatory [+ATR] harmony in the Maande verb

[tʊ̀	tì-ŋá	hánà	**ə̀sù**	**lík-ím-ə̀**]		*We are not*
1p	neg-T/A	again	1p	be.afraid		*afraid again.*

[**tù**	**tì-ŋə́**	**tə́ɲì**	àsʊ̀	bànʊ́	**bí-lítʃ-íɲ-ìɲ-ì]**	*We didn't notice*
1p	neg-T/A	quickly	1p	2p	reflx-notice	*you quickly.*

Nen is a SOV language, which means that an object noun may be present among the pre-stem elements of the verb unit. If the object noun (underlined in Example 310 below) is [+ATR], it optionally triggers ATR harmony in the pre-stem elements to its left; if it is [-ATR] it will block ATR harmony from spreading from the verb stem.

Example 310: ATR harmony in Nen pre-stem elements[228]

[mɛ̀	ná	**hìsíní**	pɛ́l-ɛ́n]	~	[**mì nə́ hìsíní** pɛ́l-ɛ́n]	*I put down the pot.*
1s	P1	pot	put.down-APPL			

[mɛ̀	ná	sànjá	**sj-ə̀k-ín**]	*I saw the mouse.*
1s	P1	mouse	see-INT-APPL	

Certain adverbs *may* also occur among the pre-stem morphemes of the verb unit. If an adverb occurring among the pre-stem elements has dominant vowels, as in the case of **hútú** *quickly*, it may trigger vowel harmony to its left. If it has recessive vowels, as in the case of **mɔ́ŋɔ́** *again*, it will block vowel-harmony spread. In Example 311, [+ATR] morphemes are bolded.

Example 311: Modification of ATR harmony in Nen verb pre-stem[229]

[mɛ́	ŋɔ̀	mɔ́ŋɔ́	**bín-ə́k-ə̥**]		*I will again dance.*
1s	FT2	again	dance-INT-FV		
[mí	ŋù	bín-ə́k-ə̀		tɔ́nə̥̀]	*I will dance again.*
1s	FT2	dance-INT-FV		again	
[**mì**	**sə́**	**hútú**	àŋɔ́á	bɔ́ŋ-ɔ̥̀]	*I did not quickly find you.*
1s	NEG	quickly	2s	find-FV	
mɛ̀	sá	àŋɔ́á	bɔ́ŋɔ́	tɔ̀fə̥̀]	*I did not find you quickly.*
1s	NEG	2s	find	quickly	

The above examples confirm Hyman's premise that vowel harmony is anticipatory. There are, however, counter-examples in certain Mbam languages, in which certain prefixes will trigger vowel harmony progressively.

3.2.2.2 [+ATR]-dominant prefixes:

Certain Nen and Tuki numeral prefixes will trigger ATR harmony on the root vowel of the numerals *one* and *two* in Nen and *two* and *four* in Tuki. In Nen, only classes 3, 4 and 19 have ATR-dominant prefixes, and in Tuki only class 8 is incontestably ATR-dominant.

The [+ATR] dominant prefixes in Nen and Tuki only operate within closed paradigms such as numerals and certain demonstratives.

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[228] Bancel 1999: 8 (with my modifications of the phonetic transcriptions).

[229] Examples from Sebineni Alphonsine Flore : p.c. Aug. 2009. According to her, ATR is more likely to spread than not in normal-speed speech.

Example 312: Nen and Tuki [+ATR]-dominant numeral prefixes

Nen	1	ɔ-	mʊ̀≠^{n}dɔ̀ ɔ̀≠mɔ̀tí	*one person*
	2	pa-	pì≠^{n}dɔ̀ pá≠fà^{n}dí	*two people*
	3	u-	mʊ̀≠lɛ́má **ú≠mòtí**	*one heart*
	4	i-	mì≠lɛ́má **í≠fə̀^{n}dí**	*two hearts*
Tuki	2	βá-	βà≠tʊ̀ βá≠βání	*two people*
			βà≠tʊ̀ βá≠íní	*four people*
	8	βí-	b^{j}≠ìrá **βí≠βə́ní**	*two arrows*
			b^{j}≠ìrá **βí≠íní**	*four arrows*

However, not all [+ATR] prefixes are dominant and trigger ATR harmony. Tuki noun-class prefixes 5, 8 and 19 are [+ATR], invariable, and do not trigger ATR harmony on the noun root.

Example 313: Tuki invariable [+ATR] NC prefixes

5	i-	**ì**≠bání	*breast, teat*
		ì≠bíɾə́	*oil palm*
8	βi-	βì≠kɔ́hí	*shoulders*
		β**ì**≠tə́tí	*roosters*
19	i-	**ì**≠hʊ́rá	*broom*
		ì≠dʒìjə̀	*fire*

So while Tuki has [+ATR] prefixes on nouns and on numerals, only the [+ATR] prefixes on numerals will trigger ATR harmony on the root vowels. These counter-examples of dominant prefixes in Tuki and Nen are perhaps stored as complete words rather than as a result of word-formation processes. This would also explain the [-ATR] "dominance" found for other numerals in Nen. These two counter-universal properties suggest a paradigmatic regularisation within a closed set.

3.2.2.3 Rounding-dominant prefixes

Noun class 3 in Mmala generally is a non-high (open) round vowel except for noun stems beginning with /a/ or its [+ATR] counterpart /e/. With these nouns, the noun-class prefix vowel is [-round] as seen in Example 314. The [-round] noun-class 3 prefixes for nouns with /a/ and /e/ in V_1 position in the root are bolded.

Example 314: Mmala noun-class 3 prefix vowels

/i/	ò≠ŋìní	*louse*
/ɪ/	ɔ̀≠dìm	*heart*
/ɛ/	ɔ̀≠mɛ̀ⁿdɛ̀	*liver*
/e/	**è≠mèkú**	*flesh*
/a/	**à≠hàb**	*green mamba*
/ɔ/	ɔ̀ŋ≠kɔ̀gɔ̀	*wine (gen)*
/o/	òm≠bòkò	*squirrel*
/ʊ/	ɔ̀n≠dʊ̀nɔ̀	*commerce, riches*
/u/	òn≠dùl	*pot for cooked meat*

There are, however, indications that the noun-class 1 and 3 prefixes in Mmala may in certain circumstances be dominant and will cause the [-round] stem vowels /a/ and /e/ to become [+round]. When V_1 of the noun root is a [+high] vowel, and V_2 is either /a/ or /e/, the noun-class 1 or 3 prefix will trigger rounding on the root V_2, as is seen in Example 315. As will be discussed in chapter 4, all high vowels are transparent to rounding harmony in Mmala.

Example 315: Noun classes 1 and 3 rounding-dominant vowels

ò≠ŋídò	ì≠ŋídè	*c3/4.hair*
ɔ̀ɱ≠fɛ̀ɲɔ̀	ìm≠fìɲà	*c3/4.termite sp.*
ɔ̀m≠bùlɔ́	bà≠bʊ̀lá	*c1/2.girl*

Generally, rounding harmony only affects vowels which are contrastively [-round], that is, the non-high vowels /a/ and /e/. There are only a handful of words found in the corpus which clearly show the noun-class 1 or 3 prefixes triggering rounding in a noun-stem vowel. This lack of examples may be due to the limitations of the database, and it is assumed that any noun root which fits the pattern, [+high] V_1 and a [-high, -round] V_2, in noun-class 3 and certain noun-class 1 prefixes would likewise undergo progressive rounding. In addition, the "unrounding" of the noun-class 3 prefix vowel before noun roots with /a/ or /e/ in V_1 position, as in Example 314 above, prove to be stem-preserving. Rather than permitting a round-dominant prefix vowel to trigger rounding harmony on a susceptible vowel in the stronger V_1 position, the prefix vowel loses its [+round] feature, whereas, when the susceptible vowel is in the weaker V_2 position, it undergoes rounding harmony triggered by the dominant [+round] prefix vowel.

Rounding harmony also occurs between preverbal morphemes in Nen, Maande and Gunu. In the first two, this rounding harmony is clearly anticipatory, meaning that P2 will trigger rounding in P1. In Maande, the 2s indirect object pronoun (underlined) will trigger rounding on the present tense marker, and in Nen, the future tense marker **ŋɔ** (underlined) will cause rounding in the negative **sá**.

Example 316: Rounding harmony P2>P1 in Maande and Nen

Maande	ʊ̀-ŋǎ≠tʊ́k-à	*3s-PR draws (water)-FV*
	ì-**ŋɔ̌**-mí **ɔ̀**≠lìtʃ-à[230]	*1s-PR-1s-2sIO≠see-FV*
	ì-**ŋǒ**-mí-**ò**≠téŋ-ít-ì	*1s-PR-1s-2sIO≠greet-FV*
Nen	à-nɔ́ ɲá[231]	*s/he drank*
	á-sá ɲá	*s/he didn't drink.*
	á-**ŋɔ̀** ɲá	*s/he will drink*
	à-**sɔ́**-**ŋɔ̀** ɲá	*s/he will not drink*

This anticipatory P2>P1 vowel harmony fits Hyman's hypothesis, however, Maande also has a progressive P1>P2 rounding harmony, as does Gunu. In these cases, the subject pronoun (P1) clearly triggers rounding harmony in the tense marker (P2). The trigger vowels are underlined.

Example 317: Rounding P1>P2 (progressive) in Gunu, Maande

Gunu[232]	à-dɛ̀-ᵐbá bʊ̀l-à	*s/he did not arrive*
	ò-**dò**-ᵐbá bʊ̀l-à	*you did not arrive*
	nò-**dò**-ᵐbí ìɲè	*you (pl) did not refuse*
Maande	ʊ̀-ŋǎ≠tʊ́k-à	*s/he draws (water)*
	ù-ŋə̌≠túk-ə̀	*s/he nourishes (child)*
	ɔ̀-**ŋɔ̌**≠tʊ́k-à	*you draw (water)*
	ò-**ŋǒ**≠túk-ə̀	*you nourish (child)*

In Maande, root-triggered rounding harmony is blocked by a high vowel (see section 4.3.2.3), but in progressive P1>P2 rounding harmony, the high (front) vowels are transparent.

3.2.2.4 Height-dominant prefix

Noun-class 3 prefix in Mmala is not only dominant for rounding harmony, but also is height dominant. It has been found with every root vowel except for the [-ATR] high vowels /ɪ/ and /ʊ/. As shown above, the noun-class 3 prefix is either **o-** or **ɔ-** for all vowels except /e/ and /a/, in which cases, the prefixes are unrounded (see Example 314 above). As there are indications that **ɔ-** is dominant for rounding, there are also indications that it is dominant for height. The verb **gʊ̀fʊ́mà** *to win* has a nominalised form **ɔ̀fɔ́m** *winnings, profits*. In Example 318, the root vowel of the nominal form has a distinctly higher F1, averaging 581 Hz and only 462 Hz in the verbal form. A similar phenomenon occurs with the front vowels, although the difference is smaller.

[230] Following examples from Taylor 1990: 12 with my phonetic transcriptions. Maande has repeated subject pronouns that occur between the tense marker and the indirect object pronoun.
[231] Following examples from Kongne 2011: 136, 140.
[232] Taken from Robinson 1999: 10.

Example 318: Mmala height-dominant noun-class 3 prefix

	gloss	**Ave. F1**	**Ave. F2**
gò≠f**ó**mà	*win*	462	859
ɔ̀≠fɔ́m	*winnings, profits*	581	922
gò≠g**í**gà/gò≠g**ɛ́**gà	*remain, watch*	511	1722
ɔ̀≠gɛ́g	*surveillance, check*	577	1653

While dominant [+ATR] prefixes are limited to closed paradigms and display several exceptional patterns, the same cannot be said for the dominant [+round] noun-classes 1 and 3 prefixes and the noun-class 3 height-dominant prefix in Mmala. The latter, in particular, is rather prominent in deverbal nouns of class 3. These rounding- and height-dominant prefixes are not limited to a closed class of words, and are found wherever the required conditions occur. Hyman's (2005, 2008) premise that a prefix cannot harmonise a root (P2>R) is contradicted by the presence of dominant vowels in other types of vowel harmony found in the Mbam languages.

3.2.2.5 "S2 can harmonise S1, and S1 can harmonise R, but S1 cannot harmonise S2"

Hyman's (2005, 2008) second hypothesis is that, due to anticipatory vowel harmony, the right-hand suffix will trigger vowel harmony on suffixes to its left and the root, but a suffix will not trigger vowel harmony progressively onto another suffix to its right.

The Mbam languages have many examples of S2>S1 vowel harmony. The [+ATR] causative suffix, which occurs at the right edge of the verb, will cause the vowel in the suffix (and the root) to its left to change into its [+ATR] counterpart. In Example 319 below, the [+ATR]-dominant vowels are underlined.

Example 319: S2>S1/R ATR harmony

Maande	≠lʊ̀l-à	*burn*	≠lùl-ìk-**ì**	*cause to burn*
	≠màn-à	*finish*	≠mə̀n-ìs-**ì**	*put to an end*
Mmala	≠dád-ìd	*sing*	≠déd-ìd-**ì**	*cause to sing*
	≠ɔ̀ᵐb-ɔ̀	*grow*	≠òᵐb-ìd-**ì**	*cause to grow*
Yangben	≠sɔ́ːk-ɔ̀	*grow*	≠sóːk-òɲ-ìɲ-**ì**	*germinate for*
	≠ɛ̌j	*become*	≠ěj-ès-**ì**	*transform*
Baca	hɔ̀ɔ̀n-à	*sweep*	hòòn-àɲ-**ì**	*cause to sweep*
	tɛ́g-à	*draw water*	tég-ìs-**ì**	*cause to draw water*

Height harmony found in Mmala also has height-dominant suffixes (underlined in Example 320 below). The vowels which undergo lowering are bolded. These, following Hyman's (2005, 2008) hypothesis, are anticipatory. As noted in section 4.3.3.2, the vowel /a/ is opaque in height harmony.

Example 320: Mmala S2>S1 height harmony:

[g^w≠àd-ʊ̀g-àn]	/gʊ̀≠àd-ʊ̀g-àn	*rise-CONT*
[g^w≠àd-**ɔ̀g**-**ɛ̀d**-**ɛ̀d**]	/g^w≠àd-ʊ̀g-ɛ̀d-ɛ̀d/	*rise a little*
[g^w≠ǎd-**ɛ̀g**-**ɛ̀n**]	/gʊ̀≠ǎd-ɪ̀g-ɛ̀n/	*seize*
[gʊ̀≠dáɲ-**ɛ́g**-**ɛ̀n**]	/gʊ̀≠dáɲ-íg-ɛ̀n/	*put pot on fire*
[gʊ̀≠dáɲ-íg-àn-**ɛ̀n**]	/gʊ̀≠dáɲ-íg-àn-ɛ̀n/	*put pot on fire-APPL*

In Tuki, Gunu and Elip, the [+ATR]-dominant causative suffix occurs before the final vowel and will trigger ATR harmony progressively on the final vowel. Since the final vowel is in direct contact with the vowel of the causative, and because there are no verbal extensions which occur to the right of the causative, these examples are not the most convincing counter-example of Hyman's hypothesis. The juxtaposition of the vowels of a verbal extension and the final vowel, however, is not sufficient, in itself, to cause the alternation in the final vowel. In Tuki, another verbal extension, **-ɪj**, has a [-ATR] high vowel and as a result does not trigger ATR harmony nor alter the form of the final vowel in any way. The **-ɪj** extension gives evidence that it is the [+ATR] feature of the causative which affects the final vowel progressively, not some other feature connected to a high front vowel. The trigger vowel is underlined in Example 321.

Example 321: Bidirectional ATR harmony from S1 to Rt and S2.

Nen	ʊ̀≠fɔ̀l-ɔ̀	*borrow*	ù≠fòl-**ì**-ə̀	*cause to borrow*
	ʊ̀≠síp-à	*peel*	ù≠síp-ə́s-**ì**-ə̀	*cause to peel*
	ʊ̀≠sàl-à	*chop*	ù≠sə̀l-ən**ì**-ə̀	*chop into pieces*
	ɔ̀≠tát-à	*guard*	ù≠tə́t-ən**ì**-ə̀	*guard often/together*
Tuki	≠sɔ́t-ɔ́	*live, dwell*	≠sót-**í**j-è	*caus. to live*
	≠kʊ́t-á	*dry(INTR)*	≠kút-**í**j-è	*caus. to dry*
	≠àt-á	*break (TR)*	≠àt-íj-à	*burst (INTR)*
Gunu	≠gɔ̀s-ɔ̀	*descend(INTR)*	≠gòs-**ì**-ò	*descend (TR)*
	≠ság-à	*dry (INTR)*	≠ség-**ì**-è	*dry (TR)*
Elip	gʊ̀≠sɔ́d	*live*	gù≠sód-**ì**-è	*cause to live*
	gʊ̀≠bʊ́l-íg	*climb*	gù≠búl-íg-**ì**-è	*raise*

In root-root compounds, vowel harmony can be bidirectional. In Yangben, many verb-verb compounds have an anticipatory vowel harmony, while in Mmala noun-noun and noun-modifier compounds may be either anticipatory or progressive. The root that triggers vowel harmony is underlined in Example 322.

Example 322: ATR harmony in compound words

Yangben:

ʊ̀-kànʲɛ́ ètím=è	c1-to.be leave	ùkétímè	*s/he is leaving*
ʊ̀-kànʲɛ́ òpók=è	c1-to.be cry	ùkópókè	*s/he is crying*

Mmala:

sʊ́gʊ̀ èᵐbʲéɲè	other nephew	séᵐbʲéɲ	*co-nephew (same generation)*
sʊ́gʊ̀ òŋìnò	other brother-in-law	sóŋìnò	*co-brother-in-law (between in-laws)*
òwú wàmɛ̀	celui 1sPoss	èwěmì̥	*co-wife*

In Mmala, ATR harmony in compound words may spread bidirectionally from either the right-hand or the left-hand root.

In dominant-recessive vowel-harmony systems, bidirectionality is often assumed. The Mbam languages support this assumption of bidirectionality with only a minor exception.

The only clear example of a directional vowel harmony is found in a post-lexical anticipatory vowel harmony in Nen (Bancel 1999: 8-9). A final [a] or [ə] will optionally assimilate to the tongue-root feature of a word to its right.

Example 323: Post-lexical vowel harmony (Bancel 1999: 9)

	word	**gloss**	**harmonisation**			***gloss***
a)	[nìhɔ́ká]	*axe*	[nìhɔ́k**ə́**	**ní**	mʷə̀ⁿdú]	*axe of the woman*
	[ìtákà]	*shelf*	[mɛ́nd	ɛ̀ták**ə̀**	sìn]	*I see the shelf*
			1s-pr	shelf	see	
b)	[ù≠mìnə̀]	*taro*	[ùmìn**à**	wà	mɔ̀ⁿdɔ̀]	*taro of the man*
	[hʲ≠ə́mə́]	*my*	[hʲə́m**á**	hʲɔ̀fɔ̀]		*my fish*

3.2.3 Conclusions

As seen, there are several contradictory ideas concerning directionality in vowel harmony: from Baković (2000), who claims that vowel harmony is stem-controlled and therefore directionality is entirely dependent on the morphological structure of the language, to Halle and Vergnaud (1981), who find that both stem-controlled and dominant vowel harmony can be bidirectional. Hyman (2002, 2005, 2008), while considering vowel harmony to be predominantly root-controlled, finds a tendency towards anticipatory vowel harmony which is not dependent on the morphological structure of the language.

Although the Mbam languages provide strong evidence for bidirectionality because of the existence of [ATR]-dominant prefixes, they also show that there is something to be said for a bias in anticipatory harmony. Dominant prefixes are few, in few languages, and often restricted to closed sets of function words.[233] Preverbal prefixes and proclitics show predominantly anticipatory harmony. Dominant suffixes may spread to the right, but morphology requires that the suffixes which happen to be dominant are the rightmost in their category.

In the next sections we will look at the domain of vowel harmony, the phonological word, and how the mismatches between phonological and grammatical words affect the spread of vowel harmony.

3.3 The domain of vowel harmony

The criteria for identifying the word are complex. Certain criteria address phonological properties of a "word"; others the grammatical properties. Following Dixon and Aikhenvald (2002), this study will consider the phonological properties as defining the "phonological word" and the grammatical properties as defining the "grammatical word". It is not a given that the phonological and the grammatical criteria coincide, and as a result, there are often mismatches between the grammatical and the phonological word.

3.3.1 The phonological word

Dixon and Aikhenvald (2002: 13) define the phonological word as "... a phonological unit larger than the syllable [...], which has at least one (and generally more than one) phonological defining property...

- *Segmental features* -- internal syllabic and segmental structure; phonetic realisations in terms of this; word boundary phenomena; pause phenomena.
- *Prosodic features* -- stress (or accent) and/or tone assignment; prosodic features such as nasalisation, retroflexion, vowel harmony.
- *Phonological rules* --some rules apply only within a phonological word; others (external sandhi rules) apply specifically across a phonological word boundary."

It is the *Prosodic features*, especially vowel harmony, which are the most germane in determining what the phonological word is in the Mbam languages.

3.3.2 The grammatical word

"A grammatical word..." according to Dixon and Aikhenvald (2002: 19), "... consists of a number of grammatical elements which:

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[233] This statement is true for ATR-dominant prefixes, but less so for rounding-dominant or height-dominant prefixes such as those found in Mmala noun-class 1 and 3 prefixes.

- always occur together, rather than scattered through the clause (the criterion of cohesiveness);
- occur in a fixed order;
- have a conventionalised coherence and meaning.”

While certain of the Mbam languages have clearly agglutinating verbs, others, in particular Nen and Maande, permit nouns, adverbs or pronouns to be inserted between the verb root and certain preverbal morphemes. In these languages, it is clear that the criterion of cohesion is violated and, as a result, these non-cohesive preverbal elements must be considered as grammatically distinct words.

3.3.3 Clitics

In between the phonological word and the grammatical word are clitics. “Clitics occupy an intermediate position between a full-fledged phonological word and an affix, and may fall into different classes depending on their phonological properties and grammatical characteristics” (Aikhenvald 2002: 42-3). A clitic attaches to an adjacent morpheme and becomes one phonological word with it. Proclitics attach before the host morpheme, and enclitics attach after.

In many of the Mbam languages, the preverbal morphemes are less than full grammatical words and attach to another lexeme and become one phonological word with it. These proclitics will attach either to the verb stem or to another lexeme to the right: an adverb, object noun or pronoun, depending on the language. In Maande in particular, these preverbal proclitics obligatorily undergo vowel harmony if the grammatical word to its right is [+ATR].

Prototypically, the verbal word in Bantu languages has an agglutinative structure. Nurse (2003: 90) summarises this structure as:

Initial- Subj- Neg- T(A)- Obj≠ Root -Extension(s) -Final -Sffx

Hyman (2005: 26) notes that in Bantu languages, the phonological word often consists of the grammatical word and any associated clitics. With some minor differences, this is more-or-less true for the Mbam languages. Nurse (2003: 91) explains that in some Cameroonian languages “... there may be a structural spectrum, from the languages having the one word structure... through languages where this structure is loosening, to languages where some or all of the pre-stem material is not phonologically bound at all...”

Hyman (2005: 27) explains “When a language has enough going on in its P-domains, there can be “mismatches”, syntactic conditions, and “look ahead” phenomena...” In this section, we will look into the phonological word in each of the Mbam languages, discuss its structure and explain why there are mismatches.

3.3.4 Vowel harmony and the phonological word

The phonological word is the domain of vowel harmony. Clitics, being morphemes that are a category separate from affixes, tend to attach to a host word and will assimilate to the vowel harmony of that host word. The phonological word, therefore, in the majority of the Mbam languages, consists of an independent grammatical word, such as a verb stem, and may include one or more prefixes and/or proclitics, the latter of which attach to the grammatical word and become one phonological word with it. In languages such as Nen, with an SOV word order, and Maande, which has separate adverbs and pronouns in the verbal construction, the subject-tense complex forms a proclitic, that will attach to the separate object noun, adverb or pronoun to its immediate right.

While the phonological word is the domain of vowel harmony, there seems to be a mismatch between the spread of ATR harmony and the spread of rounding harmony in certain languages. This mismatch, however, is superficial and can be explained. The difference in spread between ATR and rounding harmony is due to three circumstances:

1) Whether rounding-neutral vowels are transparent or opaque;
2) Whether other phonological words occur between the verb stem and the subject concord complex, as happens due to the SOV word order in Nen, and
3) Where the dominant vowel is located (verb stem or preverbal morpheme).

These three circumstances will be discussed in turn in the sections below.

3.3.4.1 Vowel-harmony spread and neutral vowels

In languages like Yangben, Mmala and Elip, which do not have any ATR-neutral vowels but only transparent rounding-neutral vowels, both ATR and rounding harmony spread equally throughout the phonological word. All preverbal morphemes obligatorily undergo both ATR and rounding harmony. In Example 324, the [+ATR] or [+round]-dominant vowel is underlined.

Example 324: Unrestricted ATR and rounding harmony: Yangben

ɔ̀-tì-mà-tɔ̀≠jɔ̀k-àn-ín	màkɛ̀p
c1-NEG-P5-1p≠bring-CONT-APPL	wine
S/he did not bring us wine.	
ù-tì-mè-tù≠**tím**-én	kʲěsì
c1-NEG-P5-1p≠dig-CONT	hole
S/he did not dig us a hole.	

ò-mɔ́-sì-ŋ≠**kɔ̀l**-ìn nsùnú
c1-P0-DIR-1sIO≠take-APPL clothes
S/he brought me the clothes.

ù-mó-n^{j}ò-**sòl**-ò
c1-P0-DIR≠pour_libation-FV
S/he poured (a libation) there.

Mmala
ò-sà-sì-ŋ≠àl-ìn b^{w}òlì
c1-P1-DIR-1sIO≠do work
S/he did work here for me.

tì-mè-nè≠**bíŋ**-ín àkɛ̀ ɛ̀yɔ̀mɔ̀
1p-P5-DIR≠enter-APPL into forest
We entered into the forest.

ù-mò-m-bí-**dòl**-ìg-òn-ì
c1-P5-1sIO-REFL-listen-INTENS-APPL-CAUS
S/he caused me to listen.

ɔ̀-sɔ̀-nɔ̀-ŋ-**ɔ̀^{n}d**-ɛ̀n gìlà
2s-P1-DIR-1sIO-buy-APPL clothes
You went to buy me clothes.

ò-sò-nò-ŋ-**od**-in-ìn gìgàd
2s-P1-DIR-1sIO-fill-CONT-APPL sack
You went to fill me a sack.

Elip
ò-wá- nà-sòg-án mb^{w}íɲì jâm
c1-P4-DIR-tie-CONT goat 1s.POSS
S/he tied my goat there.

ù-wé-sì-**núb**-é jɔ́
c1-P4-DIR-whip-CONT 3s
S/he whipped him here.

bɔ́-sɔ̀-sɔ́≠**gɔ́l**-ɔ̀n
c1-P2-NEG≠take-CONT
They didn't take.

ò-mò-só≠**dól**-ìd
2s-P4-NEG≠tickle-DIM
You didn't tickle.

In those languages where neutral vowels may be opaque, rounding harmony spreads differently from ATR harmony. In Maande, all high vowels are opaque to rounding harmony but participate in ATR harmony. The result is that rounding harmony is blocked where ATR harmony is not. In Example 325 below, the bolded segments have ATR or rounding-dominant vowels. The underlined segments have rounding-opaque vowels. Note that the high vowels participate fully in the ATR harmony.

Example 325: Maande rounding-opaque vowels in vowel harmony

tʊ̀-tì-ŋá-àsʊ̀≠lʊ́k-ʊ́m-à — *we do not understand*
1p-NEG-T/A-1p≠understand-SEPAR-FV
tù-tì-ŋə́-əsù≠**lík**-ím-ə — *we are not afraid.*[234]
1p-NEG-T/A-1p≠be.afraid-POS -FV

bɔ́-ŋɔ̂≠**bɔ́k**-ɔ́k-ɔ̀ — *they created.*
c2-P1≠create-INTENS-FV
bá-tì-ŋɔ̂≠**bɔ́k**-ɔ́k-ɔ̀ — *they did not created.*
c2-NEG-P1≠create-INTENS-FV

bó-ŋǒ≠**bòk**-ò — *they scream.*
c2-PR-scream-FV
bə́-tì-ŋǒ≠**bòk**-ò — *they did not scream.*
c2-NEG-PR-scream-FV

ì-ŋɔ̌≠**kɔ́n**-ɔ̀[235] — *I am sick.*
1s-PR≠be.sick- FV
ì-ŋǎ-mí≠**kɔ́n-ɔ̀** — *I am sick.*
1s-PR-1s≠be.sick-FV

In Yambeta, like Maande, all high vowels are opaque and block rounding harmony. In Example 326 below, the segments with an ATR and/or rounding-dominant vowel are bolded; the opaque vowels are underlined.

Example 326: Yambeta rounding-opaque vowels in vowel harmony

mʷǒ≠**sóp**-ò
c.*mu*.P1≠be.sweet
they (foods) were sweet

móⁿgòlòʔ	móònì	má-tì-**ɔ́kɔ̀**	ə̀-kù≠**sóp**
c6.mangos	DEM	c6-NEG-be	CONT-INF≠be.sweet

these mangos are not sweet

[234] Examples from Taylor 1990: 11
[235] Taylor 1990: 12, my phonological interpretation.

ɔ̀≠**ɲɔ́ŋ**-ìn...
c1(3s)-want-APPL
s/he wants to...

à-tì≠**ɲɔ́ŋ**-ìn...
1s-NEG-want-APPL
s/he doesn't want to...

ɔ̀≠**sɔ̀k**-ìn	ùdì
c1(3s)≠wash-APPL	3.face

he washes his face

à-tì≠**sɔ̀k**-ìn	ùdì
c1(3s)-NEG≠wash-APPL	3.face

he didn't wash his face

pá-má=mɔ̀	**bɔ́k**	mɔɔnɛ́
3p-P1=3sIO	grab	money

they took money from him

In Gunu, providing there are no inserted grammatical words, the subject concord/tense proclitic will attach to the verb stem as its host and undergo full ATR harmony. However, only the tense marker will undergo rounding harmony. Where both ATR and rounding harmony apply, triggered by a [+ATR, +round]-dominant vowel in the verb stem, rounding harmony is not only blocked from spreading onto the subject concord, but ATR harmony is also blocked, so that the subject-concord surface representation is [-ATR, -round]. In Example 327, the shaded cells indicate the spread of ATR and rounding harmony.

Example 327: Gunu pre-stem ATR and rounding harmony

à-	gàá=	sɔ̀g-á	gìlà
c1-	FT1=	wash-FV	cloth

S/he will wash the clothes.

à-	báà=	tʃɔ̀g-ìn-à	gìlà[236]
c1-	P1=	1s.wash-APPL-FV	cloth

She washed the clothes for me.

è-	béè=	**tím**-ín-é	gìbílá
c1-	P1=	1s.dig-APPL-FV	hole

S/he digged the hole for me.

[236] The 1sIO. marker is a homorganic nasal. The /N/+/s/ is realised on the surface as [tʃ]. /N/ + /d/ is realised on the surface as [t]. This phenomenon is more clearly explained in Robinson (1984: 44).

è-	gèé=	**dím**-é	gìbílá
c1-	FT1=	dig-FV	hole

S/he will dig a hole.

à-	bɔ́ɔ̀=	**g<u>ɔ́</u>l**-ɔ̀
c1-	P1=	take-FV

s/he took

à-	bóò=	**pòl**-ò
c1-	P1=	pierced
*è-	bóò=	pòl-ò

s/he pierced

Although there is no obvious reason why the subject-concord prefix does not undergo rounding harmony, one possible reason is to ensure the differentiation between the c1 (3s) subject concord and the 2s concord, **o-**.

3.3.4.2 Vowel harmony and phonological-word boundaries

With the exception of post-lexical anticipatory spread such as found in Nen, no phonological word will assimilate to the vowel harmony of another phonological word. This is most clearly seen in Nen which, unique among the Mbam languages, has a SOV word order. The object noun or pronoun customarily occurs between the subject-concord/tense complex and the verb stem. The Nen subject-concord/tense complex is not its own phonological or grammatical word. It is a proclitic, which attaches to whatever host word is to its immediate right, whether that is the verb stem or an object noun or adverb. When the object noun (underlined in Example 328 below) is [+ATR], it generally triggers ATR harmony in the subject concord/tense proclitic to its left. Segments which are [+ATR] are bolded.

Example 328: ATR harmony in Nen pre-stem elements[237]

[mì-	ná=	<u>hìsíní</u>	píl-ín]	~	[**mì-nə́=<u>hìsíní</u>** p[!]íl-ín]
1s-	P1=	pot	put.down-APPL		

I put down the pot.

[mì-	ná=	<u>sànjá</u>	**<u>sj</u>-ək-ín**]
1s-	P1=	mouse	see-INTENS-APPL

I saw the mouse.

Certain adverbs may also occur among the pre-stem morphemes of the verb unit. The subject-concord/tense proclitic will attach to the adverb to its right and if the adverb has a [+ATR]-dominant vowel, the proclitic may undergo vowel harmony. Example 329 illustrates the ATR-harmony assimilation of the subject-concord/tense

[237] Bancel 1999: 8 (with my modifications of the phonetic transcriptions).

complex in the context of two adverbs, **hútú** *quickly* and **mə́ŋə́** *again*. The [+ATR] morphemes are bolded and the adverbs are underlined.

Example 329: Modification of ATR harmony in Nen verb pre-stem[238]

[mí-	ŋɔ̀=	<u>mɔ́ŋɔ́</u>	**bín-ə́k-ə̥**]		*I will again dance.*
1s	FT2	again	dance-INTENS-FV		
[mí-	**ŋù=**	**bíb-ə́k-ə**		tɔ́nḁ̀]	*I will dance again.*
1s	FT2	dance-INTENS-FV		again	
[**mì-**	**sə́**=	<u>**hútú**</u>	àŋʊ́á	bɔ́ŋ-ɔ̥̀]	*I did not quickly find you.*
1s	NEG	quicky	2sIO	find-FV	
mì-	sá=	àŋʊ́á	bɔ́ŋɔ́	tɔ̀fḁ̀]	*I did not find you quickly.*
1s	NEG	2sIO	find	quickly	

Unlike in Nen, ATR harmony spreads obligatorily throughout the preverbal morphemes in Maande. Although Maande does not have full object nouns occurring before the verb stem, it does have full object pronouns and adverbs that do. These object pronouns and adverbs are phonological and grammatical words and as such interrupt vowel-harmony spread from the verb stem. Like Nen, however, an adverb with a [+ATR]-dominant vowel will trigger ATR harmony to the left, as is seen with the adverb, **téɲì** *quickly*, in Example 330. The interposing words are underlined. As discussed earlier, Maande repeats the subject pronoun, one occurs with the subject-tense proclitic and the second before the verb stem.

Example 330: ATR harmony in Maande pre-stem elements

tù-	**tì-ŋə́=**	**sù≠**	**lík-ím-ə**	
1p-	NEG-T/A=	1p≠	be.afraid-POS-FV	

We are not afraid.[239]

tʊ̀-	tì-ŋá=	<u>hánà</u>	**əsù=**	**lík-ím-ə**	
1p-	NEG-T/A=	again	1p	be.afraid-POS-FV	

We are not afraid again.

tù-	**tì-ŋə́=**	<u>**tə́ɲì**</u>	àsʊ̀=	<u>bànʊ́</u>	**bí≠lítʃ-íɲ-ìɲ-ì**
1p-	NEG-T/A=	quickly	1p	2pIO	REFL-notice

We did not notice you quickly.

In Gunu also, adverbs and object pronouns are phonological as well as grammatical words and as such interrupt vowel-harmony spread from the verb stem. The subject-

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[238] Examples from Sebineni Alphonsine Flore: p.c. Aug. 2009. According to her, ATR harmony is more likely to spread than not in normal-speed speech.

[239] Examples from Taylor 1990: 11

concord/tense proclitic attaches to the host word to its right. Unlike in Maande, none of the adverbs or object pronouns has a dominant vowel, so they cannot trigger vowel harmony. The negative marker **dì** is illustrated in Example 331 (a); the adverb **gɔ̀nɔ̀** *again*, in Example 331 (b), and the object pronouns in Example 331 (c) below. The interposing lexemes are underlined.

Example 331: Gunu adverb and object lexemes

a)

à=	dì	báà≠	sʊ̀g-à
c1=	NEG	P1	wash-FV

S/he did not wash.

à=	dì	**béè≠**	**dím-è**
c1=	NEG	P1	dig-FV

S/he did not dig.

b)

bá-	báà=	gɔ̀nɔ́	bá≠sìg-à
c2-	P1=	again	REFLEX-insult-FV

They insulted each other again.

bá-	ná=	gɔ̀nɔ̀	**dím-è**	gìbílá
c2-	FT2=	again	dig-FV	hole

They will dig a hole again.

c)

à-	báà=	gʊ̀	**dím-èn-è**	gìbílá
c1-	P1=	2sIO	dig-CONT-FV	hole

S/he dug you a hole

à-	báà=	tʃʊ̀	**dím-èn-è**	gìbílá
c1-	P1=	1pIO	dug-CONT-FV	hole

S/he dug us a hole.

ŋkɔ̀	ᵐbà=	mʊ̀	bɔ́≠sɔ̀n-ìn-ɔ̀
leopard	P3=	3sOBJ	REFLEX≠decide.against-FV

Leopard decided against him.

à-	báà=	tʃʊ̀	**not-on-i-o**
3s-	P1=	1pIO	oblige-CONT-CAUS-FV

S/he made us (do it).

Tuki,[240] Baca and Mbure are the only Mbam languages which have no vowel-harmony processes in the preverbal morphemes. The subject concord is a phonological as well as grammatical word and the tense markers are possibly enclitics which attach to the host word to their left. There are phonological processes

[240] There is one exception in Tuki, which will be discussed below.

which occur between the subject concord and the tense marker, including nasal assimilation to the point of articulation of a following consonant. These morphemes are generally [-ATR], but there are some which are [+ATR]; all are invariable. In Example 332, illustrating the preverbal morphemes of Baca and Mbure, the [+ATR] verb roots are bolded.

Example 332: Lack of vowel harmony in preverbal elements

Mbure	à	sɔ́h-à			*S/he smoked.*
	c1	smoke-FV			
	ì=ní	pâr	mùɾònè		*I pulled up peanuts.*
	1s=FT2	pull up	peanuts		
	w=ǎ	kà^{n}d	ì^{m}bàs		*You harvested maize.*
	2s=P2	break	maize		
	à	**pín-è**			*S/he dances.*
	c1	dance-FV			
	ʊ̀=ní	**pín-ìt**			*You will dance a little.*
	2s=FT2	dance-DIM			
Baca	jì	tɔ́ɾ-à	àká	nʲɔ̀ɲɔ̀	*I sell at market.*
	1s	sell-FV	PREP	market	
	jì	**kès-ìm-à**			*I sneeze.*
	1s	sneeze-POST-FV (PRES)			
	ŋ̀=gɛ̀	sá^{m}b			*I will pay.*
	1s=FT	pay			
	ŋ̀=gɛ̀	**kò^{m}b**		bìlìgí	*I will throw away garbage.*
	1s=FT	throw.away		filth	
	ʊ̀=m	**fʷák-isi**[241]		kʲà^{n}tʃ	*S/he builds me a house.*
	c1(3s)=1sIO	build-CAUS		house	

Tuki, like Mbure and Baca, does not harmonise preverbal tense or subject concord morphemes. These morphemes remain invariable whether the verb is [+ATR] or not, as is seen in Example 333.

[241] The vowel /a/ in Baca has a [+ATR] variant [ɜ]; this word therefore is [ʊ̀m fʷɜ́kisi kʲɜ̀^{n}tʃ].

Example 333: Lack of ATR spread in Tuki preverbal morphemes

Tuki[242]	à		**gún**-ámʊ̀		*S/he hunts.*
	c1		hunt-PERF		
	à=	má	**gún-ə́**		*S/he hunted.*
	c1=	P2	hunt-FV		
	ʊ̀=	ɾə́[243]	mìn-à	mètí	*You swallowed saliva.*
	2s=	P1	swallow-FV	saliva	
	ʊ̀=	ɾə́	**húm-ə́**		*You left.*
	2s=	P1	exit-FV		

However, according to Kongne (2004: 118-9), the completive aspect of the P2 (recent past) has two forms: **mâ** and **mə̂**, depending on the ATR value of the verb. Unlike the other preverbal morphemes, Kongne attaches this P2 morpheme to the verb stem, as in Example 334

Example 334: ATR harmony of completive-recent past (P2) in Tuki

Tuki[244]	ǎ	mâ≠bàn-à	*S/he has already read.*
	c1	COMP.P2≠read-FV	
	ǎ	**mə̂≠tùᵐb-ə̀**	*S/he has already bathed.*
	c1	COMP.P2≠bathe-FV	

The completive aspect/recent past, with its obligatory ATR harmony is clearly a prefix of the verb stem. All other preverbal morphemes are invariable and indicate the presence of a phonological word boundary.

3.3.4.3 Rounding-dominant vowels in preverbal morphemes

The spread of ATR harmony also differs from the spread of rounding harmony because of the presence of rounding-dominant vowels in the preverbal morphemes of some Mbam languages. These rounding-dominant morphemes spread only within the proclitic or between the proclitic and its host word.

Both Gunu and Maande have certain subject concords which have a dominant round vowel. In Gunu, for example, 2s **o-** and the 2p **no-** will trigger rounding harmony in an adjacent negative marker. What is most interesting in this situation, however, is that the negative morpheme is **dɪ-**, which contains a transparent neutral vowel that is not generally susceptible to rounding harmony. The reason for this is not clear. However, due to the fact that the vowel *is* transparent rather than opaque makes it

[242] Examples from Kongne Welaze J. 2004: 61 with my phonetic modifications.
[243] Tuki has [+ATR] preverbal morphemes. It does not trigger ATR harmony.
[244] Examples from Kongne Welaze J. 2004: 119.

more apt to rounding harmony. There is nothing impeding its harmonisation, unlike what would be true for an opaque vowel.

In Maande, only the 2s subject and object concords, **o-/ɔ-**, have a [+round] vowel. Like the 2s/2p pronoun vowels in Gunu, these morphemes will trigger the rounding of adjacent preverbal morphemes. In Maande, this morpheme is [-ATR] and is also susceptible to ATR harmony, whereas in Gunu, the second person subject concord is always [+ATR], as in Example 335. The trigger vowels are underlined and the domains in which they operate are bolded in the examples below.

Example 335: Rounding-dominant preverbal morphemes.

Gunu[245]	à=dì	ᵐbá	≠bʊ̀l-à	*s/he did not arrive*
	c1=NEG	P3	≠arrive-FV	
	ò=dò	ᵐbá	≠bʊ̀l-à	*you did not arrive*
	2s=NEG	P3	≠arrive-FV	
	nò=dò	ᵐbí	≠ìŋ-è	*you (pl) did not refuse*
	2p=NEG	P3	≠refuse-FV	
Maande	ʊ̀-ŋǎ	≠tʊ́k-à		*s/he draws (water)*
	c1-PR	≠draw-FV		
	ɔ̀-ŋɔ̌	≠tʊ́k-à		*you draw (water)*
	2s-PR	≠draw-FV		
	ù-ŋə̌	≠túk-ə̀		*s/he nourishes (child)*
	c1-PR	≠nourish-FV		
	ò-ŋǒ	≠túk-ə̀		*you nourish (child)*
	2s-PR	≠nourish-FV		
	ì-**ŋɔ̌**-mí=**ɔ̀**	≠lìtʃ-à[246]		*I see you*
	1s-Pr-1s=2s	≠see-FV		
	ì-**ŋǒ**-mí=**ò**	≠tə́ŋ-ít-ì		*I greet you*
	1s-Pr-1s=2s	≠greet-DIM-CAUS		

High vowels in Maande are generally opaque and block rounding harmony. However, in the case of the anticipatory rounding triggered by the second person indirect-object pronouns, the high front vowels of the first person concord, in Example 335 above, exceptionally do *not* block rounding.

While Nen does not have robust rounding harmony in the preverbal morphemes, it does have a rounding-dominant vowel in the subject concord/tense proclitic. The future tense morpheme **ŋɔ̀-** (underlined below) will cause the negative marker **sá-** to undergo rounding, as seen in Example 336.

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[245] Taken from Robinson 1999: 10, my phonological interpretation.
[246] Following examples from Taylor 1990: 12

Example 336: Rounding of negative marker with the future in Nen[247]

[à-	nɔ́		≠ɲá]	*S/he drank.*
[á-	sá		≠ɲá]	*S/he didn't drink.*
[ɔ́	**<u>ŋɔ̀</u>**		≠ɲá]	*You will drink.*
[ɔ̀-	**sɔ́-**	**<u>ŋɔ̀</u>**	≠ɲá]	*You will not drink.*

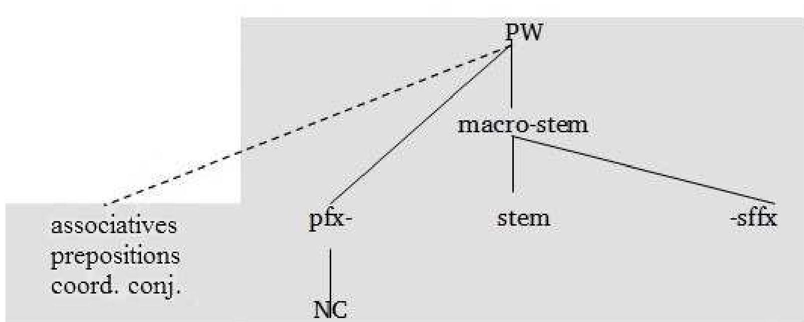
In summary, the differences in the spread of rounding harmony and ATR harmony in the verb can be explained by the location of dominant vowels, the type of neutral vowel (transparent or opaque), and the presence of word breaks and cliticisation. There is variation among the Mbam languages in the position of the grammatical word boundaries in the preverbal morphems. With the exceptions of Yangben, Mmala and Elip, all show grammatical word boundaries in the verb and thus differ from cannonical Bantu in that respect.

3.3.5 Mismatches in the noun phrase

Similar to the mismatches between the grammatical and phonological word in the verb phrase, there are also mismatches between the grammatical and the phonological word in the noun phrase. The associative marker, the coordinating conjunction and prepositions are either proclitics, full lexemes or have characteristics of both, depending on the language.

3.3.5.1 All noun-phrase elements are proclitics

The associative markers, prepositions and the coordinating conjunction are proclitics which attach to the noun to their right. ATR, rounding and fronting vowel harmonies will anticipatorily spread to these proclitics. Only height harmony in Mmala does not spread to these associated proclitics. In Figure 19, the phonological word (PW) is shaded. Solid lines show the constituents of the phonological word and the dotted lines show the association of the proclitics to the phonological word. The vowel-harmony features spread throughout the expanded phonological word.



[247] Kongne 2011: 136, 140

Figure 19: Phonological-word structure: Yangben, Mmala, Elip and Maande nouns

Table 58 gives examples of the participation of associative markers, the conjunction *with* and various prepositions in vowel harmony. In the associative construction, the associative marker (translated by *of* below) agrees with the noun class of the head noun. The examples which undergo vowel harmony are bolded.

Table 58: Vowel harmony in the associative markers, conjunctions and prepositions: Elip

associatives	gʲàⁿtʃì gʲá=mɔ̀ⁿd	*c7.house of the man*
	gìlímb **gʲé=bʷébì**	*c7.tongue of thieves (liar)*
	mìᵐbì **mɔ́=gìdɔ̀ŋ**	*c6.water of the village*
	mègúd **mó=gìgǒ:gè**	*c6.fat of bone*
conjunctions	ŋŋíᵐbíkɔ nà=gʲáⁿsì	*sparrowhawk and cockroach*
	ntʃɔ́ⁿdɔ́ **nè=ŋŋúné**	*antelope and tortoise*
	ŋŋɔ̀jí, nsɔ́g **nɔ̀=gìjɔ̀b**	*lion, hare and hyena*
	màɲán **nò=mǒkʰòné**	*yams and sweat potatoes*
prepositions	ʊ̀gʷá=gʲàⁿtʃì	*in the house*
	ùgʷé=mèsígè	*in the fields*
	ʊ̀gʷɔ́=m̀pɔ́m	*in the forest*
	ùgʷó=jòógi̥	*in the fire*

Mmala:

associatives	gʲàⁿsì gá=mʊ́ʊ̀ⁿd	*c7.house of the man*
	gʲàⁿsì **gé=sʲê**	*c7.house of the father*
	màdàdà **mɔ́=jɛ̀ŋɔ̀lɔ̀**	*c6.sap of "Jengolo" tree*
	ɔ̀sɔ́ŋ **wó=gìkʰò**	*c3.soup of the bone (marrow)*
conjunctions	bʊ̀dɛ̂d nà=nìdàŋ	*tree and stone*
	àsàg **nè=mèbìn**	*song and dance*
	ǹtʃédí **nɔ̀=gɛ̀bɔ̀sɔ̀sɔ̀**	*diker and toad*
	bʊ̀tɔ̂ **nò=bòkónó**	*yam and sweet potato*
prepositions	àgá=gʲàⁿtʃì	*at the house*
	ègé=mèsíg	*at the field*
	ɔ̀gɔ́=nùbɔ̀mɔ̀	*at the river*
	ògó=ɲòɲì	*at the market*

Yangben:

associatives	màkìp má=mʊ́ʊ̀ⁿd	*c6.the wine of the man*
	màkìp **mé=sí**	*c6.the wine of the father*
	mèté **mɔ́=nʊ́kɔ̀mɔ̀**	*c6.sap of "nukɔmɔ" tree*
	mèkút **mó=kìkòkó**	*c6.fat of bone (marrow)*
	mèté **mɛ́=kítɛ̀ⁿdɛ́**	*c6.sap of the palm*

conjunctions	èmèkú nà=mànʊ́ŋ	*flesh and blood*
	mbùɲ **nè=kìtétì**	*goat and cock*
	ɔ̀mbɔ̀k **nɔ̀=kìkɔ́nd**	*hand and foot*
	nò=mòò^{m}b	*with water*
	nɛ̀=p^{j}ɛ̀j	*with the spirits*
prepositions	á=nìtáɲ	*on the rock*
	é=kùsì	*on the ground*
	ɔ́=mʊ̀kɔ̀	*at the cemetery*
	ó=ɲòɲí	*at the market*
	ɛ́=kìtɛ̀ndɛ̀	*on the palm tree*

Maande:

associatives	ìcálì tʃí=báhɔ́lì[248]	*c9.fight of the Bafias*
	ɲìkʊ̀tʃà **ɲí=mèhúɲì**	*c5.group of words*
	bàánà **bɔ́=jɔ̀ɔ́kɔ́kɔ́lɔ̀**	*c2.children of the frog*
	bàánà **bó=Bókìtò**	*c2.children of Bokito*
conjunctions	tʊ̀nààná nà=bìlàŋà[249]	*pots and clothes*
	ìbálà **nə̀=hìsétì**	*leopard and duiker*
	hìsə́tì **nɔ̀=jɔ̀ɔ́kɔ́kɔ́lɔ̀**	*duiker and frog*
	òòtʃó **nò=tʃ^{j}ójò**	*fire and smoke*
prepositions	àá=bʊ́ŋá^{n}dà	*at the feast*
	ə̀ə́=tʃìíbè[250]	*at the house*
	ɔ̀ɔ́=mɔ̀lɔ̀kɔ̀	*to Moloko market*
	òó=ɲòɲí	*to market*

3.3.5.2 Certain noun-phrase elements are proclitics

In Gunu, the prepositions and the conjunction are proclitics which will always undergo ATR and rounding harmony triggered by the vowels of the following noun, but the associative markers act differently. While they will obligatorily undergo ATR harmony, they only optionally undergo rounding harmony. Due to these tendencies, the associative marker is considered as a separate phonological word which in certain circumstances becomes associated with the phonological word of the noun and undergoes vowel harmony, as in Figure 20.

[248] Taylor 1990: 8. The associative marker is always [+ATR] before [+ATR] nouns in the associative construction. There is variation only before [-ATR] nouns. According to some, a majority of Maande speakers actually use the [+ATR] form of the associative in *all* contexts.
[249] Taylor 1990: 8 with my phonetic transcriptions.
[250] Taylor 1990: 13 with my phonetic transcriptions.

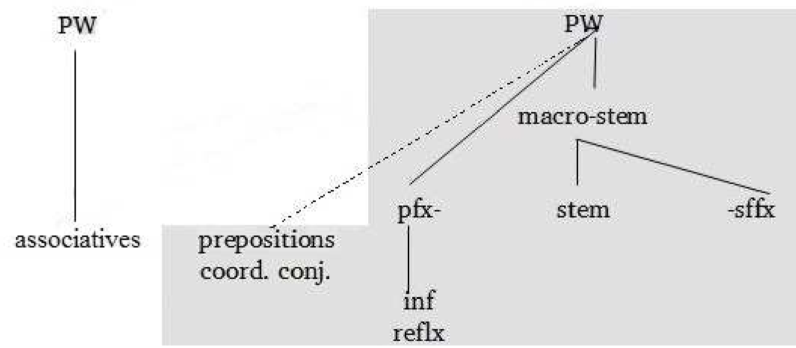


Figure 20: Phonological word structure: Gunu nouns

In Table 59, the examples which undergo vowel harmony are bolded. The shaded cells highlight the optional rounding harmony in Gunu associative markers.

Table 59: Vowel harmony in the associative markers, conjunctions and prepositions: Gunu

associatives	gìlèfì gá gílà	*c7.wripped c7.ASSOC clothing*
	gìsìnì **gé cí**[251]	*c7.matter c7.ASSOC land*
	bìfólìnà bá mòtɔ̀	*c14.cultivation c14.ASSOC the man*
	bìfólìnà **bé ǹtʃèé**	*c14.cultivation c14.ASSOC yams*
	mègúdé má/**mɔ́ pɔ́ŋí**	*c6.oil c6.ASSOC the bee*
	gìsìnì ná/**nó nʲòɲì**	*c7.affaire c7.ASSOC the market*
conjunctions	bùgúlè nà=mòtɔ̀[252]	*friendship with a man*
	àlí **nè=bùsùgé**	*s/he is with the meat*
	tʃédì **nɔ̀=ŋkɔ̀i**	*duiker and panther*
	gìsìgì **nò=bòkó**	*monkey and squirrel*
prepositions	nàá=ntímí	*in the field*
	nèé=nùfèⁿdù	*in the ravine*
	nɔ̀ɔ́=gʲɔ̌lɔ̀	*in the granary*
	nòó=nʲòɲì	*at the market*

It is the coordinating conjunction in Nen is a phonological word in itself which never undergoes vowel harmony. The prepositions and the associative markers are proclitics which, in certain circumstances, may undergo ATR harmony. None of these noun-phrase proclitics will undergo rounding harmony (Figure 21).

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[251] Robinson 1984: 77.
[252] Robinson 1984: 76.

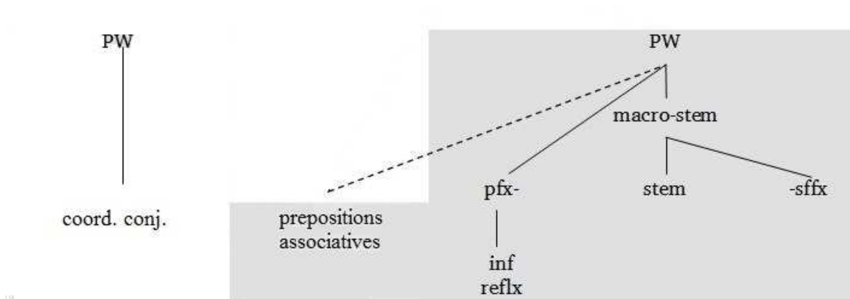

Figure 21: Phonological word structure: Nen nouns

In Table 60, the examples which undergo vowel harmony are bolded. The shaded cells highlight the lack of vowel harmony in the Nen conjunctions. The symbol = indicates the clitic boundary.

Table 60: Vowel harmony in the associative markers, conjunctions and prepositions: Nen

associatives	nìhɔ́ká **ní**=mɔ̀ⁿdɔ̀[253]	*c5.axe c5.ASSOC the man*
	nìhɔ́ká **ní/ní**=mʷə̀ⁿdú	*c5.axe c5.ASSOC the woman*
	mə̀lùk **mà=**pʷɔ̀jí̥	*c6.wine c6.ASSOC honey*
	bànà́ **bá**=mɔ̀kɔ́ŋɔ̥́	*c2.children c2.ASSOC the frog*
	bànà́ **bá/bə́**=mùkójì̥	*c2.children c2.ASSOC the co-wife*
conjunctions	ìsɔ̀bɔ́ **nà** mìkʷà	*civet cat and leopard*
	hìsélì **nà** mìsèkú	*duiker and elephant*
	nà bɔ̀lɔ̀mɔ́	*with baggage*
prepositions	**ù**=nʷìjì	*to the river*
	ò=wàjí íbókà	*to their places*
	ò=nìsɔ́ᵐbɔ́l[254]	*on the termite mound*

In the Yambeta noun phrase, the coordinating conjunction, the prepositions and the associative markers all undergo anticipatory [+ATR] vowel harmony in the context of a [+ATR] noun. However, only the associative markers and the prepositions undergo anticipatory rounding harmony. The coordinating conjunction never undergoes rounding (Figure 22).

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[253] Bancel 1999: 7 with phonetic changes according to my databases.
[254] Dugast 1971: 218 (with my phonetic modifications).

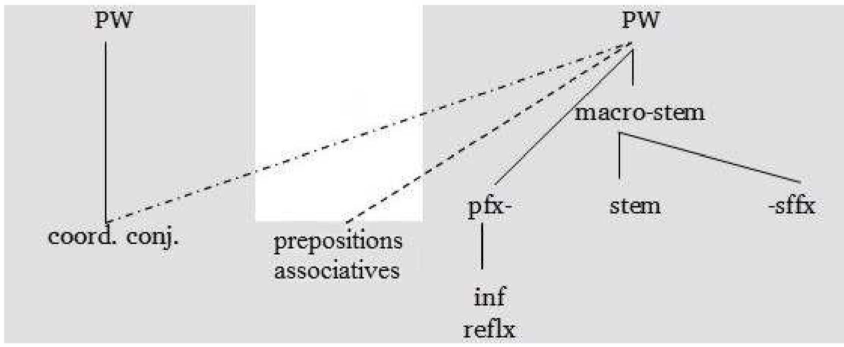

Figure 22: Phonological word structure: Yambeta nouns

In Table 61, the examples which undergo vowel harmony are bolded. The shaded cells highlight the lack of rounding harmony in the conjunctions.

Table 61: Vowel harmony in the associative markers, conjunctions and prepositions: Yambeta

associatives	mɔ̀ɔ́n ʊ̀=mɔ̀ɔ̀d	*c1.child c1.*ASSOC *the man*
	mɔ̀ɔ́n **ù=kììd**	*c1.child c1.*ASSOC *the devil*
	pɔ̀ɔ́n pá=mɔ̀ɔ̀d	*c2.children c2.*ASSOC *the man*
	pɔ̀ɔ́n **pə́=kìíd**	*c2.children c2.*ASSOC *the devil*
	pɔ̀ɔ́n **pɔ́=pɔ́lɔ́^{n}lɔ́k**	*c2.children c2.*ASSOC *the deaf-mutes*
	pɔ̀ɔ́n **pó=pólò^{n}dók**	*c2.children c2.*ASSOC *sorcerers*
conjunctions	nà sì	*with father*
	ɔ̀t^{w}îŋ **nə̀ nììs**	*ear and eye*
	ŋŋʊ̀níà nà g^{j}ɔ̌kɔ̀n	*boar and monkey*
	nà pòmóŋŋí	*with sisters*
prepositions	**à=pʊ̀lím**	*to the plantation*
	ə̀=mə̀ní	*to the water (hole)*
	ɔ̀=pìjɔ̀	*in the marshes*
	ò=n^{j}òn	*to the market*

3.3.5.3 No noun-phrase elements are proclitics

In Tuki, Baca and Mbure noun phrases, no associative marker, preposition or coordinating conjunction will assimilate to the vowel harmony of the noun. These morphemes are considered independent phonological words.

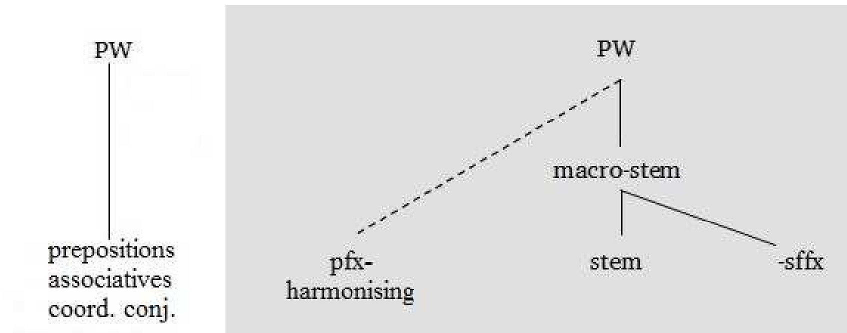

Figure 23: Phonological word structure: Tuki nouns

Table 62 illustrates the complete lack of vowel harmony in the associative markers, conjunctions and prepositions in these three languages. The nouns with [+ATR] vowels are bolded.

Table 62: Lack of vowel harmony in the associative markers, conjunctions and prepositions: Baca

assocatives	kìpíl kí ŋkɔ̀ⁿdɛ̀	*c7.bunch c7.ASSOC bananas*
	tʃɛ́nɛ́ sí **mpȕtʃú**	*c10.worms c10.ASSOC stomach*
conjunctions	àká:nd nà mɔ̀ɔ́n	*woman and child*
	àtû nà **nìîs**	*ear and eye*
prepositions	àká **nʲòɲò**	*at the market*
	ò̙ Kàlɔ̀ŋ	*to Kalong (Yangben)*
	ò̙ **Béɲí**	*to Begni*
Mbure:		
assocatives	m̀bót dʒì m̀bàs	*c10.seed c10.ASSOC maize*
	m̀bót dʒì **rònè**	*c10.seed c10.ASSOC peanuts*
	màbéŋ má **ɲò**	*c6.place c6.ASSOC burial*
conjunctions	ŋ̀káⁿd nì mɔ̀ɔ́n	*woman and child*
	ŋ̀káⁿd nì **nùᵐbét**	*woman and man*
prepositions	kó̙ kìbɔ́ᵐbɔ́	*on the bed*
	kó̙ **ǹtʷè**	*on the head*

Tuki:

associatives	ǹtʃɔ́ ɾá mbàsà	*c6a kernel 6a.*ASSOC *c9.maize*
	mʷànà wà **mbᶣìnì**	*c1.child c1.*ASSOC *c9.goat*
conjunctions	tʃítí nà mbàːné	*duiker and porcupine*
	kúɾè nà **tʃítí**	*turtle and duiker*
prepositions	nà jàⁿdʒè	*at the house*
	nà **wùtú**:	*at night*
	nà kɔ̀ⁿdɔ̀	*in the savannah*
	nà **dévere**[255]	*on the table*

3.3.6 Conclusion

The phonological word is made up of a grammatical word and various clitics which will attach to it, forming a phonological unit. A dominant vowel found within this phonological unit will spread throughout the word, unless blocked by an opaque neutral vowel.

The difference in spread between ATR and rounding harmony in the verb is due to three factors: the presence and type of neutral vowels, phonological word breaks between the subject-concord/tense proclitic and the verb stem, and the location of harmony-dominant vowels. Only one of these factors plays a role in the difference in the spread of vowel harmony in the noun phrase: phonological word breaks. Since neither neutral vowels nor [+ATR] and/or [rounding]-dominant vowels occur outside of the noun, associative markers, conjunctions and prepositions undergo vowel harmony only if they are proclitics which attach to the head noun as its host.

Vowel harmony in the Mbam languages is obligatory in the phonological word and between a clitic and its host. Vowel harmony spreads in the direction of cliticisation. As a result, Baković (2000: 7) is to some degree correct in saying that the morphological structure of the language plays a role in the directionality of vowel harmony.

There is a mismatch between the scope of ATR harmony and that of rounding harmony in the noun phrase in certain languages; this may be the result of a change in the structure of the phonological noun word. Noun-phrase proclitics may be in the process of becoming independent grammatical words rather than proclitics, resulting in an increasingly irregular spread in vowel harmony. In all cases of mismatches in the spread of ATR harmony as opposed to the spread of rounding harmony, the latter is less robust.

[255] Essono 1980: 53. Essono has the coordinative conjunction with a high tone in this example.

While Bantu languages[256] are generally considered to be agglutinating, the Southern Bantoid languages, especially the Grassfields languages tend to be isolating. The Mbam languages are found geographically and historically[257] between these two groups and share characteristics with both groups. For example, in his study of the consecutive morpheme in Bamileke-Ngomba,[258] Satre (2010: 48) summarises that the preverbal morphemes are considered elements of the verb phrase rather than of the verb word.

If the constraint to vowel-harmony spread in the preverbal morphemes is due to a residual historical phonological boundary, the tendency of vowel harmony to spread right-to-left has perhaps, to a greater or lesser extent, eroded the phonological boundaries within the morphosyntactic domain. If the preverbal morphemes are indeed morphosyntactic prefixes, then the anticipatory tendencies of vowel harmony, barring other impediments, will spread throughout the entire grammatical word, which is the case for Yangben, Mmala and Elip.

On the other hand, strong morphosyntactic boundaries signalled by the SOV word order in Nen and the periphrastic tense constructions in Yambeta would be the most obvious and powerful blockages to the spread of vowel harmony in these languages. Nen, despite strong morphosyntactic boundaries, does have anticipatory vowel harmony. Its spread is less powerful, having the tendency to be optional and gradient, rather than the vowel-harmony spread of other Mbam languages with similar morphosyntactic boundaries, such as Gunu and Maande. At the other extreme, strong morphosyntactic boundaries prevent any anticipatory vowel-harmony spread in the preverbal morphemes, as is the case for Tuki, Baca and Mbure.

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[256] Many of the Bantu languages of Cameroon are written in a rather isolating manner. This is especially true for the A70 languages of Ewondo and Bulu and the A40 language of Basaa. My assumption is that the orthography somewhat camouflages the underlying agglutinating nature of these languages.

[257] See Chapter 5 for more discussion on the historical classification of the Mbam languages.

[258] Bamileke-Ngomba [jgo] is a Western Bamileke, Grassfields Bantu language spoken primarily on the Bamileke plateau in the Mbouda Subdivision of the Bamboutos Division in the West Region of Cameroon.

4
Contrastive features and the relationship between inventory and behaviour

> "Feature markedness refers to the likelihood (or the unlikelihood) of certain features co-occurring. For instance, vowel height features and tongue root features have a close connection (see Archangeli & Pulleyblank 1994): Tongue root advancement, [+ATR], and [+high] are compatible, as are [+low] and tongue root retraction (or [-ATR]). The opposite combinations are not compatible" (Archangeli 1999: 543).

The above point of view is widely accepted and does indeed have some validity. It is clear that there is good evidence that certain combinations of height and tongue-root features can be treated as especially marked (Casali 2013: 2). However, in vowel inventories with ATR contrast in the high vowels (**i/ɪ** and **u/ʊ**), there is evidence that □[ɪ], [ʊ] often occur with very high frequency, characteristically have unrestricted distributions, and may have a wider distribution than their [+ATR] counterparts [i], [u] (Casali 2002, 2012).

This typological generalisation, coupled with the difficulty in identifying certain vowels in previous studies and the tendency of these vowels to function in contradictory ways vis-à-vis the vowel-harmony system is an indicator that an /i, e, ɛ, a, ɔ, o, u/ inventory analysis of the Mbam languages is inadequate. In many ways, the misanalysis of the Mbam vowel inventories is not surprising; others have noted as Schadeberg (1994/95: 74) that "linguists are all too often influenced by their own spellings."[259]

4.1 Vowel inventories and vowel harmony

Languages with the most clear and ideal form of ATR harmony have ten contrastive vowels which divide into two mutually exclusive sets of five vowels: a [-ATR] set and a [+ATR] set, which vary at each chart position only in their ATR value, see Table 63.

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[259] Including, I doubt not, myself.

Table 63: Ideal ten-vowel ATR-harmony languages

a. [-ATR] vowels	front	central	back
high	ɪ		ʊ
mid	ɛ		ɔ
low		a	

b. [+ATR] vowels	front	central	back
high	i		u
mid	e		o
low		ə	

Ten-vowel systems however are not the most common. More frequent are languages which lack a contrastive [+ATR] counterpart of /a/. This leaves nine contrastive vowels which divide into five [-ATR] vowels but only four [+ATR] vowels, see Table 64.

Table 64: Nine-vowel ATR-harmony languages

a. [-ATR] vowels	front	central	back
high	ɪ		ʊ
mid	ɛ		ɔ
low		a	

b. [+ATR] vowels	front	central	back
high	i		u
mid	e		o
low		---	

Another common vowel system in ATR-harmony languages is the 7/9-vowel system. These languages have seven contrastive vowels and two additional predictable vowels. Malila (Kutsch Lojenga 2006: 2-3) has seven underlying vowels but nine surface realisations with [e] and [o] as the allophonic [+ATR] variants of /ɛ/ and /ɔ/. In addition, as with some 9-vowel systems, /a/, although phonetically [-ATR], is neutral, and may occur in [+ATR] environments.

Among the seven-vowel languages which have ATR harmony. Two types of systems are attested: type (1) which lack [+ATR] mid vowels /e/ and /o/ as in Table 65, and type (2) which lack the [-ATR] high vowels /ɪ/ and /ʊ/, as in Table 66. Type (1) seven-vowel languages tend to have ATR harmony (Casali 2003). Type (2) seven-vowel languages tend to have a retracted root harmony (RTR) (Casali 2003, Leitch 1996).

Table 65: Seven-vowel systems (type 1)

a. [-ATR] vowels	front	central	back
high	ɪ		ʊ
mid	ɛ		ɔ
low		a	

b. [+ATR] vowels	front	central	back
high	i		u
mid	---		---
low		---	

An eight-vowel variant of the (type 1) vowel system, with a [+ATR] counterpart of the central vowel also exists.

Table 66: Seven-vowel systems (type 2)

a. [-ATR] vowels	front	central	back
high	---		---
mid	ɛ		ɔ
low		a	

b. [+ATR] vowels	front	central	back
high	i		u
mid	e		o
low		---	

These are typical vowel inventories commonly found in Bantu languages. The vowel inventories of three Mbam languages, Mmala, Yangben and Mbure fit the very typical and frequent 9-vowel system presented above in Table 64 which is common in many ATR-harmony languages. A fourth language, Baca, has a 9/10-vowel inventory consisting of nine contrastive and one non-contrastive vowel, [ɜ]. Most of the Mbam languages, however, have a less typical inventory. These will be discussed in section 4.1.1 below.

4.1.1 The high front vowel in the Mbam 8-vowel languages

A number of the Mbam languages, however, do not have particularly common vowel inventories. The 8-vowel languages appear asymmetric when one looks at them from a merely phonetic perspective with two [+/-ATR] pairs of back/round vowels and only one [+/-ATR] pair of front vowels, see Table 67.

Table 67: Mbam 8-vowel vowel inventory (phonetic specifications)

	Front	Centre	back/round	
High	i		u	[+ATR]
			ʊ	
Mid		ə	o	[+ATR]
	ɛ		ɔ	
Low		a		

Hyman proposes a "bottom-up" or "system-driven" approach to the analysis of the vowels of two Mbam languages, Yangben and Gunu. He (Hyman 2001, 2003a) identifies only those features which are "phonologically active" in the vowel system, and suggests four active features either present or once present in the Mbam languages. For example, Hyman (2003a) proposes four contrastive features for Yangben (Kalɔŋ): ATR, front, round and open (or non-high). Table 68 illustrates how Hyman's (2001, 2003a) features present a more symmetrical inventory which we will see fits the phonological characteristics of the Mbam languages, Table 68.

Table 68: Mbam 8-vowel inventory modified Hyman (2001, 2003a)

	[(+front) -round)]	[(-front)+round]	
[-open]	i	u	[+ATR]
	ɪ (ɛ)	ʊ	
[+open]	ə	o	[+ATR]
	a	ɔ	

The [+/-ATR pair] [i]/[ɛ] illustrates an asymmetry in the Mbam 8-vowel inventories. Although phonetically and acoustically a mid vowel, [ɛ] patterns phonologically as a high vowel, /ɪ/.

Maande gives evidence that this [-ATR] front vowel is actually a high rather than a mid vowel. Noun class 5 in many of the Mbam languages is **nɪ**-/**ni**-; however, in Maande, the nasal is palatalised before high front vowels, so the noun-class 5 prefix in Maande is **ɲɪ**-/**ɲi**-. In Example 337, the noun-class 5 prefix in Maande is compared with the same prefix in a selection of other Mbam languages. Where Maande has /ɲ/ before a high front vowel, the others have /n/.

Example 337: Variation in prefix nasal in NC 5 before high front vowels

	previous analyses	**this study**	***gloss***
Maande	nyɛbána	ɲì≠bánà	*breast, teat*
	nyikekú	ɲì≠kə̀kú	*beard*
Mmala	---	nì≠bánà	*breast, teat*
	---	nì≠sèlú	*chin*
Gunu	nɛbánya	nì≠báɲà	*latrine*
	niheŋé	nì≠hèŋé	*tree sp.*
Yambeta	nɛdóm	nì≠dʊ́m	*breast, teat*
	nigúu	nì≠gúù	*village*

The Maande high vowels, /i/ and /ɪ/, in the causative suffixes **-i** and **-is-i** and in the neuter suffix **-ɪ**, will cause anticipatory palatalisation of alveolar nasals /n/ to /ɲ/ (right-to-left). In the case of the causative suffixes, occurring at the right edge of the verb word, /i/ will trigger the iterative palatalisation of several alveolar nasals in the verb word. In Example 338 (a), the verbal suffixes **-on** and **-ɪn** become **-oɲ** and **-iɲ** (bolded below) preceding the causative suffixes (underlined). The palatalisation is not limited to the suffix immediately preceding the causative, multiple suffixes with /n/ may be palatalised by the causative suffix **-i**, as in Example 338 (b).

Example 338: Palatalisation of /n/ in Maande causative constructions

(a)	o≠ból-ót-ó**n**-o	*become red*	o≠ból-ót-ó**ɲ**-ís-i	*to make red*
	ɔ̀≠hʊ̀l-ì**n**-à	*pass by*	ò≠hùl-ì**ɲ**-ì	*transmit, cause to pass*
(b)	ò≠sìm-ìn-ìn-ə̀			*to enclose*
	ɔ̀≠làt-ìn-ìn-à			*to add, enlarge*
	ò≠tóŋ-í**ɲ**-í**ɲ**-i			*to show*

The neuter suffix **-ɪ**, unlike the causatives, occurs either in the first or second suffix slot after the root (see Example 339 (b) below). In this position, there are never multiple targets for palatalisation. Non-high vowels will block the spread of palatalisation (see Example 339 (c) below). In Example 339 (a), the alveolar nasal of the verb root **≠san** *disperse*, (bolded below) is palatalised by the neuter suffix **-ɪ** (underlined).

Example 339: Palatalisation of /n/ with the Maande neuter suffix -ɪ

(a)	ɔ̀≠sá**n**-à	*disperse*	ɔ̀≠sá**ɲ**-ì-à	*escape, flee, scatter oneselves*
(b)	ò≠tʃìk-ìl-ì-ə̀n-ə̀			*arrange, classify*
	ɔ̀≠hàt-ì-àk-ìn-à			*catch, stop as a group*
(c)	ɔ̀≠bɔ́n-ɔ́s-ì-à			*punish*

Other suffixes and extensions with high vowels /i/ or /ɪ/ do not cause palatalisation. In Example 340, the applicative suffix **-ɪn** (underlined) does not palatalise /n/.[260]

[260] See footnote 47 above.

Example 340: Non-palatalisation by applicative suffix -ɪn/-in (Maande)

ò≠lə́n-ə̀	*love, desire*	ò-bí≠lə́n-ín-ə̀	*rejoice in, take pleasure in*
ɔ̀≠tʃàn-à	*split*	ɔ̀≠tʃàn-ìn-à	*split (APPL)*

In conclusion, although previously analysed otherwise, the [-ATR] front vowel is high and is best analysed as /ɪ/. For what reason does an underlying high [-ATR] front vowel /ɪ/ have a surface form as [ɛ]. One reason may be that, with a lack of underlying front mid vowels, the [-ATR] high vowel is lowered. Roark (2001: 4), in his theoretical article on vowel-inventory tendencies, posits three underlying assumptions:

1. "there is a range of possible vowel locations that makes up a perceptual "space";
2. there is a tendency to maximise contrast between vowels within a particular inventory;
3. contrast = distance in the perceptual space"

It is the second and third of these assumptions which are of particular interest as a possible explanation to 1) the lowering of /ɪ/ to [ɛ] in the 8-vowel inventories, and 2) the tendency in most[261] of the Mbam languages for all the [+ATR] vowels to be higher than all of the [-ATR] vowels as is the case with Nen (Bancel 1999: 3). The acoustic "distance" maximises the contrast between the [-ATR] vowels and their corresponding [+ATR] counterparts. So the [+ATR] vowel is *not* acoustically adjacent to its [-ATR] counterpart. While /ʊ/ and /o/ may be very close to each other in the acoustic space, they are acoustically quite distant from their tongue-root counterparts, /u/ and /ɔ/. In the case of the front vowels, /ɪ/ has two allophones, [ɪ] and [ɛ], in 9-vowel languages, but with the loss of the **e/ɛ** pair in the 8-vowel languages, /ɪ/ maximises the distance from /i/ and always surfaces as [ɛ]. This acoustic distance between the [+ATR] and the [-ATR] members of a pair facilitates the ability to "hear" the difference between them, and in part explains why /ʊ/ has been often confused with /o/ (or /ɔ/). For the native speaker, there is no ambiguity between /ʊ/ and /o/ as these two vowels never occur in the same phonological context.

Figure 24 below, illustrates the general order of positions (based on the acoustic data) of the vowels in most of the Mbam 9- and 8-vowel languages. The [+/-ATR] pairs are indicated by the connecting lines. While customarily, [-ATR] high vowels are presented as being above [+ATR] mid vowels, as has been shown elsewhere in many of the Mbam languages, the [-ATR] high vowels acoustically have a higher F1 than the [+ATR] mid vowels. This tendency is seen below and highlights the maximum contrast (distance) between the members in the [+/-ATR] vowel pairs.

[261] The exceptions are Elip, Baca and Mbure. In these three languages, the [-ATR] high vowels /ɪ/ and /ʊ/ have a lower F1 than the [+ATR] mid vowels /e/ and /o/. In the other seven languages, the F1 of /ɪ/ and /ʊ/ is *higher* than the F1 of the mid vowels /e/ and /o/.

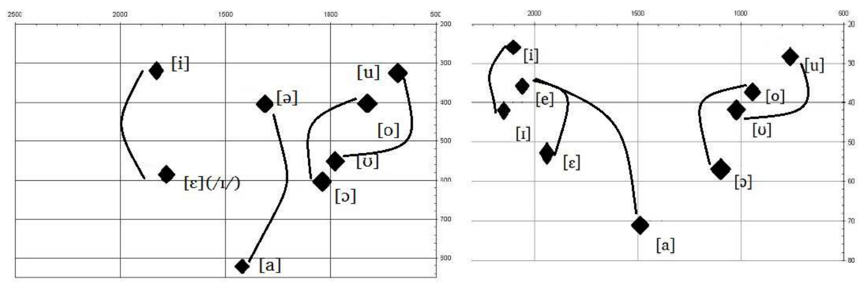

Figure 24: Positions and [+/-ATR] pairs of 8- and 9-vowel inventories[262]

The phonetic content of a phoneme is determined by its ‘patterning’ and “the behaviour of a phoneme is a function of its contrastive features” (Dresher 2009: 72). By this definition, the patterning of the [-ATR] counterpart of /i/ differs phonologically from /i/ only in the contrastive feature [ATR], despite its tendency to have acoustically a rather high F1. It patterns as a high vowel.

4.1.2 Comparison of the Mbam vowel systems

The Mbam languages have two sets of vowels that are mutually exclusive within the phonological word. One set is [+ATR] and usually “dominant” the other [–ATR] and usually “recessive”. These pairs vary somewhat depending on the language. Table 69 below shows the [+ATR]/[-ATR] vowel pairs for each language. The non-contrastive forms are noted in phonetic brackets.

In some of the languages, the underlying front [-ATR] high vowels surface with a high F1. Interestingly, these languages are the ones which no longer have two pairs of front vowels (**ɪ/i** and **ɛ/e**). An additional independent phenomenon, a fronting of /ə/ to [e], is also taking place. Table 69 lists each of the languages in this study, and the [+/-ATR] vowel pairs attested. Two of the languages have non-contrastive vowels included. These are Tuki, which has a non-contrastive [o], which is the [+ATR] counterpart of /ɔ/, and Baca, which has a non-contrastive [ɜ], which is the [+ATR] counterpart of /a/. These two non-contrastive vowels are bolded below.

[262] The values of these charts are taken from the averages of the vowel formants for two representative languages, one eight-vowel language (Nen), and one nine-vowel language (Yangben).

Table 69: Comparison of the [-/+ATR] pairs in the Mbam languages

Name	[+/-ATR] vowel pairs				
Nen	ɪ/i	–	a/ə	ɔ/o	ʊ/u
Maande	ɪ/i	–	a/ə	ɔ/o	ʊ/u
Yambeta	ɪ/i	–	a/ə	ɔ/o	ʊ/u
Tuki	ɪ/i	–	a/a, e	ɔ/[o]	ʊ/u
Gunu	ɪ/i	–	a/e[263]	ɔ/o	ʊ/u
Elip	ɪ/i	–	a/e	ɔ/o	ʊ/u
Mmala	ɪ/i	ɛ/e	a/e	ɔ/o	ʊ/u
Yangben	ɪ/i	ɛ/e	a/e	ɔ/o	ʊ/u
Baca	ɪ/i	ɛ/e	a/[ɜ]	ɔ/o	ʊ/u
Mbure	ɪ/i	ɛ/e	a/e	ɔ/o	ʊ/u

In addition to ATR harmony, all of the Mbam languages except for Baca and Mbure also have rounding harmony. There are two sets of vowels: those that have a contrastive feature for rounding and either trigger or undergo rounding assimilation, and those that are neutral to rounding harmony even if they are phonetically round. Rounding-neutral vowels fall into two types in the Mbam languages: opaque neutral vowels (indicated in the shaded cells) and transparent neutral vowel (indicated in the non-shaded cells in the neutral column in Table 70. Neutral vowels will be discussed at greater length in section 4.3 below. Yangben fronting harmony functions as the mirror image of rounding harmony. The high vowels in Yangben are transparent in both fronting and rounding harmony.

Table 70: Comparison of vowels sets in rounding/fronting harmony

Name	[+round]	[-round]	neutral	
Nen	o, ɔ	a, ə	i, ɪ,	u, ʊ
Maande	o, ɔ	a, ə	i, ɪ,	u, ʊ
Yambeta	o, ɔ	a, ə	i, ɪ,	u, ʊ
Tuki	ɔ	a	i, ɪ,	u, ʊ
Gunu	o, ɔ	a, ə	i, ɪ,	u, ʊ
Elip	o, ɔ	a, e	i, ɪ,	u, ʊ
Mmala	o, ɔ	a, e	i, ɪ,	u, ʊ
Yangben	o, ɔ	a, e	i, ɪ,	u, ʊ
Baca	---	---	---	
Mbure	---	---	---	
	[+front]	[-front]	neutral	
Yangben	e, ɛ	a, e (ə)	i, ɪ	u, ʊ

[263] The [+ATR] counterpart of /a/, although often found with a relatively high F2, with some speakers is slightly centralised. Due to this, Robinson (1984: 50) considered it a central vowel. A similar situation is found in Tuki, and Hyman (2003: 87) states concerning Yangben that "While some speakers pronounce schwa, others convert it to [e]..." It is clear that despite the high F2, [e] as the [+ATR] counterpart of /a/ is derived from a central vowel.

Height harmony, reminiscent of the Bantu Vowel-Height Harmony (presented in detail in section 4.3.3.1 below) with the high vowels *ɪ and *ʊ lowering to *ɛ and *ɔ (Hyman 1999: 236-7) is found only in Mmala. Only the [-ATR] high vowels are targeted by the harmony and only the [-ATR] mid vowels, /ɛ/ and /ɔ/ trigger height harmony, although some speakers will idiosyncratically lower /ɪ/ and /ʊ/ also in the context of /a/. The [+ATR] vowels never participate in height harmony, as in Table 71 below.

Table 71: Height-harmony vowel sets in Mmala

	-ATR			+ATR
		[+mid]	[-mid]	
Mmala	ɪ, ʊ	ɛ, ɔ	a	i, e, o, u

The two principal types of vowel harmony found in the Mbam languages, ATR and rounding, are attested in both 9-vowel and 8-vowel inventories. Fronting and height harmonies are found in only one language each, both of which have 9-vowel inventories. The vowels tend to divide into subsets according to whether or not they participate in a given vowel-harmony type.

4.2 The vowel /a/ in ATR-harmony systems.

In vowel-harmony languages with seven- or nine-vowel inventories, the vowel /a/ does not have a contrastive [+ATR] counterpart. The behaviour of this vowel in these systems is noteworthy and therefore merits further discussion.

4.2.1 An overview of the behaviour of /a/ in ATR-harmony systems

The vowel /a/ is inherently [-ATR], but in some languages, it may occur in a [+ATR] environment. In languages where /a/ occurs in a [+ATR] environment, there are three harmony-resolution processes found:

1) The vowel /a/ is realised as [a] and is neutral with respect to vowel-harmony spreading, namely it can be either transparent or opaque. Although it is [-ATR], it occurs in both [+ATR] and [-ATR] vowel sets. The vowel /a/ may be transparent, in that it does not block ATR harmony, as in languages such as Kibudu (D35) (Kutsch Lojenga 1994: 128), or opaque, in that it will block ATR harmony, as in languages like Akan (Clements 1976: 27). Blocking is the more common type of neutral /a/ according to typological and theoretical studies.
2) The vowel /a/ has a predictable [+ATR] variant which is not contrastive. Kinande (Mutaka 1995: 42) is an example.

3) In some languages, the [+ATR] counterpart of /a/ is realised as a mid front or mid back round [+ATR] vowel, [e] or [o]. In some languages, the /a/ may not occur in a [+ATR] environment and the back vowel /o/ functions as the [+ATR] counterpart of both /ɔ/ and /a/. Lika, a Bantu language of the northern Bantu borderland spoken in the north-east of the D.R. of Congo, is an example (Kutsch Lojenga 2008). In other languages, a front vowel /e/ functions as the [+ATR] counterpart both of /ɛ/ and /a/. Alur, a Western-Nilotic language of the D.R. of Congo is an example (Kutsch Lojenga 1989).

Of the ATR-harmony resolution techniques for /a/ listed above, all three are attested in various Mbam ATR-harmony languages.

4.2.2 Behaviour of /a/ in the Mbam languages

As discussed above, there are various types of harmony-resolution processes when the [-ATR] /a/ is found in a [+ATR] environment.

Nen, Maande, Yambeta and Tuki[264] each have atypical eight-vowel systems with four pairs of [+/-ATR] vowels: **i/ɪ**, **ə/a**, **o/ɔ** and **u/ʊ**. Two additional languages, Gunu[265] and Elip, have a variation in which the [+ATR] counterpart of /a/ is more fronted, so that the four pairs are **i/ɪ**, **e/a**, **o/ɔ** and **u/ʊ**. In all these languages except Tuki, the vowels /e/ or /ə/ occur without exception[266] as the [+ATR] counterpart of /a/ within the phonological word.

In the 9-vowel Mbam languages, such as Mbure, Yangben and Mmala, the vowel which functions as the [+ATR] counterpart of /a/ is realised as an open front [+ATR] vowel, /e/ (option 3, above). In the case of Yangben and Mmala the /a/ never occurs in a [+ATR] context.

In Baca, the vowel /a/ in [+ATR] contexts is realised as [ɜ] a predictable [+ATR] variant which is not contrastive (option 2, above). In all [+ATR] contexts, this non-contrastive counterpart of the vowel /a/ is found.

The most interesting is the behaviour of /a/ in Tuki and Mbure. Both these languages have a contrastive [+ATR] counterpart to /a/, yet both languages, unlike all the others, allow /a/ to occur as unchanged in certain [+ATR] contexts.

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[264] Tuki does not have a contrastive [+ATR] counterpart of /ɔ/.

[265] Robinson (1984: 50) notes in his Phonologie du gunu: parler yambassa that “Chez certains locuteurs la réalisation [du phonème /e/] est légèrement centralisée.” This being the case, Robinson defines /e/ as a central vowel.

[266] Nen has an instance of post-lexical anticipatory ATR harmony involving **a/ə** and affecting only the last vowel of the word, see section 3.2.2 below. In such cases, a [+ATR] word may have a final /a/ if the following word is [-ATR]. The reverse is true as well: a [-ATR] word may have a final /ə/ if the following word is [+ATR].

The greatest co-occurrence restrictions on /a/ in [+ATR] contexts are found in the noun root. In both Tuki and Mbure, the [+ATR] counterpart of /a/, namely /e/ or /ə/, will occur in a ≠CVCV noun root. In Table 72 below, V_2 in ≠CVCV noun roots must respect ATR harmony and is limited to either a high, open, front or round vowel in Mbure. In Tuki, V_2 may only be high, open or round. Certain combinations are neutralised, such as **ɛ-ɪ** and **ɛ-ɛ** in Mbure. In Tuki, **i-u** and **ɪ-ʊ** are lowered to [i-o] and [ɪ-ɔ] due to a constraint of having two high vowels together. This same constraint lowers **ʊ-ɪ** to [o-i] and causes a change in vowel harmony.

Table 72: Mbure

V1/V2	high	open	front/round	high	open	front/round
i	i-i	i-e	---			
e	e-i	e-e	(e-e)			
o	o-i	o-e	o-o			
u	---	u-e	---			
ɪ				---	ɪ-a	---
ɛ				(ɛ-ɛ)	ɛ-a	ɛ-ɛ
a				a-ɪ	a-a	a-ɛ
ɔ				ɔ-ɪ	ɔ-a	ɔ-ɔ
ʊ				---	ʊ-a	---

Tuki

V1/V2	high	open	round	high	open	round
i	i-i	i-ə	i-u ([i-o])			
e	ə-i	ə-ə	ə-u			
u	u-i	u-ə	u-u			
ɪ				ɪ-ɪ	ɪ-a	ɪ-ʊ ([ɪ-ɔ])
a				a-ɪ	a-a	a-ʊ
ɔ				ɔ-ɪ	---[267]	ɔ-ɔ
ʊ				ʊ-ɪ ([o-i])	ʊ-a	ʊ-ʊ

Vowel harmony in the verb is limited to the verb stem in both Tuki and Mbure. The final vowel /a/ will assimilate to the ATR value of the verb root in Tuki (see Example 341), but many verbal suffixes will block ATR harmony.

[267] The absence of **CɔCa** is due to rounding harmony, so underlying forms surface as [CɔCɔ].

Example 341: The behaviour of the final vowel in Tuki CVC verb stems

Rt vowel	ATR	Round	FV	example	*gloss*
i	x	---	-ə	≠hít-ə́	*coil (rope)*
ɪ	---	---	-a	≠tít-á	*draw (water)*
ə	x	---	-ə	≠pə́t-ə́	*seal (door)*
a	---	---	-a	≠pát-á	*pick (fruit)*
ɔ	---	x	-ɔ	≠sɔ́t-ɔ́	*dwell, inhabit*
ʊ	---	---	-a	≠kʊ́t-á	*dry (INTR)*
u	x	---	-ə	≠sús-ə́	*ask, demand*

In Mbure, however, vowel harmony is more restricted. The final vowel is realised as the [+ATR] counterpart /e/, only in the context of the high vowels /i/ and /u/. In all other cases, the vowel /a/ in affixes is realised as [a], even with other [+ATR] verb-root vowels (note the bolded examples) in Example 342.

Example 342: The behaviour of the final vowel in Mbure CVC verb stems

	ATR	surface form	*gloss*
i	x	≠tʰíb-è	*pierce*
ɪ	---	≠mɪ́ɲ-à	*drink*
e	x	**≠pél-à**	*call*
ɛ	---	≠sɛ́ɾ-à	*flow*
a	---	≠sáɾ-à	*chop*
ɔ	---	≠sɔ́d-à	*live*
o	x	**≠sòg-à**	*wash*
ʊ	---	≠pʊ́h-à	*bark (dog)*
u	x	≠pʰùg-è	*close*

In both Tuki and Mbure, the domain of vowel harmony is essentially the root. Within the root, the vowel /e/ is the [+ATR] counterpart of /a/ and occurs in all [+ATR] contexts. This extends, in Tuki in particular, to the final vowel in verbs, whereas other affixes with the vowel /a/ occur as [a] and do not undergo ATR harmony.

4.2.3 Conclusion

With the exception of the eight-vowel languages where the vowel /a/ has a [+ATR] counterpart, the vowel /a/ in the Mbam languages fits one of three patterns. In most of the nine-vowel languages, /a/ in a [+ATR] context has a [+ATR] counterpart, /e/. Baca, however, has a non-contrastive vowel, [ɜ] in [+ATR] contexts. In Mbure (nine vowels) and Tuki (seven vowels), /a/ in [+ATR] contexts will take the [+ATR] counterpart /e/ or /ə/ within noun roots and between the verb root and the final vowel, but where the vowel /a/ occurs in other affixes, it is neutral and blocks ATR harmony from spreading.

4.3 Neutral vowels

All types of Mbam vowel harmony have neutral vowels. But what is neutral in ATR harmony is not neutral in rounding harmony and vice versa. ATR-neutral vowels will be discussed in section 4.3.1. Rounding and fronting neutral vowels will be discussed in section 4.3.2. Neutral vowels in rounding harmony are particularly challenging as they demonstrate both opaque and transparent tendencies. Height-harmony neutral vowels are presented in section 4.3.3, and finally, in section 4.3.4, we will consider various analyses of opaque and transparent neutral vowels and discuss their merits in the context of rounding harmony in the Mbam languages.

4.3.1 Neutral vowels in ATR harmony

One of the more complex problems in analysing vowel-harmony systems involves the occurrence of neutral vowels. According to Van der Hulst and Smith (1986: 234), neutral vowels may occur in one of two circumstances, (1) where the two non-overlapping sets of vowels intersect, resulting in a situation where one or more vowels do not have a harmonic counterpart, and (2) where the "... harmony system is "obscured" by the presence of vowels which, although they do have a harmonic counterpart [...] fail to harmonise, either in particular morphemes, or everywhere."

In both these circumstances, neutral vowels may either be transparent, in which the harmony, so to speak, passes through the vowel as if it were not there, or opaque where the neutral vowel blocks the harmony process. The Mbam languages have both circumstances where neutral vowels may occur, as mentioned by Van der Hulst and Smith (1986) above: those that do not have a harmonic counterpart and those that do, but fail to harmonise. In addition, certain vowels are neutral in relationship to ATR harmony, but they participate in rounding harmony, and others there are others that are neutral in relationship to rounding harmony, but participate in ATR harmony. These will be discussed in turn below.

4.3.1.1 Neutral vowel /a/ in ATR harmony

Two languages, Mbure and Tuki, have an ATR-neutral vowel /a/. In both cases, the vowel /a/ has a harmonic counterpart /e/ or /ə/, which occurs predominantly in roots. As Van der Hulst and Smith (1986: 234) find, "the harmony system is obscured" because the vowel /a/ fails to harmonise in particular morphemes. In both Tuki and Mbure, the vowel /a/ occurs external to the root and is opaque, blocking-ATR harmony spread. In Example 343, the bolded elements are [+ATR]. The suffixes with /a/ which block ATR harmony are underlined.

Example 343: Suffixes blocking ATR-harmony spread in the verb stem

Mbure		≠ɛ̌n-<u>àn</u>-**ì**	*see*
		≠see-CONT-CAUS	
		≠màt-ìk-<u>àn</u>-**ì**	*divide, separate*
		≠divide-INTENS-CONT-CAUS	
Tuki	≠húm-ə́	≠**húm**-<u>án</u>-à	*exit / sprout*
		≠exit-CONT-FV	
	≠dìᵑg-ə̀	≠**dìᵑg**-<u>àn</u>-à	*love / love e.o.*
		≠love-RECP-FV	
	-βe≠tùᵐb-j-ə̀	≠**tùᵐb-ùɾ**-<u>àn</u>-à	*bathe / swim (ITER)*
	-REFL≠bathe-?-FV	≠bathe-EXTENS-CONT-FV	

In both Mbure and Tuki, noun-class prefixes with the vowel /a/ do not have a [+ATR] counterpart. The prefix vowel is realised as [a], even with [+ATR] vowels in the noun root, as indicated by the bolding in Example 344.

Example 344: Neutral vowel /a/ in prefixes

Mbure	[pàkáⁿd̪]	pà≠káⁿd	*women*
	[pà**kónì]**	pà≠kónì	*adults*
Tuki	[βàkʊ́tʊ́]	βà≠kʊ́tʊ̋	*women, wives*
	[βà**wùtə̀]**	βà≠wùt-ə̀	*farmers*

Outside the root, the only affix in Tuki with the vowel /a/ which optionally undergoes ATR harmony is the reflexive verb prefix, **βá-**. The [+ATR] elements are bolded in Example 345.

Example 345: Optional ATR harmony of the reflexive prefix in Tuki

ʊ̀-βá≠**tíj-ə́**	~	ʊ̀-**βə́≠tíj-ə́**	~	**ù-βə́≠tíj-ə́**	*embrace, hug*
c3-REFL≠hug-FV					
ʊ̀-βá≠**tə́m**-ìn-à	~	ʊ̀-**βə́≠tə́m**-ìn-à	~	**ù-βə́≠tə́m**-ìn-à	*lie down, sleep*
c3-REFL≠sleep-APPL-FV					
ʊ̀-βá≠**hún-ə́**	~	ʊ̀-**βə́≠hún-ə́**	~	**ù-βə́≠hún**-ə́	*blow (nose)*
c3-REFL≠blow-FV					

In Tuki, if the prefix /a/ undergoes ATR harmony, other prefixes to its left may also undergo ATR harmony. If the prefix /a/ does not undergo ATR harmony, it is neutral and blocks the spread of ATR.

4.3.1.2 Other neutral vowels in ATR harmony

While the vowel /a/ is the most common neutral vowel in ATR harmony, Tuki has another neutral segment with a high [-ATR] neutral vowel. The applicative suffix **-ɪn** (underlined) occurs in verbs as neutral and blocks ATR harmony from spreading, although the vowel /ɪ/ has a [+ATR] counterpart /i/.

Tuki	---	-**βә́≠tә́m**-<u>ìn</u>-à -REFL≠sleep-APPL-FV	*lie down, sleep*
	≠gún-ә́	≠**gún**-<u>ín</u>-à ≠drive.away-APPL-FV	*drive away*
		≠ɾìt-<u>ìn</u>-**j**-**ә̀** ≠harmonise-APPL-CAUS-FV	*harmonise*

While most ATR-neutral vowels are [-ATR], there is a handful of [+ATR] neutral vowels found in Tuki and Maande noun-class prefixes. In the case of Tuki, noun-class prefixes 5, 8, and 19 are invariably [+ATR] even with noun roots which are [-ATR] as in Example 346.

Example 346: Invariable [+ATR] noun-class prefixes in Tuki

ì≠táːní	*c5.rock*
ì≠bùmù	*c5.stomach*
βì≠tɔ́ⁿdɔ́	*c8.navels*
βì≠tә́tí	*c8.roosters*
ì≠hʊ́ɾá	*c19.broom*
ì≠kә́kú	*c19.breast, chest*

Taylor (1990: 5) notes that in Maande, there are a few [-ATR] words which are exceptional in that their prefix may optionally be [+ATR]. Of the three cases given by Taylor (see Example 347 below), two are from noun class 19[268].

Example 347: Optional disharmonic [+ATR] prefixes in Maande

Maande	hì≠kɔ́lɔ́kɔ́tɔ̀	~	**hì**≠kɔ́lɔ́kɔ́tɔ̀	*c19.wasp*
	hì≠ɔ̀fɔ̀	~	**hì**≠ɔ̀fɔ̀	*c19.fish*
	ì≠bálà	~	**ì**≠bálà	*c9.leopard*

Prepositions in Maande will generally become [+ATR] when followed by a [+ATR] noun as seen in Example 348 (a). However, these disharmonic [+high, +ATR] prefixes are not dominant; rather like [-ATR] words, they do not cause the preposition to become [+ATR], as seen in Example 348 (c) and compared with (b).

Example 348: Maande disharmonic [+ATR] prefixes in noun phrases

a)	ìbálà **nә̀ hìsә́tì**[269]	*leopard and duiker*
b)	tɔ̀nààná **nà** bìlàŋà	*pots and clothes*
c)	nà tʃʲɔ́yɔ́ **nà** <u>hì</u>kɔ́lɔ́kɔ́tɔ̀	*bee and wasp*

The disharmonic [+high, +ATR] prefixes, although they are neutral vowels, cannot be said to be either transparent or opaque to vowel harmony. In the Mbam languages, [-ATR] does not spread, rather it is the default value. Thus in Example 348 above, one cannot speak of [-ATR] spreading through a "transparent" [+ATR]

[268] It is not surprising that noun class 19 would be [+ATR] since it is a reflex of the proto-Bantu *pi-.
[269] The first two examples come from Taylor (1990: 8) with my phonetic transcriptions.

vowel. Rather, the [+ATR] vowel is disharmonic but not dominant so that its [+ATR] feature does not spread to the preposition which then surfaces in its default form.

4.3.1.3 Relevance of neutral vowels in the context of the Mbam languges

As mentioned above, one of the more complex problems in analysing vowel-harmony systems involves the occurrence of neutral vowels. In the following sections, we will look at how neutral vowels (both opaque and transparent) have been previously analysed and discuss some of the problems with these analyses given the facts of the behaviour of neutral vowels in the various vowel-harmony types present in the Mbam languages.

First, in sectons 4.3.2 and 4.3.3 we will discuss Mbam rounding, fronting and height harmonies and their neutral vowels, placing these vowel harmonies in the wider context of Bantu and African lingustics. Then in section 4.3.4, we will look at various analyses of neutral vowels taking into account the characteristics and behaviours of neutral vowels in Mbam rounding harmony, and discussing the problems they pose to the theories pertaining to neutral vowels. Later in section 4.4, we will consider the interaction of vowel inventory and vowel harmony in the Mbam languages and what they can reveal about neutral vowels.

4.3.2 Neutral vowels in rounding and fronting harmony

Rounding and fronting harmony are less common in African or Bantu languages, but, especially in the case of the former, are robustly attested in the Mbam languages. This section looks at these two harmonies in the wider context of African languages (sections 4.3.2.1 and 4.3.2.2 respectively), in order to place the rounding and fronting harmony of the Mbam languages into the wider context of Niger-Congo and other African languages. Then in section 4.3.2.3, we will discuss neutral vowels in rounding (and fronting) harmony. Neutral vowels occur in both rounding and fronting harmony. However, fronting harmony occurs only in Yangben and patterns identically with rounding harmony. For this reason, fronting neutral vowels will be discussed with Yangben rounding neutral vowels.

Rounding neutral vowels include both opaque and transparent vowels. For example, the vowels (/i/, /ɪ/, /u/ and /ʊ/) are all neutral in rounding and fronting harmony and can be either transparent or opaque depending on the language. Of most interest is that in Tuki, the vowels /i/ and /ɪ/ are opaque to rounding harmony, and the vowels /u/ and /ʊ/ are transparent, but in Gunu, the opposite is true: the vowels /i/ and /ɪ/ are transparent to rounding harmony and the vowels /u/ and /ʊ/ are opaque to it.

4.3.2.1 Overview of rounding harmony

Rounding harmony “is a phonological process whereby certain vowels surface as rounded under the influence of a neighbouring rounded vowel” (Kaun 2004: 87).

Rounding or round harmony is common in the Turkic, Mongolian and Tungusic branches of Altaic, but it is also found in many Niger-Congo languages. Rounding harmony is often restricted, and only applies when the affected vowel happens to “agree with respect to a second feature like height or backness” (Krämer 2003: 7).

Akan, a Kwa (Niger-Congo) language of Ghana, is described by O'Keefe (2003) as having both ATR and rounding harmony. O'Keefe looks at three dialects of Akan: Asante, Akuapem and Fante. In this section, I look only at what O'Keefe says about Akan rounding harmony. He lists several Akan prefixes which undergo rounding as well as ATR harmony (2003: 10). In particular, the future prefix is either /be-/ or /bɛ-/ in Akuapem and Asante dialects, but it can also surface as /bo-/ or /bɔ-/ in Fante (O'Keefe 2003: 11), when the verb root has a round vowel. In Fante, when the root vowel is not round, the future prefix is not round. He gives the following in Example 349 as evidence. The rounded future prefix is bolded and the round root vowel, which triggers rounding, is underlined:

Example 349: Akan rounding harmony in verbal prefixes

Dialect	**[-ATR]**	***gloss***	**[+ATR]**	***gloss***
Akuapem/Asante	ɔ.bɛ.kʊ	*he will fight*	o.be.tu	*he will dig it up*
Fante	ɔ.**bɔ**.kʊ	*he will fight*	o.**bo**.tu	*he will dig it up*
			o.be.dzi	*he will eat it*

In Example 350, O'Keefe (2003: 15-16) demonstrates a case in Asante where both rounding and ATR harmony are at work. A past tense suffix /-Vyɛ/ and a nominal suffix which is a mid vowel undergo both ATR and/or rounding harmony. The target vowel is bolded and the trigger vowels are underlined.

Example 350: Akan (Asante) rounding harmony in suffixes

Suffix	**[-ATR]**	***gloss***	**[+ATR]**	***gloss***
-V:yɛ	ɔ.tɔn.**ʊː**yɛ	*he sewed it*	ɔ.kan.**ɪː**yɛ	*he read it*
-$V_{[mid]}$	adɪ.**ɛ**	*thing*	esi.**e**	*anthill*
	ɛwʊ.**ɔ**	*honey*	owu.**o**	*death*

4.3.2.2 Overview of fronting harmony

Fronting harmony is commonly found in Finno-Ugric and Turkic languages, among others (Krämer 2003: 6), where it is more generally called palatal or back harmony. All vowels in the domain, often the phonological word, are either front vowels or back vowels. As in other types of vowel harmony, there are often some vowels which are neutral, either transparent or opaque to the vowel harmony.

Unlike the Uralic languages, which have two mutually exclusive sets of vowels differing only in regards to the feature back, many African languages have a fronting vowel harmony where the feature affects only susceptible vowels.

Kera, an East Chadic (A.3) language of south-western Chad, has height, fronting and rounding harmony (Pearce 2007: 94). In Kera, height harmony is bidirectional and will raise a low vowel (ex. /ɛ/ or /a/) to high in the environment of a high vowel (Pearce 2003: 8 and 2007: 93), as is seen when the suffix /-ɛ/ becomes /-i/ when it is added to /viːg/ *empty* or the suffix /-i/ causes /bàːd/ *wash* to assimilate to /bɨ̀ːd/ as in Example 351. Fronting harmony in Kera is illustrated when the underlying high central vowel, /ɨ/, is fronted to /i/ by an underlying high front vowel (Pearce 2007: 94), as is seen in the words /cɨɨ/ *head* and /ɨsk/ *hear* when the suffix /-i/ is added also in Example 351 below.

Example 351: Fronting harmony in Kera (Pearce 2003: 8)

	underlying form	**surface form**	***gloss***
H. trigger/target	cɨɨ-i	cīirī:	*your (f) head*
	ɨsk-i	īskī:	*hear you (f)*
non-H trigger	viːg-ɛ	viːgi	*is emptying*
non-H target	baad-i	bɨ̀ɨdì:	*wash you (f)*

Pearce (2003: 9, 14; 2007: 95) also identifies another type of fronting harmony triggered by a front suffix vowel and targeting central vowels in the same foot,[270] Example 352 Kera feet are identified by parentheses. Note that fronting does not occur across the foot boundaries.

Example 352: Kera suffix-triggered fronting (Pearce 2003: 2007)

	underlying form	**surface form**	***gloss***
single foot	ɨs-ɛ	(īsī:)	*to sit down*
	bɨŋ-ɛ	(bìŋì:)	*to open*
	bal-ɛ	(belɛ)	*to love*
	fal-ɛ	(félɛ́:)	*to find*
two feet	ɨsk-ɛ	(ís)(kí:)	*sit you (f) down*
	fal-t-ɛ	(fál)(tɛ́:)	*find (HAB)*

Kɔnni, a Gur language of Ghana, has a type of front assimilation which occurs where a sequence **a**C**ɪ** optionally becomes **ɛ**C**ɪ** if the C is coronal (Cahill 2007: 277), as in Example 353 (a). When the intervening consonant is a velar or labial, front assimilation does not occur, as in Example 353 (b).

270 Kera is a weight-sensitive language. Feet may include one or two syllables. The licensed feet are 1) one heavy (CV: or CVC) syllable, 2) a light syllable (CV) with a heavy syllable, or 3) two light syllables. (Pearce 2003: 22).

Example 353: Kɔnni fronting of /a/ with coronal (Cahill 2007: 277-8)

(a)	balɪ	~	bɛlɪ	*speak (v)*
	tasɪ	~	tɛsɪ	*kick (v)*
	gbáríáŋ	~	gbɛ́ríáŋ	*earthworm*
	gbalɪgɪ	~	gbɛlɪgɪ	*be tired*
	pɪasɪ	~	pɪɛsɪ	*ask*
	kpɪasɪ	~	kpɪɛsɪ	*chickens*
(b)	dagɪ			*show (v)*
	ŋmabɪ			*shatter*

Fronting harmony is probably the least attested vowel harmony in African languages, with only a few languages found having it. While the fronting harmony of Yangben is more general and robust than is found in the languages above, it does illustrate that although perhaps rare, the fronting harmony of Yangben is not an anomaly.

4.3.2.3 Neutral vowels in rounding harmony

While the neutral vowel /a/ in ATR harmony is clearly opaque or occurs at the word edge, the neutral vowels in rounding harmony are more complicated. The fact that /i, ɪ, u, ʊ/ are neutral to rounding harmony is not exceptional, since they are phonologically-motivated non-participating vowels (Finley 2009: 18). Following Dresher (2009: 9), who proposes assigning "contrastive features based on an ordering of features into a hierarchy" rather than "based on minimal differences between fully specified phonemes..." none of the high vowels /i/, /ɪ/, /u/, /ʊ/ in the Mbam languages has a contrastive feature [round], see section 4.4 for a more complete discussion of Dresher's contrastive-feature hierarchy and its application to the Mbam languages.

The question therefore is why there is variation between the Mbam languages concerning the opacity or the transparency of these high vowels (/i/, /ɪ/, /u/, /ʊ/) in rounding harmony. Four patterns are attested: (1) both high front and high back vowels are opaque and block rounding harmony, (2) only high front vowels are opaque, (3) only high back vowels are opaque, (4) neither high front nor high back vowels are opaque:

High front and high back vowels are opaque to rounding harmony.

In Nen and Maande, all high vowels block rounding harmony from spreading from the verb root to the final vowel, as in Example 354.

Example 354: All high vowels are opaque to rounding harmony

Nen	ʊ̀≠kɔ́ŋ-**ɔ́n**-à	*tip over-SEPAR-FV*
	ù≠hól-**ín**-ə̀	*wrap up-APPL-FV*
	ʊ̀≠m^{j}ɔ̀t-**ìl**-à	*press (v)-DIM-FV*
Maande	ɔ̀≠bɔ́ŋ-**ɔ́n**-à	*find, obtain-SEPAR-FV*
	ò≠bók-**ít**-ə̀	*cry-DIM-FV*

In Yambeta, high front vowels are clearly opaque to rounding harmony in the verb stem. Very few examples of suffixes with high back vowels are found in the corpus, and the few examples found either do not have a target vowel /a/, or occur on verbs without a non-high (open) round vowel. However, in Yambeta preverbal morphemes, the high back vowels do block rounding harmony, see section 3.3.4.1 above.

Example 355: Yambeta opaque high front vowels

Yambeta	≠ɔ̀p-**ìn**-à	*crush-APPL-FV*
	≠kós-**ín**-ə̀	*cough-CONT-FV*

Only high front vowels are opaque

While high front vowels are opaque, high back vowels are transparent. In Tuki, only /ɔ/ triggers rounding harmony. The high back vowels /ʊ/ and /u/ do not trigger or block rounding harmony. Example 356 shows the opacity of the high front vowels /ɪ/ and /i/, but it shows also that /ʊ/ is transparent to rounding harmony. Since the [+ATR] [o] is not contrastive, examples of the transparency of /u/ are precluded.

Example 356: High front vowels are opaque

Tuki	≠nɔ̀^{ŋ}g-**ìt**-à	*fold-DIM-FV*
	≠tò^{m}b-**ìj**-è	*calm o.s.-CAUS-FV*
	≠tʃók-óm-**ìj**-è	*narrow-STATIV-CAUS-FV*
	≠sɔ́m-**ɔ́n**-ɔ̀	*accuse-SEPAR-FV*
	≠tɔ́^{ŋ}ɡ-ɔ́ɾ-**ɔ̀n**-ɔ̀	*admire-SEPAR-FV*

Only high back vowels are opaque

While high back vowels are opaque, high front vowels are transparent to rounding harmony. In contrast to Tuki, high back vowels in Gunu are opaque and block rounding harmony, while even multiple high front vowels are transparent to rounding harmony, as in Example 357.

Example 357: High back vowels are opaque

Gunu	≠sɔ́m-**ìn**-ɔ̀	*accuse-APPL-FV*
	≠sɔ́l-**ìg**-ɔ̀	*insist-INTENS-FV*
	≠pòl-**ìn**-ò	*pierce-APPL-FV*
	≠bóɲ-**ìg**-**ì**-ò	*cause to drink-INTENS-FV*
	≠fɔ̀j-**ʊ̀g**-à	*wake up-SEPAR-FV*
	≠jɔ̀b-**ʊ̀m**-à[271]	*stagger-STATIV-FV*

High front and high back vowels are transparent to rounding harmony

In three Mbam languages, Elip, Mmala and Yangben, all high vowels are transparent to rounding harmony. Example 358 below illustrates Elip and Yangben.

Example 358: All high vowels are transparent to rounding harmony

Elip	≠dɔ́l-**íg**-ɔ̀n	*set fish trap-INTENS-CONT*
	≠sòn-**ìg**-òɲ-è[272]	*insert-INTENS-CONT-CAUS*
	≠ɔ̀^{m}p-**ʊ̀n**-ɔ̀n-ìn	*peel-SEPAR-RECP-APPL*
	≠ǒ^{n}d-**úg**-òɲ-è	*heal-?-CONT-CAUS*
Yangben	≠pɔ́^{n}d-**ìk**-ɔ̀n	*shrink-INTENS-CONT*
	≠ǒk-**ìk**-òn	*bank a fire-INTENS-CONT*
	≠jɔ́p-**ìl**-ɔ̀	*stutter, babble-?-FV*
	≠tɔ̀t-**ìn**-ɔ̀	*smile-APPL-FV*
	≠ǒm-**ùk**-òs-ì	*honour, praise-SEPAR-CAUS*
	≠kɔ́s-**ʊ̀n**-ɔ̀	*cough-SEPAR-FV*

In Mmala, the intensive extension **-ɪg** lowers to **-ɛg** due to height harmony triggered by /ɔ/ in the verb root. It is underlyingly a high vowel, see section 2.7.3.2.4. The separative suffix **-ʊn** never surfaces with a [-ATR] vowel in the context of /ɔ/, see Example 359. The reasons for this are discussed in section 4.4.4 below.

Example 359: Transparent high vowels in Mmala

Mmala	-bí≠dɔ̀l-**ɛ̀g**-ɔ̀n	*REFL≠listen-INTENS-CONT*
	≠góg-**íd**-òɲ-ì	*pull-DIM-RECP-CAUS*
	≠ɔ̀ŋ-**ùn**-ɔ̀	*sell, barter-SEPAR-FV*
	≠ɔ̀^{ɱ}f-**ùn**-ɔ̀	*peal-SEPAR-FV*
	≠ol-**un**-o	*unwrap, untie-SEPAR-FV*

As with rounding harmony, no high vowels block fronting harmony in Yangben, as is seen in Example 360 (a). However, there is loss of contrast between [+ATR/-front] and [+ATR/+front] harmony combinations. Since front is dominant in Yangben, it is assumed that the final vowel **-e** is due to fronting and ATR harmony rather than merely to ATR harmony in Example 360 (b).

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[271] No [+ATR] examples were found in the Gunu corpuses, because /o/ is less commonly found in roots.
[272] As indicated above, most dialects of Elip never round the final vowel, see section 2.6.3.2.4 above.

Example 360: High-vowel transparency in fronting harmony

Yangben	(a)	≠tὲt-**ìn**-ὲ	*tremble-INTENS-FV*
		≠sὲs-**òn**-ὲ	*crush, step on-SEPAR-FV*
	(b)	≠sèŋ-**ùl**-è	*tickle-EXTENS-FV*
		≠pèp-**ìn**-è	*palpitate (of heart)-INTENS-FV*

4.3.3 Neutral vowels in height harmony

While height harmony is fairly common in Bantu languages, only one Mbam language, Mmala, has a robust and active height harmony. Since Elip has only unproductive traces of height harmony in its noun-class system, it will not be discussed in this section. An overview of Bantu height harmony is presented in section 4.3.3.1, and a description of Mmala height-neutral vowels is discussed in section 4.3.3.2.

4.3.3.1 Overview of height harmony in Bantu languages

Hyman identifies vowel height harmony (VHH) as the harmonising of the historical degree-2 vowels (**ɪ*, **ʊ*) in height with a preceding mid vowel. This process may be different with respect to the back vs. front vowels (Hyman 2003: 46).

Hyman (1999: 236-8) identifies certain characteristics considered canonical in vowel-height harmonies in Bantu languages. These characteristics are that only mid root vowels trigger vowel harmony. The high vowels undergo harmony and the low vowel /a/ is generally opaque. Vowel-height harmony usually affects only certain derivational suffixes and may be symmetric as in the case of proto-Equatorial Bantu, or asymmetric, as in the case of proto-Savannah Bantu where the front mid vowels do not trigger the harmonic lowering of /u/.

Kinande (D/J.42) has a 7/9-vowel system ([e] and [o] are not contrastive) and asymmetric vowel-height harmony where both high vowels are lowered after a back mid vowel, but only the front high vowel is lowered after a front mid vowel (Hyman 1999: 237). In Example 361, given by Mutaka (1995: 43),[273] the suffixes **–ul** and **-ir** in the bolded examples are lowered to **-ɔl** and **-ɛr** after the back mid vowel /ɔ/, but only **-ir** is lowered after the front mid vowel /ɛ/.

[273] There is more going on in Kinande that I go into here. This example does not take into account more recent analyses.

Example 361: Kinande VHH (Mutaka 1995: 43)

-lim-a	-lim-ir-a	*to work (for)*
-hɛk-a	-hɛk-**ɛr**-a	*to carry (for)*
-sɛng-a	-sɛng-ul-a	*to (un)pack*
-hat-a	-hat-ir-a	*to peel (for)*
-lɔg-a	-lɔg-**ɛr**-a	*to bewitch (for)*
-βɔh-a	-βɔh-**ɔl**-a	*to (un)tie*
-lung-a	-lung-ul-a	*to join (straighten)*

Unlike in the previous example, where the front mid vowels did not trigger lowering of the round mid vowels, vowel-height harmony in many Western or Equatorial Bantu languages have symmetrical VHH in which both the front and the back mid vowel(s) will lower all high vowels of the extensions to mid. Hyman (2003: 47) illustrates symmetric VHH of Mongo (7-vowel system) in Example 362. Note (in the bolded examples) that both suffixes **-el** and **-ol** are lowered to **-ɛl** and **-ɔl** (bolded) after both /ɛ/ and /ɔ/ in the verb root (underlined).

Example 362: Mongo-Nkundo VHH (Hyman 2003: 47)

-íy-el	steal for	-is-ol-	*uncover*
-ét-el-	call for/at	-bet-ol-	*wake up*
-kɛnd-**ɛl**-	go for/at	-tɛ́ng-**ɔl**-	*straighten out*
-kamb-el	work for/at	-bák-ol-	*untie*
-kɔt-**ɛl**-	cut for/at	-mɔm-**ɔl**-	*unglue*
-tóm-el	send for/at	-komb-ol-	*open*
-lúk-el-	paddle for	-kund-ol-	*dig up*

4.3.3.2 Neutral vowels in Mmala height harmony

Height harmony spreads from right-to-left from a height-dominant suffix or root vowel to all [-ATR] high vowels. The vowel /a/ is opaque to height harmony unless it has also undergone rounding harmony. The vowel /ɔ/, whether it is underlyingly /ɔ/ or the result of rounding harmony, always participates in height harmony. The [+ATR] disharmonic vowel /u/ is transparent to height harmony in Mmala.

In Example 363 (a), the height-dominant suffix **-ɛn** (underlined) triggers lowering of the vowel in the verb root, the reflexive prefix **bí-**, and the near-future prefix **gàgɔ́-** (bolded). The vowel /a/ in the tense markers is neutral and blocks height harmony to the c1 (3s) concord **ʊ-**, which does not undergo lowering.

In Example 363 (b), the height-dominant root vowel (underlined) will cause lowering in the vowel of the negative preverbal morpheme **dì-** (bolded). As /ɔ/ also triggers rounding harmony, both the final vowel and the tense markers with the vowel /a/ are rounded. The rounded vowel is *not* opaque to height harmony, allowing the height harmony to trigger the lowering of the vowel in the negative marker.

Due to the [+ATR] disharmonic vowel in the context of /ɔ/ (see section 4.4.4 for a full discussion on the disharmonic [+ATR] high back vowel in Mmala), all the high back vowels are [+ATR] and as such do not participate in height harmony, as seen in Example 363 (c). However, these disharmonic [+ATR] high vowels are *transparent* to height harmony as well as rounding harmony. In Example 363 (d), the verb root with /ɔ/ triggers height harmony in the first person plural concord, despite the fact that the [+ATR] /u/ is in the present tense marker **gú-**.

Example 363: Height harmony in Mmala preverbal morphemes

(a)	UF	ò-sà-bí≠dóg-èn		*S/he put her load on her head.*
	SF	ò-sà-**bɛ́≠dɔ́g**-ɛ̀n		
		c1-P1-REFL≠load-APPL		
	UF	ò-gàgó-bí≠dóg-èn		*S/he will put her load on her head.*
	SF	ò-gàgó-**bɛ́≠dɔ́g**-ɛ̀n		
		c1-FT1-REFL≠load-APPL		
(b)	UF	ǹ-dì-má-g^{w}≠ɔ̀n-à		*I am not laughing at you.*
	SF	ǹ-**dɛ̀**-mɔ́-g^{w}≠ɔ̀n-ɔ̀		
		1s-NEG-P0-2sIO-laugh-FV		
(c)	UF	ò-gàgó≠dɔ́ŋ-à		*S/he will sing.*
	SF	ù-gɔ̀gú-dɔ́ŋ-ɔ̀		
		c1-FT1-sing-FV		
(d)	UF	dì-gó≠ɔ̀^{n}d-à	mò≠ɔ̀bɔ̀	*We are buying fish*
	SF	**dɛ̀**-gú≠ɔ̀^{n}d-ɔ̀	m^{w}ɔ̀bɔ̀	
		1p-PRES≠buy	mu≠fish	

4.3.4 Various analyses of neutral vowels

Neutral vowels, especially transparent vowels, have been a topic of discussion in many phonological theories:

> "... vowel transparency flies in the face of the assumption maintained in this dissertation that assimilation only applies between strictly adjacent segments" (Baković 2000: 266).

Many efforts have been made to explain why certain neutral vowels "seem to allow the opposite value of the harmonic feature to pass right through them..." (Baković 2000: 265). Baković (2000: 266-8) summarises three different analyses of transparent vowels, favouring the last one:

- **Non-local assimilation**: The harmonising feature skips over the transparent vowel. There have been many arguments against this analysis in the literature.
- **Feature copying**: The transparent vowel blocks the spread of vowel harmony, as though it were opaque, but then the harmonic feature is copied onto a vowel on the opposite side of the neutral vowel and vowel harmony continues as usual.
- **Derivational opacity**: The neutral vowel is harmonic at an intermediate level, which later is neutralised at the surface level.

Van der Hulst and Smith (1986: 261) propose classing vowels into two categories “accessible” and “inaccessible”. Inaccessible vowels are opaque. They are represented autosegmentally as having segmental boundaries which extend to the harmonic tier. Accessible vowels fall into two subsets: those that are underlyingly associated (i.e. transparent vowels) and those that are not associated (i.e. harmonising vowels). Opaque vowels are those which are outside “the scope of a feature” and cannot associate to it or are associated to a feature within a segmental domain and cannot associate to a feature outside that domain (Van der Hulst & Smith 1986: 260). Van der Hulst and Smith's analysis assumes privative features for vowels, with the unassociated vowels taking a default value.

Archangeli and Pulleyblank (1994) propose that the lack of contrast may underlie the transparency of these vowels. That is, in Wolof, the non-contrastiveness of [+high, –ATR] vowels is reflected in their neutrality to vowel harmony.

Finley (2008) proposes an adaptation on Goldrick's (2001) Turbidity Theory to explain the occurrences of opaque and transparent neutral vowels in vowel harmony. Finley (2008: 127-8) explains that

> “In Turbid Spreading, all features have three levels of representation: an underlying form, a projection (abstract) form and a phonetic (surface) form. These three levels interact such that spreading is initiated by an underlying form and applies through the projection level. Because the pronunciation representation need not share the same feature value as the projection level, vowels may undergo spreading abstractly, but pronounce a different feature, providing an account of transparent vowels. Because this mismatch of pronunciation and projection comes at a cost (violating a RECIPROCITY constraint), some rankings will produce transparent non-participating vowels, while other rankings will produce opaque non-participating vowels.”

So transparent vowels are those that undergo spreading abstractly, but their underlying form is pronounced, while opaque vowels are those that do not have a mismatch of pronunciation and projection.

Following Finley's (2008) examples but using the feature [round] instead of [ATR], her Turbid Spreading does account for some of the Mbam data. The modified features used therefore are:

- *[+high, +round]: high vowels may not be *contrastively* round (following Dresher's (2009) contrastive-feature hierarchy (see Section 4.4). The high back vowels /u/ and /ʊ/, which are redundantly round, are also neutral.
- SPREAD [+round]-R: Rounding harmony spreads to the right ([-round] does not spread).
- RECIPROCITY: "When projection and pronunciation are mismatched, the RECIPROCITY constraint is violated" (Finley 2008: 65).
- ID[round]: "ID[F][274] is violated by any segment that is projected by its surface representation or the projection of one of its neighbours" (Finley 2008: 88).
- The down arrow (↓) represents a phonologically unchanged (faithful) representation; a projection from the underlying form. The side arrows (←, →) represent spreading from a neighbouring form (Finley 2008: 75).

Taking an example from Yangben (Table 73), in which all high vowels are transparent to rounding harmony and as well an example from Maande (Table 74) in which all high vowels are opaque, Finley's model works rather well. In Finley's model, SPREAD[F] involves the spread of both [+F] and [-F]. In order to best fit the data of the Mbam languages, this study claims that only [+round] spreads. For the neutral vowels to be transparent, SPREAD is ordered before RECIPROCITY.

[274] ID(F) is featureal identity and "...governs the relationship between the underlying form and the projection level" (Finley 2008: 88).

Table 73: Transparency & Turbid Spreading (Finley 2008: 95): Yangben

/≠pɔ́^{n}d-**ìk**-àn/ [≠pɔ́^{n}d-**ìk**-ɔ̀n] *shrink*-INTENS-CONT	*[+high, +round]	Spread [+round] - R	Recipro-city	ID [round]
a /+ - -/ ↓ ↓ + - → - [+ - -]		**!		*
b ☞ /+ - -/ ↓ + → + → + [+ - +]			*	**
c /+ - -/ ↓ ↓ ↓ + - - [+ - -]		**!		
d /+ - -/ ↓ + → + → + [+ + +]	*!			**

In Yangben, where all high vowels are transparent to rounding harmony, options (a) and (c) are excluded due to the lack of spreading rounding harmony. Option (d) is excluded because it produces the ungrammatical [+high, +round] vowel. This leaves the winner as (b) even though reciprocity is violated.

In Maande (Table 74), where all high vowels are opaque, RECIPROCITY is ordered before SPREAD. Option (a) is excluded because it produces the ungrammatical [+high, +round] vowel. Options (b) and (d) are excluded because reciprocity is violated. This leaves the winner as (c), although spread is violated.

Table 74: Opacity & Turbid Spreading (Finley 2008: 96): Maande

/≠bók-**ít**-ə̀/ [≠bók-**ít**-ə̀] *cry-DIM-FV*	*[+high, +round]	Recipro-city	Spread [+round] - R	ID [round]
a /+ - -/ ↓ + → + → + [+ + +]	*!			**
b /+ - -/ ↓ + → + → + [+ - +]		**!		**
c /+ - -/ ☞ ↓ ↓ ↓ + - - [+ - -]			**	
d /+ - -/ ↓ + → + → + [+ - -]		**!		**

Finley (2008: 91) states, "If RECIPROCITY is ranked above SPREAD, the non-participating vowel is opaque. If RECIPROCITY is ranked below SPREAD, the non-participating vowel is transparent" (Finley 2008: 91). While this works for those languages which have only transparent or only opaque vowels (as illustrated above), the problem with Finley's Turbid Spreading becomes apparent with those languages with both opaque and transparent vowels active in the same vowel-harmony process. It is not clear what kind of ranking would permit certain high vowels to be transparent while others are opaque to rounding harmony. There is inconsistency between the languages about whether the [+high, +back] vowels are transparent or opaque to rounding harmony. In Gunu, the [+high, +back] vowels are opaque, but in Tuki, they are transparent (see Example 356 and Example 357 above).

Kiparsky and Pajusalu (2006: 221) following Van der Hulst and Smith (1986) posit three typological generalisations concerning neutral vowels: (1) *Unmarkedness* meaning that the neutral vowel is [-F] where [F] is the harmonic feature. (2) *Uniformity* meaning that all vowels with a given value [αF] will be either opaque or transparent. [-F] neutral vowels are transparent, [+F] vowels are opaque. (3) *Asymmetry* in that transparent vowels are predictably [-F].

The rounding neutral vowels in the Mbam languages do not support Kiparsky and Pajusalu's generalisations. Vowels transparent to rounding harmony in the Mbam languages are not predictably [-round]. In some of the Mbam languages with rounding harmony, the high [+round] vowels /u/ and /ʊ/ are transparent and in others the high [-round] vowels, /i/ and /ɪ/, are opaque to rounding harmony or vice versa.

Generally, Optimality Theory assumes strict segmental locality and that "no outputs are generated in which a single featural autosegment is associated with segments S1 and S3 but not an intervening segment S2" (Walker 2012: 585). In support of this strict segmental locality, Ní Chiosáin and Padgett (2001) claim that intervening consonants also participate in vowel harmony, but may not be perceived as altered.

Following a similar line, Gafos and Dye (2011) discuss the phonetic bases of vowel harmony in general and of neutral vowels in particular. According to Gafos and Dye and others (2011: 22-3), there is a discontinuity in both the articulatory and electromyographic measures of lip rounding when English speakers pronounce identical vowels with an intervening consonant (uCu). There is a trough in the electromyographic signal co-occurrent with the production of the intervening consonant. "The cessation of muscle activity during the consonant is consistent with the analysis that [...] the rounding of the two identical vowels [represents] two independent events". However when a speaker of a vowel-harmony language, like Turkish, produces a similar uCu utterance, instead of a trough, there is a "plateau of continuous activity" through the production of the consonant.

> "... the linguistic representation underlying the production of lip rounding in Turkish is consistent with a central idea of autosegmental theory, namely, that assimilation and harmony involve representations in which a single instance of the assimilating or harmonising property extends over a domain encompassing all segments required to agree on that property" (Gafos and Dye 2011: 23).

If vowel harmony extends throughout the domain, affecting even consonants, the logical conclusion would be that even transparent vowels are somehow affected by rounding harmony in the Mbam languages. Then, it is assumed that even the high [-round] vowels, /i/ and /ɪ/, are affected by rounding harmony even though they do not show any perceptible rounding to [y] and [ʏ].

"If the phonetics of 'rounding' is pursued with some care (Goldstein 1991, Disner 1983), lip posture can be hypothesised to spread through the intervening [i] without a substantial effect on its acoustics. Overall, then, the plausible hypothesis is that transparency is not failure to participate in harmony but *failure to produce salient acoustic consequences of harmony* (my italics) on a specific class of segments" (Walker 2012: 25). It is generally held that lip rounding will lower all three of the first formants. So, if rounding harmony spreads though the transparent vowels, there should be some symptom of this rounding (even if it is subphonemic) in the acoustic output of the transparent vowels. With this theory in mind, acoustic measures were taken for two languages, Yangben with all transparent high vowels in rounding harmony, and Maande with all opaque high vowels in rounding harmony to see whether there was any acoustic difference between the "transparent" vowels of Yangben and the "opaque" vowels of Maande. The tokens analysed are as found in Example 364. The shaded cells indicate high vowels in the context of rounding harmony.

Example 364: Rounding neutral suffixes in Yangben and Maande

Yangben	≠pɔ́ⁿd-**ìk**-ɔ̀n	*shrink-CONT*
	≠ɔ̌k-**ìk**-ɔ̀n	*bank a fire-CONT*
	≠jɔ́p-**ìl**-ɔ̀	*stutter, babble-EXTENS-FV*
	≠tɔ̀:t-**ìn**-ɔ̀	*smile-APPL-FV*
	≠kɔ́s-**ɔ̀n**-ɔ̀	*cough-SEPAR-FV*
	≠ɔ̌m-**ùk**-ɔ̀s-ì	*honour, praise-SEPAR-CAUS*
	≠kít-**ìk**-èɲ-ì	*find (at some place)-INTENS-CONT-CAUS*
	≠aᵐb-**ìk**-àn	*spread out, dry-INTENS-CONT*
	≠sím-**ìl**-è	*surprise, be astonished-EXTENS-FV*
	≠sík-**ìl**-à	*notch, carve something small and round-EXTENS-FV*
	≠fàːt-**ìn**-àn	*carve, sharpen-APPL-CONT*
	≠àn-**ɔ̀n**-à	*examine-SEPAR-FV*
	≠àt-**ɔ̀k**-ɛ̀n	*get up and leave-SEPAR-FV*
	≠tép-**ùk**-ès-ì	*pass, traverse-SEPAR-CAUS*
Maande	≠bɔ́ŋ-**ɔ́n**-à	*find, obtain-SEPAR-FV*
	≠sɔ́l-**ɔ́n**-à[275]	*extract-SEPAR-FV*
	≠ɔ́t-ɔ́k-**ín**-à	*attach-SEPAR-APPL-FV*
	≠ɔ̀t-**ìn**-ə̀	*water, sprinkle-APPL-FV*
	≠lɔ́ŋ-**ít**-à	*call, invite-DIM-FV*
	≠bók-**ít**-ə̀	*cry-DIM-FV*
	≠fál-**ɔ́n**-à	*succeed, lead to-SEPAR-FV*
	≠fàŋ-**ɔ̀n**-à	*unhook-SEPAR-FV*
	≠ták-**ín**-à	*plan, organise-DIM-FV*
	≠bí-bíén-**ín**-ə̀	*REFLEX-give birth-APPL-FV*
	≠tʃàn-**ít**-à	*wound-DIM-FV*
	≠fàl-**ìt**-à	*weed a little-DIM-FV*
	≠líh-**ít**-ə̀	*last, remain-DIM-FV*

In Yangben, where all the high vowels are transparent to rounding harmony, there is an indication that the high vowels have slightly lower frequencies in the context of rounding harmony than where there is no rounding harmony. The vowels /i/ and /ɪ/ in particular have, on average, lower F3 formants, and somewhat lower F1 (for the vowel /i/) or F2 (for the vowel /ɪ/). The high back vowels /u/ and /ʊ/ are less

[275] No example of the [+ATR] **-un** suffix in a [+round] context was found in the corpus. While examples were found for non-round verb roots, these were excluded due to the lack of the corresponding round verb roots.

consistent which may be due to the fact that they are already phonetically round vowels. However, a similar phenomenon is evident in Maande, where all the high vowels are opaque to rounding harmony. The high front vowels /i/ and /ɪ/ were perhaps even more consistently lowered in the rounding harmony contexts than in Yangben. The shaded boxes in Example 365 indicate the lower formant averages for the neutral vowels in rounding harmony, and the italics show where the lower formant averages showed up in the non-round contexts.

Example 365: Variation in F1/F2/F3 values of neutral vowels in [+/-round] verbs: Yangben

AVE	in [+round] verbs			in [-round] verbs		
	F1	F2	F3	F1	F2	F3
/i/	203	2215	2896	265	*2172*	2994
/ɪ/	335	2027	2723	*321*	2099	2789
/u/	287	893	2524	*272*	891	*2325*
/ʊ/	347	955	2572	*334*	1225	*2229*

[+/-round] verbs: Maande

AVE	in [+round] verbs			in [-round] verbs		
	F1	F2	F3	F1	F2	F3
/i/	216	2077	3075	268	2285	3102
/ɪ/	444	2129	2684	*400*	2156	2815
/u/[276]	---	---	---	---	---	---
/ʊ/	510	1028	2552	*471*	*979*	2584

“The hypothesis grounding transparency in articulatory-acoustic relations may also allow us to understand why certain vowels exhibit transparency but other similar vowels exhibit opacity” (Gafos and Dye 2011: 25). In these two Mbam languages, however, there is not much evidence that the lowering of the frequencies of the first three formants in the context of rounding harmony is different in a language with transparent vowels than it is in a language with opaque vowels. The most that can be said from this limited data is that there is some indication that the frequencies of all rounding-neutral vowels are slightly lowered in the context of rounding harmony as opposed to the same vowels in non-round contexts. This slight lowering, too slight to make a perceptible difference, is perhaps sufficient to justify Ní Chiosáin and Padgett (2001) and Gafos and Dye (2011)'s hypothesis that vowel harmony does encompass all segments occurring in the vowel-harmony domain, including transparent vowels.

In rounding harmony, all the high vowels are neutral. They may be either transparent or opaque, but none of the high vowels, even the phonetically round vowels /u/ and /ʊ/, are phonologically [+round]. While no one disputes that /u/ and /ʊ/ are

[276] No example of /u/ in suffixes in a [+round] context was found in the corpus.

phonetically round "... the question [...] is whether they function *phonologically* as though they are specified..." for rounding (Dresher 2009: 175).

It is possible that, with more sophisticated testing and a larger data sample, those languages where all the high vowels are transparent to rounding harmony (Yangben, Mmala and Elip) will provide evidence that the transparent vowels do undergo some phonetic variations as a result of rounding harmony, and that those languages where all the high vowels are opaque to rounding harmony (Maande, Nen, Yambeta, etc.), the opaque vowels are not (or less) affected by the phonetic variations caused by the rounding harmony. As a result, the vowel harmony is blocked.

The neutral vowels in ATR harmony are different. The ATR-neutral vowels, unlike the rounding-neutral vowels, are contrastively indicated as [-ATR]. Since they do in fact have the opposite value of the harmonising feature, in this case [+ATR], these vowels are invariably opaque.

4.4 Interaction of vowel inventory and vowel harmony

In this section we will look a phonological framework of contrastive features proposed by Dresher (2009) to explain a number of anomalies in Mbam vowel-harmony systems. While Dresher's approach is used, I am in no way claiming that it is superior to other approaches, nor do I try to improve on the theory as such. After looking at a number of other approaches, I found it a useful tool to enhance the description of the Mbam languages and the peculiarities of their vowel-harmony systems. Section 4.4.1 describes Dresher's (2009) contrastive-feature hierarchy and section 4.4.2 gives further information about Dresher's (2009) Modified Contrastive Specification (MCS) which is used to assign an order to the contrastive-feature specifications into a hierarchy. Then in section 4.4.3, we will apply Dresher's model to the Mbam languages and in section 4.4.4 discuss some of the anomalies on which it sheds light.

4.4.1 Contrastive-feature hierarchy in phonology (Dresher 2009)

> "Phonological contrast refers to those properties of phonemes that are distinctive in a given phonological system. In most theories of phonology, this means determining which features are contrastive and which are redundant" (Dresher 2009: 2).

In the Mbam languages, it is evident, by this definition, that ATR must be a contrastive feature. But what are the other vowel features which account for the secondary vowel harmonies present in these languages and how do we account for the differences in the vowel-harmony systems with similar vowel inventories? Dresher (2009: 169) proposes a contrastive-feature hierarchy which makes two empirical claims:

1. “Distinctive features in each language are organised into a hierarchy.”
2. “This hierarchy determines which feature values are contrastive in a given language.”

Dresher (2009) considers that the most logical approach assigns “contrastive features based on an ordering of features into a hierarchy” (Dresher 2009: 9) rather than “based on minimal differences between fully specified phonemes.” He lists five diagnostics for identifying contrastive features.

Figure 25: Diagnostics for identifying contrastive features (Dresher 2009: 72)

A phoneme φ has the contrastive feature F if:

a. φ enters into an alternation or neutralisation that is best explained if F is part of φ.
b. φ causes other phonemes to alternate or neutralise in a way that is best explained if F is part of φ.
c. φ participates in a series with other phonemes, ϕ, with respect to phonotactic distribution, where F is required to characterise φ in a general way.
d. the set of allophones which make up φ all have F in common.
e. speakers adapt a sound from another language in a way that can be explained by supposing that they assign F to the foreign sound.

According to Dresher (2009: 74), “Only contrastive features are active in the phonology. System-redundant features are inert.” This view reflects Hyman's in his discussions of the vowel-harmony systems of Kalɔŋ (Yangben) and Gunu. Hyman proposes a “bottom-up” or “system-driven” approach to the analysis of Yangben vowel harmony in which “the study of languages is informed by theory” (Hyman 2003a: 85). He follows a similar approach for Gunu (Hyman 2001).

Hyman (2001, 2003a) identifies only those features which are “phonologically active” in the vowel system, and suggests four active features either present or once present in the Mbam languages. For example, Hyman (2003a) proposes four contrastive features for Yangben (Kalɔŋ): ATR, front, round and open. In Table 75, reproduced from Hyman (2003a: 8), the double line indicates a tenth underlying vowel /ə/ which surfaces as [e]. This tenth vowel is phonetically undistinguishable from /e/.

Table 75: Hyman's (2003a: 8) contrastive features for Yangben (Kalɔŋ)

	i	u	ɪ(I)	ʊ(U)	e	o	ɛ	ɔ	a	ə[e]
A	+	+			+	+				+
F	+		+		+		+			
R		+		+		+		+		
O					+	+	+	+	+	+

These four features are the only ones Hyman (2001, 2003a) needs to account for, and they explain all the types of vowel harmony found in Gunu and Kalɔŋ (Yangben).[277] Dresher has a different approach to determine the contrastive features of a phoneme based on its behaviour within the system. While both Hyman and Dresher identify the "phonologically active" features, they differ in how these features are determined. Dresher proposes an algorithm for defining contrast and redundancy for members of an inventory as indicated in Table 76.

Table 76: The Successive Division Algorithm (Dresher 2009: 16-7)

a. Begin with no feature specifications: assume all sounds are allophones of a single undifferentiated phoneme.
b. If the set is found to consist of more than one contrasting member, select a feature and divide the set into as many subsets as the feature allows for.
c. Repeat step (b) in each subset: keep dividing up the inventory into sets, applying successive features in turn, until every set has only one member.

While both Hyman and Dresher speak of "phonologically active" features, Hyman does not assume a hierarchical organisation of these features. As a result, although Hyman's (2003a) contrastive features for Yangben do explain much of the vowel-harmony processes, it does leave open the question why the high vowels, which do have a feature round or front, do not participate in rounding and fronting harmony. Hyman's solution is "... since /i/ and /u/ do not condition front or rounding harmony, we need a feature open on which these harmonies are -parasitic" (Hyman 2003a: 5). Why this should be true is not explained.

Dresher's (2009) contrastive-feature hierarchy provides a different rationale as to why the high vowels do not participate in rounding and fronting harmony in Yangben. Using Dresher's (2009: 16-7) Successive Division Algorithm (SDA) as in Table 76 above, we can identify the contrastive specifications "by splitting the inventory by means of successive divisions, governed by an ordering of features" (Dresher 2009: 16) as in Figure 26 below. The height feature is [+/-open] following Hyman (2001, 2003a). Only two height levels are required for most of the Mbam languages. For reasons which will become clear in the discussion of the contrastive-feature hierarchy for Mmala (section 4.4.3.3), I prefer [open] to [low] as it is more general and with the addition of a feature [mid] for Mmala, it fits the pattern better.

While this hierarchical ordering of features necessitates a feature "back" as well as a feature "front", that Hyman (2003a) doesn't require, it allows for high vowels not to have the contrastive features "round" and "front" and thus explains why they do not undergo rounding or fronting harmony.

[277] While Hyman (2003a) only finds seven surface vowels, he effectively argues that Yangben must have nine underlying vowels based on the active features of the language and the vowel-harmony processes. His (2001) treatment of Gunu is similar.

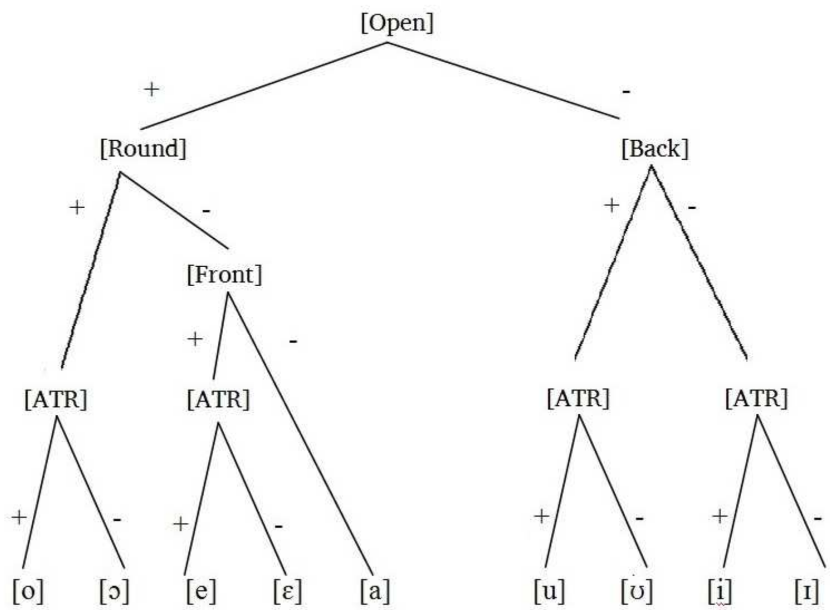

Figure 26: Contrastive-feature hierarchy for Yangben vowels

Dresher's ordering of contrastive features and his premise that it is only contrastive features that are phonologically active are both elements in an approach to phonology that comes out of research done at the University of Toronto since the mid 1990s known as Modified Contrastive Specification or MCS.

4.4.2 Modified Contrastive Specification

Modified Contrastive Specification (MCS) assigns a central role to contrastive feature specifications and has two main tenets (Dresher 2009: 75):

1) “Only contrastive feature specifications are active in the phonology (the Contrastivist Hypothesis)”
2) “Contrastive features are assigned by ordering the features and applying the Successive Division Algorithm (SDA)”

Modified Contrastive Specification started as a focus of complexity in phonology and grew into a discussion of the interrelation between contrast and markedness. Dresher's notion of markedness is structural (logical), rather than phonetic (natural), and as a result relative to a particular inventory (Dresher 2009: 164, footnote 2). In the MCS model, complexity in phonology is driven by both contrast and structural markedness. Features are binary with both marked and unmarked values rather than privative. Complexity is driven only by marked features, so segments with fewer marked features are less complex than those with more marked features (Dresher 2009: 163-4).

> “MCS proposes that contrasts are determined by the SDA operating on a hierarchy of features. Since a more marked representation is permitted only if needed to establish a contrast with a less marked one, the theory of MCS leads us to expect a relation between the amount of segmental markedness a system allows and the number and nature of contrasts it has” (Dresher 2009: 163-4).

The MCS approach assumes that phonology is underspecified with respect to phonetics. While “the number and nature of contrasts that a segment enters into influence, [they] do not determine its phonetic realisation. Therefore, the contrastive specifications assigned by the phonological component must be supplemented by further principles to derive the detailed phonetic specification of a speech sound” (Dresher 2009: 168). As a result, the concept of phonetic enhancement is adapted by MCS.

Phonetic enhancement is posited by Stevens, Keyser and Kawasaki (1986) and Stevens and Keyser (1989), who propose that “phonological contrasts can be *enhanced* by phonetic specification of non-contrastive features” (Dresher 2009: 168). Phonetic enhancement also explains why certain vowel inventories are more common than others.

4.4.3 Contrastive-feature hierarchy and MCS analysis of the Mbam languages

The Mbam languages, despite similar vowel inventories, have rather distinct vowel-harmony systems. Given Dresher's premise that only contrastive features are phonologically active and that features are hierarchically ordered, the differences in what vowel harmonies occur are the function of which features are active and their position in the language-specific contrastive-feature hierarchy. No feature can occur at different levels within the hierarchy of any given language, nor does the level of the feature tell us anything about the robustness of the vowel harmony associated with it. Languages with very robust ATR harmony may rank ATR high or low. The most important aspect of the contrastive-feature hierarchy is that it determines which vowels are affected by which feature. Vowels such as /u/ or /ʊ/ in Yangben (see Figure 26 above), although they are clearly round vowels (phonetically), are not contrastively round. The feature [+round] affects only [+open] vowels in Yangben.

4.4.3.1 Yangben

As discussed above in Figure 26 and reproduced in Figure 27 below, Yangben has a contrastive-feature hierarchy, open>>round/back>>front>>ATR.

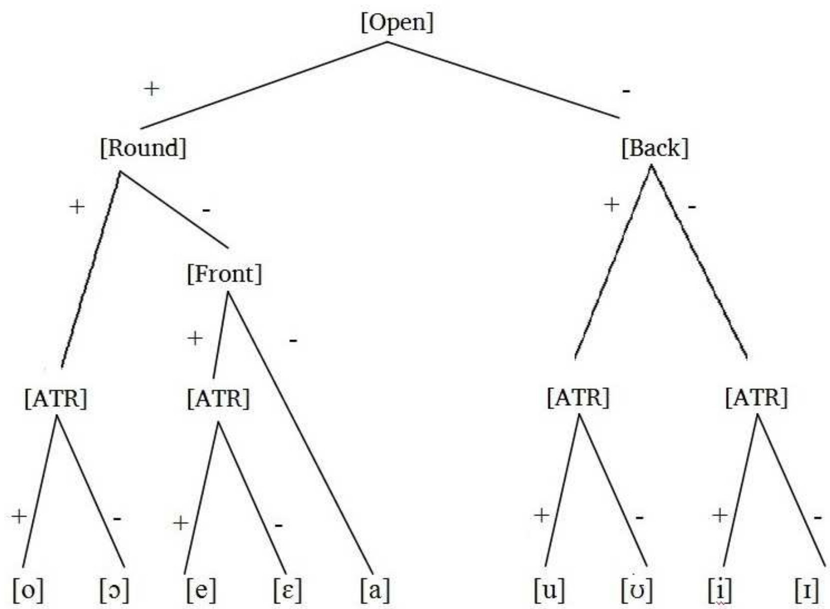

Figure 27: Contrastive-feature hierarchy for Yangben vowels

The first contrast divides the vowels into [+open] (**e, ɛ, a, ɔ, o**) and [-open] (**i, ɪ, u, ʊ**) separated in Table 77 below by the double line. As Dresher (2009: 177) finds for Classical Manchu, "Splitting the inventory in this manner has the effect of allowing for different contrasts in each set." The next features, [back] and [round] (separated by the heavy line) apply to different sets. The feature [back] applies only to the [-open] vowels and distinguishes between **i, ɪ** and **u, ʊ**. The feature [round] only applies to the [+open] vowels. It distinguishes **o**, **ɔ** from **a, ɛ, e**. The [round] feature is relevant in Yangben for rounding harmony, the [-open] vowels, even **u**, **ʊ** are not contrastive for rounding and do not participate in or block rounding harmony. The next feature, [front], applies only to the [-round] vowels and distinguishes **ɛ**, **e** from **a**. The [front] feature (indicated by the fine line) is relevant in Yangben for fronting harmony. The [-open] vowels, even **i** and **ɪ** are not contrastive for [front] and hence do not participate in fronting harmony. The last contrastive feature is [ATR] (distinguished by the dashed lines). It distinguishes between all of the remaining pairs except for **a**. The [ATR] contrast for **a** is determined in Yangben by the next higher node, which in this case is the feature [front], so **a** takes its [+ATR] counterpart from the [front] node, hence /e/.

Table 77: Contrastive features for Yangben

i	**[ATR]**			**u**
ɪ			[back]	ʊ
[open]	**e** **[ATR]**		**o**	
	ɛ	a	ɔ	
	[front]		[round]	

The contrastive-feature hierarchy differs between the various Mbam languages. Baca and Mbure, which have inventories similar to Yangben's, do not have fronting harmony.

4.4.3.2 Baca and Mbure

Baca and Mbure both have 9-vowel systems with similar features to Yangben, but with a different order. While the features [front] and [back] are at the same level, [front] is associated with the [-open] vowels in Baca and Mbure, and with the [+open] vowels for Yangben. Since the vowels /e/ and /ɛ/ are not contrastive for [front], they do not undergo fronting harmony. There is still need for a contrastive feature [round] (needed to distinguish between /a/ and the round vowels /ɔ/ and /o/), and to account for the trace of rounding in both these languages. The contrastive-feature hierarchy for Baca and Mbure is: open>>back/front>>round>>ATR, as illustrated in Figure 28.

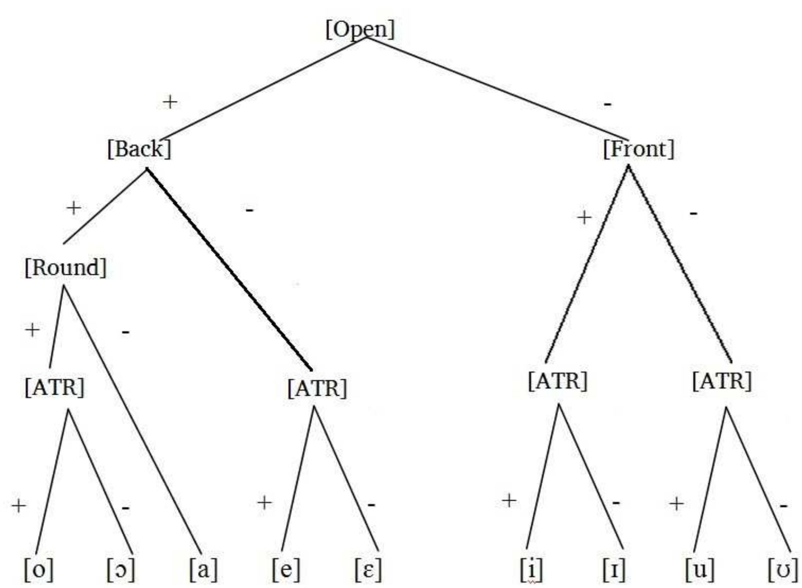

Figure 28: Contrastive-feature hierarchy for Baca and Mbure vowels

Like with Yangben, both Baca and Mbure first divide vowels by the feature [+open]. Unlike Yangben, the next contrastive feature [back] applies only to [+open] vowels and the contrastive feature [front] only to [-open] vowels and distinguishes **i**, **ɪ** from **u**, **ʊ**. This slight change is the reason why fronting harmony does not occur in either Baca or Mbure. The feature [back] distinguishes **a**, **o**, **ɔ** from **e**, **ɛ**. The feature [round] distinguishes **o**, **ɔ**, from **a**. The final contrastive feature, [ATR], distinguishes between all the remaining pairs except for **a**, which does not have a [+ATR] counterpart in certain environments and uses /e/ in others.

Table 78: Contrastive features for Baca and Mbure

i				**[ATR]**	**u**
ɪ		[front]			ʊ
[open]	**e**	**[ATR]**		**o**	
	ɛ		a	ɔ	
			[back]	[round]	

4.4.3.3 Mmala

Mmala, which is unique for its active height harmony, has a rather different contrastive-feature hierarchy. The feature [mid] is proposed rather than [front] to distinguish the [+open] mid vowels **ɔ**, **ɛ** from **a**. Unlike the languages discussed above, the feature [ATR] is the highest ranked. The features [back] and [round] are similarly ranked after [mid] with [back] affecting only the [-open] vowels and [round] affecting only the [+open] vowels. The contrastive-feature hierarchy for Mmala is: ATR>> open>>mid >>round/back as illustrated in Figure 29.

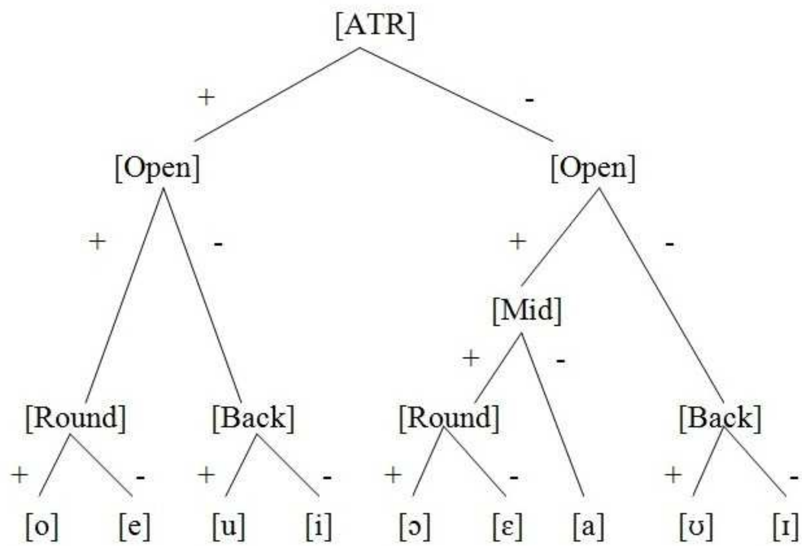

Figure 29: Contrastive-feature hierarchy for Mmala vowels

[ATR] is the highest-ranked feature in the hierarchy for Mmala. It separates **i**, **u**, **e**, and **o** from **ɪ**, **ʊ**, **ɔ**, **ɛ**, and **a**. Second in the hierarchy is [open] which applies to both [+ATR] and [-ATR] vowels. The feature [mid] applies only to [-ATR], [+open] vowels and distinguishes **ɔ**, **ɛ** from **a**. The feature [mid] is required to account for height harmony in Mmala, which is triggered by /ɔ/ and /ɛ/ but not generally by /a/. The lowest-ranked features in the Mmala hierarchy are [round], which applies to all [+open] vowels and [back] which only applies to [-open] vowels. This distinction accounts for why rounding harmony in Mmala only affects the [+open] vowels.

Table 79: Contrastive features for Mmala

ɪ			[ATR]	i
ʊ			**[back]**	**u**
[open]	**ɔ**		**o**	**[round]**
	ɛ		e	
		[mid] a		

4.4.3.4 The 8-vowel languages

Five languages with 8-vowel systems, Elip, Gunu, Nen, Maande and Yambeta, all have similar contrastive feature hierarchies. As with most of the other languages, the highest-ranked feature is [open] and separates **a**, **ə**, **ɔ**, **o** from **i**, **ɪ**, **u**, **ʊ**. Since there is no fronting harmony, only the feature [back] is necessary for distinguishing between the [-open] vowels. The [+round] feature is needed to account for rounding harmony in the [+open] vowels. The contrastive-feature hierarchy for the 8-vowel languages is open >>round/back>>ATR as illustrated Figure 30.

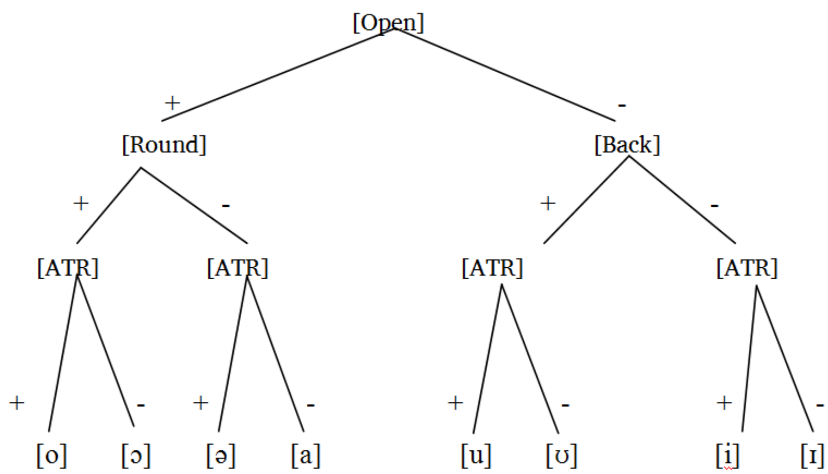

Figure 30: Contrastive-feature hierarchy for the 8-vowel languages

Like the 9-vowel systems, the feature [round] applies to the [+open] vowels and the feature [back] to the [-open] vowels. Unlike the 9-vowel systems, /a/ in the 8-vowel languages has a distinct [+ATR] counterpart.

Table 80: Contrastive features for the 8-vowel Mbam languages

i	**[ATR]**		**u**
ɪ		[back]	ʊ
[open]		[round]	
[ATR]	**ə**	**o**	
	a	ɔ	

4.4.3.5 Tuki

The tenth language, Tuki, has only seven contrastive vowels, having lost the [+ATR] open vowel /o/, which now only occurs as an allophone of /ɔ/ in a [+ATR] context. The contrastive-feature hierarchy of Tuki ranks the feature [ATR] as second after [open]. The lowest-ranked contrastive features are [back] and [round]. The contrastive-feature hierarchy for Tuki is open>>ATR>>round/back as illustrated in Figure 31.

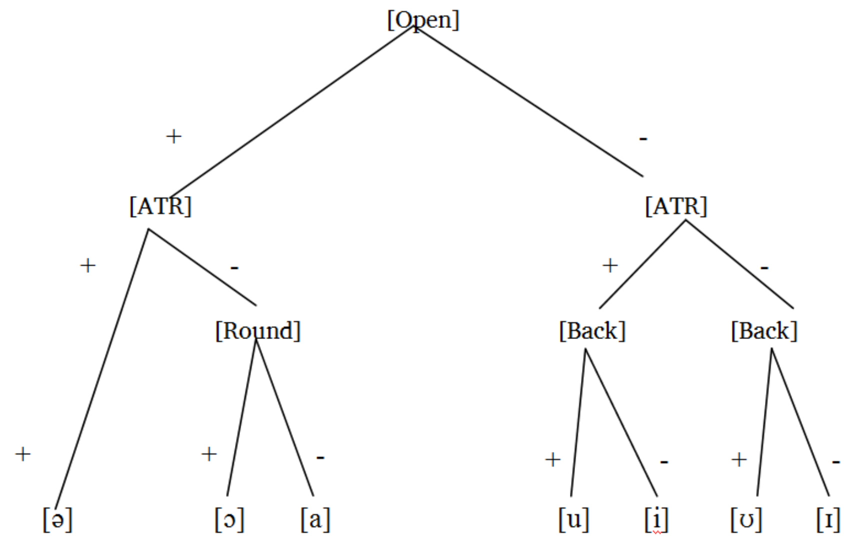

Figure 31: Contrastive-feature hierarchy for Tuki

Tuki, like Mmala, places [ATR] high in the contrastive-feature hierarchy. The features [open] and [ATR] affect all vowels. The features [back] and [round] are ranked last; the former applies only to [-open] vowels and the latter to [+open] vowels. The feature round is needed to distinguish between /ɔ/ and /a/ and accounts for the rounding harmony, which occurs in the word root.

Table 81: Contrastive features for Tuki

ɪ		[ATR]	i
ʊ	[back]		**u**
ɔ [round]	a	ə	[open]

4.4.3.6 Summary of the contrastive feature hierarchies of the Mbam languages

Yangben, Mbure and Baca have similar contrastive features, but the ranking is different. The differences in ranking affect which types of vowel harmony are present. While both Baca and Mbure, like Yangben, have a contrastive feature [front], this feature, because of its position in the feature hierarchy, only applies to the [-open] vowels and does not trigger fronting harmony.

Mmala, unique among the 9-vowel languages, does not have a contrastive feature [front]. It is replaced with the feature [mid] which allows for the height harmony found in the language.

The 8-vowel languages, Elip, Gunu, Nen, Maande and Yambeta, have similar contrastive features to Tuki, but the ranking differs, with [ATR] ranking higher than [round/back] in Tuki. Table 82 summarises the contrastive features of the Mbam languages and their hierarchical ranking.

Table 82: Summary of the contrastive-feature hierarchy for the Mbam languages

Yangben	[open]>>[round/back]>>[front]>>[ATR]
Mbure, Baca	[open]>>[back/front]>>[round]>>[ATR]
Mmala	[ATR]>>[open]>>[mid]>>[round/back]
Elip, Gunu, Nen, Maande, Yambeta	[open]>>[round/back]>>[ATR]
Tuki	[open]>>[ATR]>>[round/back]

While Dresher's (2009) contrastive-feature hierarchy of features is useful to explain how vowel harmony is triggered and to some degree why certain vowels do not participate (e.g. why the high vowels do not trigger rounding or fronting harmony), the situation is less clear about why some segments are transparent and others opaque. “There are various reasons why segments may block harmony, not all derived from their contrastive status. Similarly, targets may be restricted for reasons beyond their contrastive status” (Dresher 2009: 176 footnote). In rounding harmony, in particular, the high vowels, /i, ɪ, u, ʊ/ do not have the contrastive feature [+/-round] (or in the case of fronting harmony the feature [+/-front]) and thus do not participate in rounding or fronting harmony. In certain languages, however, they are all transparent, while in other languages, they are all opaque and in some cases /i, ɪ/ are opaque while /u, ʊ/ are transparent or vice versa.

Van der Hulst and Smith (1986: 246) propose a universal law that a neutral vowel is transparent if it shares the dominant value, and is opaque if it has the recessive value. This hypothesis does not work in the Mbam languages nor in Dresher's model with regards to rounding harmony, since neutral vowels are those vowels that have no specification at all for the harmonising (contrastive) feature. Even the concept “phonetic enhancement”, posited by Stevens, Keyser and Kawasaki (1986) and Stevens and Keyser (1989), which adds phonetic specification with non-contrastive features, does not help. It cannot account for why even the phonetically-enhanced round vowels, /u/ and /ʊ/,[278] (i.e. the dominant feature) are opaque to rounding harmony in Gunu and transparent to rounding harmony in Tuki. Likewise it cannot account for why /i/ and /ɪ/ (i.e. the recessive value vis-à-vis rounding harmony) is transparent in Gunu (as well as Elip, Mmala and Yangben), and opaque in Tuki (and Nen and Maande). This study can offer no solution for these problems, but it is

[278] If the high vowels are phonetically enhanced, it would make sense to associate the redundant feature [+round] with [+back], but this still doesn't help us. The vowels /u/ and /ʊ/ in Gunu are [+back], thus redundantly [+round], but they block rounding harmony, while /i/ and /ɪ/, which are [-back], thus redundantly [-round], are transparent to rounding harmony.

hoped that the issues and questions brought forward here will contribute to the understanding of the behaviour of neutral vowels.

In the 9-vowel inventory, Dresher's contrastive-feature hierarchy can explain in part why the [+ATR] counterpart of /a/ surfaces as /e/ and not /o/, as happens in a number of other Bantu languages. Several methods are found depending on the language:

1) The [+ATR] counterpart of the odd vowel is drawn from the next higher node.
2) A non-contrastive [+ATR] allophone occurs in [+ATR] contexts.
3) /a/ occurs without alternation in [+ATR] contexts (i.e. /a/ is neutral).

Illustration of method (1): The [+ATR] counterpart of /a/ is /e/ in Yangben and Mmala. Where there is a lack of a contrastive [+ATR] counterpart [a̧], we must go up to the first superior node which can provide it to get the [+ATR] counterpart for /a/. In Yangben, which has [ATR] as the lowest node, the [+ATR] counterpart of /a/ ([+open]>>[-round]>>[-front]) must come from the [front] node, which is the immediately superior node, see Figure 26 above. So we go down the [+front] side to get to the [ATR] node, which gives us /e/ ([+open]>> [-round]>> [+front]>> [+ATR]) as the [+ATR] counterpart of /a/.

In Mmala, since [ATR] is the highest node, we must get the [+ATR] counterpart of /a/ ([-ATR]>>[+open]>>[-mid]) from the highest node. We must go down the [+ATR] side and chose [+open] (since /a/ is an open vowel), and [-round] (since /a/ is [-round] phonetically, even though not [-round] contrastively and hence not specified as [-round]). The [+ATR] counterpart of /a/ in Mmala therefore is /e/ ([+ATR]>> [+open]>> [-round]), see Figure 29 above.

Method (2) above, is illustrated in Baca. A non-contrastive [+ATR] vowel [ɜ] occurs in [+ATR] contexts in Baca.

Since "... harmony observes limitations that are not due to contrast, but to other factors, that is, having a contrastive feature is a necessary but not sufficient condition for triggering harmony..." (Dresher 2009: 184), we see two methods at work in Mbure and Tuki.

In Tuki, it is the vowel /ɔ/ (not /a/) that lacks a contrastive [+ATR] counterpart. Tuki uses method (2) and has a non-contrastive allophone [o] occurring in [+ATR] contexts.

However, for both Tuki and Mbure, the vowel /a/ functions differently depending on its position: within the word root or in affixes. In noun roots, the vowel /a/ must undergo ATR harmony. Both languages use method (1) for the [+ATR] counterpart.

In Mbure, the [+ATR] counterpart of /a/ is /e/. Since /a/ ([+open]>>[+back]>> [-round]) has no [ATR] value in the feature hierarchy, it must get it through the superior node, [back]. As the feature [round] distinguishes /a/ from /o/ and /ɔ/ and is hierarchically higher than [ATR], the vowel /a/ must get its ATR value from the node higher than [round], that is the [back] node, see Figure 28 above. There we must take the [-back] side and choose the [+ATR] side to /e/ ([+open]>>[-back]>> [+ATR]) when imposed by [+ATR] dominance within the root. In affixes, both languages use method (3): the vowel /a/ occurs unaltered in [+ATR] contexts in prefixes and suffixes.

The choice between these methods is language specific, and Dresher's model offers an explanation only for the first.

4.4.4 The problem of ATR disharmony in Mmala

> "Any new theory puts old questions into a new light..." (Dresher 2009: 138).

As seen earlier, Mmala has an unusual ATR disharmony which cannot be explained by either positional neutralisations of [ATR] contrasts or the favouring of a disharmonic but faithful candidate over a spreading one. The Mmala ATR disharmony is not the instance of a [-ATR] segment occurring in a [+ATR] context, but rather that of a [+ATR] segment occurring exceptionally in a [-ATR] context. The context is extremely limited and it seems impossible to find a way of ordering OT constraints to account for it. Descriptively, it is easy to define:

- All instances of /ʊ/ found in the context of /ɔ/ in the phonological word will surface as a [+ATR] vowel, /u/.
- /ɔ/ will trigger rounding harmony, and height harmony in /ɪ/ but not in /ʊ/.
- The [+open] allophone of /ʊ/[279] will trigger height harmony in both /ɪ/ and /ʊ/, but it never triggers rounding harmony.

There are numerous examples found both in prefixes and suffixes in nouns and verbs. In Example 366, the vowel /ɔ/ is underlined and the effect on the [-ATR], high back vowel is bolded. In Example 367, the rounding harmony triggered by /ɔ/ is also underlined.

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[279] With the limitation of symbols, this allophone must be written as "ɔ"; however, phonologically, it is not identical to the contrastive vowel /ɔ/. The vowel /ɔ/ has a contrastive feature [+round] whereas the allophone of /ʊ/ does not, as we will see below, the contrastive features of this allophone are [-ATR], [+open] and [+back], while the contrastive features of /ɔ/ are [-ATR], [+open], [+mid] and [+round]

Example 366: Mmala ATR disharmony in nouns

bʊ̀≠ɲánʊ̀	*c14.yam (generic)*
nʊ̀≠mà^{n}dì / dʊ̀≠mà^{n}dì	*c11/13.wild cat*
b**ù**≠lɔ̀g	*c 14.meat*
n**ù**≠bɔ̀mɔ́ / d**ù**≠bɔ̀mɔ́	*c11/13.river*
n**ù**≠bɔ̀l / d**ù**≠bɔ̀l	*c11/13.rain*

Example 367: Mmala ATR disharmony in verbs

[≠ɔ̀ŋ-ɔ̀]	*join*	[≠ɔ̀ŋ-**ù**n-ɔ̀]	*separate*
[≠nʊ́ŋ-ʊ́n] ~ [nɔ́ŋ-ɔ́n]	*evade*	[≠nʊ́ŋ-**ún**-à]	*evade (cont)*

[**ù**-sɔ̀≠sɔ́s-ɛ̀d] *s/he smoked.*
c1-P2≠smoke-DIM

[gɔ́-n**ù**-ŋ≠gɔ́l-ɛ̀n] *you (pl) take me.*
DIST-2p-1sIO≠take.IMP-APPL

[**ù**-gɔ̀g**ú**-dɔ́ŋ-ɔ̀] *s/he will sing*
c1-FT1-sing-FV

However easy it may be to describe the phenomenon, *explaining it* is more difficult. While OT constraints and orderings do not shed light, Dresher's contrastive-feature hierarchy does. This study will argue that, instead of being an unexpected occurrence of [+ATR], the presence of /u/ is an instance of a height analysis.

While Dresher does not speak about allophones in detail, he does state that "the set of allophones which make up φ all have F in common..." (Dresher 2009: 72). Regardless of how similar a particular allophone might be *phonetically* to another phoneme, ϕ, the allophone(s) of φ will have similar contrastive features to φ, varying from φ only within the hierarchical position of φ. Therefore, allophones will have only the contrastive features of the phoneme; they will not assume additional contrastive features from elsewhere in the hierarchy.

For example, in Mmala, the high vowels (see Figure 29 above) are contrastively [+/-ATR]>>[-open]>>[+/-back]. Their allophonic variations, therefore, must include only these contrastive features, and therefore logically may only be [+/-ATR] or [+/-open] or [+/-back]. So theoretically, there are 2^3 possible allophones of /ʊ/ ([-ATR]>>[-open]>>[+back]):

- [-ATR]>>[-open]>>[+back]: [ʊ].
- [-ATR]>>[-open]>>[-back]: [ɪ]. This does not occur as an allophone of /ʊ/ in Mmala

- [-ATR]>>[+open]>>[+back]: the feature [+back] is not a contrastive element for the [+open] node. It would be interpreted as something close to [ɔ], but lacking the contrastive feature [+round]. This does occur as an allophone for /ʊ/ in Mmala.
- [-ATR]>>[+open]>>[-back]: the feature [-back] is not a contrastive element for the [+open] node. It would be interpreted as something close to [ɛ]. This does not occur as an allophone of /ʊ/ in Mmala.
- [+ATR]>>[-open]>>[+back]: [u]. This does occur as an allophone of /ʊ/ in Mmala.
- [+ATR]>>[-open]>>[-back]: [i]. This does not occur as an allophone of /ʊ/ in Mmala.
- [+ATR]>>[+open]>>[+back]: the feature [+back] is not a contrastive element for the [+open] node and does not occur as an allophone of /ʊ/ in Mmala.
- [+ATR]>>[+open]>>[-back]: the feature [-back] is not a contrastive element for the [+open] node and does not occur as an allophone of /ʊ/ in Mmala.

In Mmala, at least, an allophone, α, of any given phoneme, φ, will allow for only *one* feature to vary; so that the allophones of /ʊ/ are actually reduced to four possibilities:

- [-ATR]>>[-open]>>[+back]: /ʊ/
- [-ATR]>>[+open]>>[+back]: similar to [ɔ]
- [+ATR]>>[-open]>>[+back]: /u/
- *[-ATR]>>[-open]>>[-back]: [ɪ]

Of these options, the first three are found in Mmala. Likewise, for /ɪ/ ([-ATR]>>[-open]>>[-back]), the possible allophones are:

- [-ATR]>>[-open]>>[-back]: /ɪ/
- [-ATR]>>[+open]>>[-back]: similar to [ɛ][280]
- *[+ATR]>>[-open]>>[-back]: /i/
- *[-ATR]>>[-open]>>[+back]: /ʊ/

Of these options, the first two are found for /ɪ/.

While phonetically the same, or at least very similar, the contrastive features of /ɔ/ in Mmala are very different from those of the [ɔ][281] allophone of /ʊ/. The former has the contrastive features [-ATR]>>[+open]>>[+mid]>>[+round], while the latter, since it is the [+open] allophone of /ʊ/, is [-ATR]>>[+open]>>[+back]. As a result,

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[280] This allophone occurs wherever height harmony lowers /ɪ/.

[281] Since the contrastive features of these two vowels are very different, I choose to consider them as entirely different vowels despite their phonetic similarity, hence the the usage of the square brackets, [ɔ], rather than referring to it as /ɔ/, which featurally, it is not.

[ɔ], not having a contrastive feature [round] will never trigger rounding harmony, but since it *does* have the feature [+open] it will trigger height harmony.

In Mmala, /ʊ/ is lowered predominantly in closed syllables.[282] This lowering will also trigger lowering in preceding (including open) syllables. In Example 368, the underlying /ʊ/ ([-ATR]>>[-open]>>[+back]) in roots is lowered to [ɔ] ([-ATR]>>[+open]>>[+back]) in closed syllables and will trigger lowering of the prefix vowel (bolded).

A second allophone of /ʊ/ occurs within the phonological word with /ɔ/ ([-ATR]>>[+open]>>[+mid]>>[+round]). While /ɔ/ generally triggers height harmony, which lowers high affix vowels, in this case, the opposite occurs, and /ʊ/ in a prefix is raised and surfaces as /u/ ([+ATR]>>[-open]>>[+back]). The surface variation of the prefix vowel is bolded in Example 368 below.

Example 368: Comparaison of /ʊ/ and /ɔ/ in Mmala.

Underlying /ʊ/ in root				Underlying /ɔ/ in root	
gʊ̀≠dɔ́m	~	g**ɔ̀**≠dɔ́m	*send something*	g**ù**≠dɔ́m	*eat first fruits*
gʊ̀≠gɔ́l	~	g**ɔ̀**≠gɔ́l	*crush, grind*	g**ù**≠gɔ́l	*take*
nʊ̀≠bɔ́g	~	n**ɔ̀**≠bɔ́g	*c11/13.prophecy*	b**ù**≠lɔ̀g	*14/6.meat*

Logically, ATR harmony must be triggered by a vowel which is contrastive for ATR, which /ɔ/ evidently is not. The disharmonic variation of /ʊ/ ~ [u] in the context of /ɔ/ is therefore not due to any spread of ATR. This disharmonic variation precludes the height-harmony lowering of /ʊ/ by /ɔ/. Since the allophone of /ʊ/ is [+ATR], it is excluded from height harmony as are all [+ATR] vowels.

4.5 Conclusions

In this chapter we looked at two questions:

- Is there a relationship between vowel inventory and ATR harmony cross-linguistically?
- Can we account for the apparent gaps in vowel harmony in the Mbam languages by using language-specific feature hierarchies to identify which features are phonologically active and which are phonologically inert?

4.5.1 The relationship of vowel inventory and ATR harmony.

Casali (2003, 2008) gives good typological evidence that there is a strong correspondence between vowel inventory and tongue-root harmony, so that [+ATR]

[282] Refer to chapter 2, section 2.7.3. Some speakers idiosyncratically lower /ʊ/ even in open syllables. The tendency to phonetically lower the [-ATR] high vowels is a common occurrence in many of the Mbam languages, and as we have seen elsewhere, acoustically it has, even in its non-lowered form, a rather high F1.

is normally dominant in languages with an [ATR] contrast among high vowels, whereas [-ATR] generally serves as the dominant value in languages in which [ATR] contrasts only for non-high vowels (Casali 2003: 307).

Previous studies of the Mbam languages (Nen, Yangben[283] and Gunu in particular) seem to contradict Casali's findings of a correspondence between vowel inventories and ATR harmony, as all previous studies of the Mbam languages have analysed these as 7-vowel systems with contrast in the non-high vowels *and* robust dominant [+ATR] harmony. However, almost all these studies also posit an underlying or a historical 9/10-vowel inventory. While there has been disagreement on this point, Casali's typological arguments lend credence to those theories which argue for an ATR contrast in the high vowels.

It is the premise of this study that, while certain vowels in the Mbam languages are realised phonetically and acoustically as rather low, notably /ɪ/ and /ʊ/, they function *phonologically* as high vowels. In other words, it is not the phonetic make-up which determines what a phoneme is, rather the phoneme is determined by its behaviour in the system. The behaviour of a phoneme in the system is a function of its contrastive features (Dresher 2009: 72). As a result, rather than having 7-vowel inventories with [+ATR] contrast in the non-high vowels and having a typologically atypical dominant [+ATR] harmony, these languages are better analysed as having an [ATR] contrast in the high vowels, and having a typologically expected dominant [+ATR] harmony.

4.5.2 Gaps in vowel harmony and language-specific feature hierarchies

Dresher (2009) argues that only phonologically active features are contrastive, and by extension, in the domain of vowel harmony, in that "harmony triggers should be contrastive features" (Dresher 2009: 175). In considering Mbam rounding harmony, the high back vowels /u/ and /ʊ/, although phonetically round, are not *contrastively* round. Roundness is a redundant feature for the high vowels and therefore inert and cannot trigger rounding harmony. The fact that /u/ and /ʊ/ do not participate in rounding harmony is phonetic evidence that the feature [round] is unspecified for the high vowels.

Dresher's (2009) contrastive-feature hierarchy also explains why languages with similar vowel inventories and even similar contrastive features may have rather different vowel-harmony processes. Within the feature hierarchy, certain features may apply only to a subset. In the cases of Yangben, Mbure and Baca, the second-highest features apply separately, the first of the set to the [+open] subset, the second to the [-open] subset, as illustrated in Table 83.

[283] Referred to as Kalong or Nukalonge in much of the literature.

Table 83: Comparison of Yangben, Baca and Mbure contrastive hierarchies

Yangben	[open] >>	+	[round >>	[front] >>	[ATR]
		--	[back] >>		[ATR]
Mbure, Baca	[open] >>	+	[back] >>	[round] >>	[ATR]
		--	[front] >>		[ATR]

The difference in the hierarchical order and to which subset each feature is applied accounts for the difference in vowel harmony between these languages. In Yangben, rounding and fronting harmony apply to the only vowel which is both [-round] and [-front], /a/. Both these harmonies target /a/ and cause it to assimilate to the contrastive feature wherever it occurs within the phonological word. As the high [-open] vowels have neither [round] nor [front] as contrastive features, they do not participate in rounding or fronting harmony.

The difference in the hierarchical order of features in Baca and Mbure cause the feature [front] to apply only to the high [-open] vowels. Since [front] is not a contrastive feature to distinguish /a/ from other vowels, it does not trigger fronting harmony. A minimal rounding harmony does occur in Mbure verb stems, which is consistent with the presence of [round] as a contrastive feature separating /a/ from the back vowels /ɔ/ and /o/. In the case of Baca, although it also has [round] applying to differentiate /a/ from /ɔ/ and /o/, it does not have any rounding harmony tendencies. Hence, while vowel harmony *must* be triggered by a contrastive feature, the presence of a contrastive feature doesn't obligate the presence of vowel harmony.

5
Classification of the Mbam languages

In this chapter, we will look into various methods of classifying the Mbam languages; in particular historic sound changes, structural changes and lexicostatistics in order to classify and further understand the differences in the vowel inventories and vowel-harmony systems of these languages.

5.1 Historical classification

In section 5.1.1, we will look at the diachronic vowel derivations from proto-Bantu, then, in sections 5.1.2, 5.1.3 and 5.1.4, the various sound changes in evidence, and finally, in section 5.1.5, we will present a possible analysis of the derivations of the Mbam languages from proto-Mbam.

5.1.1 Mbam diachronic vowel derivations from proto-Bantu.

The vowels of proto-Bantu,*į *i *e *a *o *u *ų, are generally considered to correspond with the phonetic vowels [i, ɪ, ɛ, a, ɔ, ʊ, u]. With this assumption in mind and for the ease of reading, this study will refer to the proto-Bantu vowels using these phonetic transcriptions.

Diachronically, the most straightforward derivations from proto-Bantu are in noun and verb stems with ***i *u** and ***a**, which generally have reflexes /i/, /u/ and /a/ in the Mbam languages. In the examples below, all words are included, even those which are not regular cognates of the proto-Bantu stem or have different lexical roots.

Example 369: Reflexes of proto-Bantu *i, *u and *a in Mbam languages

	language	**item**	**BLR 3**[284]	***gloss***
***i>i**	**PB**	***-bîì**	**6425**	***excreta***
	Nen	-pí		
	Maande	-bí		
	Yambeta	-bì		
	Tuki	-mí		
	Gunu	-bîì		
	Elip	-bí		
	Mmala	-bì		
	Yangben	-pì		

[284] The proto-Bantu reconstructed forms come from Bantu Lexical Reconstruction 3 (BLR3) database from the Royal Museum for Central Africa in Tervuren, Belgium: http://www.africamuseum.be/collections/browsecollections/humansciences/blr. The number in this column is the ID of the reconstructed PB form from BLR3.

	language	item	BLR 3[284]	gloss
	Baca	-pìh		
	Mbure	-pí		
	PB	***-dìbà**	**1025**	***water***
	Nen	-nífə́		
	Maande	-ɲífə́		
	Yambeta	-ní		
	Tuki	-tíjá		
	Gunu	-ìᵐpò		
	Elip	-ìᵐbì		
	Mmala	--- (-dígà)		
	Yangben	-òᵐb		
	Baca	-ìᵐb		
	Mbure	-ìᵐpʰ		
	PB	***-jínò**	**3472**	***tooth***
	Nen	-íɲə̀		
	Maande	-íɲə̀		
	Yambeta	-ìŋ		
	Tuki	-ìjó		
	Gunu	-íɲò		
	Elip	-íɲ		
	Mmala	-íɲ		
	Yangben	-ìɲ		
	Baca	-îj		
***u>u**	**PB**	***-tíkʊ̀** **var.*-tṵ́kʊ̀**[285]	**2917 (3105)**	***night***
	Nen	-lú		
	Maande	-ətú		
	Yambeta	-dúk		
	Tuki	-túː		
	Gunu	-dúgú		
	Elip	-dúg		
	Mmala	-dúg		
	Yangben	-túk		
	Baca	-túk		
	Mbure	-pɛ̀ɾ		

[285] It is from the variant rather than the main form that these tokens are derived.

language	**item**	**BLR 3**[284]	***gloss***
PB	***-túd-**	**3101**	***forge***
Nen	-lún-		
Maande	-tún-		
Yambeta	-tún-		
Tuki	-tún-		
Gunu	-dún-		
Elip	-dún-		
Mmala	-dún-		
Yangben	-tún-		
Baca	-tún-		
Mbure	-tùŋ-		
PB	***-gùbʊ́**	**1532**	***hippopotamus***
Nen	-ᵑgùpú		
Maande	-júbú		
Yambeta	--- (-gʊ́áŋ)		
Tuki	-dʒúwé		
Gunu	---		
Elip	-súb		
Mmala	-sùb		
Yangben	-súp		
Baca	-súp		
Mbure	-sùp		
PB	***-kúpà**	**2132**	***bone***
Nen	-ùhə́		
Maande	-úhə́		
Yambeta	-gú		
Tuki	-tí-[286]		
Gunu	-gúé-		
Elip	-gʊ̌gè		
Mmala	-kò		
Yangben	-kóó		
Baca	-kóh		
Mbure	-sɔ́hà		

[286] Both Tuki and Gunu have reduplicated stems. Only the reduplicant is indicated here.

	language	item	BLR 3[284]	gloss
***a>a**	**PB**	***-tátʊ̀**	**2811**	***three***
	Nen	-lálʊ́		
	Maande	-tátʊ́		
	Yambeta	-dáád		
	Tuki	-tátʊ́		
	Gunu	-dàdʊ́		
	Elip	-dád		
	Mmala	-dádʊ̀		
	Yangben	-tátʊ̀		
	Baca	-tát		
	Mbure	-táːt		
	PB	***-dà**	**773**	***abdomen***
	Nen	-nà		*intestines*
	Maande	-nà		
	Yambeta	--dɔ̀		
	Tuki	-nà		
	Gunu	-ɔ̀nà		
	Elip	-nɔ̀à		
	Mmala	-nà		
	Yangben	-nà		
	Baca	-ɲà		
	Mbure	-nà		
	PB	***-nyàmà**	**3180**	***animal***
	Nen	-ɲàmà		
	Maande	-ɲàmà		
	Yambeta	-ɲàm		
	Tuki	-nàmà		
	Gunu	-ɲàmà		
	Elip	-ɲàm		
	Mmala	-ɲàm		
	Yangben	-ɲàm		
	Baca	-jàm		
	Mbure	-ɲàm		

In some cases, where the proto-Bantu stem has both ***a** and ***i**, the reflex in some of the Mbam languages is the [+ATR] vowel, **ạ** /ə/. This primarily happens in Nen and Maande, and on one occasion in Tuki. Yangben, Mmala and Elip tend to have a reflex /a/ but in these cases, the ***i** has a [-ATR] reflex /ɪ/, as in the words for *leaf* and *two*. In the examples below, the ***a>ạ** process is underlined.

Example 370: Reflexes of PB *a...i and *i...a in the Mbam languages

	language	**item**	**BLR 3**	***gloss***
***a...i>ạ**	**PB**	***-kádí**	**1674**	***woman***
		comp.*-káíntʊ̀[287]	**(9300)**	
	Nen	-əⁿdú		
	Maande	-əⁿdʒú		
	Yambeta	-kíìd		
	Tuki	-kʊ́tʊ́		
	Gunu	-kɔ́dɔ̀		
	Elip	-gáⁿdʊ́		
	Mmala	-gáⁿdʊ́		
	Yangben	-kàⁿdʊ̀		
	Baca	-ká:ⁿd		
	Mbure	-káⁿd		
***i...a>ạ**	**PB**	***-dá**	**780**	***louse***
		var. *-ìdá[288]	**(9653)**	
	Nen	-ìnə́		
	Maande	-ìnə́		
	Yambeta	-náŋ		
	Tuki	-ìnə́		
	Gunu	-ìɲó		
	Elip	-ìɲì		
	Mmala	-ŋìní		
	Yangben	-pàl		
	Baca	-sɛ̂l		
	Mbure	-séɾ		
	PB	***-bàdí**	**36**	***two***
	Nen	-fàⁿdí		
	Maande	-fəⁿdí		
	Yambeta	-bààn		
	Tuki	-wá		
	Gunu	-àⁿdí		
	Elip	-áⁿdì		
	Mmala	-àⁿdì		
	Yangben	-àⁿdí		
	Baca	-áⁿtʃî		
	Mbure	-pàⁿd		

[287] While the BLR 3 main entry for this reconsturction is found in Zone A, it is hard to justify the *i>*ʊ variation. The complex form, also found in Zone A as *woman* may be the actual source in the Mbam languages. Interestingly, the word for man (male) is also a complex form, therefore, it is perhaps not so strange that *woman* should be complex as well.

[288] BLR 3 has this variant for Zone A only. Neither the main entry nor the other variant, ***-ná**, lists that they occur in Zone A.

	language	item	BLR 3	gloss
***a...i>a**	**PB**	***-jánì**	**1567**	***leaf***
	Nen	-á^{n}dʒì		
	Maande	-áɲí		
	Yambeta	-áŋánán		
	Tuki	-àní		
	Gunu	-á^{n}tʃì		
	Elip	-ǎɲ		
	Mmala	-ǎɲ		
	Yangben	-àɲ		
	Baca	-àɲ		
	Mbure	-kás		

The PB ***ɔ** generally has the reflex /ɔ/ in the Mbam languages; although in a few cases /ʊ/ also occurs.

Example 371: Reflexes of PB *ɔ in the Mbam languages

	language	item	BLR 3	gloss
***ɔ**	**PB**	***-tɔ́**	**2954**	***ashes***
	Nen	-ɔ̀lɔ́		
	Maande	-ʊ̀tá		
	Yambeta	-dɔ̀		
	Tuki	-tʊ́		
	Gunu	-dɔ̂		
	Elip	-dɔ́		
	Mmala	-dɔ́		
	Yangben	-tɔ́		
	Baca	-tɔ̂		
	Mbure	-tɔ́		
	PB	***bɔ́kɔ̀**	**260**	***arm, hand***
	Nen	-kátá		
	Maande	-ɔ̀bɔ́		
	Yambeta	-pɔ̀k		
	Tuki	-bɔ̌		
	Gunu	-bɔ́gɔ̀		
	Elip	-bɔ́g		
	Mmala	-bɔ́g		
	Yangben	-pɔ̀k		
	Baca	-pɔ̂k		
	Mbure	-kàɾ		

In some PB stems, with ***i** or ***u** as a second vowel, ***ɔ** often has the reflex /o/. The ***ɔ>o** variation is underlined in Example 372 below.

Example 372: Reflexes of PB *ɔ...u and *ɔ...i in Mbam languages

	language	**item**	**BLR 3**	***gloss***
***ɔ**	**PB**	***-kɔ́bú**	**1865**	***navel***
	Nen	-ló		
	Maande	-tó		
	Yambeta	-tòk		
	Tuki	-tɔ́^{n}dɔ́		
	Gunu	-dégù		
	Elip	-dégù		
	Mmala	-dégú		
	Yangben	-tèkù		
	Baca	-ték		
	Mbure	-ték		
***ɔ**	**PB**	***-jɔ̀nì**	**1627**	***bird***
		var. *-nɔ̀dì	**(2285)**	
	Nen	-nòní		
	Maande	-nòɲí		
	Yambeta	-sàk		
	Tuki	-nôːní		
	Gunu	-nòní		
	Elip	-nòɲì		
	Mmala	-nòní		
	Yangben	-nòní		
	Baca	-nòɲó		
	Mbure	-nòn		
***ɔ**	**PB**	***-gɔ̀dí**	**1417**	***string***
	Nen	-kòlí		
	Maande	-kòlí		
	Yambeta	-wòò		
	Tuki	-èɾí		
	Gunu	-èlí		
	Elip	-ólì		
	Mmala	-ólì		
	Yangben	-òlí		
	Baca	-ɡòlʊ́		
	Mbure	-káhì		

The sound changes ***ɔ**> /o/ and ***a**> /ə/ mentioned above are evidently the result of [ATR] harmony. Stewart (2000: 51-3) proposes that an initial sound change from PB to proto-Nen must have included [+ATR] spreading, this sound change is summarised in Example 373.

Example 373: Stewart's (2000: 51-3) proto-Nen [+ATR] spread

PB	*i	*ɪ	*ɛ	*a	*ɔ	*ʊ	*u
[+ATR] spread	i	ɪ/i	ɛ/e	a/ə	ɔ/o	ʊ/u	u

5.1.2 Origins of ATR harmony and proto-Bantu *i (and *u)

ATR is historically derived from dominant ***i** (and to a lesser extent ***u**). Kutsch Lojenga (2009: 4-6) in her study of certain Bantu languages of the Great Lakes Region and a little beyond in the Democratic Republic of Congo (DRC), Uganda, and Tanzania finds that there are five [+ATR] suffixes which all relate to proto-Bantu forms with the extra high vowels ***i** and ***u.**[289] These [+ATR] suffixes will often trigger ATR harmony in various languages. In the Mbam languages, only the Agentive ***-i** and the causatives ***-i** and ***-ici** trigger ATR harmony. These suffixes are as follows:

Table 84: Proto-Bantu suffixes which may trigger ATR harmony

Agentive ***-i**	(Schadeberg 2003: 80)
Causative ***-i** and ***-ici**	(Schadeberg 2003: 73)
Perfective / Past ***-ide**	(Nurse 2003: 96)
Adjectiviser ***-u**	(Schadeberg 2003: 81)
Plural Addressee ***-Vni**	(Nurse 2008: 277)

What is it about /i/ and /u/ that makes them the best candidates to introduce ATR harmony? Are there any acoustic or articulatory reasons why these vowels should trigger tongue-root harmony? While acoustic studies of ATR harmony show that F1 is probably the most reliable acoustic correlate between [+ATR] and [-ATR] vowel pairs, it is not evident that even though, the F1 values of /i/ and /u/ are lower than the F1 values of /e/ and /o/, they should trigger the genesis of ATR harmony.

As concerns the question of what makes /i/ and /u/ the best candidates to introduce ATR harmony, Archangeli and Pulleyblank (1994) posit that vowel height and ATR are related and that, if a vowel is high, it will also be [+ATR]. This HI/ATR constraint "... expresses the optimal enhancement relation between highness and advancement" (Ola 2001: 118-9). As both height and ATR affect F1 values to the extent that [+high] [+ATR] vowels always have the lowest F1 values, could it be that this "optimal enhancement" between height and ATR is the reason the high vowels synchronically trigger ATR harmony and diachronically are responsible for the evolution of ATR harmony?

In regards to articulatory reasons why the high vowels should trigger tongue-root harmony, Ladefoged and Maddieson (1996: 300-1) show x-ray tracings redrawn

[289] The vowels of proto-Bantu,*į *i *e *a *o *u *ų, are generally considered to correspond with the phonetic vowels [i, ɪ, ɛ, a, ɔ, ʊ, u]. With this assumption in mind, for the ease of reading, this study will refer to the PB vowels using the phonetic transcription.

from Lindau (1975) of the articulatory positions of non-low vowels in the Akan dialect Akyem. These x-ray tracings show that the tongue-root advancements of /i/ and /u/ are greater than that of /e/ and /o/. Could the more extreme advancement of the tongue root be a possible reason why /i/ and /u/ are the best candidates to introduce ATR harmony historically?

It is interesting to note that these same two vowels, *i and *u also trigger other phonological phenomena such as spirantisation. “Meinhof's term 'heavy vowels' was intended to catch the mysterious property of his reconstructed vowels *i and *u to trigger spirantisation” (Schadeberg 1994/95: 75). More recently, Maddieson (2003) suggests that “... the distinctive characteristic of these original vowels was ... an unusually narrow constriction nearly consonantal in character” (Maddieson 2003: 19-20). This narrow constriction gives rise to a “noisy release” of a stop which is assumed to be the genesis of assibilation or “spirantisation” in various Bantu languages (Bostoen 2008: 309). Fricative vowels such as those found in Mambila in Cameroon are also considered derived from the proto-Bantu super-close vowels *i and *u (Ladefoged and Maddieson 1996: 314).

However, this view is not universally accepted. Bostoen argues that “The major objection against these theories is the fact that such ‘super-close’ vowels are nowhere (convincingly) attested in Bantu today. Phonetically speaking, the highest vowels in all present-day 7V languages are always [i] and [u]...” (Bostoen 2008: 307).

Whether the proto-Bantu vowels ***i** and ***u** were “super-high” or, phonetically speaking, like the present day [i] and [u] is a question that cannot be answered here. Of interest is that the proto-Bantu suffixes which may trigger spirantisation are generally the same as the suffixes which may trigger ATR harmony (compare Table 85 with Table 84, above), and generally have reflexes of *i and *u. Bostoen (2008: 311-2) lists four proto-Bantu suffixes which trigger spirantisation as a morphological alternation; all four are also implicated in triggering ATR harmony:

Table 85: proto-Bantu suffixes which often trigger spirantisation
1) the agentive suffix ***-i**
2) the causative suffix ***-i**
3) the perfect and/or past tense suffix ***-ide**
4) the adjectival derivation suffix ***-u**

Maddieson (2003: 20-1) raises the question of how “... the role of ATR interacts with ... the nature of the high vowels, as the *super-high/*high contrast might have been an expression of an ATR contrast, or transformed into one in daughter languages” (Maddieson 2003: 20-1).

While many of the Bantu languages have undergone spirantisation and, a subsequent a seven-to-five (7>5) vowel merger, a number of other languages took a different path involving ATR spreading to a 7>9/10 vowel system and ATR harmony (cf. Hyman 2003, among others). Stewart (2000: 51-3), in effect, proposes such a sound change from proto-Bantu to proto-Nen.[290]

It is interesting to note that in one Mbam language, Mbure, both ATR harmony and spirantisation/assibilation/aspiration occur distinguishing between the proto-Bantu ***i**, ***u** and ***ɪ**, ***ʊ**.

In Mbure, a high [+ATR] vowel will trigger aspiration or assibilation of the preceding stop. The vowel itself is sometimes reduced to mere aspiration or assibilation on the occlusive. The [-ATR] high vowels do not cause aspiration/assibilation, as in Example 374.

Example 374: Aspiration of Mbure occlusives preceding /i/ and /u/

surface forms			**underlying form**	***gloss***
kʰùtʰùɾ	~	kʰtʰùɾ	kù≠tùɾ	*dull (v)*
kʰùbʰítʰíbʰínì	~	kʰpʰítʰpʰínì	kù≠pít-íp-ín-ì	*make dirty*
ǹtʰú			ǹ≠tú	*ear*
kʰìpʰùg-è	~	kʰpʰugè	kì≠pùk-à	*close*
jòtʰìnè	~	jòtʰnè	j≠òtìnè	*star*
kʊ̀kʊ́ŋà			kʊ̀≠kʊ́ŋ-à	*hunt (v)*
kìpʊ̀má			kì≠pʊ̀má	*dust*
kìdídīmà			kì≠tí-tímà	*butterfly*
kĩ̀ĩ̀			kĩ̀≠ĩ̀n	*yam sp.*
màbìdìgà			mà≠pìt-ìk-à	*think (v)*

Of all of the Mbam languages, Mbure is the only one where the phonetic distance between the high vowels is very small, whereas in most of the other languages,[291] the distance between the high vowels is so large that the [-ATR] high vowels are perceptibly closer phonetically to the mid vowels. The aspiration/assibilation on consonants preceding [+ATR] high vowels in Mbure gives an additional phonetic clue distinguishing the [+ATR] from the [-ATR] high vowels.

There are many tantalising hints concerning whether the acoustic and/or articulatory characteristics of the high vowels, /i/ and /u/, shed light on why they are the best candidates for introducing ATR harmony. We have seen diachronically that the proto-Bantu extensions with ***i** and ***u** are most likely not only to trigger ATR harmony, but also spirantisation/assibilation in the daughter languages. While this

[290] Stewart is specifically looking at Nen in his article, but one could expand this analysis to include proto-Mbam. Stewart's (2000) study of Nen is discussed in greater depth in Chapter 5.
[291] Elip is the only other exception, and it has an allophone of /ɪ/, [ɛ] occuring in certain contexts.

study can not give a definitive response to any of these questions, it is hoped that its contribution will lead to the greater understanding of vowel harmony in general.

5.1.3 Sound change: from ɪ, ʊ to e, o?

Many of the Mbam languages have the same vowel inventory as Nen, so a further discussion of Stewart's (2000) analysis of Nen with an eye to the other 8-vowel Mbam languages is in order.

In comparing Nen vowels with the proto-Bantu vowels, Stewart (2000: 47-53) posits a series of sound changes and arrives at a vowel inventory for Nen of seven vowels /i, ɛ, ə, a, ɔ, o, u/. The sound change which is the most important for this study is the one that posits a change from **ɪ**, **ʊ** to **e**, **o**, with a later lowering of **e** to **ɛ** in stems. In prefixes, Stewart (2000: 55) claims that the vowel **e** still occurs in the context of [-ATR] noun roots that do not have the vowel **ɛ**. My analysis of the synchronic situation, however, is different from Stewart's.

Based on my own acoustic and phonological research, the vowel ***ʊ** in proto-Bantu stems, in most instances, corresponds with /ʊ/ in Nen. Although there are a few examples were found where PB ***ʊ** corresponds with /ɔ/. Where a proto-Bantu stem has ***i** or ***u** as an additional vowel, often,[292] ***ʊ** has the reflex /u/ in Nen.

Example 375: Reflexes of proto-Bantu *ʊ in Nen

	gloss	**proto-Bantu**	**BLR3 ID**	**Boyd**	**Stewart/Van Leynseele 1979**
*ʊ>ʊ	*to wash*	*-cʊ̀k-	711	-sʊ́	-sʊ̀
	to fight	*-dʊ̀	1150	-nʊ̀	-nʊ̀
	to bite	*-dʊ́m-	1181	-nʊ́m-	-nʊ́m-
	head	*-tʊ́è	3023	-lʊ́á	-lʊ́
	hair (body)	*-bʊ̀dì	369	-hʊ̀tá	---
	dog	*-bʊ́à	282	-mʊ́à	---
	to be dry	*-kʊ́t-	5215	-kʊ́t	---
	three (3)	*-tátʊ̀	2811	-lálʊ́	-làl[293]
	to send	*-tʊ́m-	3055	-lʊ́m-	---
	to fall	*-gʊ̀	1466	-kʊ̀	-kɔ̀
	leg	*-gʊ̀dʊ̀	1490	-kʊ̀lʊ́	---
*ʊ>ɔ	*nose*	*-jʊ́dʊ̀	1620	-ɔ̂nɔ̀	-ɔ́n
	pig	*-gʊ̀dʊ̀bè	1494	-kɔ̀nífí	---
*ʊ>u	*ear*	*-tʊ́ì	3030	-lúə́	---
	goat	*-bʊ́dì	303	-múíɲí	---

[292] There are exceptions, e.g. *-bʊ̀dì *body hair* in the examples given.
[293] From Stewart 2000: 52.

The other Mbam languages follow a similar pattern, with ***ʊ** corresponding to either /ʊ/ or /ɔ/ (underlined in Example 376 below).

Example 376: Reflexes of PB *ʊ in the other Mbam languages

	language	**item**	**BLR 3**	***gloss***
***ʊ**	**PB**	***-dʊ́m-**	**1181**	***bite***
	Nen	-nʊ́m-		
	Maande	-nʊ́m-		
	Yambeta	-nʊ́m-		
	Tuki	-nʊ́m-		
	Gunu	-nʊ́m-		
	Elip	-nʊ́m-		
	Mmala	-nʊ́m-		
	Yangben	-nʊ́m		*cling to teeth*
	Baca	-nɔ́m-		
	Mbure	-nɔ́m-		
***ʊ**	**PB**	***-gʊ̀**	**1466**	***fall***
	Nen	-kʊ̀		
	Maande	-kʊ̀-		
	Yambeta	-tə́ə̀ŋ-		
	Tuki	-dúm-		
	Gunu	-ʊ̀b-		
	Elip	-gʊ̀-		
	Mmala	-gʊ̀-		
	Yangben	-kʊ̀-		
	Baca	-kʊ̀-		
	Mbure	-kʊ̀w-		
***ʊ**	**PB**	***-gʊ̀dʊ̀**	**1490**	***leg***
	Nen	-kʊ̀lʊ́		
	Maande	-kʊ̀lʊ́		
	Yambeta	-gʊ̀ʊ̀		
	Tuki	-gʊ̀ɾʊ́		
	Gunu	-gɔ́^{n}dɔ́		
	Elip	-gɔ́^{n}d		
	Mmala	-gɔ́^{n}dɔ́		
	Yangben	-kɔ́^{n}d		
	Baca	-kɔ́^{n}d		
	Mbure	-kɔ̀^{n}d		

language	item	BLR 3	gloss
PB	***-kʊ́t-**	**5215**	***to be dry***
Nen	-kʊ́t-		
Maande	-kʊ́t-		
Yambeta	-kɔ́s-		
Tuki	-kʊ́t-		
Gunu	-kʊ́t-		
Elip	-gʊ̀d-		
Mmala	-gʊ̀d-		
Yangben	-kʊ́t-		
Baca	-kɔ́t-		
Mbure	-kóɲ-		

As with other vowels where a proto-Bantu stem has ***i** or ***u** as an additional vowel, *ʊ often has a reflex /u/ in the Mbam languages.

Example 377: Reflexes of PB *ʊ...i in the Mbam languages

	language	item	BLR 3	gloss
***ʊi**	**PB**	***-tʊ́ì**	**3030**	***ear***
	Nen	-lúə́		
	Maande	-ə̀tú		
	Yambeta	-tʊ́ìŋ		
	Tuki	-tú		
	Gunu	-dû		
	Elip	-dú		
	Mmala	-dú		
	Yangben	-tù		
	Baca	-tû		
	Mbure	-tú		
***ʊ...i**	**PB**	***-bʊ́dì**	**303**	***goat***
	Nen	-múíɲí		
	Maande	-búɲì		
	Yambeta	-bʊ̀m		
	Tuki	-búíní		
	Gunu	-búɲè		
	Elip	-búíɲì		
	Mmala	-búɲ		
	Yangben	-púɲ		
	Baca	-bûɲ		
	Mbure	-pùn		

The non-back vowels present another problem. While Stewart's **ʊ>o** merger is excluded based on acoustic data which shows the current existence of both vowels in Nen and the other 8-vowel Mbam languages, the same cannot be said for his **ɪ>e** merger. All previous analyses of Nen present only four contrastive non-back vowels **i**, **ɛ**, **ə**, **a**. A very straightforward diachronic explanation would be as Stewart proposes:

*i > i
*ɪ > e > ɛ
*ɛ > ɛ
*a > a, ə

However, as this study has shown, non-back vowels are in reality /i, ɪ, ə, a/, and the proto-Bantu ***ɛ** reflex is generally /ɪ/, or as is also the case, /a/ in Nen. Where the gloss in Nen differs slightly from the proto-Bantu, the Nen gloss is added.

Example 378: Reflexes of PB *ɛ in Nen

	gloss	**P-Bantu**	**BLR3**	**Nen**	***gloss***
*ɛ>ɪ	*sand*	*-cɛ̀kɛ̀	528	-sí	
	walk, travel	*-gɛ̀nd-	1362	-kɪ̀nd-	
	bell	*-gɛ̀ngɛ́dɛ́	1365	-ŋgɪ́ŋɪ́	
	cricket	*-jɛ́njɛ́	1583	-ɪ̀ndʒɪ́	*cockroach*
	(der. cockroach)		(3311)		
	blow (wind)	*-pɛ́p-	2463	-fɪ́f-	*blow, fan*
	slip	*-tɛ̀dɪd	2817	-tɪ̀l-	*slip, smear*
	put pot on fire, stand up (TR)	*-tɛ́dɪk (*-tɛ́dam)	2821 (2816)	-tɪ́nɪ́m-	*stand, get up*
*ɛ>a	*be honoured*	*-dɛ̀m[294]	907	-ɲàm- -ɲə̀m-ɪ̀-ə	*be famous* *to honour*
	molar tooth	*-gɛ̀gɔ̀	1355	-kà	*molar*
	cut	*-kɛ̀t-	1782	-kà-	*chop up*

Unlike the back vowels, where the proto-Bantu derived vowels reflect rather closely the modern Mbam reflexes, the proto-Bantu derivations of the non-back vowels are not so close. The proto-Bantu ***ɛ** has a wider range of reflexes, including **a**, **ạ** and **ɪ**. Several languages have reflexes which may not be regular cognates of the proto-Bantu stem, despite their similarity. Reflexes with /ɪ/ or /ɛ/ are italicised, reflexes with **a** or its [+ATR] counterpart **ạ** (/ə/ or /e/) are underlined in Example 379.

[294] The verb -lɛ̀m- *be heavy* in Nen is also derived from the PB *-dèm. Apparently -lɛ̀m- does not have the connotation *be honoured.*

Example 379: Reflexes of PB *ɛ in the Mbam languages

	language	item	BLR 3	gloss
***ɛ**	**PB**	***-cɛ̀kɛ̀**	**528**	***sand***
	Nen	*-sí*		
	Maande	-síbíá		
	Yambeta	--- (-sájín)		
	Tuki	*-tʃìtʃìɾì*		
	Gunu	--- (-sánánà)		
	Elip	*-sílìg*		
	Mmala	--- (-sánɔ́)		
	Yangben	*-sɛ́lɛ̀k*		
	Baca	*-sɛ̀lɛ̀k*		
	Mbure	--- (-sásáán)		
***ɛ**	**PB**	***-dɛ̀dù**	**897**	***beard, chin***
	Nen	-tə́lù		*chin*
	Maande	-^{n}dʒə̀lú		*chin*
	Yambeta	-às		*chin*
	Tuki	-àsó		*chin*
	Gunu	---		
	Elip	-sèlù		*chin*
	Mmala	-sèlú		*chin*
	Yangben	-sèlú		*chin*
	Baca	-kègé		*chin*
	Mbure	-^{n}dʒèɾì (-às)		*beard (chin)*
***ɛ**	**PB**	***-tɛ́dɪk** **der *-tɛ́dam**	**2821** **(2816)**	***put pot on fire,*** ***stand up(TR)***
	Nen	*-tíním-*		*redress*
	Maande	-tálím		*stand*
	Yambeta	*-tíím-*		*stand up*
	Tuki	-tíɾîn-		*put pot on fire*
	Gunu	*-dílìm-*		*stand*
	Elip	-délím-		
	Mmala	-délím-		
	Yangben	-téɲ-		
	Baca	-téɲíb-		
	Mbure	-tí^{m}b-		

	language	**item**	**BLR 3**	***gloss***
***ɛ**	**PB**	***-bɛ́ɛ̀dɛ̀**	**125**	***breast***
	Nen	-pɔ́^{m}bì		
	Maande	-bánà		
	Yambeta	-dʊm		
	Tuki	-bání		
	Gunu	*-pínì*		
	Elip	-bánà		
	Mmala	-bánà		
	Yangben	*-pɛ́nɛ̀*		
	Baca	*-p^{j}ɛ́nɛ̀*		
	Mbure	-ɲúk		
***ɛ**	**PB**	***-gɛ̀nd-**	**1362**	***walk, travel***
	Nen	*-kìnd-*		
	Maande	-kànd-		
	Yambeta	-táŋ-		
	Tuki	-ndìnd-		
	Gunu	*-ìnd-*		
	Elip	-ànd-		
	Mmala	-ànd-		
	Yangben	*-ɛ̀nd-*		
	Baca	*-ɛ̀nd-*		
	Mbure	*-ɛ̀nd-*		

Furthermore, proto-Bantu ***ɪ** also has a reflex /ɪ/ in Nen. Rather than Stewart's sound changes, one finds that both proto-Bantu ***ɪ** and ***ɛ** both have reflexes /ɪ/ in Nen.

Example 380: Reflexes of PB *ɪ in Nen

*ɪ>ɪ	*boil up*	*-bíd	181	-fìn-
	eat	*-dí	944	-ní
	cry, wail	*-dìd	959	-lìl-
	tree	*-tí	2881	-lí
	heart	*-tímà	2895	-límá

In the Mbam languages with eight or fewer vowels, ***ɪ** generally has a reflex /ɪ/; in those languages with nine vowels, the proto-Bantu ***ɪ** will have a reflex in either /ɪ/ or occasionally /ɛ/. In Example 381, the words with a reflex /ɪ/ are underlined. The few cases of an /ɛ/ reflex of ***ɪ** are underlined below.

Example 381: Reflexes of PB *ɪ in the other Mbam languages

	language	item	BLR 3	*gloss*
***ɪ>ɪ**	**PB**	***-dí**	**944**	***eat***
	Nen	-ní-		
	Maande	-ɲí-		
	Yambeta	-ní-		
	Tuki	-ɲí-		
	Gunu	-ɲí		
	Elip	-ɲí-		
	Mmala	-ɲí-		
	Yangben	-ɲì-		
	Baca	-ɲì-		
	Mbure	-ɲí-		
***ɪ>ɪ/ɛ**	**PB**	***-tí**	**2881**	***tree***
	Nen	-lí		
	Maande	-ìtí		
	Yambeta	-ìd		
	Tuki	-ɾítí		
	Gunu	-ítì		
	Elip	-dí		
	Mmala	-dîd		
	Yangben	-tɛ́		
	Baca	-àsá		
	Mbure	-ᵐbúm		
***ɪ>ɪ/ɛ**	**PB**	***-tímà**	**2895**	***heart***
	Nen	-límá		
	Maande	-tímá		
	Yambeta	-tím		
	Tuki	-tímá		
	Gunu	-dímá		
	Elip	-dím		
	Mmala	-dìm		
	Yangben	-tím		
	Baca	-tʃɛ́m		
	Mbure	-tím		

A further indication that, while the ***ɛ>ɪ** reflex seems odd, Nen verbs derived from ***ɛ** will go to /i/ with the [+ATR]-dominant causative suffix in the same fashion that verbs derived from *ɪ go to **/i/** with the causative suffix, as seen in Example 382. In the 9-vowel Mbam languages, verbs derived from proto-Bantu *ɛ tend to have a reflex /e/ with the causative, not /i/.

Example 382: Reflexes of PB *ɛ and *ɪ with the causative in Nen

	gloss	**PB**	**BLR 3**	**Nen V**	**der. V**	*gloss*
*ɛ>ɪ	*walk*	*-gɛ̀nd-	1362	-kìnd-	-kìnd-ì-ə̀	*cause to walk*
	stand	*-tɛ́dɪk	2821	-tíním-	-tín-ím-ì	*to redress,*
	TR	(*-tɛ́dam)	(2816)			*straighten*
*ɪ>ɪ	*boil up*	*-bíd	181	-fìn-	-fìn-ì-ə̀	*boil (food)-CAUS*
	eat	*-dí	944	-ní-	-ní-ə́s-ì-ə̀	*eat (CAUS)*

5.1.4 Sound change: e >ə?

In this section, Stewart's (2000) proposed sound changes and mergers account for the changes from proto-Bantu, through proto-Nen to present-day Nen. In this section, his proposal is described and discussed. This study builds on Stewart's analysis for the diachronic sound changes in Nen, and by extension, the other Mbam languages which will be presented in detail in section 5.1.5 below.

While in many of the studies on Nen (especially in Dugast 1971), the [+ATR] vowel **e** is present, most studies either account for it in a sound change (i.e. **e** >**ə** as in Stewart 2000: 53, simply ignore it (De Blois 1981: 12: “Roots having [e] as the only vowel are very restricted in number and will be left out of discussion”). The existence of the vowel **e** in modern-day Nen is doubtful. The various analyses in previous studies of the vowel **e** are discussed briefly.

Dugast contrasts **e** and **ə**, but she (1971: 29) admits that “... /e/ apparaît rarement dans les radicaux des substantifs...” She lists only a few words, many of which are derived forms. For the others, where she lists “e”, my databases have /ə/, some examples are found in:

Example 383: Comparison of words with “e” in Dugast (1971)

Gloss	Dugast (1971: 33)	Boyd		
uncle	ì-sen	ì≠sə̀n		
give birth	-bíen	-pʲə́n-		
field of yams	ì-ten	ì≠tə́ní		
fly swatter	bù-kiek-i	from	ì≠kʲə̀	*fly*
lion	ŋgwêy	ì≠ŋə̀ⁿdə́		

Dugast also admits that in many words, there is “une réalisation intermédiaire” between /ə/ et /e/. This “réalisation intermédiaire” of Dugast is similar to other synchronic variations in a number of the Mbam languages. While some, like Maande and Yambeta, clearly have a central [+ATR] vowel /ə/ (although in both instances, it is written in the orthography as **e**), in other languages such as Yangben (or Kalɔŋ: Hyman 2003a) and Gunu, as Robinson (1984: 50) found: -Chez certains locuteurs la réalisation (du phonème /e/) est légèrement centralisée.” This being the case, [e] is likely a realisation of the central [+ATR] vowel /ə/.

Stewart (2000: 54-5), using data from Dugast (1967, 1971), found a lowering of certain Nen prefixes (those with **e-**) before a stem vowel **ɛ.** While the vowel /ɪ/ is acoustically rather low, it is also quite widespread in its acoustic space. While I do not doubt that there is some phonetic variation, I found no evidence in my databases or acoustic analysis of a lowering such as Stewart found. Stewart's examples are as follows:

Stewart (2000: 55)	Boyd	*gloss*
nɛ̀-sɛ̀k	nì≠síkí	*termite*
nè-bàt	nì≠pàtà	*cloth*
né-hɔ̀k	nì≠hóká	*axe*
nè-bók	nì≠pókà	*forehead*
nì-bíl	nì≠pílə̀	*palm tree*
nì-fù	nì≠fʷə́	*bundle*

Stewart (2000: 53-4) therefore suggests an additional sound change, merging /e/ from proto-Bantu ***ɛ** and /ə/ from ***a** due to [+ATR] spread. In support of this, he shows a few cases where proto-Bantu ***ɛ** has the reflex /ə/ in Nen.

As seen above, when proto-Bantu has ***i** or ***u** in the stem (often, but not always in final position), a non-high vowel in the same stem has a reflex that is [+ATR] in Nen. In Example 384, the low vowels are bolded in both the proto-Bantu derivation and the [+ATR] reflex in Nen.

Example 384: [+ATR] reflexes of PB low vowels in Nen

*a>ə	*give birth*	*-bí**a**d-	226	-pí**ə́**n-	
	name	*-jín**à**	3464	-íɲ**ə̀**	
*ɔ>o	*string*	*-g**ɔ̀**dí	1417	-k**ò**lí	*string, thread*
	bird	*-jɔ̀nì	1627	-n**ò**ní	
		var. *-n**ɔ̀**dì	(2285)		
	navel	*-k**ɔ́**bú	1865	-l**ó**	
*ɛ>ə	*elephant*	*-jɔ̀gù	1607	-s**ə̀**kù	
		var. *-j**ɛ̀**gù	(1580)		
	beard	*-d**ɛ̀**dù	897	-t**ə́**lù	*chin*

There are instances where ***ɛ** has a reflex /ə/ in Nen where there is not an obvious high vowel in the proto-Bantu stem:

speak	*-dɛ́b-	7745	-jə́m-	*speak*
father (his)	*-cɛ́	501	-sə́	*father*

After [ATR] spread, Stewart (2000: 53) proposes three sound changes to arrive at his inventory of vowels for Nen 1) **ɪ, ʊ>e, o** 2) **e>ə** and 3) **stem e>ɛ**. In this manner, he accounts for the **ɛ/i** ATR harmony pair. A fourth change is the ouster of the **ɛ/ə** harmony pair in lexical items. With these changes, Stewart arrives at a Nen inventory of i ɛ/i,[295] a/ə, ɔ/o, o/u, u.

In light of the other Mbam languages, however, a different analysis is possible, which fits the wider data collected from the ten Mbam languages discussed in this study.

5.1.5 Towards proto-Mbam

Stewart (2000) proposes three sound changes to arrive at his inventory of vowels for Nen 1) **ɪ, ʊ>e, o** 2) **e>ə** and 3) stem **e>ɛ**. This study presents a different analysis for each of these proposals. Stewart's first sound change, **ɪ, ʊ>e, o**, is excluded since my data shows evidence that **ɪ** and **ʊ** are present in modern-day Nen as well as in all of the other Mbam languages. It is rather **e** and, in the case of Tuki, also **o** which are lost rather than the high vowels. Stewart's second sound change, **e>ə**, is plausible but unnecessary and the presence of **ə** can be more simply accounted for as the [+ATR] counterpart of /a/ without other sound change necessary. The third sound change, stem **e>ɛ**, is excluded since in my data, there is no reflex /e/ of either ***ɛ** or ***ɪ**, as seen in the discussion above. In this section I present my proposal of the sound changes from proto-Mbam.

Following Hyman's (2001, 2003a) and Dresher's (2009) idea of identifying only those features which are "phonologically active" in the vowel system, using either Hyman's four features: ATR, front, round and open or Dresher's contrastive-feature hierarchy, most of the Mbam languages which have nine contrastive vowels have a "phonologically active" feature [front] and those with eight or fewer vowels lack a "phonologically active" feature [front].

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[295] Stewart (2000: 54) does claim that ɛ/ə occurs in "the diminutive extention **-ɛl/-əl**" only. The situation, however, isn't so easy as this. There is no phonological conditioning as there were, or still are, two different extensions which are similar: one is **-ɪl/-il** (possibly a reflex of ***-id** (nº2188)) and the other **-al/-əl** (/-ɔl/-ol) (possibly a reflex of ***-ad** (an expansion or ill-defined suffix (Meeussen 1967: 90)). Another possibility is that **-al/-əl** may be a reflex of ***-at**. One word has been found which contains both extenstions: ʊ̀≠tʊ́ᵐb-**ál**-<u>ɪ̀l</u>-à *approach s.o.* (from the verb ʊ̀≠tʊ́ᵐb-à *pass, succeed*). Below is a paradigm of all the forms found in the corpus with each extension (bolded). While not all forms have been attested, there are enough examples to show the differences, as presented in the example below.

ù≠tìŋ-**ə̀l**-ə̀	*attach*	ù≠míŋ-**íl**-ə̀	*polish*
ʊ̀≠sɪ̀k-**àl**-à	*slice*	ʊ̀≠sɪ̀k-**ɪ̀l**-à	*winnow*
ʊ̀≠sál-**ál**-à	*whistle*	ʊ̀≠tát-**íl**-à	*wait*
ù-pí≠hʲə́ŋ-**ə́l**-ə̀	*soar*	---	---
ʊ̀≠tɔ̀ᵐb-**ɔ̀l**-à	*peel*	ʊ̀≠mʲɔ̀t-**ɪ̀l**-à	*press*
ù≠ɲòŋ-**òl**-ò	*tickle*	---	---
ʊ̀≠kʊ́p-**ál**-à	*insult*	ʊ̀≠tʊ́ᵐb-ál-**ɪ̀l**-à	*approach s.o.*
ù≠pùl-**ə̀l**-ə̀	*stir*	ù-pí≠kúp-**íl**-ì-ən-ə̀	*capsize, blow down*

While they could be allomorphs which are (exceptionally) not phonologically conditioned, the fact that they do co-occur in one stem gives credence to the argument that they were, at least historically, two differenct morphemes, despite dificulty of determining the difference in meaning.

Baca, with ten surface vowels, most closely resembles proto-Mbam after the [+ATR] spread from the proto-Bantu vowels. The hierarchy of contrastive features for Baca, as well as my proposal for proto-Mbam is as follows: open>>back/front>>round>>ATR, and illustrated in Table 86.

Table 86: Contrastive features for Baca and Mbure

i				**[ATR]**	**u**
ɪ	[front]				ʊ
[open]	**e** **[ATR]**		**o**		
	ɛ	a	ɔ		
		[back]	[round]		

The only sound change in Baca from proto-Mbam is the loss of contrast between the [+ATR] and [-ATR] low vowels **a/ạ**. While the [+ATR] vowel is still found as an allophone, it is no longer contrastive.

Table 87: Baca sound changes from PB

proto-Bantu	i	ɪ	ɛ	a	ɔ	ʊ	u
(1) [+ATR] spread	i	i/ɪ	ɛ/e	a/ạ	ɔ/o	ʊ/u	u
(2) Loss of contrast of ạ				(ạ)			
Baca	i	ɪ/i	ɛ/e	a/[ɜ]	ɔ/o	ʊ/u	u

While Mbure has the same contrastive-feature hierarchy as Baca (open>>back/front>>round>>ATR), it has an additional sound change. The third sound change proposed is the merger of ạ>e.[296] Mbure, Yangben and Mmala undergo this sound change.

Table 88: Mbure sound changes from PB

proto-Bantu	i	ɪ	ɛ	a	ɔ	ʊ	u
(1) [+ATR] spread	i	ɪ/i	ɛ/e	a/ạ	ɔ/o	ʊ/u	u
(3) Merger of ạ>e				a/e			
Mbure	i	ɪ/i	ɛ/e	a/e	ɔ/o	ʊ/u	u

The other 9-vowel languages, Yangben and Mmala, have similar vowel inventories and vowel features as Mbure, but their contrastive hierarchies differ from each other and from Mbure. Yangben's contrastive-feature hierarchy differs from the Mbure's contrastive-feature hierarchy by a change in the order of the features. The contrastive-feature hierarchy for Yangben is open>>round/back>>front>>ATR.

[296] While Mbure does have instances where /a/ may occur in [+ATR] contexts, this is discussed elsewhere and is not important here.

Table 89: Contrastive features for Yangben

i	**[ATR]**			**u**
ɪ			[back]	ʊ
[open]	**e** **[ATR]**		**o**	
	ɛ	a	ɔ	
	[front]		[round]	

An additional sound change evident in both Yangben and Mmala, namely, a gradient phonetic lowering of **ɪ** and **ʊ** in certain environments (sound change #4), as is seen in Table 90.

Table 90: Yangben and Mmala sound changes from PB

proto-Bantu	i	ɪ	ɛ	a	ɔ	ʊ	u
(1) [+ATR] spread	i	ɪ/i	ɛ/e	a/ạ	ɔ/o	ʊ/u	u
(3) Merger of ạ>e				a/e			
(4) Lower ɪ,ʊ (phonetic)		ɪ~ɛ				ʊ~ɔ	
Yangben, Mmala	i	ɪ/i	ɛ/e	a/e	ɔ/o	ʊ/u	u

While Yangben and Mmala have the same vowel inventory and have undergone the same sound changes, their contrastive hierarchies are very different. Instead of a contrastive feature, *front*, Mmala has a height feature *mid*. Mmala's contrastive feature hierarchy is then ATR>>open>> mid>>round/back.

Table 91: Contrastive features for Mmala

ɪ			[ATR]	i
ʊ			**[back]**	**u**
[open]	**ɔ**		**o** **[round]**	
	ɛ		e	
		[mid] a		

In the 8-vowel languages, another sound change is evident. Hyman (2001: 155) concludes that in Gunu, the feature [front] is not required in underlying representations. While certain vowels in a general sense are *front* vowels, the feature [front] is not active in the vowel system. All of the vowels in Gunu and the other 8-vowel languages can be accounted for with the contrastive feature hierarchy and is open>>round/back>>ATR

Table 92: Contrastive features for the 8-vowel Mbam languages

i	**[ATR]**		**u**
ɪ		[back]	ʊ
[open]		[round]	
	[ATR] **ə**	**o**	
	a	ɔ	

With the loss of [front], the gap left by its absence triggers the lowering of the [-ATR] high vowel. In Nen, /ɪ/ occurs only optionally (depending on the speaker) in certain noun-class prefixes, when not lowered by the vowel **ɔ** in the noun root.[297]

Table 93: Nen, Maande and Yambeta sound changes from PB

proto-Bantu	i	ɪ	ɛ	a	ɔ	ʊ	u
(1) [+ATR] spread	i	ɪ/i	ɛ/e	a/a̹	ɔ/o	ʊ/u	u
(5) Loss of feature: [front]			---				
(6) Lowering of ɪ>[ɛ]		ɛ/i					
Nen, etc.	i	ɛ/i	---	a/ə	ɔ/o	ʊ/u	u

However, among the 8-vowel languages, the situation of two, Elip and Gunu, is more complicated. Both Elip and Gunu have undergone a sound change similar to sound change #3 (a merger of a̹>e) as well as the loss of the feature [front], sound change #5. There are two possibilities for classifying these two languages:

- Elip and Gunu should be grouped with Yangben and Mmala as having undergone sound changes #1, #3 and #4, which precludes sound change #5, which they also seem to both have undergone, or
- Elip and Gunu should be grouped as a separate subgroup along with the other 8-vowel languages which have not undergone sound change #3, but have undergone sound changes #5 and #6.

Both these options have their difficulties. The first option would argue that the loss of the feature *front* in both Elip and Gunu would have come about later through contact. We will discuss this scenario in section 5.2 below.

The second option would have to account for the high F2 frequency of the [+ATR] counterpart of /a/ which surfaces in the acoustic space of [e] and for the limited and optional height harmony found in Elip. The latter is likely influenced by contact with Mmala.

In the latter scenario, the F2-raising of /ə/ can be perhaps attributed to either contact with the neighbouring languages to the south and/or maximising the acoustic space due to the loss of the feature *front* similar to the lowering of the high front vowel found in sound change #6. A seventh sound change is therefore proposed, that of the fronting or F2-raising of **ə**.

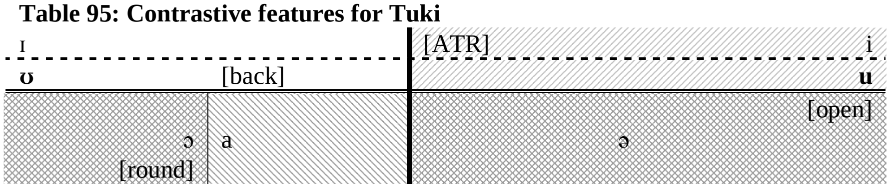
[297] Of the recordings of three Nen speakers, only one had a *slightly* lower F1 for noun-class 5 or 7 prefixes on [-ATR] nouns. The vowel [ɔ] in the noun root nullified this lowered F1 in the prefix, although it was still evident when [ʊ] was in the noun root.

Table 94: Possible Elip and Gunu sound changes from PB

proto-Bantu	i	ɪ	ɛ	a	ɔ	ʊ	u
(1) [+ATR] spread	i	ɪ/i	ɛ/e	a/a̹	ɔ/o	ʊ/u	u
(5) Loss of feature: [front]			---				
(6) Lowering of ɪ>[ɛ]		ɛ/i					
(7) “Fronting” or F2-raising of **ə**				a/e			
Gunu, Elip	i	ɛ/i	---	a/e	ɔ/o	ʊ/u	u

A final sound change is in process in the tenth language, Tuki. The open [+ATR] round vowel [o] is no longer contrastive. The vowel [o] occurs only as the [+ATR] allophone of /ɔ/. Tuki's contrastive feature hierarchy is: open>>ATR>>round/back.

Table 95: Contrastive features for Tuki



In Tuki, the vowel [o] does not occur in noun roots or verb stems unless another [+ATR] vowel is present. In these cases, it can be interpreted as a [+ATR] allophone of /ɔ/ within the root or stem.

Table 96: Tuki sound changes from PB

proto-Bantu	i	ɪ	ɛ	a	ɔ	ʊ	u
(1) [+ATR] spread	i	ɪ/i	ɛ/e	a/a̹	ɔ/o	ʊ/u	u
(5) Loss of feature: [front]				ə			
(6) Lowering of ɪ>[ɛ]		[ɛ]/i	---				
(8) Loss of contrast of o					(o)		
Tuki	i	[ɛ]/i	---	a/ə	ɔ/[o]	ʊ/u	u

We have discussed the sound changes which may have occurred from proto-Bantu to arrive at the current vowel inventories of the Mbam languages. The eight primary sound changes proposed above are listed in Table 97.

Table 97: Proposed historic sound changes in the Mbam languages

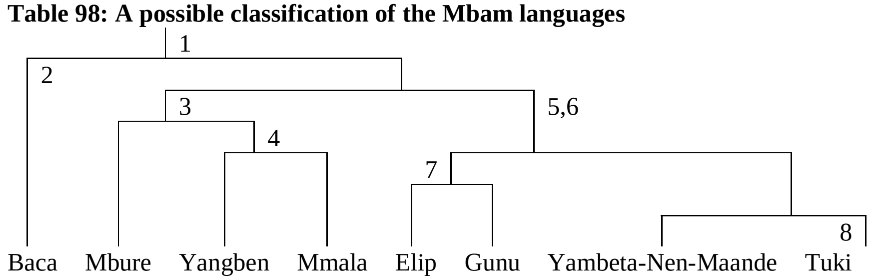
1.	[+ATR] spread
2.	Loss of contrast of a̹
3.	Merger of a̹>e
4.	Lower ɪ,ʊ (phonetic)
5.	Loss of feature: [front]
6.	Lowering of ɪ>[ɛ]
7.	“Fronting” or “F2-raising” of **ə**
8.	Loss of contrast of o

Along with the historical sound changes discussed above and summarised in Table 97, there are also hints of possible sound changes occurring now, perhaps due to language contact with Basaa. Both Mbure and Baca are at the extreme south of the Mbam and adjacent to the greater Basaa region. Mbure in particular has a very narrow distance between the high vowels and may be undergoing a vowel merger of the high vowels; for example a 9>7 vowel merger. However, the distinction is being preserved by aspiration or assibilation on consonants preceding /i/ and /u/, which does not occur on consonants preceding /ɪ/ and /ʊ/. This aspiration/assibilation is similar to Schadeberg's (1994/95: 73) finding that “No language has undergone [a] 7>5 [vowel merger] but not Spirantisation”.

Mbure seems to be in a process of undergoing a merger influenced by contact with Basaa: that of merging [-ATR +high] vowels with either the [+ATR] high or the [-ATR -high -low] vowels.

The Mbam languages are classified from proto-Mbam with the above sound changes noted (by the numerals listed above). It is assumed that proto-Mbam had ten vowels, so the loss of contrast (sound change #2) is the change where Baca splits off. The next sound change #3, along with sound changes #5 and #6 separates Mbure, Yangben and Mmala from Elip, Gunu, Yambeta, Maande, Nen and Tuki. The non-contrastive lowering of the [-ATR] high vowels, sound change #4, distinguishes Mbure from Mmala and Yangben. Sound change #7, the “fronting” or F2-raising of the vowel ə separates Elip and Gunu from Yambeta, Maande, Nen and Tuki. The final vowel change, #8, the loss of contrast of /o/, separates Tuki from Yambeta, Maande and Nen, as in Table 98:

Table 98: A possible classification of the Mbam languages



5.2 Structural issues in language classification

A fuller understanding of the history of the Mbam languages must include language contact. The dilemma of Elip which manifests a trace of height harmony like Mmala indicates either a long shared history with, or borrowing, not only of lexical items but of structural features, from Mmala.

In this section, we will consider some structural changes evident in these languages, in order to investigate the scenario of contact to explain the differences in the vowel-harmony systems which are not accounted for by historic sound changes alone.

As mentioned above, Elip and Gunu appear to have undergone similar historic sound changes as Yambeta, Maande and Nen, but also to have undergone a similar historic sound change as Mbure, Yangben and Mmala. In addition, Elip shares an obvious trait with Mmala, that of having a trace of height harmony. The question is whether Elip and Gunu are better classified as belonging to the same subgroup as Mmala, but borrowing structural features from the Yambeta-Maande-Nen subgroup (mentioned above), or are better classified as belonging to the same subgroup as Yambeta-Maande-Nen, and borrowing structural features from the Mmala subgroup.

In Table 98 above, Yangben and Mmala are not differentiated by a sound change (they both have the same vowel inventory). The difference between Yangben and Mmala is structural. As has been seen in Chapter 4, they have different contrastive hierarchies of their vowel systems. The main structural difference that distinguishes Mmala from Yangben is the replacement of the feature *front* with the feature *mid.* While this structural change has no bearing on the surface vowels, it does have a critical effect on the vowel-harmony systems of these two languages.

While the historic sound changes alone would favour the classification found in Table 98 above, taking into consideration structural features, Elip and Gunu can be classified differently. Assuming that a sound change may have a structural change at its root, but that not all structural changes have an associated sound change, we will start out with the sound changes presented above in Table 97, to which we will add two structural changes to account for both the differentiation of Mmala from Yangben and resolve the dilemma of Elip.

The first structural change proposed, is the replacement of the feature *front* with the feature *mid* (structural change #4a. [front]>[mid]), which distinguishes Mmala (ATR >>open >>**mid** >>round/back) from Yangben (open >>round/back >>**front** >>ATR). If we assume that both Elip and Gunu have undergone sound change #3 (the merger of **ạ>e**), they can now be connected with the larger subgroup Mbure-Yangben-Mmala rather than the larger subgroup Yambeta-Maande-Nen-Tuki, which has not undergone sound change #3. A further structural change, the loss of the feature *mid* (structural change #4b), can thus be proposed to distinguish Elip and Gunu (open>>round/back>>ATR) from Mmala (ATR>>open>>**mid**>> round/back), see Table 99 below. The differences in ranking are language-specific and do not have any bearing on the structural change[298] between languages (see discussion of the contrastive-feature hierarchy in Chapter 4).

Table 99: Proposed historic sound and structural changes in the Mbam languages

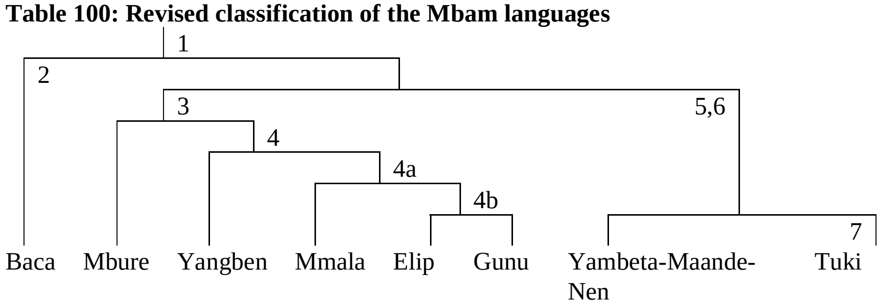
1.	[+ATR] spread
2.	Loss of contrast of a̞
3.	Merger of a̞>e
4.	Lower ɪ,ʊ (phonetic)
4a.	[front]>[mid]
4b.	Loss of feature: [mid]
5.	Loss of feature: [front]
6.	Lowering of ɪ>[ɛ]
~~7.~~	~~“Fronting” or F2-raising of **ə**~~
7.	Loss of contrast of o

With the loss of *mid*, Elip and Gunu would be historically closer to Mbure-Yangben-Mmala but would structurally more closely resemble Yambeta-Maande-Nen (which also have a contrastive-feature hierarchy: open>>round/back>>ATR). Although similar, the contrastive-feature hierarchy of Gunu and Elip would be the result of a different series of historic changes than the contrastive-feature hierarchy of Nen, the latter due to the loss of the feature *front*, the former due to the loss of the feature *mid*.

With these two structural changes, we can account for why both Elip and Gunu have a [+ATR] counterpart of /a/ with a surface form [e], unlike the Yambeta-Maande-Nen-Tuki subgroup, and account for the trace of height harmony found in Elip, now interpreted as a remnant left over after structural change #4b. This reinterpretation would eliminate the necessity of proposed sound change #7 in Table 97 (and barred in Table 99 above) since Elip and Gunu are no longer considered a part of the Yambeta-Maande-Nen-Tuki subgroup that requires it. The modified tree would then be as found in Table 100 below.

[298] Both Baca and Mbure have the same contrastive-feature hierarchy, but, due to historic sound changes, are separated in the classification tree.

Table 100: Revised classification of the Mbam languages



The advantage of considering structural innovations along with historic sound changes is that it presents a more complete picture of the classification of the Mbam languages.

The position of Elip in the classification of the Mbam languages is a dilemma. It has a shared history either with the Yambeta-Maande-Nen subgroup and, through contact, borrowed a trace of height harmony from Mmala, or it (and Gunu) has a shared history with the Mbure-Yangben-Mmala subgroup and due to contact with the other Mbam languages, has lost its feature *mid*, leaving only a remnant of height harmony, generally retained only be the oldest speakers of the language. While there is no synchronic evidence that Gunu ever had height harmony, it is generally considered to be more closely related to Baca, Mbure, Yangben, Mmala and Elip than to Nen and Maande.

5.3 Lexicostatistical classification

Generally languages are classified by their lexical similarities. This section presents my own lexicostatistical analyses of these ten Mbam languages, and considers whether the lexicostatistical evidence supports or contradicts the classification based on historic sound and structural changes discussed above.

There is some discussion about what is the best size of wordlist to use. With a shorter list, each word has a higher importance in the percentages. However the longer lists likely include cultural vocabulary and may have lateral influences from neighbouring languages (Piron 1997: 535). On the other hand, while a list of 100 words is sufficient to establish a synchronic classification, it is too small for establishing regular phonological correspondences, which are essential as they form the basis for deciding whether a partial divergence is phonological or merely phonetic (Möhlig 1986: 23).

In collecting data for this study, a Swadesh 200-word list[299] was elicited for each of the ten languages included in this study. Due to various lacunas in several of the

[299] These wordlists are included in the larger lists mentioned in the introduction.

languages, the actual number of terms compared is between 165 and 190. Table 101 gives the results.

Table 101: Lexicostatistical comparison of the Mbam languages

N[300]										
53%	Ma									
37%	33%	Ya								
33%	36%	33%	T							
33%	39%	38%	44%	G						
36%	41%	35%	44%	60%	E					
36%	41%	34%	43%	61%	81%	M				
36%	40%	34%	37%	52%	65%	74%	Yg			
41%	38%	35%	36%	48%	55%	58%	66%	B		
37%	30%	34%	34%	41%	43%	44%	51%	59%	Mb	

The two extreme methods of lexicostatistical subclassification are Nearest Neighbour (NN) and Furthest Neighbour (FN). “NN assumes that the distance is equal to the closest distance between any member of X and (any member of) Y; FN takes the greatest distance as its measure” (Schadeberg 1986: 71-2). A third method, often called Branch Average (BA), takes the average between the greatest and the closest distance. Table 102 presents the result of the cluster analyses. Each row indicates the distance between languages or clusters of languages according to the three calculations. For example, Elip and Mmala have a distance of 810 (81%) and form the first cluster. In the next row, by the Nearest Neighbour calculation cluster 1 (i.e. Elip-Mmala) and Yangben have the next closest distance at 740 (74%) and form the second cluster, while the Furthest Neighbour calculation, the next closest distance is between Yangben and Baca at 660, and they form cluster 2. The Branch Average calculation, like the Nearest Neighbour, groups cluster 1 (Elip-Mmala) with Yangben at 695 (69.5%). Cluster 2 in row three includes the elements found in the second row and compares with the next closest language or cluster of languages.

[300] Abbreviations are as follows:

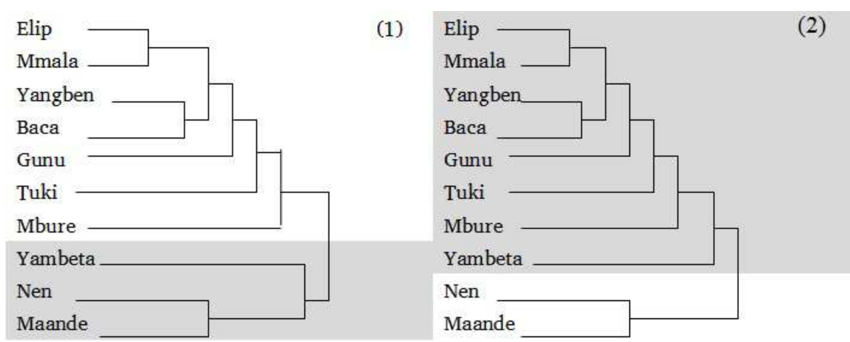
E = Elip	M = Mmala	Yg = Yangben	B = Baca	Mb = Mbure
G = Gunu	Ma = Maande	T = Tuki	N = Nen	Ya = Yambeta

Table 102: NN, FN, and BA Cluster Analyses

Clusters	Nearest Neighbour			Furthest Neighbour			Branch Average		
	lg x	lg y	1/1000	lg x	lg y	1/1000	lg x	lg y	1/1000
1	E	M	810	E	M	810	E	M	810
2	cl.1	Yg	740	Yg	B	660	cl.1	Yg	695
3	cl.2	B	660	cl.1	cl.2	650	cl.2	B	605
4	cl.3	G	610	cl.3	G	600	N	Ma	530
5	cl.4	Mb	590	N	Ma	530	cl.3	Mb	530
6	N	Ma	530	cl.4	T	430	cl.5	G	483
7	cl.5	T	440	cl.6	Mb	340	cl.6	T	400
8	cl.7	cl.6	410	**cl.5**	**Ya**	**330**	cl.7	cl.4	352
				cl.7	**Ya**	**330**			
9	cl.8	Ya	380	cl.7/5	cl.8	300	cl.8	Ya	350

In the Furthest Neighbour analysis, Yambeta has 33% similarity with both the Nen-Maande cluster and with the Elip-Mbure cluster. If Yambeta is grouped with the Nen-Maande cluster, it joins the Elip-Mbure cluster at 30%, and vice versa. Therefore two Furthest Neighbour trees are possible depending on to which group Yambeta is attached. In Table 103, Yambeta is bolded and the competing classifications are shaded.

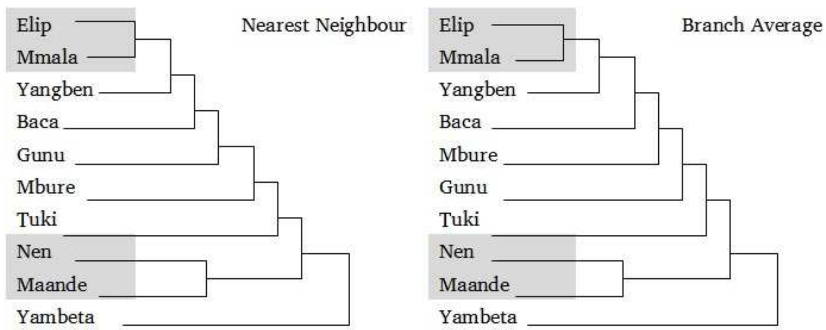
Table 103: Furthest Neighbour subclassifications (1) & (2)



The unstable position of Yambeta in the Furthest Neighbour subclassification is reflected differently in the Nearest Neighbour and Branch Average classifications. Yambeta is the most distant language in both of these subclassifications.

In all three subclassifications, two nodes are evident: the Elip-Mmala node and the Nen-Maande node. No other nodes are evident in all the subclassifications. While Furthest Neighbour classification has a Yangben-Baca node, this is not found in the Nearest Neighbour or Branch Average subclassification in which Yangben and Baca join the Elip-Mmala node one after the other. Gunu, Tuki and Mbure join the Elip-Mmala-Yangben-Baca node successively in all three subclassifications, but in different orders. In the Furthest Neighbour classification, the order is Gunu, Tuki and Mbure (Table 103). In the Nearest Neighbour classification it is Gunu, Mbure and Tuki and in the Branch Average classification it is Mbure, Gunu and Tuki (Table 104).

Table 104: Nearest Neighbour and Branch Average subclassifications



These classifications differ from Phillips' (1979) comparison of Yambeta with eight other languages of the Mbam region: Bafia and Bape (A50), Maande, Nen, Alinga (a Nen dialect), Bonek (A40), Gunu, and Tuki (A60).[301] Her conclusions were that Yambeta more closely related to Gunu and Tuki than to Maande or Nen. My analysis indicates otherwise. The Furthest Neighbour trees put Yambeta at equidistance from both the Gunu-Tuki subgroup and the Maande-Nen subgroup. The Nearest Neighbour and the Branch Average trees, put the Maande-Nen subgroup closer to the Gunu-Tuki group than to Yambeta.

While earlier studies may differ in calculating the distance between Yambeta and its neighbours, it is interesting to note that the position of Yambeta as being in between the other clusters is not different. Mous and Breedveld (1986: 187) note that "Yambeta occupies a position in between different groups." While Mous and Breedveld indicate a distance of 60% with Maande, they acknowledge 14 missing items between Yambeta and Maande (Mous and Breedveld 1986: 184), which is substantial in a list of 100 items. Yambeta forms a group with the other languages in the same group as Maande (Nen, Alinga, and Bonek) at only 34.5% (Mous and Breedveld 1986: 187) which is similar to my findings.

5.4 Conclusions

In comparing the lexicostatistical classification (section 5.3) with that of the historic sound and structural changes discussed in section 5.2, there are several conclusions that may be drawn:

---

[301] Phillips (1979: 22-35) uses a 120-word list based on the Swadesh basic wordlist.

- The revised classification (Table 100) is more similar to the Nearest Neighbour and Branch Average classifications (Table 104) than the classification proposed in Table 98.
- In every lexicostatistical subclassification (Nearest Neighbour, Furthest Neighbour and Branch Average), Elip and Mmala form a node. This supports the argument that Elip and Mmala have a long shared history and supports the revised classification (Table 100). The other languages, Yangben, Baca, Mbure and Gunu join the Elip-Mmala node earlier than the languages of the other historic subgroup, Yambeta, Maande, Nen and Tuki.
- While the historic classification groups Yambeta and Tuki more with the Nen-Maande subgroup, the lexicostatistical classification groups Tuki distantly to the Gunu-Elip-Mmala-Yangben-Baca-Mbure subgroup and Yambeta as between the two groups. A possible explanation is that Yambeta, structurally closer to the Nen-Maande node, has probably borrowed substantially from the Gunu-Elip-Mmala-Yangben-Baca-Mbure subgroup.

Due to their close proximity, it is not surprising that Tuki should pattern lexicostatistically with Baca, Mbure, Yangben, Mmala, Elip and Gunu. These are small groups with a high degree of intermarriage and movement between them. An indication of this mobility and intermingling of populations is the long-time presence of a displaced Tuki village, Nyamanga I,[302] established between the Elip village Kananga and the Yangben village Omende. Dugast (1949) also relates substantial movement of most of these people groups even as late as the late 1800's, preceding German colonisation.

Of additional interest is the fact that Mbure, historically and physically close to Baca and Yangben in particular, is lexicostatistically relatively distant from them. One reason appears to be geographic. The Mbure people live at the southernmost extremity of the Mbam region along the banks of the Liwa River, which forms part of the border of the Mbam-et-Inoubou District with the Sanaga-Maritime District (Littoral Region) and Basaa country. The Mbure people tend to look south towards Basaa more than north towards their Mbam relatives. Most Mbure people are bilingual in the dialect of Basaa spoken south of the Liwa River, and they are more likely to frequent the closest Basaa markets to the south, than the closest market to the north in the Yangben village of Batanga.

The road which accesses the village of Mbola from the north dwindles down after the Yangben village of Batanga and, in 2011, when I last visited the village, the bridge over the Liwa River was barely passable; few vehicles other than motorcycles were able to reach Mbola. This relative isolation counteracts the historical relation of

[302] I do not know the date of the founding of this village, but Dugast's (1949: 49, 65-7) maps of the area identified it as a Tsinga-Betsenga (i.e. Tuki) village.

Mbure with the neighbouring Mbam languages, and is perhaps a reason for the lower lexicostatistical similarities between it and them.

Baca, like Mbure, is a border language, but the road south of Yangben village to Bongo village is a major road (joining the Douala road south of Yaoundé at Mboumnabel) and has relatively dense traffic. Baca, therefore, is less isolated. Furthermore, there is another language, Bati, which is located between Baca and the larger Basaa community. This geographic location of both Baca and Mbure near the border with Basaa also explains the intermediary position of these two languages with reduced vowel-harmony systems, between the strong vowel harmony of Yangben and Mmala on one hand, and the absence of vowel harmony in Basaa, on the other.

The situation of Yambeta is also interesting. Historically, it is unambiguously grouped with the other eight-vowel languages, but lexicostatistically, it is equidistant between the two groups Nen-Maande and the Mbure-Baca-Yangben-Mmala-Elip-Gunu-Tuki group. Their oral histories indicate an affiliation with both groups.

The two Yambeta dialects claim different origins in their oral histories with the *Nɛdɛk* people coming from Bamoun like the Nen, and the *Nigii* claiming correlation with the other children of Ombono, especially the Gunu. This division in the oral histories is suggestive and leads one to imagine a possible blending of two speech forms to create a new one. Such a blending could explain a structural tie to the Nen-Maande group and a lexical tie to the Mbure-Baca-Yangben-Mmala-Elip-Gunu-Tuki group.

5.5 Classification of the Mbam languages in the wider linguistic context

This chapter started with a discussion of the interrelationships and subgroupings of the Mbam languages within the context of the wider group by means of diachronic sound and structural changes and synchronic lexicostatistical subclassifications. In this section, we will look at the relationship of the Mbam languages in the wider linguistic context. First we will look at two neighbouring languages, Basaa and Nyokon (section 5.5.1), and then we will consider how the Mbam languages have been classified in the wider context of the Bantu and Bantoid languages (section 5.5.2).

5.5.1 Basaa and Nyokon

Any discussion about the Mbam languages and their placement in the wider linguistic context should also include a discussion of two additional languages: Nyokon, due to it purported close relationship with Nen and its location in the Mbam region, and Basaa, the largest of the A40 languages.

5.5.1.1 Nyokon

A recent study of Nyokon posits a somewhat unusual 9-vowel inventory, /i, ɪ, ɛ, ɨ, ə, a, u, ʊ, ɔ/ (Lovestrand 2011: 13-14). However, [ɪ] is uncommon and occurs following a palatal approximant in every case. It is in complementary distribution with [ɨ], which is more common. Lovestrand (2011: 15) also posits "... that the other near-close back vowel [ʊ] may also be disappearing from the language by merging with the close back vowel [u]... If so, the language is moving from a symmetrical 9-vowel system to a symmetrical 7-vowel system."

While the presence of /ɨ/ in Nyokon is hard to explain in the context of the Mbam languages, it can be explained in the context of the Bamileke (Mbam-Nkam) languages. Nyokon is on the border with the Bamileke languages which *do* tend to have vowel inventories similar to Nyokon's. A near neighbour of Nyokon, a Mbam-Nkam language, Medʉmba, is reported to have ten vowels, /i, ɪ, ɛ, a, ɨ, ə, u, ʊ, ɔ, ɑ/. The influx of the Bamileke into the Nyokon area perhaps explains the presence of /ɨ/ in the language.

The other peculiarity of Nykon is that it does not appear to have an active ATR-harmony system. Lovestrand (2011: 15) notes:

> "Evidently, the language once had an ATR harmony system but lost it at some point in the not-so-distant past. The hypothesis regarding the near-close vowel [ɪ] is that once the binary phonological feature separating it from the close vowel [i] stopped being part of an active phonological process, the need to distinguish the binary pair also disappeared. It is suspected that the other near-close back vowel [ʊ] may also be disappearing from the language by merging with the close back vowel [u]..."

The primary domain of vowel harmony is the word root. As is seen in many of the Mbam languages, the scope of vowel harmony spreads to a greater or lesser extent from the root. Nyokon, which structurally has at least 80% of nominal stems being monosyllabic (Lovestrand 2011: 25), vowel harmony will be less evident, especially if it does not spread beyond the word root. Structurally, Nyokon reduces the possibility of vowel harmony even if the vowel inventory permitted it.[303]

Nyokon, situated at the northern limit of the Mbam region, has a vowel system which resembles many of the Mbam-Nkam (Southern Bantoid) languages to its

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[303] While the presence of central vowels does not preclude ATR harmony, as is evident in some of the Kru langauges, such as Kpokolo, which has six [+/-ATR] pairs: i/ɪ, e/ɛ, ɨ/ɨ, ə/ɜ, u/ʊ, o/ɔ plus /a/ and ATR harmony (Kaye et al. (1985), the Mbam-Nkam languages nearest geographically and genetically to the Mbam languages do not have ATR harmony.

north and west. It has a vowel system distinctly different from the vowel systems of the other Mbam languages which have ATR harmony.

Rather than the idea put forth in Lovestrand (2011) that Nyokon *lost* ATR harmony, perhaps another way to look at it, is that Nyokon never *developed* ATR harmony.

5.5.1.2 Basaa

While Basaa is an A40 language like Nen and some of the others, it has never been considered a part of the Mbam languages. Basaa has been described as having a typical seven vowel system, i, e, ɛ, a, ɔ, o, u (Hyman 2003: 258). However, Basaa has a "vowel raising" process that occurs in verb roots when either the causative or applicative extensions are added to the verb (Hyman 2003: 274-275).

Example 385: Vowel raising in Basaa (Hyman 2003: 274)

		causative	applicative
lim	*be silent*	limis	limil
ɓép	*beat*	ɓíbîs	ɓíbîl
kɛ́p	*tattoo*	kébês	kébêl
kun	*choose*	kúnûs	kúnûl
hól	*sharpen*	húlûs	húlûl
ɓɔl	*rot*	ɓólôs	ɓólôl
pát	*pick off*	pédês	pédêl

The Basaa vowel raising looks suspiciously like the ATR harmony found in the Mbam languages.

Schlindwein Schmidt (1996: 241-2) sees similarities in the Basaa "vowel raising" and the Nen vowel harmony discussed by Stewart and van Leynseele (1979). She gives the pattern for Basaa:

Basaa harmonic sets (Schlindwein Schmidt 1996: 242)

basic vowels ([-ATR])	i	e	ɛ	a	ɔ	o	u
raised vowels ([+ATR])	i	i	e	e	o	u	u

In similar fashion to Nen and other languages, the vowels **e**, **o** in Basaa surface in both [+ATR] and [-ATR] contexts. In the latter, they have **i**, **u** as their [+ATR] counterparts. She goes so far as to say that the [-ATR] **e**, **o** must be **"**... in some sense really /ɪ/ and /ʊ/" (Schlindwein Schmidt 1996: 243).

While Schlindwein Schmidt rejects the idea of absolute neutralisation, she finds that "... the surface realisations of /ɪ/ and /ʊ/ are indistinguishable from the raised versions of [ɛ] and [ɔ]..." (Schlindwein Schmidt 1996: 245).

Contrary to Schlindwein Schmidt (1996: 247), Mutaka and Kody (2001: 17-18) explain the **ɛ ~ i** instead of the expected **ɛ ~ e** alternation in certain Basaa verbs and posit a [-ATR +high] vowel **ɪ**, in the underlying representations, which has "either merged with the [+ATR] high or the [-ATR -high -low] vowels", resulting in an underlyingly nine-vowel inventory.

Basaa vowel raising, however, is limited to verb morphology and does not appear to be found in stems, and there are no vowel co-occurrence restrictions found in noun roots. For this reason, although in many ways similar, Basaa vowel raising differs from the vowel harmony in the Mbam languages.

Basaa did not undergo the Mbam sound change that introduced ATR vowel harmony. The raising here reported is unlikely to be the remnant of vowel harmony as it is different in nature from vowel harmony.

5.5.2 The Mbam languages in the wider context of Bantu and Bantoid

Guthrie's original classification of the languages of the District of the Mbam divides them into three groups: A50, the Bafia group, A60, the Sanaga group, and A40, the Basaa group. It is the latter two groups which are of concern in this study, specifically the A60 group, and part of the A40, notably A44-A46 languages. Guthrie (1971: 31-2) lists the languages in Figure 32 in his A40 and A60 groups. The bolded languages are the ones that are discussed in this study. The A40 group in particular has a divide between the A41-A43 languages and the A44-A46 languages; the latter are physically located in the District of the Mbam-et-Inoubou. There are also important linguistic differences between the two parts of Guthrie's A40 group.

Guthrie identifies A61 and A64 as separate languages that are elsewhere considered dialects of Tuki. Of the other two languages identified by Guthrie in the Sanaga group, *Leti* (one of the two languages of the Mengisa people) or *Tungijo*, as other Tuki speakers call it, is considered by the Tuki as a dialect of Tuki (Kongne Welaze 2004: 8-9).

A.40 (Basaa group)
- A.41 Lɔmbi (Rombi)
- A.42 Bakon (Abo)
- A.43a Mbɛnɛ (Basa, Koko, Mvele)
- A.43b N. Kogo
- A.43c S. Kogo
- **A.44 Banɛn**
- **A.45 Nyɔ̃'ɔ̃ (Nyokon)**
- **A.46 Mandi (Lemande)**

A.60 (Sanaga group)
- A.61 Ngɔrɔ [Tuki dialect]
- **A.62 Yambassa**
- A.63 Mengisa [Leti]
- **A.64 Bacɛnga [Tuki dialect]**
- A.65 Bati

Figure 32: Guthrie (1971: 31-2) A40 and A60 languages[304]

The Atlas Linguistique du Cameroun (ALCAM) (Dieu and Renaud 1983), taking note of the linguistic differences in Guthrie's A40 group, divides A.40 into the Basaa group and the (Tu)nen group, and groups the latter with Guthrie's A60. There is no question that the Nen A40 group is linguistically much more closely related to the A60 group than to the other A40 languages. Both the Nen group and the A60 group have robust vowel harmony which the Basaa A40 group lacks. ALCAM also separates these languages from narrow Bantu (Equatorial, Zambesi) referring to the whole group as “le bantou du Mbam”. Figure 33 lists the Benue-Congo languages of Cameroon from ALCAM, in particular the Mbam languages (bolded) discussed in this study.

[304] Comments between square brackets are additions by author.

- Benue-Congo
  - Junkunoid
  - Cross River
  - Bendi
  - Bantoid
    - Mambiloid
    - Bantu
      - Jarawan
      - Tivoid
      - Ekoid
      - Nyang
      - Beboid
      - Grassfields
      - Tikari, Ndemli
      - Equatorial
      - Zambesi
      - **Mbam**
        - **ex-A40**
          - **(1)**
            - **[514] nyɔ'ɔ (Nyokon)**
            - **[511] tunen (Nen)**
            - [513] tuɔtɔmb
            - **[512] numand (Maande)**
          - **(2)**
            - **[520] nigi (Yambeta)**
          - (3)
            - [530] bati
        - **ex-A60**
          - **yambassa**
            - **[541] nugunu (Gunu)**
            - **[542] yambassa central**
              - **-mmaala (Mmala)**
              - **-nu yangben (Yangben)**
              - **-nu libie (Elip)**
            - **[543] nubaca (Baca)**
            - **[544] dumbulɛ (Mbure)**
          - **sanaga**
            - **[551] tuki (Tuki)**
              - -tu ngɔrɔ
              - -tukɔmbe
              - -tonjo
              - -tocenga
              - **-tutsingo**
              - -tumbɛlɛ
            - [552] leti

Figure 33: ALCAM classification of the Mbam languages in Benue-Congo.

One problem with the ALCAM classification (Dieu and Renaud 1983) is that its conclusions are generally impressionistic rather than based on any rigorous lexicostatistical count (Watters 1989: 410) or comparative historical research.

Watters and Leroy (1989: 433, 435) modify the ALCAM classification slightly by separating Bantoid into two groups, northern and southern, with the Mbam languages in Southern Bantoid. The Mbam languages are split into three subgroups: West, Yambassa, and Sanaga, following ALCAM (Dieu and Renaud 1983).

I. Northern Bantoid
II. Southern Bantoid
  - A. Tivoid
  - B. Jarawan
  - C. Mbe
  - D. Ekoid
  - E. Mamfe (Nyang)
  - F. Beboid
  - G. Wide Grassfields
  - H. Tikar
  - J. Ndemli
  - **K. Mbam**
    - **1. West**
    - **2. Yambassa**
    - **3. Sanaga**
  - L. (Narrow) Bantu

Figure 34: Southern Bantoid (Watters and Leroy 1989: 433)

While Dieu and Renaud (1983) and Watters and Leroy (1989) group the Mbam A40 (Nen group) and A60 languages as a subgroup of (Southern) Bantoid or (wide) Bantu, the placement of the Mbam languages is not so simple. Others, notably Bastin et al. (1983), Piron (1995), Bastin and Piron (1999), note that these languages statistically sometimes pattern with Bantu north-west and other zone A and some zone B languages, and sometimes with Bantoid non-Bantu languages, depending on which method (Group Average or Furthest Neighbour) is used (Piron 1997: 624-630). The place of the Mbam Bantu languages shifts depending on which method is employed, as seen in Figure 35.

Bastin and Piron (1999: 155) summarise this tendency by stating that "... la clef de l'articulation entre bantou et bantoïde se situe dans le bantou du Mbam qui tantôt attire le reste de la zone A et B/10, 20, 30 vers le bantoïde, tantôt est associé, avec le seul A50, à un embranchement bantoïde non bantou."

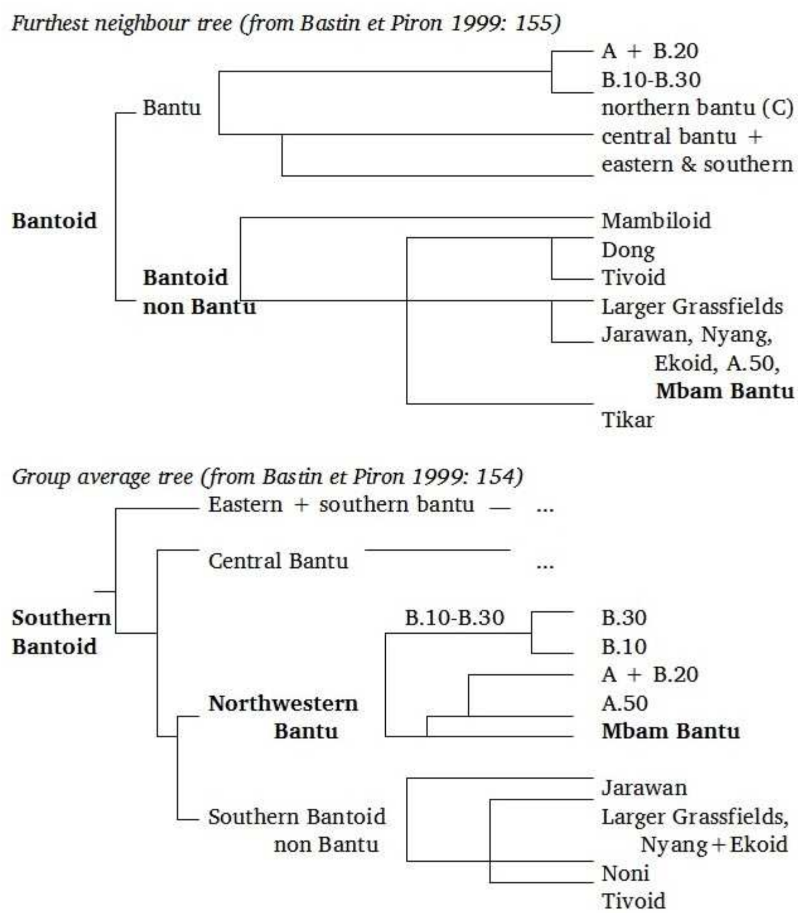

Figure 35: Lexicostatistical trees from Bastin and Piron 1999: 154-5

Grollemund (2012: 403-5) expands on the thesis of Bastin and Piron (1999) in saying that the “clef de l'articulation” between Bantu and Bantoid is localised in the Mbam languages. Based on her classification (Figure 36), and exploiting the well-known split in the A40 languages between the languages like Basaa which are clearly “bantu-like”, and the Mbam A40 languages, like Nen, which are more “bantoid-like”, Grollemund identifies a similar split in her so-called A60 languages.

She identifies two groups "A40-60-Bantoid" (i.e. the Mbam languages) and her "A40-50-60-70 Bantu".[305]

[305] Grollemund (2012) lists Mengisa (A63) and three little-known languages mentioned in Guarisma and Paulian (1986) which she labels as "Ngoro-Asom", "Ngoro-Lunda" and "Ngoro-Bisoo" (A61) as among the A60 "Bantu-like" languages which fit into North-West Bantu as opposed to the Mbam A40-A60 languages, which pattern more as Bantoid. She however acknowledges (2012: 233) that all these languages are lexico-statistically closer to the A70 "Yaunde-Fang" group. Mengisa, in particular, is confusing as there are two distinct languages spoken by the Mengisa people, one, *Leti* is most definitely an A60 language and is often considered a dialect of Tuki. The other, *Njowi* (the source of Grollemund's data (2012: 232)), is definitely an A70 language (see footnote 13). The confusion is perhaps due to the possiblity that Guthrie's classification was based on *Leti* whereas others since then have instead studied *Njowi* (Guarisma and Paulian 1986: 94, footnote 2, posit this explanation as well for the A60 code for Mengisa). As for the A61 varieties, Breton et Fohtung (1991: 39) report, "Enfin se trouvent dans le Mbam trois petit îlots de populations de langue **bəti-faŋ** (i.e. A70) détachés du dialecte septentrional eki; les Feuk- parlant le *bafək* et le *yaŋavɔk* (yangafok) - et les Yasəm" (***asəm***). The languages *Bisoo* (bìsɔ̀ɔ̀) and *Lùndá* mentioned in Guarisma and Paulian (1986: 94-6 footnote 3) are not mentioned in the atlas. Bisɔɔ is mentioned in Dieu et Renaud (1983: 100) as a dialect of Bakoko [402] and closely related to Basaa (A43): "Au Nord-est le *bisɔɔ,* du canton Basso (arr. de Ndom, département de la Sanaga-Maritime), parler des ɓasɔɔ ɓa likol ("Basso du Nord")..." While Grollemund connects *Bisoo* with *Lunda* and *Asəm* based on Guarisma et Paulian (1986: 94, see Grollemund 2012: 232 footnote 57), I suspect she misread Guarisma et Paulian's chart, which lists *Lunda*, *Asom* and *Bisɔɔ* as numbers 12, 13, and 14 with only 12 and 13 connected with Guthrie's A61 Ngɔrɔ. Guarisma et Paulian's (1986: 95) map places *Bisɔɔ* much further south near Yaoundé, not at all in the vicinity of Ngoro, and Maho (1999: 284) lists Bisoo as A79. Although I have not been able to find a language called *Lunda* in the Mbam region in any written source, I did get oral information about it. According to Ambonda Olounou Martin (about 70 years old), a dignitary of the Supreme Chief of Ngoro, the *Lunda* people include four groups which migrated from Adamawa, The *Bɔkɔ* (village of Boko, 4°58'60" N et 11°13'0" E, west of Ngoro), the *Nanda* as well as the *bafək* and the *yaŋavɔk*. They are located in the village of Séréré (4°58'60" N, 11°22'60" E) in the District of Ngoro. It is considered as one of the **bəti-faŋ** "dialects" mentioned in ALCAM (Dieu et Renaud 1983: 101) which lists the *Yaŋavɔk*, *Bafək* and *Yasəm* all in "l'extrémité nord de l'arr. de Ngoro, dép. du Mbam." All of these supposed A60-Bantu languages are in reality A70 languages.

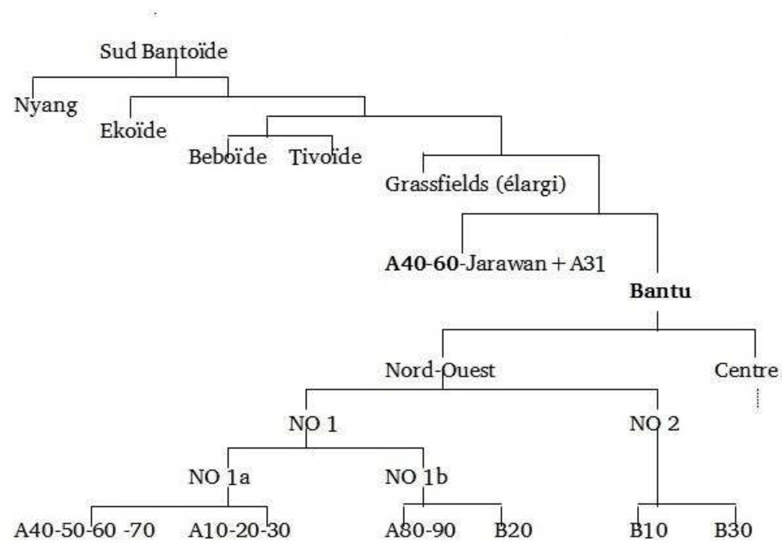

Figure 36: Grollemund's (2012: 391) simplified tree: Neighbour-Joining

This split in A40 languages between “A40-Bantoid” and “A40-Bantu” and Grollemund's supposed similar split in the A60 languages below) is one of her arguments that the foyer of the Bantu languages was in the Mbam, and that those groups which migrated out of the Mbam could be the earliest of the Bantu languages. She summarises as follows:

> “La division de ce groupe A40-60 semble résulter de la séparation entre bantoïdes et bantu. En conséquence, le centre de diffusion proto-bantu, a partir duquel auraient débuté les migrations bantu, se situerait a proximité de la région du Mbam ... Cette division des langues A40 constitue un premier argument en faveur d’une possible migration bantu ayant débutée dans cette région. En effet, les langues A40 bantu se séparent et migrent en direction du sud-ouest. Elles donnent ensuite naissance aux autres langues appartenant au groupe NO 1. Au sein du groupe “A40 bantu” le basaa A43a constitue la première langue à diverger (selon l’étude de l’arbre Neighbor-Joining) ... Si l’on suppose que la migration bantu ait débuté dans la région du Mbam, cela permettrait d’expliquer la division des langues A40-60 (ainsi que le statut ambivalent des langues A50 observée dans notre classification)” (Grollemund 2012: 404).

While Grollemund's A60 split is not well founded, her supposition of migration is not necessarily wrong. In much of the Mbam region, there is a migration legend telling about the crossing of “the river” (usually considered to be the Sanaga River).

In this story, the people find themselves trapped at the banks of a vast river they cannot cross. In the morning, they discover that a miraculous bridge has appeared overnight. Overjoyed, they begin crossing the river on this “bridge”. At one point during the crossing, something happens: in one account, an old blind man using his spear as his walking stick, stumbles and plants the point of his spear into the “bridge”, which turns out to be an immense boa. The boa, in pain, sinks into the water and flees, thus dividing the immigrants into two groups; those who have successfully crossed and those left behind. The Mengisa people, who are effectively divided by the Sanaga and speak two distinct languages, a variety similar to Tuki (A63) in the Mbam region and along the banks of the Sanaga river, and a variety similar to Eton (A71) south of the river, lend an oral-history credibility to the theory of migration from the Mbam region.

Interestingly, almost all the language groups of the Mbam region have a river-crossing story, although in some, such as in one of the Elip versions (Abiadina Samba 1988: 5-6), the migrating peoples cross the Sanaga from the south to the north to access the vast savannas of the Mbam region or as in the *Nigii* Yambeta version, it was the Noun river that was so crossed. The Yangben have two river-crossing stories, one south-to-north over the Sanaga and the other back south.

It is not only in the Mbam region and its surroundings where the story of the crossing of the Sanaga is found. On a trip to Campo, on the Gulf of Guinea at the border with Equatorial Guinea, I heard another version of this story by an Iyassa (A33) speaker, Patrice Ipoua (13 August 2014. p.c. in the village of Campo Beach). The Iyassa also claim a connection to the Mbam region. They say that they left the Mbam region as a people and crossed the Sanaga on the back of a huge snake, but when the majority had crossed, the snake disappeared leaving only a small number behind on the other side. The *Iyassa* call the people who were left behind the *Isanaga.*[306] Patrice Ipoua assured me that among the *Isanaga*, they recount the story of how they were once a much larger group, but that some of them crossed the river and went to the sea in search of salt.

[306] A rather suggestive name! Generally the Tuki people are called the Sanaga by outsiders.

The migration traditions about crossing a river are shared by many peoples speaking Mbam languages. These traditions show a sense of unity among the Mbam peoples and one that is, by a perceived common history, linked to a major river, possibly the Sanaga. While these histories are not direct evidence for a historical event of such a river-crossing, they do suggest that these traditions are shaped to forge an idea of common origin.

6
Conclusion

The goal of this study has been to give a comprehensive look at the complexities of the vowel and vowel-harmony systems of the genetically related Mbam languages. Of particular interest is the comparison and classification of these languages and what they reveal about language typological. Furthermore, the study of the microvariations found in the vowel system provides a greater understanding of the phonology of each language and the relevant parameters of variation between them. It also contributes to the understanding of vowel harmony in particular and phonology in general.

ATR harmony is found in all ten of the Mbam languages discussed in this study. While not unique, these languages are somewhat unusual in that a number of them have additional vowel-harmony processes which interact with ATR harmony, namely rounding harmony, fronting harmony and height harmony. Most of the Mbam languages have both ATR and rounding harmony, but there are some languages which only have ATR harmony, and some which have a third vowel-harmony process, either fronting harmony or height harmony.

Of particular interest is that the Mbam languages differ in the number of underlying and surface vowels and the scope of vowel harmony. It is likely that historically, the Mbam languages had ten contrastive vowels. Currently, seven to nine contrastive vowels are found.

6.1 Summary of the topics discussed in this study

This study has looked into various topics pertaining to the phonological systems of ten Mbam languages. In chapter one, we introduced the Mbam languages, considered the sociolinguistic context of the Mbam, presented the previous work done in these languages, and presented the types of data collected for this study.

Chapter two presented a phonological overview of each of the ten languages, discussing principally their consonant systems, vowel systems, vowel-harmony processes, hiatus-resolution processes and lexical tone. Of particular interest is that most of the Mbam languages have a mixture of two or three of the four types of vowel harmony found, namely, ATR, rounding, height and fronting harmony, of which ATR harmony is the most prevalent. In presenting the phonologies of these ten languages, the similarities and differences in the application of their vowel-harmony systems are emphasised.

Chapter three discussed in-depth the vowel-harmony processes of the Mbam languages. Included was a discussion of the acoustic characteristics of the vowels, in particular the high vowels; the correlation between the vowel inventory and vowel harmony and non-participating (neutral) vowels. In addition, the scope and domain of vowel harmony was examined, in particular the directionality in the spread of vowel harmony.

Various phonological issues in vowel harmony are considered in chapter 4, in particular how contrastive vowel features and vowel harmony are related. Dresher's (2009) contrastive-feature hierarchy of features and his Successive Division Algorithm are discussed in detail and applied to the vowel-harmony systems of the Mbam languages. Finally in chapter 5, we looked at various means of classifying the Mbam languages, looking at their sociolinguistic context, lexicostatistical, historical (lexical sound changes), and structural classifications.

6.2 The salient aspects of vowel harmony in the Mbam languages

The three most salient aspects of vowel harmony in the Mbam languages examined in chapter 3 of this study are the following:

- Non-participating (neutral) vowels and their behaviour in the vowel-harmony system
- Directionality in vowel harmony and
- The domain of vowel harmony

6.2.1 Non-participating (neutral) vowels

Non-participating or neutral vowels occur in all the types of vowel harmony found in the Mbam languages. They do not, however, behave in the same manner. As seen in this study, the fact that certain vowels are neutral can be attributed to their position in the contrastive feature hierarchy, but this hierarchy cannot explain why neutral vowels may be transparent or opaque. For example, certain rounding-neutral vowels are opaque in one language and transparent in the neighbouring language.

Given the generally accepted strict segmental locality of Optimality Theory, that “... no outputs are generated in which a single featural autosegment is associated with S1 and S3 but not an intervening segment S2” (Walker 2012: 585), it is possible that the height-transparent vowels, such as found in the rounding harmony of some of the Mbam languages, are affected by rounding but fail to produce salient acoustic consequences of harmony While clear evidence that transparent vowels are affected in Mbam rounding harmony has not yet been found, there are hints in slightly lowered frequencies of the first three formants that rounding may in fact have an effect on neutral vowels. More research, however, is needed to determine whether this subphonemic rounding has any real affect in determining whether these neutral vowels are transparent or opaque.

6.2.2 The role of domains and directionality in vowel harmony

The contrastive features of vowels may explain which of the various vowel-harmony processes occur and why, but it cannot explain the scope or direction of vowel harmony. The scope of vowel harmony is determined by the language-specific definition of the phonological word, which may not be the same as the grammatical or morphosyntactic word. These mismatches may indicate an historical residue of a strong phonological border. The existence of such a phonological border in the preverbal morphemes of at least some of the Mbam languages is not particularly surprising, considering that they are geographically and historically located between Bantu and the Southern Bantoid Grassfields languages, and share characteristics with both groups.

The domain of vowel harmony in all of the Mbam languages is the phonological word, which comprises at least one grammatical word and any associated clitics. A dominant vowel found within this phonological unit will spread throughout the unit unless blocked by an opaque neutral vowel. Vowel harmony in the Mbam languages is obligatory within the phonological word and between a clitic and its host.

Rounding harmony and ATR harmony do not spread identically. In the verb, rounding harmony is curtailed by three factors:

a. the presence and type of neutral vowels (opaque or transparent),
b. phonological word boundaries, and
c. the location of the harmony-dominant vowel(s).

Only the second factor plays a role in curtailing the spread of rounding harmony between the noun and its prepositions, associative markers and coordinating conjunction. This mismatch between the scope of ATR harmony and that of rounding harmony may be the result of a change in the structure of the phonological noun word. The proclitics associated with the noun may be in the process of becoming independent grammatical words rather than proclitics, resulting in an increasingly irregular spread in vowel harmony. In all cases of mismatches, the spread of ATR harmony is more robust than that of rounding harmony.

If the lack of vowel-harmony spread to the preverbal morphemes is due to a residual historical phonological boundary, the tendency of vowel harmony to spread right-to-left has perhaps eroded the phonological boundaries within the morphosyntactic domain. If the preverbal morphemes are indeed morphosyntactic prefixes, then the anticipatory tendencies of vowel harmony, barring other impediments, will spread throughout the entire grammatical word, which is the case for Yangben, Mmala and Elip.

The strong morphosyntactic boundaries signalled by the SOV word order in Nen and the periphrastic tense constructions in Yambeta would be the most obvious and powerful blockages to the spread of vowel harmony in these languages. While Nen, despite strong morphosyntactic boundaries, does have anticipatory vowel harmony, its spread is less powerful, having the tendency to be optional, and is more gradient than the vowel-harmony spread of other Mbam languages with similar morphosyntactic boundaries, such as Gunu and Maande. At the other extreme, strong morphosyntactic boundaries prevent any anticipatory vowel-harmony spread in the preverbal morphemes, as is the case for Tuki, Baca and Mbure.

Much has been discussed elsewhere concerning directionality in vowel harmony as well as whether it is root-/stem-controlled or dominant-recessive. It is hoped that this study of the Mbam languages will contribute to the discussion. The Mbam languages have 7- to 9- vowel systems with an active and complex dominant-recessive vowel-harmony system. The vowel harmony of the Mbam languages shows strong evidence for bidirectionality due to the existence of a few dominant prefixes. Dominant prefixes occur in the two most robustly attested vowel-harmony types, ATR and rounding. While [ATR]-dominant prefixes occur in only two languages, and only in closed paradigms such as numerals, the rounding-dominant prefix in Mmala is a noun-class prefix and triggers rounding on the noun stem wherever conditions apply. There is also evidence that this noun-class prefix is also height-dominant in Mmala (as discussed in Section 3.2.2 above).

6.3 Relationship between vowel inventory and vowel harmony

While certain vowels in the Mbam languages are realised phonetically and acoustically as quite low, notably /ɪ/ and /ʊ/, they function *phonologically* as high vowels. It is not the phonetic make-up which determines what a phoneme is; instead, the phoneme is determined by its behaviour in the system, which is a function of its contrastive features (Dresher 2009: 72). As discussed in this study, only contrastive features are phonologically active, and thus capable of triggering vowel harmony. Following Dresher (2009), contrastive features are hierarchically ordered, and the differences in what types of vowel harmony occur are the function of which features are active and their position in the language-specific contrastive-feature hierarchy.

In Mbam rounding harmony in particular, the high back vowels /u/ and /ʊ/, although phonetically round, are not *contrastively* round. Roundness is a redundant feature for the high vowels and therefore inert and cannot trigger rounding harmony. The fact that /u/ and /ʊ/ do not participate in rounding harmony is phonetic evidence that the feature [round] is unspecified for the high vowels.

Dresher's (2009) contrastive-feature hierarchy also explains why languages with similar vowel inventories and even similar contrastive features may have rather different vowel-harmony processes. Within the feature hierarchy, certain features may apply only to a subset. The difference in order and to which subset each feature in the hierarchy is applied makes the difference which vowel harmony type may occur. Furthermore, while vowel harmony *must* be triggered by a contrastive feature, the presence of a contrastive feature doesn't obligate the presence of vowel harmony.

6.4 Classification and interrelationship of the Mbam languages

The Mbam languages are generally situated between Bantu and the other Southern Bantoid languages, both geographically and genetically. They pattern sometimes with the northwestern Bantu languages and at other time with the nearest Bantoid languages.

This study has looked at several different ways to classify the Mbam languages internally, considering first what the various diachronic sound changes from proto-Mbam can reveal. Then we considered how the role of contact and various subsequent structural changes clarify the interrelationships between these languages. Finally we compared the basic lexicons of the languages and compared the various types (Nearest Neighbour, Furthest Neighbour and Branch Average) of lexical subclassifications to substantiate the historic and structural classifications.

Both the lexicostatistical, historical and structural comparisons show that, while the Mbam languages make up a cohesive unit, there are two subgroupings within it, although the division between these two groups varies somewhat depending on the type of classification.

If recent history is any indication, and as hinted also in the origin and migration stories of the populations, the Mbam region and the area around it underwent multiple population displacements. Migrations into and out of the Mbam area were frequent, and even people groups who today speak the same language, or dialects of the same language, consider themselves to have different origins. It is evident that many if not all of these people groups met, enslaved, and fought each other, intermarried, and in more than one case, joined each other to form a larger group, even if traces remain in the form of dialectal differences and individual sentiments. It is to be assumed that these contacts and mergings must have had an impact on the development of and changes in today's Mbam languages. With ever-increasing mobility and intercommunication, these groups are in closer contact with each other than ever before, and most people master more than one of their neighbouring languages.

Language contact can also explain why the languages at the extremities, such as Mbure and to a lesser extent Baca, while still evidently Mbam languages, show signs of borrowing from the larger and more prestigious Basaa to the south. This is most evident in the weakening of the vowel-harmony systems of these two languages.

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English Summary

The languages of the Mbam-et-Inoubou district of the Centre Region of Cameroon have a unique position in Bantu linguistics. Being in between “narrow” Bantu and “wide” Bantu, they sometimes pattern with the one and sometimes with the other, and as such are a rich motherlode for comparative and historical research. The Mbam languages have another point of interest as well. They have formerly been analysed as standard 7-vowel languages (/i, e, ɛ, a, ɔ, o, u/) with Advanced Tongue Root (ATR) harmony

There is a high degree of multilingualism among the speakers of the Mbam languages. These are small language groups in close proximity, acknowledging an ethnic interrelationship and history. As a result, most adults speak not only French as a second language but often one or more of the neighbouring (not exclusively Mbam) languages. The languages discussed in this study are Nen, Maande, Yambeta, Tuki, Gunu, Elip, Mmala, Yangben, Baca and Mbure.

This study begins with an overview of the ten languages concerned, the previous linguistic work done in them and the type of data collected for this analysis.

Basic phonological summaries of the contrastive consonants, vowels and tones, as well as overviews of how the vowel-harmony systems operate within roots and between roots and affixes, for each of the ten languages are given as background information for the study of the complexities of the vowel harmony of these languages. The microvariations within these comparable but different vowel (-harmony) systems provide a greater understanding of the phonologies of each individual language, and, by finding in a bottom-up manner, the relevant parameters of variation, contribute to the understanding of vowel harmony in general.

The vowel harmony of the Mbam languages is very complex. Four different types of interrelated vowel harmony (ATR, rounding, fronting and height) exist in these languages, with any given language having between one and three types of vowel harmony. The particularities of vowel harmony of the Mbam languages, various issues such as the behaviour of /a/ and other non-participating vowels, directionality in, and the domain of vowel harmony as well as the mismatches between the phonological and the grammatical word between the different vowel-harmony types are discussed in light of the variations found in the Mbam languages.

The phonological issues in vowel harmony, in particular Dresher's (2009) model of a contrastive-feature hierarchy of features, are discussed at length and applied to explain the relationship between the vowel inventory, vowel harmony and the gaps

in vowel harmony found in the Mbam languages. Dresher's contrastive-feature hierarchy is useful in particular to explain why high round vowels, /u/ and /ʊ/ do not participate in rounding harmony, why languages with similar vowel inventories and even similar contrastive features have rather different vowel-harmony systems. This is particularly useful in explaining the unusual ATR disharmony found in Mmala where all instances of /ʊ/ in the context of /ɔ/ surface as a [+ATR] vowel, /u/.

Next we look at the interrelationships and subgroupings of the Mbam languages within the context of the group by means of diachronic sound and structural changes to consider to what extent historical processes can explain the patterns found in Mbam vowel harmony.

Finally we consider the synchronic lexicostatistical subclassifications of the Mbam languages and their relationship in the wider context of the Bantu and Bantoid languages.

Samenvatting

De talen van het Mbam-en-Inoubou district in de *Center* provincie in Kameroen bekleden een unieke positie in de Bantu taalkunde. Aangezien ze het midden houden tussen de -narrow" en -wide" Bantu talen, gedragen ze zich soms als de een en soms als de ander, en zijn dus een rijke bron van informatie voor vergelijkende en historische taalkunde. De Mbam talen zijn ook interessant op een ander gebied. Ze zijn eerder altijd geanalyseerd als talen met 7 klinkers (/i, e, ɛ, a, ɔ, o, u/) met Advanced Tongue Root (ATR) harmonie.

Er is een hoge mate van meertaligheid onder de sprekers van de Mbam talen. Het zijn kleine, dicht bij elkaar gelegen taalgroepen en men erkent dat er etnische onderlinge banden en een gezamenlijke geschiedenis zijn. Als gevolg daarvan spreken de meeste volwassenen niet alleen Frans als tweede taal maar vaak ook nog één of meer van de naburige (niet alleen Mbam) talen. De talen die in deze studie besproken worden zijn Nen, Maande, Yambeta, Tuki, Gunu, Yangben, Elip, Mmala, Baca en Mbure.

De studie begint met een overzicht van elk van deze tien talen, eerder onderzoek dat gedaan is en de data die verzameld zijn voor de analyse.

Als achtergrondinformatie voor de studie van de complexe klinkerharmonie van deze talen wordt een fonologisch basisoverzicht van de contrastieve consonanten, klinkers en tonen gegeven. Vervolgens wordt ook het klinkerharmonie systeem – zowel binnen de wortels als tussen de wortels en affixen- voor elk van de tien talen behandeld. De kleine variaties in deze vergelijkbare maar toch verschillende klinker(harmonie) systemen geven een beter begrip van de fonologie van iedere individuele taal. En het ontdekken van de relevante voorwaarden voor variatie draagt bij aan een beter inzicht in klinkerharmonie in het algemeen.

Klinkerharmonie in de Mbam talen is erg complex. Er bestaan 4 verschillende types onderling gerelateerde klinkerharmonie (ATR, -rounding", -fronting" en -height") in deze talen, waarbij iedere taal over één tot drie van de verschillende soorten beschikt. In het licht van de verschillende opties die in de Mbam talen worden gevonden, worden specifieke bijzonderheden van klinkerharmonie besproken; de kenmerken van /a/ en andere neutrale klinkers, richting binnen en domein van klinkerharmonie, als ook de verschillen tussen het fonologische en grammaticale woord bij al de verschillende types klinkerharmonie.

De fonologische aandachtspunten van klinkerharmonie, met name het model van Dresher (2009) van contrastieve hiërarchische kenmerken, worden uitgebreid beschreven en toegepast om de relatie tussen de bestaande klinkers, klinkerharmonie en de restricties binnen de klinkerharmonie in de Mbam talen te verklaren.

De contrastieve hiërarchie van Dresher is vooral van toepassing om te kunnen begrijpen waarom de hoge ronde klinkers /u/ en /o/ niet deelnemen aan -round" harmonie, en waarom talen met vergelijkbare klinker bestanden en zelfs vergelijkbare contrastieve kenmerken toch nog zeer verschillende klinkerharmoniesystemen hebben. Dit is vooral nuttig om de bijzondere ATR disharmonie in Mmala te verklaren, waarbij alle gevallen van /ʊ/ in the omgeving van /ɔ/ gerealiseerd worden als de [+ATR] klinker /u/.

Vervolgens kijken we naar de onderlinge verwantschap en sub-groeperingen van de Mbam talen binnen de grotere groep door middel van diachronische klinkerveranderingen en veranderingen in structuur, om te bepalen in hoeverre historische processen de Mbam klinkerharmonieregels kunnen verklaren.

Als laatste behandelen we de synchrone lexico-statistische sub-classificatie van de Mbam talen, en hoe ze zich verhouden tot de bredere groep Bantu en Bantoïde talen.

Curriculum vitae

Virginia Lee (Ginger) Boyd was born on 05 February 1961 in Bethesda, Maryland, USA. She graduated from John F. Kennedy High School in Silver Spring, Maryland, USA in 1979. From 1979 to 1984 she studied early childhood education at Frostburg State University, where she graduated with a Bachelor of Science. After a couple of years teaching children in private schools, she pursued further studies in linguistics at the University of Texas at Arlington in 1989. Following linguistic research on the Gbaya Mbodomo language in Cameroon from 1993 to 1996, she obtained a Masters of Art in Linguistics in 1996. From 1997 to 2003 she did further linguistic research on Moloko, a Chadic language of Cameroon. Subsequently, she began research on the languages of the Mbam.