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

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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 It is based on personal research as well as previous research of several linguists and an unpublished wordlist[32].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 The main wordlist used is an unpublished 2000+ word Toolbox lexicon.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 Much of the information and analysis collected from both published and unpublished sources has been checked, and in many cases modified, by my own research.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		ᵐb	ⁿd	ᶮdʒ	ᵑg
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.

[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	[jùhá]	*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	ò≠kít-à	*pick (fruit)*
ə	x	---	-ə	ù≠kə́t-ə̀	*paint, decorate*
a	---	---	-a	ò≠tát-à	*guard, watch over*
ɔ	---	x	-ɔ	ò≠sɔ́s-ɔ̀	*smoke, suck*
				ò≠kɔ́l-ɔ̀	*scratch, scrape*
o	x	x	-o	ù≠kót-ò	*bite, crunch*
				ù≠kòl-ò	*create*
ʊ	---	---	-a	ò≠kót-à	*dry*
				ò≠kòl-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≠pə̀^{m}bə́	*valley*		ù≠^{n}dòkó	*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≠tə̀lú	≠LH	[nìtə̀lù]	[nìtə̀lú]	*chin*
mò≠kàŋá		[mòkàŋà]	[mòkàŋá]	*root*
ì≠pə́kù	≠HL	[ìpə́k]	[ìpə́kù]	*wing*
hì≠páŋà		[hìpáŋ]	[hìpáŋà]	*ankle*
mì≠sə̀kù	≠L	[mìsə̀kṳ̀]	[mìsə̀kù]	*elephant*
hì≠lùpù		[hìlùp]	[hìlùpù]	*cocoon*
mì≠ɲàmà		[mìɲàm]	[mìɲàmà]	*grain*
ì≠lə́ŋú	≠H	[ìlə́ŋ]	[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	mə ≠ 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)*	èpàkɔ́	*agama lizard*	568	1003
èkaho	*crachat (p75)*	èkàhɔ́	*phlegm*	569	1038

	[-ATR] vowels			[+ATR] vowels	
ʊ-ɪ	pò≠ò jí	*beehive*	u-i	pù≠lùfí	*curse (n)*
ʊ-a	ò ≠ hʊ̀tá[36]	*hair*	u-ə	ì≠lúkɔ́	*latrine*
ʊ-ʊ	mò≠kòlʊ́	*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/	i-i	---	i-ə
/ɪ/	ɪ-ɪ	--- (ɪ-ʊ)[37]	ɪ-a
/u/	u-i	u-u	u-ə
/ʊ/	ʊ-ɪ	ʊ-ʊ	ʊ-a
/o/	o-i	o-o	---[38]
/ɔ/	ɔ-ɪ	ɔ-ɔ	---[39]
/a/	a-ɪ	a-ʊ	a-a
/ə/	ə-i	ə-u	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		class	prefixes
1	mʊ- /mu-		2	pa- / pə-
1a	ʊ- / u-			
3	mʊ- /mu-		4	mɪ- / mi-
3a	ʊ- / u-		4a	ɪ- / i-
5	nɪ- / ni-		6	ma- / mə-
7	ɪ- / i-		8	pɪ- / pi-
9	mɪ- / mi-			
9a	ɪ- / i-			
14	pʊ- / pu-			
19	hɪ- / hi-		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≠lìᵐbà	*sorcerer*
		mù≠kójì	*co-wife, sister-in-law*
1a	ʊ- / u-	ʊ̀≠mólá	*young woman*
		ù≠mìnə̀	*taro*
2	pa- / pə-	pà≠lìᵐbà	*sorcerers*
		pə̀≠kójì	*co-wives, sisters-in-law*
		pà≠pólá	*young women*
		pə̀≠pìnə̀	*taros*
3	mʊ- / mu-	mʊ̀≠líŋí	*tail*
		mù≠lə́ⁿdù	*tendril*
3a	ʊ- /u-	ʊ̀≠ŋɔ̀ⁿdɔ̀	*peanut*
		ù≠mílə̀	*palm nut*
4	mɪ- / mi-	mì≠líŋí	*tails*
		mì≠lə́ⁿdù	*tendrils*
4a	ɪ- / i-	ì≠ŋɔ̀ⁿdɔ̀	*peanuts*
		ì≠mílə̀	*palm nuts*
5	nɪ- /ni-	nì≠fófá	*current (stream, river)*
		nì≠púnə́	*wall*

class	noun-class prefix	example	*gloss*
6	ma- /mə-	mà≠tàⁿdà	*urine*
		mə≠lùkù	*wine*
		mà≠fófá	*currents (streams, rivers)*
		mə≠púnə́	*walls*
7	ɪ- /i-	ì≠tátó	*mushroom*
		ì≠pə́kù	*wing*
8	pɪ- / pi-	pì≠tátó	*mushrooms*
		pì≠pə́kù	*wings*
9	mɪ- /mi-	mì≠ɲàmà	*meat*
		mì≠sə̀kù	*elephant*
9a	ɪ- /i-	ì≠máká	*monitor lizard*
		ì≠mítə́	*calabash*
13	tʊ- / tu-	tò≠kɔ̀lì	*squirrels*
		tù≠kòlí	*strings, threads*
14	pʊ- /pu-	pò≠nɔ̀ŋɔ̀	*village*
		pù≠nùtə̀	*swelling*
19	hɪ- /hi-	hì≠kɔ̀lì	*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*
	ò≠kít-à	*pick (fruit)*
	ù≠kə́t-ə̀	*carve*
	ò≠kàl-à	*patch (v)*
	ò≠kɔ́l-ɔ̀	*scrape, scratch*
	ù≠kòl-ò	*create*
	ò≠kɔ̀t-à	*gather, pile up*
	ù≠kùl-ə̀	*hoe (v)*

pí-	ù-pí≠kìⁿd-ə	*wipe off excrement*
	ò-pí≠kís-à	*shave oneself*
	ù-pí≠lɔ́n-ə	*rejoice*
	ò-pí≠fàl-à	*comb oneself*
	ò-pí≠nɔ́k-ɔ	*slither*
	ù-pí≠hól-ʲə	*thank*
	ò-pí≠nóm-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-	mò≠ⁿdɔ̀ ɔ̀≠mɔ̀tí	*one person*
2	pa-	pì≠ⁿdɔ̀ pá≠fàⁿdí	*two people*
3	u-	mò≠límá **ú≠mòtí**	*one heart*
4	i-	mì≠límá **í≠fàⁿdí**	*two hearts*
5	nɪ-	nì≠káɲí ní≠mɔ̀tí	*one king-fisher*
6	ma-	mà≠káɲí má≠fàⁿdí	*two king-fishers*
7	ɪ-	ì≠hàkì í≠mɔ̀tí	*one genet*
8	pɪ-	pì≠hàkì pí≠fàⁿdí	*two genets*
9	ɪ-	mì≠ímə̀ ì≠mɔ̀tí	*one house*
13	tʊ-	tʷ≠áⁿdʒì tó≠fàⁿdí	*two leaves*
14	pʊ-	pò≠ʲá pó≠mɔ̀tí	*one tree*
19	hi-	hʲ≠áⁿdʒì **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≠nìsə̀	*four people*
c3 (ú-)	mʷ≠ìlí **ú**≠mòtí	*one month*
c4 (í-)	mʷ≠ìlí **í**≠fəⁿdí	*two months*
	mʷ≠ìlí í≠lá̲ló	*three months*
	mʷ≠ìlí **í**≠nìsə̀	*four months*
	mʷ≠ìlí í≠lá̲nò	*five months*
	mʷ≠ìlí í≠lí̲ⁿdálò	*six months*
	mʷ≠ìlí í≠lí̲ⁿdálómònà	*seven months*
	mʷ≠ìlí í≠ná̲mànì	*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 pronouns	pá≠mʲá pə̀≠nísə̀	*c2≠1s.POSS c2≠brothers/cousins*
	j≠àjí ì≠ŋgílí	*c9≠3s.POSS c9≠idea*
	wə̀≠**ə́sú** ə̀≠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	tónə̰	*I will dance again*
b.	mí-ŋù	pín-ə́k-ə̀	tónə̰	
c.	mí-ŋò	pín-ə́k-ə̀	tónə̰	
	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

[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	hʲɔ́pʷɔ́	hìfʲà	tùm-ək-ə
	bə́-nɔ́	hʲɔ́pʷɔ́	hìfʲà	tùm-ək-ə
	c2-P2[43]	c19.3pPOSS	c19.pit	dig-pl-FV
	They dug their pit.			

(b)	hìsɔ́lì	à-ná	pəsú	ìᵐbátà	hík-ín-ə
	hìsɔ́lì	ə-nɔ́	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	ò≠kòl-ìn-à	*go buy protective medicine*
		ò≠lòt-ìn-à	*gather up something*
		ù≠kòl-ìn-ə	*create*
		ù≠lòt-ìn-ə	*tease oneself*
reciprocal	-an	ò≠ɲán-àn-à	*join, meet, put together*
		ù≠kùs-ən-ə	*receive, get, obtain*
positional	-ɪm	ò≠tín-ím-à	*stand, stand up*
		ò≠pàⁿd-ìm-ìn-à	*stoop, bend over*
		ù≠kíl-ím-ə	*shiver, tremble*
		ù≠kùt-ìm-ìn-ə	*bend, bow*
separative	-ɔn	ò≠fát-ón-à	*loosen*
		ù≠súŋ-ún-ə	*untie*
??	-al	ò≠sìk-àl-à	*slice*
		ù≠kìt-əl-ə	*slap*
progressive	-ak	ù≠tát-ák-à	*watch, guard*
		ù≠tìm-ək-ə	*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*	mɔ̀≠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≠tàⁿd-à	*urinate*	mà≠tàⁿd-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≠túᵐb-ól-ənʲ-ə̀	*announce*	mù≠túᵐb-ól-ənʲ-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≠fɔ̀l-ì-ə̀	*loan (cause to borrow)*
		ò≠kót-à	*dry*	ù≠kút-ì-ə̀	*cause to dry*
		ò≠fát-à	*tighten*	ù≠fɔ́t-ì-ə̀	*cause to tighten*
		ò≠hìk-à	*be tasty*	ù≠hìk-ì-ə̀	*please, satisfy*
	-əsi	ò≠síp-à	*peel*	ù≠síp-ɔ́sì-ə̀	*cause to peel*
		ò≠pɔ̀k-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≠tɔ́t-ɔ́nì-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	ò≠lɔ́ŋ-ɔ́	*whistle (v)*
		ò≠sɔ̀n-ɔ̀	*sweep*
		ù≠kót-ò	*crunch*
		ù≠tóp-ò	*paint (v)*
		ò≠kòt-à	*gather, heap up*
		ù≠húk-ə̀	*blow (wind)*
progressive	-ak	òw≠ɔ̀l-ɔ́k-ɔ̀	*fasten, bind*
		ò≠sɔ́s-ɔ́k-ɔ̀	*suck, smoke*
		òw≠ò^{m}b-òk-ò	*throw away*
		ò≠kòt-ák-à	*gather, heap up*
		ù≠húl-ə́k-ɔ́	*come*
??	-al	ò≠kɔ̀l-ɔ̀l-ɔ̀	*snore*
		ù≠ɲòŋ-òl-ò	*tickle*
		ò≠kòt-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 **-ʊ̀n** separative suffix and **-ʊ̀m** which were only found with words such as **ù≠hə́l-úm-ə̀** *rest* and **ù≠tə́l-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	-ɔn	ò≠kɔ́ŋ-**ɔ́n**-à	*tip over*
?? [44]	-ɔm	ò≠kɔ́l-**ɔ́m**-à	*be afraid*
		ò≠lɔ́ŋ-**ɔ́m**-à	*listen*
applicative	-ɪn	ò≠pɔ̀ŋ-ɔ̀l-**ìn**-à	*fence in*
		ù≠hól-**ín**-ə̀	*wrap up*
		ù≠kóp-**ín**-ə̀	*surround, protect*
diminutive	-ɪl	ò≠mʲɔ̀t-**ìl**-à	*press (v)*
positional	-ɪm	ò≠ɲɔ́ⁿd-**ím**-ìn-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**
hʲǒlì	hì≠ólì	*hawk*
hʲɔ̀fɔ́	hì≠ɔ̀fɔ́	*fish*
pʷòlí	pù≠òlí	*work*
pʷɔ̀sí	pò≠ɔ̀sí	*day*
mʷìpí	mò≠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***
ùfəŋʲə	ò≠fàŋ-ì-à	*hang up*
òsánʲà	ò≠sán-ì-à	*blow up, inflate*
ùhʷɔ́	ù≠hú-ɔ́	*cover*
òkʷà	ò≠kò-à	*fall*
ùnʷənʲə	ù≠nù-ən-ì-ə	*defend*
òhʷínà	ò≠hó-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*
	məɔ́sə	mə≠ísə	*c6.eyes*
(b)	mùùmɔ́	mə≠ùmɔ́	*c6.baobabs*
	mòòjí	mà≠òjí	*c6.beehives*
	mòòní	mə≠òní	*c6.markets*
	mɔ́ɔ́pɔ̀	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*
nìísə	nì≠ísə	*c5.eye*
mòòkò	mò≠òkò	*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	*apply oil*
	ò≠fàf-ìt-à	
H	ò≠pát-à	*gather, pick up*
	ò≠pát-íl-à	
LHL	ò≠wǎːl-à	*babble (baby)*
	ò≠wǎːl-ìl-à	

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 (HƐNYƐNↃ) 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≠ᵐbòkí	tù≠ᵐbòkí	*c19/13.large terracotta pot*
nù≠ᵐbə̀tí	tù≠ᵐbə̀tí	*c11/13.earth worm*
hì≠ⁿdə̀ŋɔ́	tù≠ⁿdə̀ŋɔ́	*c19/13.calabash for drinking wine*
bù≠ⁿdìwə́	mə̀≠ⁿdìwə́	*c14/6.bush used to mark territory*
nò≠ᵑgáhɔ́	tò≠ᵑgáhɔ́	*c11/13.smell of good food cooking*
hì≠ᵑgífílí	tù≠ᵑgífílí	*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-**ójɲ**-ís-i	*make red*
	ɔ≠hɔ̀l-**ìn**-à	*pass by*	ɔ≠hùl-**ìjɲ**-ì	*transmit, cause to pass*
(b)	ɔ̀≠sìm-ìn-ìn-ə			*enclose*
	ɔ̀≠làt-ìn-ìn-à			*add, enlarge*
	ɔ̀≠tóŋ-**íjɲ-íjɲ**-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**jɲ**-i-à	*escape, flee, scatter oneself*
(b)	ɔ̀≠tʃîk-ìl-i-ən-ə			*arrange, classify*
	ɔ̀≠hàt-i-àk-ìn-à			*catch, stop as a group*
(c)	ɔ̀≠bɔ́n-ɔ́s-i-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

ɔ̀≠lən-ə	*love, desire*	ɔ̀-bí≠lən-**ín**-ə	*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	ə̀≠hìk-à	*be beautiful, good*
ə	x	---	-ə	ò≠lə̀k-ə̀	*prohibit, impede*
a	---	---	-a	ə̀≠kát-à	*pick (fruit)*
ɔ	---	x	-ɔ	ə̀≠bɔ́k-ə̀	*create, conceive*
o	x	x	-o	ò≠bók-ò	*cry, scream*
ʊ	---	---	-a	ə̀≠tók-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	nò≠bí^{m}bì	*tongue*	ʊ	à≠bóló[49]	*mushroom sp.*
	à≠kìŋì	*hill*		à≠fòkò	*trad. manacle*
ə	mə̀≠sə̀kə̀	*sleeping sickness*	o	ò≠tókó	*calf (of leg)*
	mù≠jə̀ká	*hot pepper sp.*		nù≠bókó	*squirrel sp.*
a	à≠tà^{n}dá	*grasshopper*	ɔ	nɔ̀≠bólɔ́	*rain*
	bò≠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*
i:	nì≠hì:tə̀	*part, turn*	ò≠hî:t-ə̀	*take*
ɪ:	ɔ̀≠mî:ndí	*limit, boundary*	ɔ̀≠hì:s-á	*pray, see*
ə:	mù≠jə̌:	*gorilla*	ò≠pə́:t-ì	*respect, cause to rise*
a:	nò≠hâ:tí	*courtyard, outside*	ɔ̀≠pá:t-à	*climb, rise*
o:	ò≠sǒ:só	*fish sp.*	ò≠hó:n-ò	*make smooth*
ɔ:	ɔ̀≠tɔ̀:	*yam*	ɔ̀≠pɔ̀:t-ɔ̀	*bump, knock*
ʊ:	---	---	ɔ̀≠kò:n-à	*say*
u:	ò≠kǔ:kə̀	*notable*	ò≠sù:n-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)*
bòòfʲà	bò≠òfià[50]	*rodent burrow*
ɲìísə	nì≠ísə	*eye*
tʃîisɔ	tʃî≠ìsɔ	*parrot*
ààtó	à≠àtó	*head*
wəənə́	wə≠ənə́	*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≠sáᵐbó	hɛ̀sáᵐbʷ	*partridge*
nì≠hásà	ɲɛ̀hás (ɲɛ̀hásà)[52]	*twin*
nì≠hásó	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 found 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≠sìlì	*fly sp.*	i-i	ò≠tʃílì	*termite sp.*
ɪ-a	à≠bíhà	*net*	i-ə	ə̀≠kìtə̀	*ram*
ɪ-ʊ	---	---	i-u	---	---
a-ɪ	hì≠ŋàlí	*striped rat*	ə-i	hì≠sə́tì	*duiker*
a-a	à≠sáká	*mushroom sp.*	ə-ə	ì≠ŋə́nə́	*infant*
a-ʊ	à≠pàkú	*agama lizard*	ə-u	ə̀≠bə́kù	*wing*
ʊ-ɪ	mà≠nómì	*sperm*	u-i	hì≠kútí	*mosquito*
ʊ-a	ì≠mùtʃá	*gizzard*	u-ə	ə̀≠húnə̀	*wind*
ʊ-ʊ	à≠lóŋó	*cadaver, body*	u-u	ì≠ⁿdʒúbú	*hippopotamus*
ɔ-ɪ	ì≠kɔ̀kí	*hen, chicken*	o-i	nù≠kòlí	*vine, cord*
ɔ-a	---	---	o-ə	---	---
ɔ-ɔ	nɔ̀≠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	ʧɪ- / ʧi-		10a	ʧɪ- / ʧi-
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*
		mʊ̀≠kə́lísì	*judge*
	ɔ-	ɔ̀≠bɔ́là	*girl*
		ɔ̀≠húhə̀	*co-wife*
2	ba-	bà≠táŋà	*spokesmen*
		bə̀≠kə́lísì	*judges*
		bà≠bɔ́là	*girls*
		bə̀≠húhə̀	*co-wives*
3	ɔ-	ɔ̀≠tɛ́má	*heart*
		ɔ̀≠mə̀hú	*flesh*
4	ɪ-	ɪ̀≠tɛ́má	*hearts*
		ɪ̀≠mə̀hú	*flesh (pl)*
5	nɪ-	nɪ̀≠ⁿdáɲí	*stone*
		nɪ̀≠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≠bàkó	*agama lizard*
		ə̀≠bə́kù	*wing*
8	bɪ-	bì≠bàkó	*agama lizards*
		bì≠bə́kù	*wings*
9/10	ɪ-	ì≠ɲàmà	*animal(s)*
		ì≠tʃə̀kù	*elephant(s)*
	tʃɪ-	tʃì≠áŋà	*guinea fowl(s)*
		tʃì≠íkə́	*porcupine(s)*
11	nʊ-	nɔ̀≠bíᵐbì	*tongue, language*
		nù≠bókó	*bush squirrel*
13	tʊ-	tɔ̀≠bíᵐbì	*tongues, languages*
		tù≠bókó	*bush squirrels*
		tɔ̀≠sàᵐbà	*bush rats*
		tù≠búbə́	*pigeons*
14	bʊ-	bɔ̀≠ŋànà	*song*
		bù≠húɲì	*word, speech*
19	hɪ-	hì≠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-	ɔ̀≠kìt-ə̀	*strike, tap*
	ɔ̀≠kìl-à	*do*
	ɔ̀≠kə́k-ə̀	*respect (v), be surprised*
	ɔ̀≠kát-à	*pick (fruit)*
	ɔ̀≠sɔ́l-ɔ̀	*hoe (v)*
	ɔ̀≠bók-ɔ̀	*shout*
	ɔ̀≠sɔ̀l-à	*absorb*
	ɔ̀≠kús-ə̀	*scratch, scrape*

bí-	ò-bí≠tís-ə	*touch*
	ɔ̀-bí≠kíl-à	*become, realise*
	ò-bí≠lɔ́n-ə	*rejoice*
	ɔ̀-bí≠fám-à	*blow one's nose*
	ò-bí≠ój-ò	*warm oneself*
	ɔ̀-bí≠hô:k-ɔ̀	*save oneself, escape*
	ɔ̀-bí≠kô:n-à	*be prideful, arrogant*
	ò-bí≠kút-ə	*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≠fə^{n}dí	*two people*
		bà≠átʃɔ̀ bá≠tátó	*three people*
3	ɔ́-	ɔ̀≠tɛ́má ɔ́≠mɔ̀tí	*one heart*
4	í-	ì≠tɛ́má í≠fə̀^{n}dí	*two hearts*
		ì≠tɛ́má í≠tátó	*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≠tátó	*three stones*
7	á-	à≠mìnà ɔ́≠mɔ̀tí	*one neck*
8	pí-	bì≠mìnà bí≠fə̀^{n}dí	*two necks*
		bì≠mìnà bí≠tátó	*three necks*
9	ì-	ì≠ɲàmà ì≠mɔ̀tí	*one animal*
10	í-	ì≠ɲàmà í≠fə̀^{n}dí	*two animals*
		ì≠ɲàmà í≠tátó	*three animals*
11	nó-	nò≠bí^{m}bì nó≠mɔ̀tí	*one tongue*
13	tó-	tò≠bí^{m}bì tú≠fə̀^{n}dí	*two tongues*
		tò≠bí^{m}bì tó≠tátó	*three tongues*
14	bó-	bò≠ŋànà bó≠mɔ̀tí	*one song*
6	má-	mà≠ŋànà mə́≠fə̀ndí	*two songs*
		mà≠ŋànà má≠tátó	*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	ŋɔ́		ə̀sù		l**i**kímə	*we are not afraid*
1p	neg	T/A		1p		be.afraid	
tɔ̀	tì	ŋá	hánà	ə̀sù		l**i**kímə	*we are not afraid*
1p	neg	T/A	again	1p		be.afraid	*again*
tɔ̀	tì	ŋá		àsɔ̀		lókómà	*we do not understand*
1p	neg	T/A		1p		understand	
tù	tì	ŋɔ́	t**ɔ́ŋ**ì	àsɔ̀	bànɔ́	bílítʃĩŋìŋ**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)*
		bɔ̀≠ɲónó	*daughters-in-law*
		bà≠bólà	*girls*
		bɔ̀≠húhɔ̀	*co-wives*
6	ma-	mɔ̀≠nɔ̀ŋɔ̀	*countries, villages*
		mò≠tòlì	*safou plum trees*
		mà≠sòlà	*soup, sauce*
		mɔ̀≠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≠fòⁿdí	*termite sp. mound*
		à≠kóbà	*furrow, groove*
		ə̀≠sùsə̀	*ant hives*
7	a-	ɔ̀≠tʃɔ́kɔ́	*lump, hump*
		ò≠fòkó	*valley, hollow*
		à≠tʃòkà	*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

ò-**ŋǒ**≠bó̲k-**ə̀**	*s/he creates*
c1-Pr≠create-FV	
bɔ́-ŋɔ̂≠bɔ̲́k-**ɔ́k-ə̀**	*they created*
c2-P1≠create-INTENS-FV	
bó-ŋǒ≠bò̲k-**ò**	*they scream*
c2-Pr-scream-FV	
ú-**ŋò**≠bò̲k-ìt-ə̀	*s/he screamed*
c1-P1≠scream-DIM-FV	
ò-ŋǎ≠tók-à	*s/he draws (water)*
c1-Pr≠draw-FV	
ù-ŋə̌≠túk-ə̀	*s/he nourishes (child)*
c1-Pr≠nourish-FV	
ò̲-**ŋǒ**≠túk-ə̀	*you nourish (child)*
2s-Pr≠nourish-FV	
ɔ̲̀-**ŋɔ̌**≠tók-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≠fɔ́n-ín-ə̀	*mock, ridicule someone*
reciprocal	-an	ɔ̀≠bánd-án-à	*join, unite*
		ò≠lɔ́n-ɔ́n-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≠tʃûk-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≠tʃə̀k-ʊ̀n-à	*play (game)*	à≠tʃə̀k-ʊ̀n-**ín**-á	*toy, game*
ɔ̀≠bə̀l-ə̀k-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**-ɔ́	*fan*
ò≠bíən-ə̀	*give birth*	ə̀≠bíən-**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≠bíə̀n-ə̀	*give birth*	òm≠bíə̀n-ì	*nephew, niece*
ò≠bín-ə̀	*dance (v)*	mə̀≠bín-ə̀	*dance (n)*
ɔ̀≠táŋ-à	*speak, talk*	mɔ̀≠táŋ-à	*spokesman*
ɔ̀≠nàᵐb-à	*hide*	nì≠nàᵐb-à	*hiding place*
ɔ̀≠táb-ón-à	*repair, fabricate*	mɔ̀≠táb-ón-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 **-ık** and the applicative **-ın**.

Example 49: ATR Dominant suffix -i

caus.	-i	ɔ̀≠lɔ̀l-à	*burn*	ò≠lùl-ì	*cause to burn*
		ɔ̀≠fɔ̀l-ɔ̀	*borrow*	ò≠fɔ̀l-ì	*cause to borrow*
		ɔ̀≠kɔ́t-à	*dry (INTR)*	ò≠kút-ì	*dry (TR)*
		ɔ̀≠kɔ̀t-ɔ̀	*refuse, miss*	ò≠kɔ̀t-ì	*cause to miss*
		ɔ̀≠tʃĩtʃ-à	*laugh*	ò≠tʃĩtʃ-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≠mə̀n-ìs-ì	*put to an end*
				ò≠mə̀n-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≠kót-à	*dry (INTR)*
		ò≠kùt-ə̀	*shave, style hair*
intensive	-ak	ɔ̀≠bɔ̀l-ɔ̀k-ɔ̀	*pierce*
		ò≠ɲóy-ók-ò	*fill up*
		ɔ̀≠lòb-àk-à	*uproot*
		ò≠búm-ə́k-ə̀	*hunt*
reciprocal	-an	ɔ̀≠hɔ̀n-ɔ̀n-ɔ̀	*quarrel*
		ò≠ból-ót-ón-ò	*be red*
		ɔ̀≠mó-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-ón-à	*find, obtain*
		ɔ̀≠sɔ́l-ɔ̀	ɔ̀≠sɔ́l-ón-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	ʧííbə̀	ʧì≠íbə̀	*c9.house*
ʊ-ɪ	---	---	---
ɪ-ɪ	ʧíítò	ʧì≠ítò	*c9.body*
ʊ-a	nʷǎɲí	nò≠áɲí	*c11.leaf*
ɪ-a	ʧʲǎŋà	ʧì≠áŋà	*c9.guinea fowl*
u-ə	bʷə̀nù	bò≠ə̀nù	*c14.yam field*
i-ə	hʲə̀ʧə́ʧʃə́	hì≠ə̀ʧə́ʧʃə́	*c19.mushroom*
ʊ-ɔ	nʷɔ̀mɔ́	nò≠ɔ̀mɔ́	*c11.river*
ɪ-ɔ	hʲɔ̀fɔ́	hì≠ɔ̀fɔ́	*c19.fish*
u-o	bʷòhó	bò≠òhó	*c14.seed for sowing*
i-o	ʧʲǒyò	ʧì≠óyò	*c9.smoke*
ʊ-ʊ	bòòtí	bò≠òtí	*c14.tree*
ɪ-ʊ	bʲòfà	bì≠òfà	*c8.fur*
u-u	tùúɲí	tò≠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≠mɔ́-à	*drink*
	ɔ̀mʷákínà	ɔ̀≠mɔ́-ák-ín-à	*consume (INTENS) wine*
	ɔ̀hʷà	ɔ̀≠hɔ̀-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*
	ɔ̀ʧʃà	ɔ̀≠ʧì-á	*light (v), collect*
	ɔ̀ʧʃǎkà	ɔ̀≠ʧì-ák-à	*light (v), collect (INTENS)*

	surface form	**underlying form**	***gloss***
iə	òɲʲə́	ò≠ní-ə̀	*rub*
	òɲʲə́kə̀	ò≠ní-ə́k-ə̀	*rub (INTENS)*
ɪɔ	ə̀ɲʲə̀	ɔ̀≠nì-ə̀	*cultivate*
	ə̀ɲʲə̀nɔ̀	ɔ̀≠nì-ə̀n-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≠ᵐbòáŋí	*arrowhead*
	ɔ̀mʷànáː	ɔ̀≠mòànáː	*sky*
	ìsʷǎjí	ì≠sòájí	*wine calabash*
uə	ònʷə́	ò≠nùə́	*orifice, hole*
	bùsʷə̀	bù≠sùə̀	*whip*
	ə̀bʷə́mə́	ə̀≠búə́mə́	*fox*
ɪa	àcʲâ	à≠cíà	*bird sp.*
	bòòfʲà	bò≠òfìà	*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	ɔ̀kʷəjì	ɔ̀≠kùə̀j-ì	*close*
	ɔ̀kʷə̀jìkì	ɔ̀≠kùə̀j-ìk-ì	*close (INTENS)*
	ɔ̀mʷə̀mə̀	ɔ̀≠mùə̀m-ə̀	*smile (v)*
ɪa	ɔ̀tʲábà	ɔ̀≠tíáb-à	*look for firewood*
	ɔ̀bʲátínà	ɔ̀≠bíát-ín-à	*break*
iə	ɔ̀bʲə́nə̀	ɔ̀≠bíə́n-ə̀	*give birth*
ɪɔ	ɔ̀mʲɔ̀tìtà	ɔ̀≠mìɔ̀t-ìt-à	*feel*
	ɔ̀mʲɔ́mínà	ɔ̀≠míɔ́m-ín-à	*grab*
io	ɔ̀hʲɔ̀lɔ̀	ɔ̀≠hìɔ̀l-ɔ̀	*get drunk*
	ɔ̀bísʲóŋɔ̀ŋì	ɔ̀-bí≠síóŋ-ɔ̀n-ì	*become cool*
	ɔ̀bítʃʲóŋɔ̀lɔ̀	ɔ̀-bí≠tʃʊ́óŋ-ɔ̀l-ɔ̀	*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***
tʃìílɔ́	tʃì≠íló	*c9.palm rat*
ɲìísə̀	nì≠ísə̀	*c5.eye*
màábá	mà≠ábá	*c6.shrubs sp (edible leaves)*
nɔ̀ɔ́là	nɔ̀≠ɔ́là	*c11.granary*
nùútʃì	nɔ̀≠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-ò-à	*return, give back*[58]
ɔ̀wàᵐbà	ɔ̀≠àᵐb-à	*search*
òwɔ́bə̀	ò≠ɔ́b-ə̀	*steal, rob*
ɔ̀wɔ́nɔ̀	ɔ̀≠ɔ́n-ɔ̀	*kill*
òwòᵐbò	ò≠òᵐb-ò	*scratch*

2.2.4.4 Vowel assimilation

In $V_1 \neq V_2$ 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	ààtó	bìitó	à≠ìtó	bì≠ìtó	*c1/2.head*
	bɔ̀ɔ̀tí	mààtí	bɔ̀≠ìtí	mà≠ìtí	*c14/6.tree*
a≠ʊ	bɔ̀ɔ̀fʲà	mààfʲà	bɔ̀≠ɔ̀fʲà	mà≠ɔ̀fʲà	*c14/6.rodent burrow*
ə≠i	ə̀ə̀ŋə̀	bìiŋə̀	ə̀≠ìŋə̀	bì≠ìŋə̀	*c1/2.tomb*
ə≠u	bùúsə̀	mə̀ə́sə̀	bù≠úsə̀	mə̀≠úsə̀[59]	*c14/6.face*
ɔ≠ɪ	ɔ̀ɔ̀sɔ̀	bìisɔ̀	ɔ̀≠ìsɔ̀	bì≠ìsɔ̀	*c1/2.habit, behaviour*
o≠i	ŋìitó	ɔ̀ɔ̀tó	nì≠ìtó	ɔ̀≠ìtó	*c5/6a.navel*
	ɔ̀ɔ̀tʃó	ìitʃó	ɔ̀≠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 ≠ɔ́sə̀ 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	tò≠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	bə̀ə̀té	mə̀ə̀té	bə̀≠ìtí[62]	mà≠ìtí	*c14/6.tree*
	hɛ̀ɛ̀tétɛ́	tə̀ə̀tétɛ́	hì≠ìtí-tí	tò≠ìtí-tí	*c19/13.tree (dim)*
ɪ≠ʊ	tʃə̀ó**ŋ**á	tʃə̀ó**ŋ**á	tʃì≠ó**ŋ**á	tʃì≠ó**ŋ**á	*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***
hʲŭ**ŋ**í	tùú**ŋ**í	hì≠ú**ŋ**í	tù≠ú**ŋ**í	*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≠ə́kúŋ̀ì** *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 **≠ìtí** 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 **bò≠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	pò≠lʲá	mà≠lʲá	Baca	pʷ≠ɔ̀sɔ́	mà≠àsá
Yambeta	kʲ≠ìt	pʲ≠ìt	Gunu	bò≠ítì	mì≠ítì
Elip	bò≠dí	mà≠dí	Tuki	wò≠ɾítí	mà≠ɾítí
Mmaala	bò≠dîːḍ	mà≠dîːḍ	Mbure	bŭ̀≠bŭ́	mŭ̀≠bŭ́
Yangben	pò≠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	ɔ≠bɔ̀l-ɔ	L ≠L -L	*pierce*
	ɔ≠bɔ̀l-ɔ̀k-ɔ	L ≠L -L -L	*pierce (INTENS)*
	ɔ≠bàt-à	L ≠L -L	*ask*
	ɔ≠bàt-àk-à	L ≠L -L -L	*ask (INTENS)*
H	ɔ≠táŋ-à	L ≠H -L	*speak*
	ɔ≠táŋ-ák-à	L ≠H -H -L	*speak (INTENS)*
	ɔ≠táŋ-ín-à	L ≠H -H -L	*speak against*
	ɔ≠kót-à	L ≠H -L	*dry*
	ɔ≠kót-ák-à	L ≠H -H -L	*dry (INTENS)*
	ɔ≠báát-à	L ≠H -L	*climb*
	ɔ≠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.

[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 /wóʊw/.

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**àŋ	*claw*
					ì≠**d**ɔŋ	*horn*
					mə≠**g**út	*oil*
/p,t,k/	→	[p,t,k]	/	#____	**p**ì≠dà	*saliva*
					tò≠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	pò≠**b**í	*cutting grass*
					m̀≠**b**òn	pò≠**b**òn	*goat*
/t, k/	→	[t, k]	/	N̩___	ǹ≠**t**àt	pò≠**d**àt	*type of basket*
					ǹ≠**t**ɔ̀ŋ	pù≠**d**ɔ̀ŋ	*fish sp.*
					ŋ̀≠**k**àt	pò≠**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.

ò**n**≠**d**ìgà	pà≠**l**ìgà	*seller(s)*
ǹ≠**d**òm	pù≠**l**òm	*sorcerer(s)*
nì≠**l**ù	ə̀n≠**d**ù	*knee(s)*
nì≠**j**ìŋ	àn≠**dʒ**ìŋ	*raphia palm(s)*
ǹ≠**dʒ**ò?	pù≠**j**ò?	*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≠jǐn-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:

[n̩-gé]	/n̩-wé/	*road*
[n̩ʰù-wé]	/n̩ù-wé/	*roads*

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

ŋgɔ́	pù≠ŋgɔ́	*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 [idàʔtáán]. 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 [idàʔtát]. 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≠f^{w}ày	pò≠f^{w}ày	*type of fish*
ǹ≠sə̀t	pù≠sə̀t	*duiker*
ǹ≠sám	pò≠sám	*nut*
ǹ≠tʃîm	pò≠tʃîm	*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 V?- 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
[ò-tò]	[òn-tò]

The VN- noun-class prefixes are realised as [VN-] before fricatives and resonants, and as [V?-] 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***
òndìgà	òN≠lìgà	*c1.seller (from **kò≠lìg-à** sell)*
ònnàn	òN≠nàn	*c1.grandson*
ù?tùlə?	òN≠tùlə?	*c1.writer*
ò?kán	òN≠kán	*c1.wife*
ù?túmə?	òN≠túmə?	*c1.singer (from **kù≠túm**-ə sing)*
òfòm	ò≠fòm	*c3.forehead*
òmbɔ̀k	òN≠pɔ̀k	*c3.hand*
ùbə́ŋ	ò≠pə́ŋ	*c3.ant sp.*
ùdì	ò≠tì	*c3.face*
ùndìŋ	òN≠lìŋ	*c3.vein, tendon*
ò?tím	òN≠tɛ́m	*c3.heart*
ò?tò	òN≠tò	*c3.head*
ù?kə́	òN≠kə́	*c3.boa constrictor*
ù?kòs	òN≠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 [?].

surface realisation	**underlying form**	***gloss***
àndʒìŋ	àN≠jìŋ	*c6a.raphias*
ə̀ndím	àN≠lím	*c6a.yams*
à?tɔ́m	àN≠tɔ́m	*c6a.breasts*
à?táán	àN≠táán	*c6a.stones*
ə̀?kúù	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 [ʔt] and [ʔk] 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≠tɔ̀ᵐ**b**ɔ́k	kì≠tɔ̀ᵐ**b**ɔ́k	*type of hat*
/ⁿt/ [ʔt]	kì≠ʔ**t**ìᵐbə̀ʔ	kì≠ⁿ**t**ìᵐbə̀ʔ	*bow (hunting)*
	kì≠ʔ**t**ɔ́k	kì≠ⁿ**t**ɔ́k[68]	*largeness*
/t/ [d]	kì≠**d**ùn	kì≠**t**ùn	*forest*
	kì≠**d**ɔ̀k	kì≠**t**ɔ̀k	*insult*
/ⁿd/ [ⁿd]	kì≠ⁿ**d**ùm	kì≠ⁿ**l**ùm	*event*
	kì≠ⁿ**d**ɔ̀k	kì≠ⁿ**l**ɔ̀k	*traditional dance*
/ⁿt/ [ʔt]	kì≠lóʔ**t**ók	kì≠lóⁿ**t**ók	*type of calabash*
/t/ [d]	kì≠bɔ́**d**ɔ̀m	kì≠bɔ́**t**ɔ̀m	*plant sp.*
/ⁿd/ [ⁿd]	kì≠sìⁿ**d**ìŋ	kì≠sìⁿ**l**ìŋ	*yam*
/ᵑk/ [ʔk]	kì≠ʔ**k**ùŋ	kì≠ᵑ**k**ùŋ	*stump*
	kì≠ʔ**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≠ᵑ**g**ɔ́ŋ	kì≠ᵑ**w**ə́ŋ[69]	*stick, pestle*

[68] In the dialect of Nɛdɛk this word is indeed /kiⁿtɔ́k/.

	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 [ᵑd] 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-ə	*dig*
				kù≠wí:j-ì	*extinguish-CAUS*
ɪ	---	---	-a	kò≠fɪ̀k-à	*think*
				kò≠tî:m-ìn	*get up*
ə	x	---	-ə	kù≠kə́k-ə	*coagulate*
				kù≠də̂:ŋ	*fall*
a	---	---	-a	kò≠pàs-à	*carve, sharpen*
				kò≠là:m-ì	*announce-CAUS*
ɔ	---	x	-ɔ	kò≠kɔ́l-ə	*burn*
				kò≠mɔ́:s-ì	*narrow-CAUS*
o	x	x	-o	kù≠sóp-ò	*be sweet*
				kù≠lò:d-ì	*show-CAUS*
ʊ	---	---	-a	kò≠sʊ́m-à	*cut*
				kò≠jʊ̂:	*flow*
u	x	---	-ə	kù≠mús-ə	*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	kì≠pɪ̀p	*lip*
	kì≠tín	*calabash for water*		kì≠kɪ̀k	*molar*
i:	ì≠kî:b	*work group*	ɪ:	ì≠tí:n	*tree squirrel*
ə	ǹ≠sə̀t	*duiker*	a	kì≠sàk	*bird*
	ì≠kə́t	*cataract*		ŋ̀≠kák	*pangolin, aardvark*
ə:	sə̂:n	*father-in-law*	a:	kì≠bà:n	*palm whip*
o	ùŋ=kòs	*cricket*	ɔ	òŋ≠kɔ̀t	*nape of neck*
	ì≠sòs	*partridge*		nò≠sɔ́s	*hot pepper*
o:	nù≠bǒ:	*frog*	ɔ:	kì≠ɲɔ̌:k	*yam*
u	kì≠pùn	*fracture*	ʊ	kì≠pʊ̀n	*back*
	ì≠túk	*domesticated animal*		ì≠tʊ́k	*hernia*
u:	kì≠lùùʔ	*odour*	ʊ:	òŋ≠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≠ᵑ́kínìt	*heel*	ɪ	ì≠pìnìn	*hatred*
	kí≠líⁿdìʔ	*shadow*		kì≠sílín	*cricket*
iː	kì≠sìːsi̍	*worm*	ɪː	ì≠ɲìːŋɛ̀ʔ	*mockery*
ə	mə̀≠sə́pə̀ʔ	*evening palm wine*	a	ì≠pàkà	*shield*
	ì≠jə́sə́n	*cooking pot*		kì≠jàsáŋ	*basket*
əː	---	---	aː	kí≠ŋâːŋà	*crow*
o	ùm≠pòló	*woven raphia mat*	ɔ	ì≠fɔ̀tɔ́	*yam sp.*
	kì≠lóⁿtók	*calabash*		kí≠lɔ̀tɔ̀k	*toad*
oː	---	---	ɔː	kì≠lɔ̀ːlɔ́	*diarrhea type*
u	---	---	ʊ	---	---
uː	---	---	ʊː	---	---

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≠ᵑ́kínìt	*heel*
ɪː-ɪ	kì≠díːdí[74]	*sp. of snake*	iː-i	kì≠sìːsí	*intestinal worm*
ɪ-a	mà≠fìkàʔ	*thoughts*	i-ə	í≠tìlə̀	*bitter leaf*
ɪː-a	ɔ̀ŋg≠wìːnàʔ	*buyer*	iː-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*
aː-ɪ	là:nìʔ	*type of drum*	əː-i	kə̀:nìʔ	*tomb*
a-a	kì≠jàsáŋ	*basket*	ə-ə	mə̀≠sə́pə̀ʔ	*evening palm wine*
a-ʊ	ŋ̀≠kàⁿwó	*lion*	ə-u	kì≠tə̀ᵑkùn	*caterpillar sp.*
aː-ʊ	ì≠sà:só	*jigger*	əː-u	kə̌:wùʔ	*gorilla*
a-ɔ	---	---	ə-o	---	---
ʊ-ɪ	ì≠tómìn	*plant sp.*	u-i	kì≠lùmìn	*mud*
ʊː-ɪ	---	---	uː-i	kì≠tù:lìʔ	*brawl*
ʊ-a	kì≠póŋàʔ[75]	*living room*	u-ə	ì≠kùtə̀ʔ	*sack*
ʊː-a	---	---	uː-ə	---	---
ʊ-ʊ	---	---	u-u	---	---
ʊ-ɔ	---	---	u-o	---	---
ɔ-ɪ	ì≠tɔ̀ɔ̀kìʔ	*confidence*	o-i	kì≠kòlìn	*throat*
ɔː-ɪ	kì≠nɔ̀:ŋìʔ	*foreigner*	oː-i	ŋ̀≠gò:jí	*childrearing rights*
ɔ-a	---	---	o-ə	---	---
ɔ-ʊ	---	---	o-u	---	---
ɔ-ɔ	ì≠fɔ̀tɔ́	*yam sp.*	o-o	ùm≠pòlóʔ	*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/	i-i	---	i-ə
/ɪ/	ɪ-ɪ	---	ɪ-a
/u/	u-i	---	u-ə
/ʊ/	ʊ-ɪ	---	ʊ-a
/o/	o-i	o-o	---[76]
/ɔ/	ɔ-ɪ	ɔ-ɔ	---[77]
/a/	a-ɪ	a-ʊ	a-a
/ə/	ə-i	ə-u	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

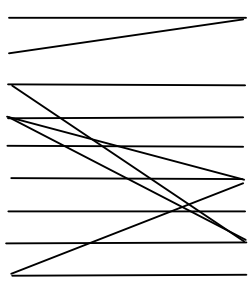
Both nominal and verbal pre-stem elements undergo vowel harmony in Yambeta. These are ATR harmony and rounding harmony which will be discussed in turn below.

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≠p^{w}ə̂m	*hunter*
2	pà	pà≠kíìt	*women*
		pə̀≠p^{w}ə̂m	*hunters*
3	ʊ(N)-	ʊ̀m≠pɔ̀k	*hand*
		ù≠pə́ŋ	*ant sp.*
5	nɪ-	nì≠pʊ̀m	*egg*
		nì≠lù	*knee*
6	ma-	mà≠ŋɔ́	*blood*
		mə̀≠ní	*water*
6a	aN-	àm≠pʊ̀m	*eggs*
		ə̀n≠lù	*knees*
7	kɪ-	kì≠pàŋ	*rooster*
		kì≠ʧút	*mouse sp.*
8	pɪ-	pì≠pàŋ	*roosters*
		pì≠ʧút	*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-	nò≠kɔ̀k	*feather*
		nú≠pòŋ	*shrew*
13	tʊ-	tò≠kɔ̀k	*feathers*
		tú≠pòŋ	*shrews*
14	pʊ-	pò≠kák	*pangolins, aardvarks*
		pù≠jòʔ	*elephants*
19	ɪ-	ì≠pàk	*machete*
		ì≠sòs	*partridge*
pl of 19	mʊ-	mò≠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*
	kò≠tít-à	*run*
	kù≠kə́k-ə̀	*coagulate*
	kò≠tál-à	*see*
	kò≠tɔ́p-ɔ̀	*touch*
	kù≠sóp-ò	*be sweet, tasty*
	kò≠tók-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-	kò≠wàs	kò≠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			
ə̀ə̀-tìlə̀		nùfùù	*S/he will write a letter (this afternoon).*
c1.FT1-write		letter	
àà-mò-wáàgìn		nʷádìʔ	*S/he will build him a house.*
c1.FT1-3sIO-build-appl		house	
ə̀ə̀-dì-sʲə̀d-ìn		ò?kɔ̀ɔ̀	*S/he will take our place.*
c1-1pIO-take-appl		place	
àlí	kò≠fìkà		*S/he will think (after tomorrow).*
c1.FT2	inf≠think		
àlí	kù≠tìlə̀	nùfùù	*S/he will write a letter (after*
c1.FT2	inf≠write	letter	*tomorrow).*

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-	mòòd ó≠mòʔ	*one person*
2	pá-	pòòd pá≠bàn	*two people*
		pòòd pɔ́≠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 ɔ́≠nìʔ	*four stones*
7	kí-	kì≠tìᵐbɔ̀ʔ kí≠mòʔ	*one bow*
8	pí-	pì≠tìᵐbɔ̀ʔ pí≠bàǹ	*two bows*
		pì≠tìᵐbɔ̀ʔ pí≠nìʔ	*four bows*
9	Ń-	ɲ̀≠ɲàm ḿ≠mòʔ	*one animal*
14	pó-	pò≠ɲàm pó≠bàn	*two animals*
		pò≠ɲàm pú≠nìʔ	*four animals*
11	nó-	nò≠gɔk nú≠mòʔ	*one feather*
13	tó-	tò≠gɔ̀k tó≠bàn	*two feathers*
		tò≠gɔ̀k tú≠nìʔ	*four feathers*
19	í-	í≠gòk í≠mòʔ	*one sugarcane*
mʊ	mó-	mú≠gòk mó≠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≠lɔ́ⁿdɔ́k	*deaf-mutes*
		pò≠lòⁿdók	*sorcerers*
		pà≠nɔ̀m	*husbands*
		pə̀≠ŋù	*co-wives*
6	ma-	mɔ̀≠ⁿdɔ́ŋ	*problems, affairs*
		mò≠ókìn	*smoke*
		mà≠tɔ̀m	*messages, commissions*
		mə̀≠túk	*nights*
6a	a(N)-	ɔ̀≠tɔ́k	*yams sp.*
		ò≠kój	*plants, grass sp.*
		à≠tóm	*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-	kò≠kɔ̀m-ìt	kɔ̀≠ɔ́-kɔ́m-ít-íí	*scratch oneself*
	kò≠tóŋ-à	kà≠á-tóŋ-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

mʷ**ŏ**-sópò *They (foods) were sweet.*
c.*mu*.P1-be sweet

ɔ̀ɔ̀-ŋɔ̀nɔ̀ c1.FT1-laugh	*S/he will laugh.*
m^{w}**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≠kɔ́s-ìm		*sneeze*	
		kù≠út-ìm		*bow*	
reflexive	-íí	kò≠ɔ́-kɔ́m-ít-íí		*scratch oneself*	
	-íí	kə≠ɔ́-píə́n-íí		*be born*	
applicative	-ɪn	kò≠sɔ̀k-ìn		*wash, purify*	
	-in	kù≠súŋ-ìn		*untie, detach*	
separative	-ɪn	kò≠fàŋ	*hang up*	kò≠fàŋ-ìn	*take down*
	-in	kù≠súŋ	*attach*	kù≠súŋ-ìn	*untie, detach*
detransitive	-ɪk	k^{w}≠ăt	*break (TR)*	k^{w}≠ăt-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≠lɔ́p-ən			*counsel (v)*
continuous	-a	kò≠kɔ́t-à			*attach*
(short form)		kò≠fɨk-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≠tɔ́ə̀ŋ	*fall (v)*	kù≠tɔ́ə́ŋ-**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)*	ò̀n≠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*
kò≠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	kò≠sɔ̀j-ɔ̀	*talk*
		kù≠sóp-ò	*be sweet, tasty*
		kò≠tók-à	*insult (v)*
		kù≠tún-ə̀	*pound (v)*
long continuous	-an	kò≠tɔ́ŋ-ɔ̀n	*call*
		kò≠tɔ́ŋ-ɔ̀n-ɔ̀n	*call one another*
		kù≠sóp-òn	*be sweet*
		kò≠nót-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)*
kò≠ò^{n}d-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)*
kʲǒs	kì≠ɔ́s	*tree sp.*
kʲùj	kì≠ùj	*maggot*
nʲɔ̀s	nì≠ɔ̀s	*parrot*
nʲǒŋ	nì≠óŋ	*bee*
nʷìt	nɔ̀≠ìt	*stake*
nʷàs	nɔ̀≠às	*chin*
pʷɔ̀s	pɔ̀≠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	kɔ̀≠íp	*steal*
kɛ̀ɛ́sà	kɔ̀≠ísà	*scrape*
kàák	kɔ̀≠ák	*put, place*
kɔ̀ɔ̀p	kɔ̀≠ɔ̀p	*grind, crush*
kɔ̀ɔ̀ⁿdìk	kɔ̀≠ɔ̀ⁿd-ìk	*wake up*
kɔ̀ɔ́n	kɔ̀≠ɔ́n	*kill*
kùút	kɔ̀≠út	*bend, fold*
kàáwásɛ́ɛ́	kɔ̀≠á-wás-íí	*comb oneself*
kɔ̀ə́bíə́níí	kɔ̀≠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*
pɔ̀ɔ̀n	pà≠ɔ̀n	*strangers, visitors*
mààk	mà≠àk	*years*
nɔ̀ɔ̀m	nɔ̀≠ɔ̀m	*river*
tùùt	tɔ̀≠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≠jìì?	*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≠fìɔŋ	*deformation of feet in "x" shape*
ɪʊ	ì≠líòt	*chicken's vent*
əə	nì≠səənî	*wake (for funeral)*
aa	ɔ≠fáàn	*wing*
ɔɔ	kì≠kɔ́ɔn	*streak of dried tears*
oo	---	---
ʊɪ	ɔ≠tóìŋ	*ear*
ʊa	pà≠fòàt	*diarrhea*
ʊɔ	---	---
ʊʊ	kì≠kòò?	*hoof*
ui	kì≠túìn	*nut sp.*
uə	ùm≠púəm	*hunter*
uo	---	---
uu	kì≠tùùli?	*brawl*
ii	kù≠nîìk	*dress (v)*
iə	kù≠ŋíən-ə	*ask*
io	kù≠sìòt-ò	*hop, skip*
iu	---	---
ɪɪ	kò≠tììs-à	*limp*
ɪa	kò≠síà	*bless*
ɪɔ	kò≠líɔ́ⁿd-ɔn	*act timidly*
ɪʊ	---	---
əə	kù≠təəŋ	*fall*
aa	kò≠wáàk	*build*
ɔɔ	kò≠mɔ́ɔs-ì	*rebraid (caus.)*
oo	kù≠lòòt-ì	*show (caus.)*
ʊɪ	kò≠lòìk-ì	*announce (caus.)*
ʊa	kò≠kóàn	*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***
nʲ≠út	ə̀ŋ**g**út	àN≠út	*nose*
nʲ≠às	àŋ**g**às	àN≠às	*twin*
nì≠ín	ə̀m**b**ín	àN≠ín	*palm tree*
nì≠ìs	ə̀ŋ**g**ìs	àN≠ìs	*eye*
nʲ≠ìn	àm**b**ìn	àN≠ìn	*kola*
nʲ≠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≠sásà?	≠H L	*reprimand, rebuke*
nò≠kàsà?	≠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≠tìəl-ì	L≠L -L	*be slippery*
	kù≠tìəl-ík-ən	L≠L -H -L	*slip, slide*
	kù≠tìəl-ík-ən-ì	L≠L -H -L -L	*make slippery*
H	kù≠mús	L≠H	*fold*
	kù≠mús-ə	L≠H -L	*fold (CONT)*
	kù≠súìt	L≠HL	*pull*
	kù≠súít-ə	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≠tɔ́əŋ	L≠HL	*fall*
	kù≠tɔ́əŋ-ì	L≠H -L	*cause to fall, cut down*
	kù≠tɔ́əŋ-ən-ì	L≠H -L	*cause to fall (CONT)*
	kù≠tɔ́əŋ-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	ᵑ͡ᵐgb
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/	≠hóɾ-á	≠hóɾ-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: **ò≠kpá** *utter (incantations)*; **ɨ≠kpáá** *forest* and **ò≠kpátá** *black ant sp*.

[82] [gb] and [ᵑ͡ᵐgb] are also rare in Tuki. The only examples found in the corpus are: **ɨ̀≠ᵑ͡ᵐgbɔ́má** *lion*, **ŋm≠gbə́ɾə́** *witchcraft*, **ŋm≠gbì** *pipe (tobacco)*, and **òŋm≠gbə̌k-ɔ́ŋ-ɔ́** *calamity*.

Example 99: Hardening of fricatives and oral resonants in Tuki

/β/	→	[b]	/	N≠___		
ù ≠ βát-ìj-ɔ́		greet (v)		mbátìjɔ́	m≠βát-ìj-ɔ́	*c9.greeting (n)*
ù-βá≠tɔ́ɾ-ɔ́		listen		mbátɔ́ɾɔ́	m-βá≠tɔ́ɾ-ɔ́	*c9.listening (n)*
ù ≠ βàŋg-à		cry, wail		mbàŋgíná	m≠βàŋg-ín-á	*c9.obj. of wailing*
ù ≠ βàŋg-à		cry, wail		m̀bàŋgàmó	m̀≠βàŋg-àmó	*1s-wail-PFV*

/s/	→	[tʃ]	/	N≠___		
N	→	∅	/	_____≠$C_{[-Voice]}$		
ù≠sìj-à		insult (v)		tʃìjɔ́	n≠sìj-ɔ́	*c9.insult (n)*
ù≠síɾ-à		scar (v)		tʃíɾɔ́	n≠síɾ-ɔ́	*c9.scarification*
ù≠sìm-à		curse (v)		tʃîmɔ̀	n≠sìm-ɔ̀	*c9.curse (n)*
ù≠sìm-à		curse (v)		tʃîmàmó	ǹ≠sìm-àmó	*1s-curse-PFV*

/j/	→	[dʒ]	/	N≠___		
ù≠jɔ̀^{m}b-ɔ̀		fade, wilt		ndʒɔ̀^{m}bíná	n≠dʒɔ̀^{m}b-ín-á	*c9.kind of wilting*
ù≠jə̀ɾ-ə̀		learn		ndʒə́ɾíná	n≠dʒə́ɾ-ín-á	*c9.teaching style*
ù≠jə̀ɾ-ɔ́		learn		ǹdʒə́ɾámó	ǹ≠dʒə́ɾ-ámó	*1s-learn-PFV*

/h/	→	[p]	/	N≠___		
N	→	∅	/	_____≠$C_{[-Voice]}$		
ù≠hòɾ-à		sweep		póɾíná	n≠hóɾ-ín-á	*c9. sweeping style*
ù≠hóm-á		peal (bark)		pómíná	n≠hóm-ín-á	*c9. pealing style*
ù≠hòɾ-à		sweep		póɾámó	ǹ≠hóɾ-àmó	*1s-sweep-PFV*

/ɾ/	→	[d]	/	N≠___		
ù≠ɾɔ̀n-ɔ̀		growl		ndɔ̀níná	n≠ɾɔ̀n-ín-á	*c9.kind of growl*
ù≠ɾì-à		swear		ndìná	n≠ɾì-ìn-á	*c9.kind of swearing*
ù≠ɾíb-á		counsel (v)		ndíbɔ́	n≠ɾíb-ɔ́	*c9.counsel*
ù≠ɾíb-á		counsel (v)		ǹdíbámó	ǹ≠ɾíb-ámó	*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)*	pátámó	Ǹ≠pát-ámó	*1s-pick-PFV*
ò≠bìn-à	*hate*	m̀bìnàmó	Ǹ≠bìn-àmó	*1s-hate-PFV*
ò≠tóm-á	*send*	tómámó	Ǹ≠tóm-ámó	*1s-send-PFV*
ò≠dáᵑg-á	*disappear*	ǹdáᵑgámó	Ǹ≠dáᵑg-ámó	*1s-disappear-PFV*
ò≠ⁿdɚ̀-ə̀	*spoil*	ǹdɚ̀rámó	Ǹ≠ⁿdɚ̀-àmó	*1s-spoil-PFV*
ò≠ⁿdʒàm-àn-à	*be.afraid*	ǹdʒàmànà	Ǹ≠ⁿdʒàm-àn-à	*1s-afraid-CONT*
ò≠kós-óm-à	*cough*	kósómàmó	Ǹ≠kósóm-àmó	*1s-cough-PFV*
ò≠kpá-á	*incantation*	kpáámó	Ǹ≠kpá-ámó	*1s-utter-PFV*
ò≠gòɾ-à	*bite, crush*	ŋ̀gòràmó	Ǹ≠gòɾ-àmó	*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***
m̩̀pɔ́mɔ́	m̩̀≠pɔ́mɔ́	→	òm-pɔ́mɔ́	*c3a.whitewash*
pɔ́nɔ́	N≠pɔ́nɔ́			*c9.viper*
ǹ̩tʃòᵐbó	ǹ̩≠sòᵐb-ó	→	òn≠sòᵐb-ó	*c3a.hunt*
tʃǒmó	N≠sóm-ó			*c9.news, announcement*
ŋ̀kàná	ŋ̀≠kàná	→	òŋ≠kàná	*c3a.story, proverb*
káná	Ǹ≠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-ɔ́	*coil (rope)*
ɪ	---	---	-a	≠tít-á	*draw (water)*
ə	x	---	-ə	≠pɔ́t-ɔ́	*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-ɔ́	*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	ò≠kósò	*baboon*
	wò≠ɾítí	*tree*		ì≠kòmó	*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≠hánó	*machete*	ə-u/o	ì≠kə̀kú	*cola nut*
ʊ-ɪ	ì≠wòkɪ́[87]	*melon*	u-i	ì≠sútí	*peeling*
ʊ-a	ì≠kòtá	*ringworm*	u-ə	í≠kútə̀	*fist*
ʊ-ʊ/ɔ	ò≠kótó[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.

class	prefixes	class	prefixes
1	mʊ-	2	βa-
	ʊ- / u-		
	a-		
3	ʊ(N)- / u(N)-	4	ɪ(N)-[92]
3a	Ṇ		
5	i-	6a	aN- / əN-
7	ɪ- / i-	8	βi-
9	∅	10	∅
11	nʊ- / nu-	13	tʊ- / tu-
14	wʊ- / wu-	6	ma- / mə-
19	i-	mʊ-	mʊ- / mu-

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≠nómótʊ̀	*husband*
		ù≠túnú	*blacksmith*
	a-[93] (invariable)	à≠bʊ̀ⁿdà	*parent*
		à≠wùt-ə̀	*farmer*
	mʊ-	mʊ̀≠tʊ̀	*person*
2	βa- (invariable)	βà≠nómótʊ̀	*husbands*
		βà≠túnú	*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)-	ìŋ≠gìní	*hills*
		ìm≠bìnɔ̀	*thighs*
		ì≠gíní	*firewood (pl)*
		ì≠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-	ì≠kɔ́hí	*shoulder*
		ì≠tə́tí	*rooster*
8	βi- (invariable)	βì≠kɔ́hí	*shoulders*
		βì≠tə́tí	*roosters*
11	nʊ-	nʊ̀≠wɔ́ɾá	*rain*
		nù≠hùtú	*mongoose*
13	tʊ-	tʊ̀≠wɔ́ɾá	*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≠hóɾá	*broom*
		ì≠dʒìjə	*fire*
pl of 19	mɔ-	mò≠hóɾá	*brooms*
		mù≠dʒìjə	*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	ò≠sìs-ə	~	ù≠sìs-ə	*land (v)*
	ò≠kís-á			*crunch (v)*
	ò≠pɔ́t-ɔ́	~	ù≠pɔ́t-ɔ́	*seal (door)*
	ò≠kàt-à			*judge (v)*
	ò≠sɔ́t-ɔ́			*live, inhabit*
	ò≠tót-á			*pick up, gather*
	ò≠sús-ə	~	ù≠sús-ɔ́	*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-	ò-βɔ́≠tíj-ɔ́	*embrace, hug*
	ò-βá≠síɾ-á	*tattoo (v)*
	ò-βɔ́≠tɔ́m-ìn-à	*lie down, sleep*
	ò-βá≠ɾáᵑg-à	*prevent, refuse*
	ò-βá≠tɔ́ɾ-ɔ́	*listen*
	ò-βá≠sóᵑg-á	*choke*
	ò-βɔ́≠hún-ɔ́	*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 **≠βáni** *two* and **≠íni** *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 **≠mʷàsí** *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	ò-	mò≠tò ò≠mʷàsí	*one person*
2	βá-	βà≠tò βá≠βání	*two people*
		βà≠tò βá≠ání	*four people*
3	ó-	ò≠tímá ó≠mʷàsí	*one heart*
4	í-	ì≠tímá í≠βání	*two hearts*
		ì≠tímá í≠íní	*four hearts*
5	nó-	n≠ìsó nó≠mʷàsí	*one eye*
6a	á-	èŋg≠ìsó á≠βání	*two eyes*
		àŋg≠ìsó á≠ání	*four eyes*
7	í-	j≠ìrá í≠mʷàsí	*one arrow*
8	βí-	bʲ≠ìrá **βí≠ββ́ní**	*two arrows*
		bʲ≠ìrá **βí**≠tátó	*three arrows*
		bʲ≠ìrá **βí≠íní**	*four arrows*
		bʲ≠ìrá **βí**≠táánó	*five arrows*
11	nó-	nʷ≠àní nó≠mʷàsí	*one leaf*
13	tó-	tʷ≠àní tó≠βání	*two leaves*
		tʷ≠àní tó≠tátó	*three leaves*
		tʷ≠àní tʷ≠íní	*four leaves*
		tʷ≠àní tó≠táánó	*five leaves*
14	wó-	wò≠rítí wó≠mʷàsí	*one tree*
6		mà≠rítí má≠βání	*two trees*
19	i-	j≠ă:pánó **í**≠mʷàsí	*one knife*
mʊ	mʊ-	mʷ≠ăpánó mó≠βání	*two knives*
		mʷ≠ăpánó 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	ò-βá≠síɾ-ìt-à	*sit down*
		ù≠tʃə́ᵑg-ít-ə	*abandon*
applicative	-ɪn	ò≠tóm-**ín**-à	*send*
		ù≠gún-**ín**-à	*drive away*
separative	-ʊn	ò≠hát-ón-à	*subtract*
		ù≠búᵑg-ún-ə	*spill, knock over*
??	-ʊm	ò≠kós-óm-à	*cough*
		ù≠hɔ́ɾ-úm-ə	*breathe*
stative	-ɪm	ò≠βám-ím-à	*admit (to a wrong)*
		ù≠kɔ́s-ím-ə	*sneeze (v)*
continuous	-an	ò≠sóɾ-**án**-à	*look at*
		ò≠pìɾ-ìs-**àn**-à	*separate, divide*
		ù≠wús-**án**-à	*urinate*
		ù≠kùɾ-ùm-**àn**-à	*bend over*
reciprocal	-an	ò≠wòn-à	*kill*
		ò≠wòn-**àn**-à	*kill e.o.*
		ù≠dìᵑg-ə	*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

≠dʒəᵐb-ə	*know*	n≠dʒəᵐb-**ín**-á	*c9.knowledge, acquaintance*
≠sìt-à	*spread, display*	ì≠sìt-**ín**-á	*c7.display (n), place to spread*
≠βàᵑg-à	*weep, cry*	m≠bàᵑg-**ín**-á	*c9.for which one weeps*
≠sɔ̀ᵑg-ə	*copulate*	mà≠sɔ̀ᵑg-**ìn**-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-ə	*hunt (v)*	n̩≠tʃùᵐb-**ʊ́**	*c3b.hunt (n)*
≠hɔ́ɾ-úm-ə	*breathe*	ì≠hɔ́ɾ-**ú**	*c19.tuberculosis*
≠túɲ-ɔ́	*smithing*	ù≠túɲ-**ú**	*c1/2.blacksmith*
≠ɾùn-ɔ́	*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*
≠tɔ́h-ân-à	*invite*	tɔ́h-ân-à[98]	*c9.invitation*
≠púᵐb-j-ɔ́	*make clean*	m≠púᵐb-án-á	*c3b.cleanliness*
≠bɔ̌ɾ-àn-à	*praise (v)*	m≠bɔ̌ɾ-àn-à	*c9.eulogy, praise (n)*
≠kàt-à	*judge (v)*	ŋ≠kàt-à	*c3b.judgement*
≠wɔ́t-íj-ɔ́	*greet (v)*	m≠bɔ́t-íj-ɔ́	*c9.greeting*
-βá≠tɔ́ɾ-ɔ́	*listen*	m-bá≠tɔ́ɾ-ɔ́	*c9.hearing*
≠sìj-ə	*saw (wood)*	ì≠sìj-ə	*c19.saw(n)*
≠gíj-ə	*support (v)*	ì≠gíj-ə	*c7.support (n)*
≠kùs-ə	*buy*	ŋ≠kùs-ə	*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-ə	*land, lower*	≠sìs-ìj-ə	*unload, lower smth*
		≠tíɾ-ím-ìn-à	*be stopped*	≠tíɾ-ím-ìj-ə	*stop, correct*
		≠pə́n-ə́[99]	*decorate*	≠pə́n-íj-ə	*caus. to decorate*
		≠hàt-ìn-à	*rise up(INTR)*	≠hət-ìj-ə	*lift*
		≠sə́t-ə́	*live, dwell*	≠sót-íj-ə	*save, caus. to live*
		≠kə́t-á	*dry(INTR)*	≠kút-íj-ə	*caus. to dry, dry(TR)*
		≠dʒùm-ə	*be wet*	≠dʒùm-ìj-ə	*soak*
nom.	-i	≠ìb-ə́	*steal (v)*	ùŋg≠úb-í[100]	*c1.thief*
		≠kə́s-ím-ə	*sneeze (v)*	ì≠kə́s-í	*c19.sneeze (n)*
		≠hʲ-á	*burn (INTR)*	ì≠hʲ-ə́n-ì	*c7.burn (n)*
		≠dìᵑg-ə	*love (v)*	ì≠dìŋ-í	*c5.love (n)*
		≠ɾùm-ə	*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)*	ʧíj-ɔ́	*c9.insult (n)*
-βá≠síɾ-á	*tattoo (v)*	ʧíɾ-ɔ́	*c9.facial scar(s)*
≠ɾìm-àn-à	*dream (v)*	n≠dìm-ɔ́	*c9.dream (n)*
≠sìm-à	*curse (v)*	ʧím-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 òniŋgìjè [òniŋgìjè] weaken. If the vowel "e" of ònèŋgà diminish is the [+ATR] vowel /ə/, one would expect this word to be [ònəŋgə̀], 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)*
		≠kót-á	*dry*
		≠sús-ɔ́	*ask, request*
		≠kùs-ɔ́	*buy*
continuous	-an	≠sɔ́m-ɔ́n-ɔ̀	*accuse*
		≠dʒɔ̀r-ɔ̀	*visit a trap*
		≠dʒɔ̀r-ɔ̀n-ɔ̀	*visit a trap (repetitive per day)*
		≠wús-ɔ́	*defecate*
		≠wús-án-à	*urinate*
		≠kót-á	*dry*
		≠kót-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-ɔ̀	*save, caus. to live (from≠sɔ́t-ɔ́ dwell)*
		≠tòᵐb-ìj-ɔ̀	*appease, pacify (from ≠tɔ̀ᵐb-ɔ̀ calm oneself)*
dim.	-ɪt	≠nɔ̀ᶯg-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-ij-à	*sting (superficially)*
≠tìᵐb-ij-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	bò≠ìᵑgò	*c14.beeswax*
bʷìⁿdá	bò≠ìⁿdá	*c14.liver*
bʲìbà	βì≠ìbà	*c8.pigeons*
nʷərí	nò≠ərí	*c11.rope, wire*
bʲàⁿdʒì	bì≠àⁿdʒì	*c8.houses*
nʷàᵑgó	nò≠àᵑgó	*c11.broom*
nʲɔrɔ́	nì≠ɔrɔ́	*c5.neck*
bʷɔrɔ́	bò≠ɔrɔ́	*c14.tree sp.*
bʲòrá	bì≠òrá	*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***
jìrá	ì≠ìrá	*c19.arrow*
jìbà	ì≠ìbà	*c7.pigeon*
wìbɔ́	ò≠ìb-ɔ́	*inf.steal*
wùrɔ́	ò≠ùr-ɔ́	*inf.come*
wònά	ò≠òn-á	*inf.kill*
jàⁿdʒì	ì≠àⁿdʒì	*c7.house*
wàtá	ò≠àt-á	*inf.shell (nuts)*
jòrá	ì≠òrá	*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***
nʲɔɾɔ́	àⁿgɔ̀ɾɔ́	nì≠ɔɾɔ́	àⁿg≠ɔɾɔ́	*c5/6a.neck*
nìsó	ɔ̀ⁿgìsó/àⁿgìsó[102]	nì≠ìsú	àⁿg≠ìsú	*c5/6a.eye*
nìjó	ɔ̀ⁿgìjó/àⁿgìjó	nì≠ìjú	àⁿg≠ìjú	*c5/6a.tooth*
---	màtə́já	---	mà≠tə́já	*c6.water*
---	mìnə́	---	mà≠ìnə́	*c6.blood*
bʷìndá	mìⁿdá	bò≠ìⁿdá	mà≠ìⁿdá	*c14/6.liver(s)*
bʷɔ̀ɾɔ́	mɔ̀ɾɔ́	bò≠ɔ̀ɾɔ́	mà≠ɔ̀ɾɔ́	*c14/6.tree(s) sp.*
bùɾù	mùɾù	bò≠ùɾù	mà≠ùɾù	*c14/6.maternity*
òkótó	βàkótó	ò≠kótó	βà≠kótó	*c1/2.woman(en)*
mʷànà	βànà	mò≠ànà	βà≠ànà	*c1/2.child(ren)*
ùⁿgìní	βìní	ùⁿg≠ìní	βà≠ìní	*c1/2.visitor(s)*
nìⁿdə́	tìⁿdə́	nò≠ìⁿdə́	tò≠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.

[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≠kɔ̀	≠L	*c7.copper*
ì≠gǒ	≠LH	*c5.elephant grass*
mà≠tó	≠H	*c6.ashes*
í≠sô	≠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≠kɔ́ⁿdɔ̀	≠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≠tǒⁿdò		*c7.leech*
í≠βǎŋgà		*c7.clod (of earth)*
í≠ndʒârà	≠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≠bìⁿd-à	L ≠L -L	*close (door)*
	ò≠bìⁿd-ìn-à	L ≠L -L -L	*close (door)*
	ò≠ɾàh-à	L ≠L -L	*be long*
	ù≠ɾəh-ìj-ə	L ≠L -L -L	*make long*
	ò≠dʒɔɾ-ɔ	L ≠L -L	*visit traps*
	ò≠dʒɔɾ-ɔn-ɔ	L ≠L -L -L	*visit traps (ITER)*
LH	ò≠jǎ-ə	L ≠LH -L	*learn*
	ò≠jǎɾ-ìt-à	L ≠LH -L -L	*learn a little*
	ò≠gŭɾ-ə	L ≠LH -L	*rub*
	ò≠gŭɾ-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≠kót-á	L ≠H -H	*dry*
	ò≠kót-án-à	L ≠H -H -L	*dry up*
	ù≠pɔ́n-ɔ́	L ≠H -H	*design, paint*
	ù≠pɔ́n-íj-ə	L ≠H -H -L	*cause to paint*
HL	ò≠wót-á	L ≠H -H	*pack, attach*
	ò≠wót-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≠wóⁿdʒ-á	L ≠H -H	*gather, heap up*
	ò≠wóⁿdʒ-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≠ǎt-úɾ-ə	≠LH -H -L	*drag*
	w≠ǎt-úr-ìt-à	≠LH -H -L -L	*drag (DIM)*
H	w≠ùɾ-ɔ́	≠L -H	*come*
	w≠ùɾ-ík-ìj-ɔ́	≠L -H -L -L	*leave, depart*
	w≠àt-á	≠L -H	*shell (peanuts)*
	w≠àt-ít-à	≠L -H -L	*shell (DIM)*
HL	w≠òw-á	≠L -H	*hear*
	w≠òw-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*
	≠dì^{ŋ}g-ə̀	*love*	-βə́≠dí^{ŋ}g-ə̀	*love oneself*
LH	≠^{n}dɔ̌ɾ-ə̀	*spoil*	-βá≠^{n}dɔ́ɾ-ə̀	*spoil oneself*
	≠jɔ̌ɾ-ə̀	*learn*	-βá≠jɔ́ɾ-ə̀	*teach oneself*
H	≠gún-ə́	*chase*	-βá≠gún-ə́	*chase oneself*
	≠wót-á	*attach*	-βá≠wót-á	*attach oneself*
	≠tíh-íj-ə̀	*teach, show*	-βə́≠tíh-íj-ə̀	*boast, brag*
HL	ò≠bíɾ-ân-à	*call*	ò-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

[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	≠dìn-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	≠dóᵐb-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	ò≠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.*		nò≠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≠tʃǐlì	*edible termite sp.*
ɪ-a	ò≠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	dɔ̀≠lɔ̀ⁿʧǐ	*insect sp.*	u-i	gì≠gúlí	*time, hour*
ʊ-a	nɔ̀≠bólá	*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]	ò≠kɔ́dɔ̀	*woman*
		ò≠gɔ́nɔ́	*elder*
		ùm≠bìénì	*nephew*
		ù≠gúlè	*friend*
	mʊ-[108]	mò≠ɔ́nɔ́	*child*
		mò≠tɔ̀	*person*
2	ba-	bà≠kɔ́dɔ̀	*women*
		bà≠áná	*children*
		bà≠gɔ́nɔ́	*elders*
		bè≠bìénì	*nephews*
		bè≠gúlè	*friends*
3	ʊ(m)-	ò≠dímá	*heart*
		òm≠bɔ́gɔ̀	*hand*
		ù≠kúᵐbè	*feather*
		ù≠fínò	*name*
4	ɪ(m)-	ì≠dímá	*hearts*
		ìm≠bɔ́gɔ̀	*hands*
		ì≠kúᵐbè	*feathers*
		ì≠fínò	*names*
5	ɪ-	ì≠dáɲí	*stone*
		ì≠bílè	*oil palm*
	nɪ-	nì≠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-	gì≠dɔ̀ŋɔ̀	*village, country*
		gì≠jèlí	*worm*
8	bɪ-	bì≠dɔ̀ŋɔ̀	*villages, countries*
		bì≠jèlí	*worms*
11	nʊ-	nò≠bólá	*rain*
		nù≠fèⁿdù	*ravine*
13	dʊ-	dò≠bólá	*rains*
		dù≠fèⁿdù	*ravines*
14	bʊ-	bò≠sáŋà	*yam sp.*
		bù≠dúgú	*night*
15	gʊ-	gò≠súgà	*poverty*
		gù≠bélìè	*day before/after*
16	hʊ-	hò≠ómà	*place*
		---	---
19	ɪ-	ì≠sólá	*hoe*
		ì≠nòní	*bird*
pl of 19	mʊ-	mò≠sólá	*hoes*
		mù≠nòní	*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	ò-	mò≠tò ù≠mùè	*one person*
2	bá-	bà≠tò bá≠àⁿdí	*two persons*
		bà≠rò bá≠dàdó	*three persons*
3	jó-	ò≠dímá jú≠mùè	*one heart*
4	í(h)-	ì≠dímá íh≠àⁿdí	*two hearts*
		ì≠dímá í≠dàdó	*three hearts*

class	**numeral prefix**	**example**	***gloss***
5	ní-	ì≠dání ní≠mùè	*one stone*
6a	á(h)-	à≠dání áh≠àⁿdí	*two stones*
		à≠dání á≠dadó	*three stones*
7	gí-	gì≠dɔ̀ŋɔ̀ gí≠mùè	*one village*
8	bí-	bì≠dɔ̀ŋɔ̀ bí≠àⁿdí	*two villages*
		bì≠dɔ̀ŋɔ̀ bí≠dàdó	*three villages*
9	Ǹ-	ɲ≠ɲàmà m̀≠mùè	*one animal*
10	í(h)-	ɲ≠ɲàmà íh≠àⁿdí	*two animals*
		ɲ≠ɲàmà í≠dàdó	*three animals*
11	nó-	nù≠èlí nú≠mùè	*one cord*
13	dó-	dù≠èlí dó≠àⁿdí	*two cords*
		dù≠èlí dó≠dàdó	*three cords*
14	bó-	bò≠sàŋà bú≠mùè	*one yam sp.*
6		mà≠sàŋà má≠àⁿdí	*two yams*
		mà≠sàŋà má≠dàdó	*three yams*
19	hí-	ì≠nòní hí≠mùè	*one bird*
mɷ	mɷ-	mù≠nòní mó≠àⁿdí	*two birds*
		mù≠nòní mó≠dàdó	*three birds*

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

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

15	gɷ-	gù≠dìd-è	*choose, compare*
		gò≠dìn-à	*pound (okra)*
		gù≠déb-è	*flow*
		gò≠dáb-à	*plant (tubers)*
		gò≠dɔ́s-ɔ̀	*peal*
		gù≠dòg-ò	*burp*
		gò≠dɔ́s-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-	gò-bá≠sìg-à	*insult e.o.*
		gò-bá≠sògà	*wash oneself*
		gù-bé≠dùl-è	*gather together*
		gù-bé≠fúùn-è	*dry oneself*

indirect object	gó	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≠nómì	*sperm*
		mè≠gúdé	*fat, oil*
6a	a(N)-	ɔ̀ŋ≠ɔ̀lɔ́ ~ àŋ≠ɔ̀lɔ́	*necks*
		òŋ≠òɲí	*markets*
		òŋ≠ìsò	*eyes*
		à≠gósà	*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	*s/he took*
		c1 P1 take-FV	
		à bóò pòl-ò	*s/he pierced*
		c1 P1 pierce-FV	

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-dós-à	*REFLX-skin, flay*
		bá-ʧòòm-àn-à	*REFLX-chatter-CONT-FV*
recent past	báà	à béè fún-èn-è	*s/he blew*
		c1 P1 blow-CONT-FV	
		à báà sóg-à	*s/he washed*
		c1 P1 wash-FV	
		à báà dóᵐb-à	*s/he transgressed*
		c1 P1 transgress-FV	

[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)*
		≠ʧék-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	≠sʊ̀g-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

≠báŋ-à	*defecate*	gì≠báŋ-ín-á	*anus*
≠dúùg-è	*rest*	gì≠dúúg-íd-én-é	*resting place*
≠bóŋ-ò	*drink*	gì≠bóŋ-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*
≠báŋ-à	*defecate*	nì≠báŋ-à	*latrine*
≠ɔ̀ŋ-ìn-ɔ	*request, ask*	gì≠ɔ̀ŋ-ìn-ɔ	*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-ɔ	*descend (INTR)*	≠gòs-ì-ò	*descend (TR)*
		≠òb-à	*fall (INTR)*	≠ùb-ì-è	*fell, cause to fall*
		≠fí-ɔ	*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)*
		≠dós-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-ɔ	*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*
		≠fʊ́ᵐb-àn-à	*sob, cough while drinking*
		≠dùl-è	*accumulate*
continuous	-an	≠gɔ̀s-ɔ̀n-ɔ̀	*descend (CONT)*
		≠dɔ̀g-ɔ̀n-ɔ̀	*boil, heat*
		≠bóŋ-òn-òn-ò	*drink (CONT)*
		≠fʊ́ᵐb-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*
		≠bóŋ-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*
nʲòŋí	nì≠òŋí	*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*
nìibà	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	fól-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	ᵐb	ⁿd		ᵑk
fricatives	voiceless	f	s		h
	prenasalised	ᵐ̪f ([pʰ])	ⁿs ([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.

[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	ᵐb	ⁿd		ᵑk
fricatives	voiceless	f	s		h
	prenasalised	ᵐ̪f	ⁿs		
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	[m̩pʰìg̰]	*weevil*
gù≠híl-è	[gùhílè]	*paint (v)*
m̀≠híl-è	[m̩pʰílè]	*paint (n)*
gò≠sìg-à	[gòsìgà]	*insult (v)*
ǹ≠sìg	[n̩tʃìg]	*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≠ⁿ**d**ól-áŋ	*giant*
k/g/ᵑk	gí≠**k**àᵐbà	*type of insect*
	ò≠**g**áⁿdɔ̀	*woman*
	bó≠ᵑ**k**ɔ̀ŋâ	*papaya*
	gì≠mú.**k**è	*mute (a)*
	ǹ≠dù.**g**é	*smoke*
	ì≠ló.ᵑ**k**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 /ᵐf/ 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*
gò≠lìⁿ**s**	[gòlèⁿ**tʃ**]	[gòlèⁿ**s**]	*know*
gì≠ᵐ**f**àᵐm	[gìᵐ**p**ʰàm]	[gìᵐ**f**àm]	*warthog tusk*
gì≠nùᵐ**f**	[gìnùᵐ**p**ʰ]	[gìnùᵐ**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 /ᵑk/ 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/ → [g]	bò≠dúg	[bùdúg]	*night*
/ᵐb/ → [ᵐb̥]	nì≠bìᵐb	[nìbìᵐb̥]	*frog sp.*
/ⁿd/ → [ⁿd̥]	nò≠gòⁿd	[nògʊⁿd̥]	*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/	gò≠bìg-à	gò≠bɛ̀g	ò-sà≠bɛ̀g	*burn*
/e/	gù≠dén-èn	gù≠dén	ù-sè≠dén	*drip*
/a/	gò≠bàs-à	gò≠bàs	ò-sà≠bàs	*germinate*
/u/	gù≠gús-è	gù≠gús	ù-sè≠gús	*pierce*
/ʊ/	gò≠bʊ́d-à	gò≠bʊ́d	ò-sà≠bʊ́d	*get, obtain*
/o/	gù≠dòg-è	gù≠dòg	ù-sò≠dòg	*burp*
/ɔ/	gò≠dɔ́b-à	gò≠dɔ́b	ò-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≠híɲì	*sun*
	ò≠gʷíɲì	*firewood*		m̀≠fíɲì	*viper*
/e/	ì≠lémdé	*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≠bómdóŋ	*tranquility*		gì≠bɔ́gɔ́d	*shoe*
/u/	gì≠húŋûl	*lump*	/ʊ/	gìlòᵐdó	*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, **L̰** indicates a devoiced vowel, and **(L̰)** 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(L̰)	Yes	Yes
≠HL	≠HL	≠L	---	Yes
≠LH	≠LH	≠LL̰	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	[bìgʷìḍ]	[bìgʷìdì]	*rubbish*
	gì≠gòdí	LH	[gìgòdḭ]	[gìgòdí]	*law*
/ɪ/	gì≠àⁿʧî	L	[gʲàⁿʧ]	[gʲàⁿʧî]	*house*
	gì≠áⁿʧî	HL	[gʲàⁿʧ]	[gʲáⁿʧî]	*cockroach*
	gì≠àʧĩ	LH	[gʲàⁿʧḭ]	[gʲàʧĩ]	*refusal*
/u/	gì≠dégú	H	[gìdég̰]~[gìdég̰ṵ]	[gìdégú]	*navel*
	m̀≠mèkʰú	LH	[m̀mègṵ]	[m̀mègú]	*muscle, flesh*
/ʊ/	mò≠ⁿdò	L	[mòⁿḍ]	[mòⁿdò]	*man*
	gì≠lòⁿdó	LH	[gìlòⁿḍṍ]	[gìlòⁿdó]	*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 [gʲántʃ] *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≠lémdè	*bar-breasted mousebird*
a-ʊ	ǹ≠tʃámɔ̀	*stone, pit*	e-u	ǹ≠tʃɛ̀lù	*chin*
ʊ-ɪ	---[123]	---	u-i	nì≠gùlì	*family*
ʊ-a	gì≠sómbà	*adult*	u-e	nì≠gùndè	*basket*
ʊ-ʊ	gì≠lòndó	*cloud*	u-u	gì≠húŋûl	*lump*
ɔ-ɪ	nɔ̀≠gɔ̀lì	*mushroom*	o-i	ì≠nɔ̀nì	*bird*
ɔ-a	ní≠gɔ̀ndà	*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*	[gɔ̀≠sìg-à]	*insult (v)*
		[gì≠mɛ̀n]	*neck*	[gɔ̀≠mín-à]	*swallow*
/ʊ/	[ɔ]	[gì≠lɔ́ŋ]	*cadaver*	[gɔ̀≠lɔ́ŋ-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.

---

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

deverbal noun	*gloss*	from verb	*gloss*
gì≠bɔ́l-íg-a	*slope*	gɔ̀≠bɔ́l-íg	*climb*
m̀≠hɔ́l-ín-à	*baldness*	gɔ̀≠hɔ́l-ín-à	*clean*
nì≠bɔ̀s-ìn	*fish barricade*	gɔ̀≠bɔ̀s-à	*bail, fish*

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

non-final	**utterance-final**	***gloss***
[ɔ̀híɲì]	[ɔ̀hέɲɛ̀]	*sun*
[m̀pʰíɲì]	[m̀pʰέɲɛ̀]	*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

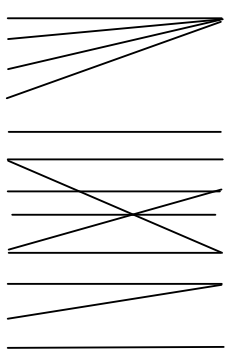
Both nominal and verbal pre-stem elements undergo vowel harmony in Elip. These are ATR harmony and rounding harmony discussed in turn below.

[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≠gáⁿdó	*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≠hìŋá	*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≠bɔ̀sìn	*fish barricade*
		à≠hìŋá	*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	nɔ-	nɔ̀≠bílà	*birdlime*
		nɔ̀≠gɔ́ⁿd	*foot*
		nù≠néŋʷé	*hevea, rubber tree*
13	dɔ-	dɔ̀≠bílà	*birdlime*
		dɔ≠gɔ́ⁿd	*feet*
		dù≠néŋʷé	*heveas, rubber trees*

[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≠nómà	*illness*
		gù≠nèɲè	*flood, inundation*
17	gʊ-	gʊ̀≠mɔ̀n	*sky*
		gʊ̀≠dàɲì	*savannah, bush*
19	ɪ-	ì≠lɔ̀g	*poison*
		ì≠líŋà	*uterus*
		ì≠nɔ̀nì	*bird*
pl of 19	mʊ-	mʊ̀≠lɔ̀g	*poisons*
		mù≠nɔ̀nì	*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	ɔ́-	mʊ̀≠ⁿdʊ̀ ʊ̀≠mʊ̀ʊ́mí	*one person*
2	bá-	bà≠ⁿdʊ̀ bá≠àⁿdì	*two persons*
		bà≠ⁿdʊ̀ bé≠níhì	*four persons*
3	ɔ́-	ʊ̀≠dú ʊ́≠mʊ̀ʊ̀mí	*one ear*
4	í-	ì≠dú íj≠àⁿdì	*two ears*
		ì≠dú í≠níhì	*four ears*
5	ní-	nì≠sàbà ní≠mʊ̀ʊ́mí	*one groundnut*
6a	á-	à≠sàbà á≠àⁿdì	*two groundnuts*
		à≠sàbà é≠níhì	*four groundnuts*
7	gí-	gì≠àⁿsì gí≠ mʊ̀ʊ́mí	*one house*
8	bí-	bì≠àⁿsì bí≠àⁿdì	*two houses*
		bì≠àⁿsì bí≠níhì	*four houses*
9	ì-	m≠fún ì≠ mʊ̀ʊ́mí	*one nose*
10	í-	m≠fún í≠àⁿdì	*two noses*
		m≠fún í≠níhì	*four noses*
11	nʊ́-	nʊ̀≠tá nú≠ mʊ̀ʊ́mí	*one arrowhead*
13	tʊ́-	tʊ̀≠tá tʊ́≠àⁿdì	*two arrowheads*
		tʊ̀≠tá tú≠níhì	*four arrowheads*
14	pʊ́-	bʊ̀≠díd bú≠ mʊ̀ʊ́mí	*one tree*
6	má-	mà≠díd má≠àⁿdì	*two trees*
		mà≠díd mé≠níhì	*four trees*

19	í-	ì≠nòní	í≠ mòómí	*one bird*
mu	mó-	mù≠nòní	mó≠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*
		gò≠sìg-à	*insult*
		gù≠gés-ên	*sneeze*
		gò≠bàⁿd-à	*hatch, crunch*
		gò≠gɔ̀ŋ-à	*scratch*
		gù≠hòg-è	*rest*
		gò≠gòl-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-	ò≠gáⁿdó	*woman*
	ùŋ≠ébì[127]	*thief (gʷ≠éb to steal)*
ɔ-	ɔ̀≠gòná	*ancestor*
	ɔ̀≠nìm	*husband*
	ɔ̀≠lìᵐb	*sage, wise man*
	ò≠gúl	*friend, comrade*
mʊ-[128]	mò≠ⁿdò	*person*
	mʷ≠ǒn	*baby*
	mò≠óŋàjɔ̀	*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*
	hɔ̆m	*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≠híŋ̀ì	*sun*
	ɔ̀m≠bɔ́g	*hand*
	ɔ̀≠dɔ́nà	*stake, prop (for plants)*
	ò≠fín	*debt*
	ò≠hólí	*moon*
	ò≠hún	*nose*
	ò≠gʷé	*stream, brook*
ʊ(N)-	ùm≠bál	*boundary*
	ò≠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-	gò-bí≠bís-à	*comb oneself*
		gò-bí≠gɔ́ᵐb-à	*shave oneself*
		gù-bí≠dúᵐb-è	*wash oneself*
negative	dì-	ò-dì-gà≠hòl-à	*c1-NEG-FT2≠sweep-CONT*
(pres. & fut.)		ù-dì-é≠dím-è	*c1-NEG-Pr≠dig-CONT*
negative	sá-	dì-sà-sá≠hòl-à	*1p-P1-NEG≠sweep-CONT*
(past tenses)		dì-mè-sé≠dím-é	*1p-P4-NEG≠dig-CONT*
recent past	sà-	ò-sà≠hòl-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≠lóⁿdì	*traditional healers*
		bà≠gònâ	*ancestor, lord*
		bè≠nùgì	*weaver*
6a	a(N)-	ɔ́≠gɔ̀ⁿdà	*plantains*
		ò≠hògè	*shadows*
		à≠sɔ̀gà	*pastures for animals*
		è≠gùⁿdè	*baskets for peanuts*
6	ma-	mɔ̀≠dɔ́g	*seasonings*
		mò≠gòdì	*thought*
		mà≠gɔ̀l	*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*
		ɔ̀-mɔ́-sɔ́≠sɔ̀s-à	*c1-P0-neg≠smoke-CONT*
		ɔ̀-sɔ̀-sɔ́≠gɔ́l-ɔ̀n	*c1-P1-neg≠take-CONT*
recent past	sà-	ɔ̀-sɔ̀≠sɔ̀s-à	*c1-P1≠smoke-CONT*
		ù-sò≠dól-è	*c1-P1≠tickle-CONT*
subject concord	à-	ò-gɔ̌≠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	gò-bí≠dɔ́l-íg-ìn	*listen intently*
		gò≠gás-íg-àn	*break up, detach, split*
		gù≠hùn-ìg-èn	*bury*
separative	-ʊn	gò≠sáŋ-ón-à	*deny*
		gù≠hùn-ùn-è	*unearth, dig up*
continuous	-an	gò≠hám-àn	*flow, leak, run*
		gu≠bùn-èn	*open*
diminutive	-ɪd	gò≠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*
gò≠ná^{m}b-à	*prepare (food)*	nì≠ná^{m}b-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

gò≠sɔ́d	*live*	nò≠sɔ́d-à	*life*
gò≠síŋ	*despise*	ì≠síŋ-à	*contempt*
gò≠dɔ́ŋ-ìn	*call*	ɔ̀≠dɔ́ŋ-ín-à	*invitation, summons*
g^{w}≠èj-ìd	*choose, pick*	g^{j}≠èj-ìd-è	*choice, vote*
gò≠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 **-ɨe**, 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≠sɔ́d-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≠nòg-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-ól-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≠ŏb-ʲè	kʲ≠ŏb-ʲò	*swelling (from verb gʷŏbè/kʷŏbò 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/	gò≠gɔ́g-à	kò≠gɔ́g-à	kò≠kɔ́k-ɔ̀	*pull*
			gò≠sɔ́s-à	kò≠sɔ́s-à	kò≠sɔ́s-ɔ̀	*smoke*
			gò≠gɔ̀ŋ-à	kò≠gɔ̀ŋ-à	kò≠kɔ̀ŋ-ɔ̀	*scratch*
	+round -open	/ʊ/	gò≠sʊ̀g-à	kò≠sʊ̀g-à	kò≠sʊ̀k-à	*wash*
			gò≠nʊ̀d-à	kò≠nʊ̀t-à	kò≠nʊ̀t-à	*vomit*
			gò≠hʊ́h-à	kò≠hʊ́h-à	kò≠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≠húm-è	kù≠húm-è	kù≠húm-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***
bʷǎn	bò≠án	*tribe*
gʷísì	gʊ≠ísì	*earth, ground*
nʷɔ̀ⁿdè	nò≠ɔ̀ⁿdì	*frog sp.*
nʷòlì	nò≠òlì	*string*
gʲɔ̀já	gì≠ɔ̀já	*feather, hair*
gʷěbèn	gʊ≠éb-èn	*steal*
gʷǒl	gò≠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***
gògʷà	gò≠gò-à	*fall (INTR)*
gògʷɛ̀n	gò≠gò-ìn	*fall (TR)*
gògʷànɛ̀n	gò≠gò-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	gìdúmbʲé	*bath*
gò≠dɔ̀g	*finish*	gì≠dòg-i-e	gìdògʲè	*fatigue, tiredness*
gò≠jɔ̀g-à	*cultivate*	mò≠jòg-i-e	mòjògʲè	*agriculture*
gʷ≠ób-è	*swell (v)*	gʲ≠ób-i-e	gʲóbʲé	*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*
gìílà	gì≠íl-à	*arrow*
mèéᵐb	mà≠éᵐb	*side (of body)*
máàdà	má≠àd-à	*poison for arrows*
mòóŋàjó	mò≠óŋ-àjó	*child*
mòóɲí	mà≠óɲí	*palaver*
bòòbí	bò≠òbí	*severity*
nùúb	nò≠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**
gò≠nòd-à	*vomit*	ìj-á≠nód-á	òw-á≠nód-á
gò≠dɔ́l-à	*twist*	ìj-ɔ́≠dɔ́l-á	òw-ɔ́≠dɔ́l-á
gù≠bùh-è	*tear*	ìj-é≠búh-é	ùw-é≠búh-é
gù≠hòɲ-è	*fill-up*	ìj-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

gò≠gà	[gògà]	*butcher*
gò≠gà-ìn	[gògɜ̃ɜ̃n]	*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	ᵐb	ⁿd		ᵑg
fricatives	voiceless	f	s		h
	prenasalised	ᵐ̩f	ⁿs		
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	ᵐb	ⁿd		ᵑg
fricatives	voiceless	f	s		h
	prenasalised	ᵐ̩f	ⁿs		
resonants	nasal	m	n	ɲ	ŋ
	oral		l	j	w

The prenasalised fricative /ⁿs/ is realised [ⁿtʃ], as seen in Example 177 below.

Example 177: Realisation of /ⁿs/ in Mmala

gì≠sèⁿs	[gèsèⁿtʃ]	*lip*
nò≠ⁿsòkʲò	[nùⁿtʃòkʲò]	*red pepper*
gì≠àⁿsì	[gʲàⁿtʃì]	*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≠sámɔ̀	[gìsámɔ̀]	*fruit*
àn≠sámɔ̀	[àntʃámɔ̀]	*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 /ᵑg/, /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≠bʷè	*white hair*
gì≠sʷá	*bowl*
m̀≠bʷá	*dog*
àŋ≠kʷàŋ	*diastema (gap between teeth)*
ɔ̀≠dʷɔ́	*head*
sʲè	*father*
gì≠sʲèn	*farm*
mà≠sʲà	*side*
ì≠ɲódʲò	*mother*
tʲò	*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 /ᵑg/ which is not found in syllable-final position.

Example 180: Final-consonant devoicing in Mmala

/b/→[b̥]	[màgɛ́b̥]	*wine*
/d/→[d̥]	[mègùd̥]	*fat*
/g/→[g̊]	[bùdùg̊]	*night*
/ᵐb/→[ᵐb̥]	[nɛ̀bɛ̀ᵐb̥]	*frog sp.*
/ⁿd/→[ⁿd̥]	[gɛ̀góⁿd̥]	*foot*
/t/→[tʰ]	[nɨ̌tʰ]	*buffalo*
/k/→[kʰ]	[gìjɛ̀kʰ]	*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	≠gʊ́l	*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≠ŋ̀nì	*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	[gʲàⁿʧ]~[gʲàⁿʧi̥]	[gʲàⁿʧî]	*house*
	gì≠àⁿsí	LH	[gʲàⁿʧî]	[gʲàⁿʧǐ]	*pledge*
/u/	gì≠dégú	H	[gìdég̥]~[gìdég̥ù]	[gìdégú]	*navel*
	à≠mèkú	LH	[èmèkʰù]	[èmèkʰú]	*muscle, flesh*
/ʊ/	bà≠àⁿdò	L	[bààⁿd̥]~[bààⁿd̥o̥]	[bààⁿdò]	*people*
	àn≠sámò	HL	[àntʃàm]~[àntʃàmo̥]	[àntʃámò]	*grain*
	gì≠sàsó	LH	[gìsàsò]	[gìsàsó]	*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/	bɔ̀≠gídè	HL	[bùgídè]	[bùgídè]	*grass*
/o/	ɲɔ́dʲɔ́	H	[ɲɔ́dʲɔ̀]	[ɲɔ́dʲɔ́]	*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≠ŋídò	*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≠bɔ̀dà	*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	bò≠ɲánɔ̀	*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)*	gɔ̀≠sìg-à	*insult (v)*
ɪ-ɔ	---	---	---	---	---
ʊ-ɛ	ɔ-ɛ	gɛ̀≠gɔ́l-ɛ̀n	*grinding stone*	gɔ̀≠gɔ́l-à	*grind (v)*
ʊ-ɔ	ɔ-ɔ	ɔ̀≠sɔ̀g-ɔ̀	*purification*	gɔ̀≠sɔ̀g-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

$V_1 \setminus V_2$	**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	ɛ-ɛ	*ǹ≠tʃɛ̀gɛ̀*	*insult (from gòsìgà to insult)*
ɛ-ɪ		--	---
ɛ-ɛ		nɛ̀≠lɛ̀gɛ̀	*yam sp.*
ɪ-a	ɪ-a	mà≠dígà	*water*
ɪ-ɔ	ɛ-ɔ	ɔ̀m≠fɛ́ŋɔ̀	*termite sp. (pl. ìm≠fíŋà)*
*ɛ-ɔ[139]		---	---
ɛ-ʊ		---	---
ɛ-a	ɛ-a	bɛ̀≠sɛ́gà	*taro field*
ʊ-ɪ	ʊ-ɪ	---	---
ʊ-ɛ	ɔ-ɛ	*gɛ̀≠gɔ́lɛ̀n*	*large grinding stone (gògòlà to grind)*
ɔ-ɪ		ɛ̀≠ŋɔ́dɛ́[140]	*machete handle*
ɔ-ɛ		ɔ̀≠fɔ̀ŋɛ̀[141]	*yellow yam*
ʊ-a	ʊ-a	m̀≠bʊ̀dà	*siluridae sp.*
ʊ-ɔ	ɔ-ɔ	*ɔ̀≠sɔ̀gɔ̀*	*funeral purification (gòsɔ̀gà to wash)*
ɔ-ʊ		---	---
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≠ŋánʊ̀	*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.

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[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≠gáⁿdɔ̀	*woman*
		è≠bʲèŋ	*midwife*
2	ba-/be-	bà≠gáⁿdɔ̀	*women*
		bè≠bʲèŋ	*midwives*
3	a(N)-/e(N)-	à≠sà	*river*
		àn≠sàmɔ̀[142]	*nut*
		è≠mèkù	*flesh, muscle*
		è≠gʷén	*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≠sàmɔ̀	*fruit*	àn≠sàmɔ̀	*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≠sàmɔ̀	*nuts*
		ì≠mèkù	*flesh, muscles*
		ì≠ŋídè	*hair*
5	nɪ-/ni-	nì≠bánà	*breast, udder*
		nì≠bùs	*anthill*
		nì≠sélù	*chin*
		nì≠lòⁿsò	*bean*
6	ma-/me-	mà≠dígà	*water*
		mè≠gùd	*fat, oil*
6a	a(N)-/e(N)-	àm≠bánà	*breasts, udders*
		à≠bɛ̀ᵐb	*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≠bʷá	*dogs*
		ìn≠ʧùb	*hippopotami*
11	nɔ-/nu-	nɔ̀≠làm	*arrow shaft*
		nù≠lèn	*stream*
13	dɔ-/du-	dɔ̀≠làm	*arrow shafts*
		dù≠lèn	*streams*
14	bɔ-/bu-	bɔ̀≠ŋàm	*animal*
		bù≠dùg	*night*
15	gɔ-/gu-	gɔ̀≠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≠ⁿdɔ̀ ɔ̀≠mòmù	*one person*
2	bá-	bà≠ⁿdɔ̀ bá≠àⁿdì	*two persons*
		bà≠ⁿdɔ̀ bé≠nî	*four persons*
3	ɔ́-	ɔ̀≠dú ɔ́≠mòmù	*one ear*
4	í-	ì≠dú íj≠àⁿdì	*two ears*
		ì≠dú í≠nî	*four ears*
5	ní-	nì≠sàbà ní≠mòmù	*one groundnut*
6a	á-	à≠sàbà á≠àⁿdì	*two groundnuts*
		à≠sàbà é≠nî	*four groundnuts*
7	gí-	gì≠àⁿsì gí≠mòòmù	*one house*
8	bí-	bì≠àⁿsì bí≠àⁿdì	*two houses*
		bì≠àⁿsì bí≠nî	*four houses*
9	ì-	m≠fún ì≠mòmù	*one nose*
10	í-	ìm≠fún íj≠àⁿdì	*two noses*
		m≠fún í≠nî	*four noses*
11	nó-	nò≠tá nú≠mòmù	*one arrowhead*
13	tó-	dò≠tá dó≠àⁿdì	*two arrowheads*
		dò≠tá dú≠nî	*four arrowheads*
14	pó-	bò≠díd bú≠mòmù	*one tree*
6	má-	mà≠díd má≠àⁿdì	*two trees*
		mà≠díd mé≠nî	*four trees*
19	í-	ì≠nòní í≠mòmù	*one bird*
mu	mó-	mù≠nòní mó≠àⁿdì	*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*
		gò≠sìg-à	*insult*
		gù≠dèg-è	*abound*
		gò≠bɛ̀g-à	*burn*
		gò≠gál-à	*speak, talk*
		gù≠gɔ́g-ɔ[144]	*pull*
		gù≠dòg-ò	*burp*
		gò≠gól-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-	gò-bí≠fɛ̀g	*spill*
	bí-	gù-bí≠bʲén	*be born*
negation	dɪ-	ǹ-dì-má-sòg-à	*I did not wash*
		1s-NEG-P1≠wash-CONT	
	di-	ǹ-dì-mé≠jèl-ì	*I did not cross*
		1s-NEG-P1≠cross-CAUS	
directional --from reference	na-	dì-mà-ná≠ɲà	*we ate there*
		1p-P4-DIR-eat-CONT	
	ne-	dì-mè-né≠bìŋ-ìn	*we entered there*
		1p-P4-DIR-enter-CONT	
directional --towards reference	sɪ-	ò-sà-sì-ŋ≠àl-ɛ̀n bʷòlì	*s/he works here for me*
		c1-P1-DIR-1sIO≠do-APPL work	
	si-	ù-sè-sì-ŋ≠dím-ìn ɔ̀mbɛ̀l	*s/he dug a hole for me*
		c1-P1-DIR-1sIO≠dig- APPL hole	
subject concord/tense	ʊ-/	ò-sà≠fòl-à	*s/he was sweeping*
	sa-	c1-P1≠sweep-CONT	
	u-/	ù-sè≠súŋ-è	*s/he was tying*
	se-	c1-P1≠attach-CONT	

[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*
		ɔ̀ŋ≠ómàⁿdɔ̀-ì	*buyer*
		à≠nómàⁿdɔ̀	*male, man*
		è≠dùmèb	*envoy*
2	ba-	bɔ̀≠kɔ̀nɔ́-kɔ̀n	*crazy persons*
		bò≠tʲò	*relatives of father*
		bà≠nómàⁿdɔ̀	*males, men*
		bè≠dùmèb	*envoys*
3	a(N)-	ɔ̀ŋ≠kɔ̀gɔ̀	*wine (gen)*
		òm≠bòkò	*squirrel*
		à≠wàgà	*chimpanzee*
		è≠mèkú	*flesh*
6a	a-	ɔ́≠gɔ̀ⁿdɔ̀	*plantains*
		ò≠lòⁿsó	*beans*
		à≠mòⁿdɛ̀	*stomach, belly*
		è≠lùkù	*bamboo stool*
6	ma-	mɔ̀≠fɔ̀ᵐf	*marrow*
		mò≠ɲòn	*burial*
		mà≠nɔ̀ŋ (/mà≠nòŋ/)	*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 **mɔ-* 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≠lìⁿʧ-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*
		ɔ̀m≠fùlɔ̀	*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-	ɔ̀-sɔ̀≠sɔ̀g-ɔ̀[145] 2s-P1≠probe-CONT		*You probed (the sack).*
		ò-sò≠bòk-ò 2s-P1≠bark-CONT		*You barked.*
directional	na-	ɔ̀-sɔ̀-nɔ̀-ŋ-ɔ̀nd-ɛ̀n c1-P1-DIR-1sIO-buy-APPL	gìlà clothes	*S/he went to buy me clothes.*
		ù-sɔ̀-nò-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 gɔ- 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/ recent past	a-/ sa-	à-sà≠fól-à 2s-P1≠sweep-FV	*you sweep*
		è-sè≠fúg-è 2s-P1≠cover-FV	*you cover*
subject concord/ near future	bá- ga-	bá-gà≠gòl c2-F2≠grind	*they grind*
		bé-gè≠dúk-è	*they rest*
directional	na-	ò-mà-nà≠sʊg-à c1-P4-DIR≠wash-FV	*s/he went there to wash*
		ù-mè-nè≠gùl-è c1-P4-DIR≠hoe-FV	*s/he went to hoe*

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)-	ì≠dìm	*hearts*
		ì≠ŋód	*machete handles*
		è≠mèⁿdè	*fences*
		èm≠bɔ́g	*hands*
5	nɪ-	nì≠gòb	*salt*
		nè≠bèᵐb	*edible frog*
		né≠gɔ̀ⁿdɔ̀	*plantain*
7	gɪ-	gì≠gɔ́ⁿd	*foot*
		gì≠sàs	*chest*
		gɛ̀≠dɔ̀ŋ	*village*
		gɛ̀≠sɛ̀g	*monkey*
8	bɪ-	bì≠gɔ̀ⁿd	*feet*
		bì≠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≠màⁿdɛ̀	*wild cat*
		nʊ̀≠bɛ̀lʲà	*spring*
		nʊ̀≠bɔ̀mɔ́	*river, stream*
13	dʊ-	**dɔ̀≠bɔ̀g** (from gʊ̀bʊ̀gà)	*prophecies*
		dʊ̀≠màⁿdɛ̀	*wild cats*
		dʊ̀≠bɛ̀lʲà	*springs*
		dʊ̀≠bɔ̀mɔ́	*rivers, streams*
14	bʊ-	bʊ̀≠dîd	*tree*
		bʊ̀≠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**	
gʊ̀≠sʊ̀g-à	~	gɔ̀≠sɔ̀g-à	*wash*	gù≠sɔ̀g-ɔ̀	*probe*
gʊ̀≠fʊ́l-à	~	gɔ̀≠fɔ́l-à	*sweep*	gù≠sɔ̀s-ɔ̀	*suck, smoke*
gʊ̀≠dʊ́m	~	gɔ̀≠dɔ́m	*send something*	gù≠dɔ́m	*eat first fruits*
gʊ̀≠gʊ́l	~	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-	ò-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-g^{w}≠<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	≠máŋ-íg-àn	*govern, dominate*
		≠díl-íg-èn	*transport*
separative	-ʊn	-bí≠làŋ-òn-à	*undress (s.o.)-CONT*
		≠òl-ùn-ìn	*unwrap-for s.o.*
continuous	-an	≠dò^{m}b-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-èn	*build-APPL*
		≠gúf-ìn	*work (field)-APPL*
diminutive	-ɪd	≠dáᵐb-èd	*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-i̱	*make run, frighten*
		≠dád-èd	*sing*	≠déd-ìd-i̱	*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

gò≠nòg-à	*weave*	è≠nùg-i̱	*weaver*
gò≠éb	*steal*	èŋ≠éb-i̱	*robber*
gò≠fáf-à	*watch*	é≠féf-i̱	*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-ón-à	*settle a dispute*
		≠làŋ-ʊ̀n-à	*weed (v)*
	-ʊm	≠ěl-úm-è	*breathe*
continuous	-an	≠sɔ́s-**ɔ̀**n	*smoke (v)*
		≠fʷòg-**ɔ̀**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	≠màⁿd-à	*heap up (TR)*	≠màⁿd-ìg-àn	*heap up (INTR)*
		≠àᵐb-àn	*dry (TR)*	≠àᵐb-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	ò-sà≠sìg-à	*c1-P1-insult*	ò-sà≠s**ɛ̀**g-ɛ̀d	*c1-P1≠insult*
	ò-sà≠fʊ̀l-à	*c1-P1-sweep*	ò-sà≠f**ʊ̀**l-ɛ̀d	*c1-P1≠sweep*
APPL	ò-sà≠bóg-à	*c1-P1-divine*	ò-sà-m≠b**ɔ́**g-ɛ̂n	*c1-P1-1sIO≠divine*
	ò-sà≠nʊ̀g-à	*c1-P1-braid*	ò-sà-d**ɛ́**≠n**ʊ̀**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≠f**ɔ́**l-ɛ̀n	*broom*
gò≠mìn-à	*swallow*	nɛ̀≠m**ɛ̀**n-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***
bʷìlò	bò≠ìlò	*large black monkey sp.*
bʷɛ̌g	bò≠ég	*porcupine*
nʷɔ̰ᵑdɛ̀	nò≠ɔᵑdɛ̀	*frog sp.*
nʷòlì	nò≠òlì	*string*
gʲǒᵐb	gì≠óᵐb	*weeding stick*
gʷɛ̌b	gò≠éb	*steal*
gʷɛ̌l	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*
gùdʷénèn	gù≠dú-èn-èn[151]	*sell (CONT)*
gùdʷénìn	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	gò≠úl	*come*
	mèég	mà≠ég	*porcupines*
	mààɲè	mà≠àɲè	*fetishes*
b)	mɔ̀ɔ́n	mà≠ɔ́n	*baby*
	ɔ̀ɔ̀ŋ	à≠ɔ̀ŋ	*sun*
	òól	à≠ól	*moon*
c)	gɛ̀ɛ̀ŋ	gì≠ɛ̀ŋ	*hill*
	gɛ̀ɛ̀^{m}f	gì≠ɛ̀^{m}f	*hide (animal)*
	gɔ̀ɔ̀ŋɔ̀	gò≠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	gò≠dú-ʊn	*sell (APPL)*
gùfùùg	gò≠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≠á^{n}d	ìj≠á^{n}d	*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
gò≠làf-à	*tear*	ìj-à≠làf-à	òw-à≠làf-à
g^w≠òd	*pour*	ìj-ò≠òd	ùw-ò≠òd
g^w≠ɔ̌n-ɔ̀	*kill*	ìj-ɔ̀≠ɔ́n-ɔ̀	òw-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)	gò≠fá	gò≠f<u>á</u>-èn	gòfɛ́n	*give (APPL)*
	gò≠dá	gò≠d<u>á</u>-èn	gòdɛ́n	*shell (APPL)*
(b)	gò-bí≠sɔ́	gò-bí≠sɔ́-<u>ì</u>d-ìd	gòbísɔ́dɛ̀d	*spiritually protect self (DIM)*
	gò≠fá	gò≠fá-<u>ì</u>d-ìd	gòfádìd	*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

gè≠sɔ̀	≠L	*drizzle*
gè≠sɔ́	≠H	*pond*
gì≠sàs	≠L	*chest*
gì≠sás	≠H	*carp sp.*
nì≠bànà	≠L	*footstep*
gì≠fànáˊ	≠LH	*hoof*
nì≠bánà	≠HL	*udders, breasts*
gì≠^{m}bádá	≠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	ᵐ̩f	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	ŋèt̪è[154]	*c9.measure, plan*
nò≠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	ɪː		ʊ	ʊː	i	iː		u	uː
ɛ	ɛː		ɔ	ɔː	e	eː		o	oː
		a aː							

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*
/iː/	kù≠tíːn-è	kù≠tîːn	*flee in fear*
/ɪ/	kò≠jìk-à	kò≠jèk	*rot*
/ɪː/	kó≠jíːl-à	kò≠jêːl	*(be) slimy (food)*
/e/	kù≠sèl-èn	kù≠sèl	*descend*
/eː/	kù-téːɲ-ì	kù≠têːn	*(make) drip*
/ɛ/	kò≠fɛ̀k-ɛ̀	kò≠fɛ̀k	*measure*
/ɛː/	kò≠nɛ̀ːn-ɛ̀n	kò≠nɛ̀ːn	*abandon, let fall*
/a/	kò≠fát-à	kò≠fàt	*husk (corn); shell*
/aː/	kò≠fáːt-à	kò≠fâːt	*carve, sharpen*
/u/	kù≠tùn-è	kù≠tùn	*back up (rear first)*
/uː/	kù≠túːn-è	kù≠tûːn	*crush*
/ʊ/	kò≠kót-à	kò≠kɔ̀t	*fasten, bind*
/ʊː/	kò≠póːk-à	kò≠pɔ̂ːk	*cook meat (wrapped in leaves)*
/o/	kù-pí≠kóf-ò	kù-pí≠kòf	*devour*
/oː/	kù≠fóːk-òn	kù≠fôːk	*advance, go ahead*
/ɔ/	kò≠sɔ́k-ɔ̀	kò≠sɔ̀k	*extract*
/ɔː/	kò≠sɔ́ːk-ɔ̀	kò≠sɔ̂ːk	*grow (of plants)*

In the noun system, however, only seven contrastive long and short vowels (excluding ɪ, ɪː ʊ or ʊː) 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]	mè≠pénè	*milk*	[ɔ]	ì≠kɔ́tɔ́	*pipe*
[ɛː]	kì≠séːpèn	*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≠$^{\downarrow}$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$^{\downarrow}$tól]~[kí$^{\downarrow}$tólị̊]	[kìtólí]	*ant*
	kì≠tòlí	LH	[kìtòlí]	[kìtòlí]	*musical form*
/ɪ/	kʲ≠àⁿsì	L	[kʲàⁿs]~[kʲàⁿsị̊]	[kʲàⁿsì]	*house*
	kʲ≠ǎⁿsì	HL	[kʲǎⁿs]~[kʲǎⁿsị̊]	[kʲǎⁿsì]	*mutter, growl*
	kʲ≠àⁿsí	LH	[kʲàⁿsí]	[kʲàⁿsí]	*challenge*

	underlying forms		final	non-final	*gloss*
/u/	kì≠tékù	HL	[kìték]~[kìtékṵ]	[kìtékù]	*navel*
	è≠mèkú	LH	[èmèkú]	[èmèkú]	*muscle, flesh*
/ʊ/	à≠ká:ⁿdò	HL	[àká:ⁿd]~[àká:ⁿdṳ̀]	[àká:ⁿdò]	*woman*
	kì≠tɛ̀kó	LH	[kìtɛ̀kó]	[kìtɛ̀kó]	*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≠pìŋé	*termite trap*
ɪ-ɔ	kì≠ᵐbìlɔ̀	*tadpole*	i-o	---	---

[-ATR] vowels			[+ATR] vowels		
ɪ:-ɛ	nì≠pì:ᵐbʲɛ̀	*goliath frog*	i:-i	kì≠pí:pì	*pus*
ɪ:-ʊ	---	---	i:-u	---	---
ɪ:-a	---	---	i:-e	èm≠fí:ɲé	*termite sp.*
ɪ:-ɔ	ɔ̀≠sí:ⁿdʲɔ̀	*leech*	i:-o	---	---
ɛ-ɛ	kì≠sɛ̀kɛ̀	*sandy earth*	e-i	kì≠kèɲí	*clam*
ɛ-ʊ	ɛ̀≠tɛ̀nó	*shame*	e-u	è≠mèkú	*flesh*
ɛ-a	---	*---(fronting)*	e-e	kì≠tèŋé	*waterhole*
ɛ-ɔ	---	---	e-o	---	---
ɛ:-ɛ	kì≠pɛ́:sɛ̀	*twins*	e:-i	è≠lè:ⁿdí	*s.o. who smooths*
ɛ:-ʊ	---	---	e:-u	---	---
ɛ:-a	---	*---(fronting)*	e:-e	ì≠té:nè	*son-in-law*
ɛ:-ɔ	---	---	e:-o	---	---
ʊ-ɛ	m̀≠bɔ̀ŋɛ̀	*manioc*	u-i	ì≠mùⁿdí	*gizzard*
ʊ-ʊ	---	---	u-u	è≠súpù	*palm-nut pulp*
ʊ-a	ì≠kópà	*loincloth*	u-e	kì≠kújè	*plant sp., fan*
ʊ-ɔ	ì≠sɔ̀ⁿdɔ́	*gazelle*	u-o	---	---
ʊ:-ɛ	kì≠tó:ᵐbɛ̀	*sheep*	u:-i	è≠tú:sì	*merchant*
ʊ:-ʊ	---	---	u:-u	è≠tú:túk	*broom*
ʊ:-a	---	---	u:-e	kì≠lŭ:mè	*story, tale*
ʊ:-ɔ	---	---	u:-o	---	---
ɔ-ɪ	pɔ̀≠kɔ̀ŋí	*cherry tree*	o-i	ì≠nɔ̀ní	*bird*
ɔ-ʊ	---	---	o-u	---	---
ɔ-a	---	*--(rounding)*	o-e	pɔ̀≠tʲŏŋé	*yam sp.*
ɔ-ɔ	ì≠kɔ́tɔ́	*pipe*	o-o	ì≠tópɔ̀	*side (of body)*
ɔ:-ɪ	---	---	o:-i	jŏ:tí	*mother*
ɔ:-ʊ	---	---	o:-u	---	---
ɔ:-a	---	*--(rounding)*	o:-e	nú≠kŏ:ŋé	*grass sp.*
ɔ:-ɔ	kì≠tɔ́:kɔ̀	*wound*	o:-o	kì≠kó:kó	*bone*
a-ɪ	kì≠kákì	*crust, scab*			
a-ʊ	àn≠sàmó	*fruit*			
a-a	kì≠kànà	*charcoal*			
a:-ɪ	à≠wà:kì	*chimpanzee*			
a:-ʊ	à≠ká:ⁿdɔ̀	*woman*			
a:-a	kì≠ɲá:ŋà	*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
/iː/	iː-i	---	iː-e
/ɪː/	ɪː-ɛ	ɪː-ɔ	---
/eː/	eː-i	---	eː-e
/ɛː/	ɛː-ɛ	---	---
/uː/	uː-i	uː-u	uː-e
/ʊː/	ʊː-ɛ	---	---
/oː/	oː-i	oː-o	oː-e
/ɔ/:	---	ɔː-ɔ	---
/aː/	aː-ɪ	aː-ʊ	aː-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≠sɨk-é*	*insult (n) (from kɔ̀sɨ̀kàn 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-ó*	*gift (from kɔ̀tɛ̀k 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≠bɔ̀ŋɛ̀	*manioc*
ʊ-a	ʊ-a	ì≠kópà	*loin cloth*
ʊ-ʊ→ʊ-ɔ	ʊ-ɔ	*kì≠fɔ̀n-ɔ́*	*sacrifice (from kɔ̀fɔ̀nà to sacrifice)*
ʊ:-ɪ→ʊ:-ɛ	ʊ:-ɛ	kì≠tó: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≠tɔ́ːkɔ̀	*wound*
a-ɪ	a-ɪ	kì≠kákɻ̀	*crust, scab*
a-a	a-a	kì≠kànà	*charcoal*
a-ʊ	a-ɔ	*àm≠bàŋ-ó*	*mourning (from kɔ̀pàŋà 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:ⁿdɔ̀	*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-		2	pa- /pe-
	a- / e-			
	∅			
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-		mʊ-	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≠sǎ:	*river*
		è≠súɲ	*tsetse fly*
4	ɪ(N) [161]-	ì≠tím	*hearts*
		ì≠mèkú	*flesh, muscles*
5	nɪ-	nì≠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-	kì≠kàsá	*fish scale*
		kì≠ŋúlè	*owl*
8	pɪ-	pì≠kàsá	*fish scales*
		pì≠ŋúlè	*owls*
10	ɪN-	ìm≠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≠mɛ̀ŋ	*knowledge*
19	ɪ-	ì≠lɔ̀ŋ	*horn*
		ì≠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 ɔ̀≠mòómí	*one person*
2	pá-	pɛ̀≠ɛ̀ⁿdɔ̀ pá≠àⁿdí	*two persons*
		pɛ̀≠ɛ̀ⁿdɔ̀ pé≠nì	*four persons*
3	ɔ́-	ɔ̀≠tím ɔ́≠mòómí	*one heart*
4	í-	ì≠tím íj≠àⁿdí[162]	*two hearts*
		ì≠tím í≠nì	*four hearts*
5	ní-	nì≠kɛ́ɛ́ ní≠mòómí	*one egg*
6a	á-	è≠kɛ́ɛ́ á≠àⁿdí	*two eggs*
		è≠kɛ́ɛ́ 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	nó-	nò≠kɔ́ŋ nú≠mòómí	*one swallow (bird)*
13	tó-	tò≠kɔ́ŋ tó≠àⁿdí	*two swallows*
		tò≠kɔ́ŋ tú≠nì	*four swallows*
14	pó-	pò≠tɛ́ pú≠mòómí	*one tree*
6	má-	ma≠tɛ́ má≠àⁿdí	*two trees*
		ma≠tɛ́ mé≠nì	*four trees*
19	í-	ì≠noní í≠mòómí	*one bird*
mu	mó-	mù≠noní mó≠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)*
		kò≠sík-à	*bite*
		kù≠sèl-èn	*land, descend*
		kò≠sɛ́k-ɛ̀	*plaster, sharpen*
		kò≠sák-à	*shake*
		kò≠sɔ́k-ɔ̀	*extract*
		kù≠fók-ò	*drive, lead*
		kò≠sɔ̀k-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)- (*mʊ-)	ɔ̀≠tím	*heart*
		ɔ̀m≠bɛ́l	*hole*
		ɔ̀≠kɛ́l	*mountain*
		ɔ̀≠kɛ̀n	*tail*
		ɔ̀≠mì^{n}dɛ́	*fence*
		ɔ̀n≠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*
è≠tɔ̀	ì≠t^{w}è	*head(s)*
è≠sɔ̌	ì≠s^{w}é	*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-	kɔ̀-pí≠fɛ̀k-ɛ̀	*measure oneself*
		kù-pí≠kìl-èn	*shake oneself*
negation/	tì-	ɔ̀-tì-má≠sɔ̀k-à	*c1-NEG-P0≠wash-CONT*
tense		ù-tì-mé≠kìt-è	*c1-NEG-P0≠strike-CONT*
subject concord/	ʊ-	ù-sʲɛ̀≠sìk-ìt	*c1-P1≠saw-DIM*
tense	sʲà-	ɔ̀-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*
		ɔ̀≠lókí	*fisherman*
		à≠káⁿdɔ̀	*woman*
		é≠túŋ	*blacksmith*
2	pa-	pɔ̀≠pɔ̀l	*daughters*
		pɔ̀≠lókí	*fishermen*
		pà≠káⁿdɔ̀	*women*
		pé≠túŋ	*blacksmiths*
6a	a(N)-	ɔ̀≠kɔ̀t	*napes of necks*
		ɔ̀≠kɔ̀j	*hatreds*
		à≠nɔ̀k	*wicker works*
		è≠kùl	*families*
6	ma-	mɔ̀≠fɔᵐfɛ̀	*marrow*
		mɔ̀≠ŋǒː	*cemetery*
		mà≠nóŋ	*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	a-	ɔ-sʲɔ≠tɔs-ɛ̀t	*2s-P1≠polish-DIM*
concord/tense	sʲà-	ò-sʲò≠pós-ìt	*2s-P1≠bark-DIM*
	mà-	ɔ-mɔ≠kɔ̀t-ɔ	*2s- P4≠work-CONT*
		ò-mò≠fók-ò	*2s- P4≠lead-CONT*
directional	nʲà-	ò-mɔ́-nʲɔ-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≠sɔ̀k-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≠tí:n-e	*2s-P4≠flee-FV*
directional	nʲà-	ò-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)-	è≠nómɛ̀ⁿdɔ́	*man, male*
		è≠pʲéɲí	*midwife*
2	pa-	pɛ̀≠nómɛ̀ⁿdɔ́	*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-	mɛ̀≠pɛ́:nɛ̀	*milk*
		mɛ̀≠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-sʲɛ̀≠fén-it	*2s-P1≠despise-DIM*
concord/tense	sʲà-	è-sʲɛ̀≠sɛ́k-ɛ̀t	*2s-P1≠sharpen-DIM*
	mà-	ù-mɛ̀≠fén-è	*c1-P4≠disdain-FV*
		ò-mɛ̀≠tɛ̀n-ɛ̀	*c1-P4≠pound-FV*
directional	nʲà-	ò-mɛ́-nʲɛ̀≠fɛ̀k-ɛ̀	*c1-P0-DIR-measure-FV*
		ù-mé-nʲɛ̀≠sɛ́:k-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*
		ò-sʲà-pɛ̀k	*c1-P1-burn*
		ò-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	kɔ-pí≠tɔ́l-ìk-ɛ̀n	*listen*
		kù≠tít-ìk-ìn	*jostle*
separative	-ɔn	kò≠pàl-òn-à	*strain, filter (food)*
		kù≠tún-ùn-è	*contradict*
continuous	-an	kò≠pál-àn	*pull up (weeds)*
		kù≠kíːk-èn	*touch*
diminutive	-ɪt	kò≠sòk-ɛ̀t	*wash*
		kù≠fúk-ìt	*blow*
final vowel	-à	kò≠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

kò≠tɛ̀k	*forgive*	kì≠tɛ̀k-ó	*gift (for forgiveness)*
kò≠tɔ̀nd-ɛ̀n	*hammer (v)*	í≠tɔ̀nd-ìn-ɔ̀	*wood pecker*
kò-pí≠nàn	*mistake (v)*	kì-pí≠nàn-ó	*mistake (n)*
kò≠pàŋ-à	*cry (v)*	àm≠bàŋ-ó	*tears, crying*
kù≠lùn	*age (v)*	kì≠lùn-ú	*old person (n)*
kù≠pʲén	*give birth*	kì≠pʲén-ín	*instrument to help birth*
kò≠pàl	*uproot (to)*	nì≠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*
		kò≠fól-à	*flow*	kù≠fúl-ì	*cause to flow*
		kò≠sɔ́ːk-ɔ̀	*grow*	kù≠sóːk-ì	*germinate*
		kò≠pàl	*uproot*	kù≠pèl-ì	*cause uproot*
		kò≠kɛ́t-ìk	*blink*	kù≠két-ìk-èŋ-ì	*cause to blink*
		kò≠jìk-à	*boil*	kù≠jìk-ì	*boil over*
agentive	-i	kò≠tát-à	*do sorcery*	è≠tét-ì	*sorcerer/esse*
		kʷ≠ĕp-è	*steal*	èŋ≠ép-ì	*robber*
		kò≠fɛ́:f-ɛ̀	*watch*	è≠fé:f-ì	*sentry*
		kò≠lɔ́k-ɔ̀	*fish*	ò≠lók-ì	*fisherman*
		kò≠sòl-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	kò≠pɔ́k-ɔ̀	*organise*
		kù≠fók-ò	*drive, conduct*
continuous	-an	kò≠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	kò≠fɛ́:f-ɛ̀	*spy, watch intently*
		kù≠fén-è	*despise*
continuous	-an	kò≠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≠téːk-ì	*announce (v)*	kìtéːkʲè	*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)	kìːné	kì≠ìné	*c7.filth (on body)*
	nìít	nì≠ít	*c5.mouth*
	kììl	kì≠ìl	*c7.small stream*
	nììp	nì≠ìp	*c5.cooking stone*
	kǐːlà	kì≠ílà	*c7.arrow*
	nòòŋ	nò≠òŋ	*c11. soldier ant*
(b)	òól	à≠ól	*c3.moon*
	òókì	à≠ókì	*c3.bee*
	ɔ̀ɔ̀pì	à≠ɔ̀pì	*c3.green mamba*
(c)	měːnè	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.

[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	kò≠kò-ʊs-ì	*cause to fall*
kòkɔ̀ɔ̀n	kò≠kɔ̀-ɔn	*fall into*
kòfààn	kò≠fà-an	*give (CONT)*
kùɲòòn	kò≠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*
nò≠kɔ̀mɔ̀	≠L	*tree sp.*
nò≠pɔ̀tɔ́	≠LH	*wasp*
nò≠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≠kè꞉k-èn-ì	kùkè꞉kènì	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≠sí꞉t-èn-ì	kùsí꞉tènì	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≠pé:ⁿd-én-ì	kùpé:↓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≠tí꞉n-è	kù≠tî꞉n	*flee in fear*
kò≠fát-à	kò≠fàt	*husk (corn); shell*
kò≠fá꞉t-à	kò≠fâ꞉t	*carve, sharpen*
kò≠kót-à	kò≠kɔ̀t	*fasten, bind*
kò≠pó꞉k-à	kò≠pɔ̂꞉k	*cook meat (wrapped in leaves)*
kò≠sɔ́k-ɔ̀	kò≠sɔ̀k	*extract*
kò≠sɔ́꞉k-ɔ̀	kò≠sɔ̂꞉k	*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	ᵐ̩f [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	tò≠ɔ́ɾ	*body*
	/k/	kìsàs	kì≠sàs	*chest*
		kòmàŋ	kò≠màŋ	*to know*
root-initial position	/p/	kìbàpʰ	kì≠pàp	*wing*
		kòbɛ̀k	kò≠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**
kʰìɨ≠ìᵐb̥ʰ	*pond (spring, lake)*	kì≠ìᵐbi̥	Yangben
kì≠bà:b̥ʰ	*wing*	kì≠pàpó	Yangben
		kì≠pàbá	Baca
mì≠ìᵐb̥ʰ	*water*	mì≠ᵐbi̥	Elip
nì≠néᵐb̥ʰ	*tongue*	kì≠lèᵐbi̥	Yangben
kì≠ɾɔ́:ⁿd̥ʰ	*cloud (fog)*	kì≠lɔ̀ⁿdɔ́	Yangben
kò≠téⁿd̥ʰ	*smooth*	kò≠lèⁿd-è	Yangben
mù≠ùⁿd̥ʰ	*person*	mò≠ⁿdɔ̰̀	Elip
nì≠bóⁿd̥ʰ	*stomach*	m̀≠pʰùⁿʧú	Baca
		nì≠pùⁿdí	Yangben
núᵐbètʰ	*man*	è≠nómèⁿdɔ́	Yangben
		à≠néᵐbèɾè	Baca
ŋ̀≠káⁿd̥ʰ	*woman*	à≠káⁿdɔ̰̀	Yangben
ʧâⁿtʰ	*house*	kʲ≠àⁿsɛ̰̀	Yangben
mò≠bàⁿd̥ʰ	*two*	pʷ≠àⁿdí	Yangben
àkʰ	*here*	àkì	Yangben
m̀≠mè:kʰ	*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***
kʰùtʰùɾ	~	kʰtʰùɾ	kù≠tùɾ	*dull (v)*
kʰìpʰùg-è	~	kʰpʰùgè	kì≠pùk-à	*close*
kʰùpʰítʰ-ípʰ-ín-ì	~	kʰpʰítʰpʰínì	kù≠pít-íp-ín-ì	*make dirty*
ǹtʰú			ǹ≠tú	*ear*
jòtʰìnè	~	jòtʰnè	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] / Ṇ-_____

surface form		**underlying form**		***gloss***
nìsóló	ǐtʃóló	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**énɛ́	--	--	gɛ̀≠**g**ɛ̀ŋà	gí≠**g**ìŋà	--
egg	kì≠**tʃ**ɛ̌ː	nì≠**k**ɛ̌ː	ǹ≠**h**ɛ̀kɛ́	nì≠**kʰ**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/ → [tʰ] / _____/i/ (Mmala, Elip)
/t/ → [tʃ] / _____/i/ (Baca, Mbure)

gloss	Mbure	Yangben	Baca	Mmala	Elip
six	mò≠**tʃ**ᶦⁿdât	má≠**t**ᶦⁿdàt	mò≠**tʃ**ᶦⁿdát	bá≠**tʰ**ᶦⁿdàḍọ̀	bó≠**tʰ**ᶦⁿdàḍ

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*
kòbɔ̀t	~	kòbɔ̀dà	kò≠pɔ̀t-à	*exit*
kʰìtô꞉t	~	kʰìtô꞉dà	kì≠tô꞉t-à	*throw*
kʷǎk	~	kʷǎgà ~ kʷǎɣà	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-ìr-ò	*braggarts*
	kìkábɾì	kì≠kápìɾì[170]	*horse*
CN	tákɳè	tákànɛ̀[171]	*uncle*
	kìkápnà	kì≠káp-àn-à	*catch in air*
	kìmòkmà	kì≠mòk-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-ènɛ̀	*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 [ìdágàɲá].
[172] Cognates of this word are found in Yangben [kìmùkè], Baca [kìmúmà] and Elip [gìmúke].

cluster types	surface form	underlying form	*gloss*
NR	kʰìsíŋɾè	kì≠síŋ-ìɾ-à	*rub*
	kìtàŋɾì	kì≠tàŋ-ìɾ-ì	*say*
	kéŋɾì	kì≠eŋ-ìɾ-ì	*ankle*
	sìŋɾè	≠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*
m̀pʰɛ̃̀	m̀ŋ≠fɛ̀ɲ[173]	*puff adder*
m̀pʰû	m̀ŋ≠fûn	*nose*
ì̀tʃàm	ìn≠sàm	*nuts*
ì̀tʃóló (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 /ᵑg/ 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 / ŋ≠fɛ́ɲ	Elip
	ŋ≠fɛ̀ɲ	Yangben, Mmaala	è≠hɛ́nè	Maande
nose	p≠fûn	Baca	ò≠hún	Elip
	m̀ŋ≠fùn	Yangben	m̀ŋ≠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	pòⁿdɔ́ⁿd̥	pò≠ⁿdɔ́ⁿd	*c14.small*
ⁿs	kɪ̀̃tʃáŋà	kì≠ⁿsáŋà	*c7.monkey*
	kɪ̀̃tʃɛ̃ː	kì≠ⁿsɛ̌ː	*c7.egg*
ⁿj	nɪ̀̃dʒèrì	nì≠ⁿjèrì	*c5.beard*
	pʊ̀̃dʒú	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	≠míŋà	≠míŋ-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	≠póhà	≠póh-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≠ŋúk	*teat, breast*
ɪ	---	---	ʊ	---	---
	---	---		---	---
e	ì≠téᵐbé	*correct*	o	ì≠kòŋò	*ridge*
	sét	*duiker*		tók	*calf*
ɛ	kì≠ʧɛ́nɛ́	*old hoe*	ɔ	kì≠kɔ́kɔ̀	*bark (tree)*
	kì≠sɛ̀k	*liver*		tɔ̀k	*stomach*
a	kì≠ʧáŋà	*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≠mḿ:	~	m̀≠mḿn	kì≠mɛ̀n	---[177]
knee	ŋ̀≠kɛ̃:	~	ŋ̀≠kɛ̃n	à≠kɛ́n	---
thigh	m̀≠bɛ́:	~	m̀≠bɛ́n	---	à≠fɛ̀n
sole (foot)	m̀≠bə̃	~	m̀≠bə̃n	m≠baná	---
child	mɔ̃≠ɔ́	~	mɔ̃≠ɔ́n	mò≠ón	mò≠ón
bird	ǹ≠nɔ̃:	~	ǹ≠nɔ̃n	ì≠nòní	fì≠nòŋó
goat	m̀≠bʉ̃:	~	m̀≠bʉ̃n	m̀≠bùŋ	m̀≠bûŋ

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	nìpʰɪ̃ⁿtʃ	nì≠fìⁿs	*c5.testicle*
	nìnɛ́ᵐb̥ʰ	nì≠néᵐb	*c5.tongue*
	ŋ̀kɛ̃ⁿd̥	ŋ̀≠kɛⁿd	*c9.voyage*
	ŋ̀kə́ⁿd̥ʰ	ŋ̀≠káⁿd	*c1.woman*
	ŋ̀kɔ̃ⁿd̥	ŋ̀≠kɔⁿd	*c9.foot*
	pʰùmɔ̃ⁿd̥	pò≠mòⁿd	*c14.panther*
	mʊ̀ʊ̀d̥	mò≠ìⁿd[178]	*c1.person*
ɪN-prefix	ɪ̃mbə̃:	ìm≠pân	*c10.knees*
	ɪ̃mpʰùtʰ	ìm≠fùt	*c10.grasses*
	ɪ̃tékʰ	ìn≠ték	*c6a.navels*
	ɪ̃tʃóló	ìn≠sóló	*c6a.yams sp.*
	ɪ̃kóɾ	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≠mè:kʰ	è≠mèkú[179]	à≠mèké
wing	kì≠bà:pʰ	kì≠pàpɔ́	kì≠pàpá
cloud (fog)	kì≠ɾɔ́:ⁿd̥ʰ	kì≠lɔ̀ⁿdɔ́	kì≠lɔ̀ⁿdɔ́
three	≠tá:tʰ	≠tátṵ̀	≠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≠tʃɛ̃:	nì≠kɛ̌:	ǹ≠hɛ̀gɛ́
river	sǎ:	à≠sǎ:	à≠sǎ:

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	nǐ:k	ní:k	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≠ⁿdʒèrì	*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≠ⁿʧɛ́nɛ́	*old hoe*	u-e	nì≠kʰúbè	*banana*
ɛ-a	ʧ≠ɛ́là	*arrow*	ʊ-a	ì≠kónà	*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

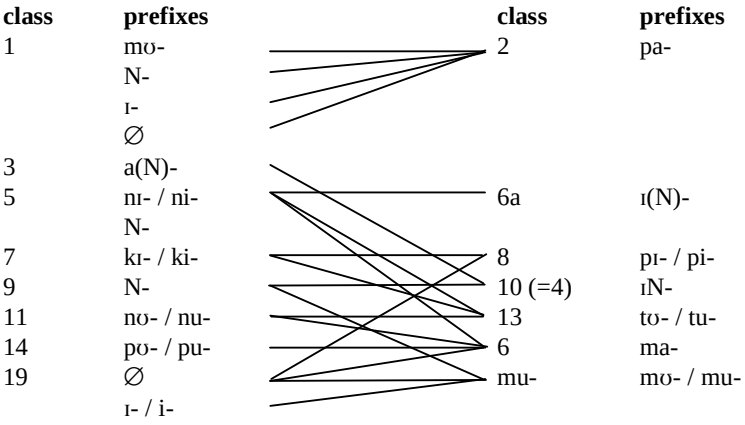
Both nominal and verbal prefixes undergo ATR harmony. Other verbal pre-stem elements do not.

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 pʊ̀bʊ́ *branch assoc. tree*
c3.branch c3 c14.tree
ǹtí dʒì pʊ̀bʊ́ *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)-	ì̀≠kàɾ	*hands*
		ì̀m≠bíɾ	*oil palms*
	ìŋg-	ì̀ŋg≠ɔ̀ŋ	*spears*
		ì̀ŋg≠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≠úŋè	*hair (sg)*
13	tʊ-	tò≠nà	*intestines (pl)*
		tù≠úŋè	*hair (pl)*
14	pʊ-	pò≠ⁿtʃá	*savanna (uncultivated)*
		pù≠kólò	*work*
19	ɪ-	ì≠kónà	*bean*
		ì≠nê	*vagina*
pl of 19	mʊ-	mò≠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*
kò≠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*
kò≠kóŋ-à	*hunt*	mà≠kók-ât	*pull*	kì≠tô:t-à	*throw*
kù≠fúŋ-è	*blow*	mà≠kòw-à	*fall*	kì≠kàk-à	*butcher*
kù≠hór	*be sharp*	mà≠tíb-ì	*pierce*	kì≠nɔ̂m-à	*bite*
kò≠kɛ́b-à	*dig*	mà≠ník-è	*bathe*		
kò≠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-	mó≠ò^{n}t mì≠m^{w}ì	*one person*
2	pa-	pɛ́≠è^{n}t pá≠pà^{n}d	*two persons*
		pɛ́≠ènt pá≠tát	*three persons*
		pɛ́≠ènt pá≠ɲɛ́	*four persons*
		pɛ́≠ènt pá≠tâːn	*five persons*
3	a-	ǹtím m^{w}ì	*one heart*
4	∅	ǹtím pà^{n}d	*two hearts*
		ǹtím ɲɛ́	*four hearts*
5	nɪ-	nìí ní≠m^{w}ì	*one eye*
6a	N-	ìŋgí ḿ≠pà^{n}d	*two eyes*
		ìŋgí ń≠ɲɛ́	*four eyes*
7	kɪ-	kìpáp kí≠m^{w}ì	*one wing*
8	pɪ-	pìpáp pí≠pà^{n}d	*two wings*
		pìpáp pí≠ɲɛ́	*four wings*
9	-ɪ	m̀pɛ̀n ì≠m^{w}ì	*one viper*
10	N-	ìmpɛ̀n ḿ≠pà^{n}d	*two vipers*
	-ɪ	ìmpɛ̀n í≠ɲɛ́	*four vipers*
11	nɪ-	n^{w}à ní≠m^{w}ì	*one chin*
13	tɪ-	t^{w}à tí≠pà^{n}d	*two chins*
		t^{w}à tí≠ɲɛ́	*four chins*
14	pʊ-	p^{w}ɔ̌s pó≠ m^{w}ì	*one day*
6	ma-	m^{w}ɔ̌s má≠pà^{n}d	*two days*
		m^{w}ɔ̌s má≠ɲɛ́	*four days*
19	ɪ-	jì≠ìk í≠m^{w}ì	*one fire*
pl	mʊ-	m^{w}ìk mó≠pà^{n}d	*two fires*
		m^{w}ìk mú≠ɲɛ́	*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-ɪr-ìn-ì *pray*

Example 260: Non-harmonising Mbure preverbal elements

sub. concord	à	à sìŋɾè	*c1 caress*
		à ɾébà mɔ̀	*c1 advise 3s*
	ìn	ìn fùké pɛ̀n	*1s harvest yams*
		ìn kàhà m̀bòt	*1s scatter seed*
	ù	ù tém̀bà	*2s PRES-rise up*
		ù táŋà ìŋàm	*2s feed animals*
tense	à	w-à tèm̀bà	*2s-P2 rise up*
	má	ù-má táŋà ìŋàm	*2s-P1 feed animals*
	à ´	m-à tém̀bà	*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	≠kɔ̀w-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	-ɔk	≠táp-ɔ̀k-à	*ford (a river)*
		≠hɔ̀m̀b-ɔ̀k	*annoy, disturb*
		≠tùɾ-ùk	*leave to marry (woman)*
diminutive	-ɪt	≠ăh-ìt	*yawn*
		≠tɔ́ŋ-ìt	*sing*
		≠hɔ̀ǹd-ìt	*lie (v)*
		≠pím-ìt	*inflate*

continuous	-an	≠ĕn-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	≠hòⁿd-à	*lie*
		≠hòⁿd-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	≠ŏb-ò	≠ŏp-à	*steal, rob*
	≠ŏɾ-ò	≠ŏɾ-à	*come*
	≠bʲŏn-ò	≠pʲŏn-à	*give birth*
	≠ɔ́g-ɔ́	≠ɔ́g-á	*save*
	≠sòg-à	≠sòk-à	*bathe*
	≠sɔ́h-à	≠sóh-à	*smoke*
	≠ɔ̆n-à	≠ŏn-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	---	---	≠ĭt-ì	*give*[182]
		≠pél-à	*call s.o.*	≠pél-ég-ì	*cause to call s.o.*
		≠**sɛ̀ɾ-**à	*descend*	≠s**ɛ̀**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*
		≠ò^{n}d	*return*	≠ò^{n}d-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***
m^{w}ìk	mò≠ìk	*cmu.fires*
n^{w}às	nò≠às	*c11.chin*
p^{w}ǎk^{h}	pò≠ák	*c14.year*
t^{w}ɔ̃	tò≠ɔ̀n	*c13.laughs*
p^{w}ɔ̌s	pò≠ɔ́s	*c14.day*
p^{j}àn	pì≠àn	*c8.hornbills*
n^{j}òmá	nì≠òmá	*c5.stream*
n^{j}ɔ̀k^{h}	nì≠ɔ̀k^{h}	*c5.bee*
k^{w}ǐdì	kò≠ít-ì	*c15.give*
k^{w}ɛ̀^{n}dà	kò≠ɛ̀^{n}d-à	*c15.walk*
k^{w}ǎk	kò≠ák	*c15.put, pour*
k^{w}ǒp	kò≠óp	*c15.rob, steal*
k^{w}ɔ̌p	kò≠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)*
kììp^h	pììp^h	kì≠ìp	pì≠ìp	*forest(s)*
tʃàn	p^jàn	kì≠àn	pì≠àn	*hornbill(s)*
tʃə̌s	p^jə̌s	kì≠és	pì≠és	*taro*
tʃɔ̀há	p^jɔ̀há	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: [bʲă] *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*
nìít^h	nì≠ít	*c5.mouth*
kìíŋɛ̀	kì≠íŋɛ̀	*c7.hair (sg)*
jììk^h	jì≠ìk	*c19.fire*
nùúŋɛ̀	nɔ̀≠úŋɛ̀	*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 [p^je] rather than [b^ja].

Example 266: Assimilation of the prefix vowel and the VC noun root

surface form		**underlying form**		***gloss***
mɜ̀ɔ́	pa̰á̰	mò≠án	pà≠án	*c1/2.baby(s)*
mṵṵ̀t	pɛ̰ɛ̰̀t	mò≠ìⁿd	pà≠ìⁿd	*c1/2.person(s)*
mìì^{m}p		mà≠ì^{m}p		*c6.water*
pùùp	pò≠òp	---	---	*c14.theft*
nɔ̌ɾ	t^{w}ɔ̌ɾ	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), CV^{n}C 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≠nɔ̰̀:	≠L	*bird*
mɜ̌:	≠LH	*baby*
nì≠kɔ́:	≠H	*stone*
m̀≠fṵ̂:	≠HL	*nose*

pù≠mòⁿd	≠L	*panther*
nì≠pǒⁿd	≠LH	*stomach*
kì≠tóᵐb	≠H	*caterpillar*
---[185]	≠HL	---
ì≠kàmɛ̀	≠L.L	*bird lime*
n≠tʃɛ̀mɛ́	≠L.H	*morning*
pì≠kɛ́ŋɛ̀	≠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	≠kóŋ-á	≠H –H	*be dry*
	≠pít-íp-ín-ì	≠H –H –H –L	*be dirty*
LH	≠fàh-á	≠L –H	*grill*
	≠bìⁿd-ɛ́	≠L –H	*follow behind*
	≠ⁿjèb-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 CVⁿC 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	ᵐ̩f	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*
		kòpɛ́k	kò≠pɛ́k	*burn*
	/t/	àtɔ̂	à≠tɔ̂	*cinders*
		pìté	pì≠té	*saliva*
		kòtémà	kò≠tém-à	*weed*
	/k/	àkā̋ā̋ⁿn̰d	à≠kāā̋ⁿd	*woman*
		fìkòló	fì≠kòló	*mushroom*
word-final position	/p/	ɜ̀ŋíp	àŋ≠íp	*thief*
		fɨ̌ɔ̌p	fì≠ɔ́p	*hoe*
		kùlùp	kò≠lùp	*be wet*
	/t/	nìít	nì≠ít	*mouth*
		kòsɔ̂t	kò≠sɔ̂t	*live*
	/k/	kìtɛ́k	kì≠tɛ́k	*navel*
		màsɔ̀k	mà≠sɔ̀k	*salt*
		pùtúk	pò≠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	kò≠lúp-à	*be wet*[187]
pòsɔ̀βɔ́	pò≠sɔ̀pɔ́	*groundnut*
kòlɔ́βà	kò≠lɔ́p-à	*get angry*
kù≠téɲíβìt	kù≠téɲ-íb-ìt	*stand up*
kùpórɜ̀n	kù≠pót-àn	*exit*
kùlírɜ̀	kò≠lít-à	*be heavy*
ɜ̀mbùrɜ̀	àm≠bùtà	*small-head mud fish*
ɜ̀mèɣé	à≠mèké	*flesh*
ŋ̀hèɣɛ́	ǹ≠hèkɛ́	*egg*
kòsɔ̀ɣà	kò≠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]
	àŋgɛ̀ⁿd̰	àN≠kɛ̀ⁿd	*c3.market*
	àmbáná	àm≠páná	*c6a.soles of feet*[189]
	àmbʲɛ́nɛ̀	àm≠pʲɛ́nɛ̀	*c6a.breasts*
	àmbʊ̰̀tʃú	àm≠pùⁿsú	*c6a.stomachs*
	mbʷâ	N≠pʷâ	*c9.dog*
	ndêj	N≠têj	*c9.slobber*
	ŋgɑ́ⁿd̰	N≠káⁿd	*c9.monkey*
	àŋgúngùn	àN≠kún-kùn	*c1.leper (from **ŋ̀≠kún** leprosy)*[190]
Fricatives	ɐ̀pfóŋ	àN≠fóŋ	*c3.wind*
	ɐ̀pfʲɔ̰́ᵐb̰	àN≠fʲɔ́ᵐb	*c3.tail*
	ɐ̀tʃàmɔ́	àN≠sàmɔ́	*c3.fruit*
	ɐ̀tʃɛ́m	àN≠sɛ́m	*c3.heart*
	pfûn	N≠fûn	*c9.nose*
	tʃènɛ́	N≠sènɛ́	*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.

[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*
[n̩pu̍ʈʃú]	n̩≠pùⁿsú	→	nì≠pùⁿsú	*c5.stomach*
[mbu̍ⁿʈʃà]	N≠púⁿsà			*c9.fishing net*
[n̩táɲ]	n̩≠táɲ	→	nì≠táɲ	*c5.stone*
[ndêj]	N≠têj			*c9.slobber*
[ŋ̩kɔ̰ⁿdɛ̀]	ŋ̩≠kɔ̀ⁿdɛ̀	→	nì≠kɔ̀ⁿdɛ̀	*c5.plantain*
[ŋgǎⁿɖ]	Ṅ≠káⁿd			*c9.monkey*
[m̩fɛ̋ʧ]	m̩≠fɛ́ⁿs	→	nì≠fɛ́ⁿs	*c5.mongoose sp.*
[pfɛ́n]	N≠fɛ́n			*c9.viper*
[n̩síl]	n̩≠síl	→	nì≠síl	*c5.termite mound*[191]
[ʧés]	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]
nʲòŋò	nì≠òŋò	*market*
nʲòŋɔ́	nì≠òŋɔ́	*spear*
nʲàs	nì≠às	*yawn (n)*

2.10.1.2.4 Prenasalised obstruents

With the exception of /ᵐf/, 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*
	[hɛ̀ᵐbɛ́]	hɛ̀ᵐbɛ́	*fish*

[191] Compare with [ǎʧíl] 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***
	[mɪ̀ɪ̀ᵐb̰]	mì≠ìᵐb	*water*
ⁿd	[kìⁿdómə̂n]	kì≠ⁿdómân	*young man*
	[ŋ̀kɔ̀ⁿdɛ̀]	nì≠kɔ̀ⁿdɛ̀	*plantain*
	[ŋ̀gǵⁿd̰]	ŋ≠káⁿd	*monkey*
ᵑg	[kɪ̀ᵑgùmə́]	kì≠ᵑgùmá	*porcupine*
	[kìlèᵑgə̀]	kì≠lèᵑgà	*fishing line*
	---	---	---
ⁿs	[kɪ̀tʃáŋàt]	kì≠ⁿsáŋàt	*monkey sp.*
	[mbʊ́ⁿtʃə̀]	m≠púⁿsà	*fishing net*
	[kɔ̀ɔ̀ⁿtʃ]	kì≠àⁿs	*house*

It is unclear, however, whether /ᵐf/ 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 ᵐf in Baca

ᵐf	[pfàgá]/[pàpfàgá]	ᵐfàgá/pà≠ᵐfàgá ŋ̀ŋ≠fàgá/pà-ŋ≠fàgá	*lion(s)*

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/→[ᵐb̰]	kùsɔ́ᵐb̰	kò≠sɔ́ᵐb	*chop, cut*
	mɪ̀ɪ̀ᵐb̰	mì≠ìᵐb	*water*
/ⁿd/→[ⁿd̰]	àkǻǻⁿd̰	à≠kááⁿd	*woman*
	ŋ̀kɔ́ⁿd̰	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	kò≠pín-à	*hunt*
/ɪ/	kòlígà	kò≠líg-à	*lick*
/e/	kùmènɜ̀	kò≠mèn-à	*swallow*
/ɛ/	kòpɛ́kà	kò≠pɛ́k-à	*burn*
/a/	kòfàkà	kò≠fàk-à	*put, pour*
/ɔ/	kòsɔ́sà	kò≠sɔ́s-à	*smoke, suck*
/o/	kùsóbɜ̀	kò≠sób-à	*suck*
/ʊ/	kòfʊ́nà	kò≠fʊ́n-à	*blow*
/u/	kùkúsɜ̀	kò≠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≠gòlʊ́	*cord*
	---	---		kì≠lʊ̀nʊ́	*old person*
/e/	kélém	*back*	/o/	fì≠kòló	*mushroom*
	tʃènέ	*worm*		fì≠nòŋó	*bird*
/ɛ/	mà≠pɛ́nɛ̀	*milk*	/ɔ/	pò≠sɔ̀bɔ́	*groundnuts*
	ṇ̀≠hέtɛ́	*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

[kòpájà]	*heat*	[kùpɜ́jísì]	/kù≠páj-ís-ì/	*cause to heat*
[kòkɛ́gà]	*guard*	[kùkégésɜ̀ŋì]	/kù≠kég-és-àn-ì/	*cause to guard*
[kòhɔ:nà]	*sweep*	[kùhò:nɜ̀ŋì]	/kù≠hɔ: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*
fijégɜ́	fì≠jégá	*doe*
nʷěhíŋɜ̀	nò≠éhíŋà	*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***
kɪ̀sɪ́sa̲**j**ɛ̀	*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	tʃĩːk	*calabash type*	---	---
ɪː	---	---	kò≠fíːm-à	*breathe*
eː	---	---	---	---
ɛː	ŋ̀≠kéːⁿd	*otter sp.*	kò≠séːŋ-à	*jump*
aː	à≠káːⁿd	*woman*	kò≠ŋàː	*defecate*
oː	jòːs	*mother*	kù≠hóːn	*fill (v)*
ɔː	hɔ́ːm	*forest*	kò≠hɔ̀ːn-à	*sweep*
ʊː	m̩̀≠pòːⁿdɛ̀	*family*	kò≠kòːɾ-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≠péːnɛ̀	~	m̀≠pʲénɛ̀	*breast*
kò≠hɔ́ːn	~	kò≠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***
mɪ̃ɪ̃ᵐb̩	mà≠ɪ̀ᵐb	*water*
nɪ̀ít	nɪ̀≠ít	*mouth*
mɔ̀ɔ́jàh	mɔ̀≠ɔ́jàh	*fat, oil*
mɔ̀ɔ́n	mɔ̀≠ɔ́n	*baby*
kɔ̀pɔ́ɔ́n	kɔ̀≠pɔ́-ɔn	*open*
kɔ̀pɔ̀ɔ̀k	kɔ̀≠pɔ̀-ɔk	*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≠pɔ́líkɛ̀	*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≠gɛ̀nìn	*pupil (eye)*	e-i	ŋ̀≠kèlí	*path*
ɛ-ɛ	kì≠kɛ̀ŋɛ̀	*old hoe*	e-e	à̰≠mèké	*flesh*
ɛ-a	kì≠lɛ́bà	*toad*	e-a	kì≠séŋà	*monkey*
ɛ-ɔ	---	---	e-o	---	---
ɛ-ʊ	---	---	e-u	---	---
ɔ-ɪ	ɔ̰≠sɔ̀gín	*wrist*	o-i	kù≠óbìk	*pain (n)*
ɔ-ɛ	ŋ̀≠kɔ́ⁿdɛ̀	*plantain*	o-e	ⁿsɔ̀ɔ́ŋè	*son-in-law*
ɔ-a	kì≠tɔ́gà	*wound*	o-a	kì≠gɔ̀là	*crow*
ɔ-ɔ	pɔ̀≠sɔ̀bɔ́	*groundnut*	o-o	fì≠nɔ̀ŋɔ́	*bird*
ɔ-ʊ	---	---	o-u	---	---
ʊ-ɪ	---	---	u-i	àn≠sùlín	*round muscle (leg/arm)*
ʊ-ɛ	ŋ≠gɔ̀gɛ́	*black fish sp.*	u-e	---	---
ʊ-a	kì≠ⁿgɔ̀má	*porcupine*	u-a	---	---
ʊ-ɔ	---	---	u-o	---	---
ʊ-ʊ	àŋ≠gɔ̀lɔ́	*cord*	u-u	ṃ̀≠pùⁿsú	*stomach*
a-ɪ	m≠básín	*flea*	a-i	---	---
a-ɛ	à≠hábɛ̀	*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.

class	prefixes	class	prefixes
1	N-	2	pa-
	a-		
	∅		
3	a(N)-	4	∅
			N-
5	Ǹ-	6a	a(m)-
7	kɪ- / ki-	8	bɪ- / bi-
9	N-	10	N-
11	nʊ- / nu-	13	tʊ- / tu-
14	pʊ- / pu-	6	ma-
19	fɪ- / fi-	mʊ-	mʊ- / mu-

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)-	àkɑ́ɑ́ⁿɖ̰	à≠kɑ́ɑⁿd	*woman*
		ɜ̀kùl	à≠kùl	*concubine*
		ɜ̀ŋíp	àŋ≠íp	*thief*
	pa-	pàkɑ́ⁿɖ̰	pà≠kɑⁿd	*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*
		pfʲɔ́ᵐb̰	N≠fíɔ́ᵐb	*tails*
		tʃɛ́m	N≠sɛ́m	*hearts*
		ŋgàŋá	N≠kàŋá	*roots*
5	Ǹ̩-[198]	m̀ŋpʲɛ́nɛ̀	Ǹ̩≠píɛ́nɛ̀	*breast, udder*
		m̀ŋpʊ̀̃tʃú	Ǹ̩≠púⁿsú	*stomach*
		ǹ̩táŋ	Ǹ̩≠táŋ	*stone*
		ŋ̀hɛ́ɾɛ́	Ǹ̩≠hɛ́tɛ́	*hearth stone*
		ŋ̀kɔ̃̀ⁿdɛ̀	Ǹ̩≠kɔ̀ⁿdɛ̀	*plantain*
6a	a(N)-	àmbʲɛ́nɛ̀	àm≠píɛ́nɛ̀	*breasts, udders*
		ɜ̀mbúⁿsú	àm≠púⁿsú	*stomachs*
		àtáŋ	à≠táŋ	*stones*
		àhɛ́ɾɛ́	à≠hɛ́tɛ́	*hearth stones*
		àkɔ̀ⁿdɛ̀	à≠kɔ̀ⁿdɛ̀	*plantains*
6	ma-	màtáŋ	mà≠táŋ	*blood*
		mɜ̀jɛ̀ⁿtʃ	mà≠jɛ̀ⁿs	*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*
		nùkúŋ	nʊ̀≠kúŋ	*firewood*[199]
13	tʊ-	tʊ̀nà	tʊ̀≠nà	*intestines*
		tùkúŋ	tʊ̀≠kúŋ	*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*
		fìnʊ̀ŋó	fì≠nʊ̀ŋó	*bird*
pl of 19	mʊ-	mʊ̀pán	mʊ̀≠pán	*hot peppers*
		mùnʊ̀ŋó	mʊ̀≠nʊ̀ŋó	*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, ŋ̀kúŋ, 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-	mó≠ònt à≠móhò	*one person*
2	pa-	pɛ́≠ènt pá≠ántʃì	*two persons*
		pɛ́≠ènt pá≠tát	*three persons*
		pɛ́≠ènt pá≠ɲíhì	*four persons*
		pɛ́≠ènt pá≠tâːn	*five persons*
3	a-	à≠tʃɛ́m á≠móhò	*one heart*
4	∅	tʃɛ́m áⁿtʃì	*two hearts*
		tʃɛ́m tát	*three hearts*
		tʃɛ́m ɲíhì	*four hearts*
		tʃɛ́m tâːn	*five hearts*
5	nɪ-	ǹ≠táɲ móhò	*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≠móhò	*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 móhɔ̀	*one chicken*
10	N-	ŋgɔ̀ɔ́ ántʃì	*two chickens*
		ŋgɔ̀ɔ́ tát	*three chickens*
		ŋgɔ̀ɔ́ ɲíhì	*four chickens*
		ŋgɔ̀ɔ́ tâːn	*five chickens*
11	nʊ-	nʷ≠ǒl nó≠móhɔ̀	*one body*
13	tʊ-	tʷ≠ǒl tʷ≠ántʃì	*two bodies*
		tʷ≠ǒl tó≠tát	*three bodies*
		tʷ≠ǒl tó≠ɲíhì	*four bodies*
		tʷ≠ǒl tó≠tâːn	*five bodies*
14	pʊ-	pù≠túk pó≠móhɔ̀	*one night*
6	ma-	mà≠túk mɑ́≠ántʃì	*two nights*
		mà≠túk má≠tát	*three nights*
		mà≠túk má≠ɲíhì	*four nights*
		mà≠túk ma≠tâːn	*five nights*
19	fɪ-	fì≠nɔ̀ŋɔ́ fí≠móhɔ̀	*one bird*
pl	mʊ-	mù≠nɔ̀ŋɔ́ mʷ≠ántʃì	*two birds*
		mù≠nɔ̀ŋɔ́ mó≠tát	*three birds*
		mù≠nɔ̀ŋɔ́ mó≠ɲíhì	*four birds*
		mù≠nɔ̀ŋɔ́ mó≠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	[kò≠fón-à]	*blow*
		[kù≠púɾ-ɜ̀]	*lie (v)*
continuous	-an	[kò≠kɔ́l-ân]	*take*
		[kù≠kɔ́l-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	[kò≠fón-ìt]	*blow (a little)*
		[kù≠púʳ-ìt]	*lie (a little)*
intensive	-ɪk	[kò≠fɛ̀j-ìk-àn]	*wake up (CONT)*
		[kù≠fúŋ-ík-ìn]	*aggravate an affair*
passive	-ɪp	kò≠jɔ́l-íb-ìt	*squat*
		kù≠téŋ-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	[kò≠fʷák-à]	*build*	[kù≠fʷɜ́k-ìsì]	*cause to build*
	[kò≠pàl-à]	*be hot*	[kù≠pɜ̀l-ìsì]	*heat*
	[kò≠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*
	[kò≠líg-à]	*lick*	[kù≠líg-ì]	*cause to lick*
	[kù≠sémb̥]	*throw*	[kù≠sémb-ì]	*cause to throw*
	[kò≠kɛ́g-à]	*guard*	[kù≠kég-és-ɜ̀ŋ-ì]	*cause to guard*
	[kò-bí≠jɛ́g-ɛ́l-à]	*learn*	[kù≠jég-él-ɜ̀ŋ-ì]	*teach*
	[kò≠hɔ̀ɔ̀n-à]	*sweep*	[kù≠hòòn-ɜ̀ŋ-ì]	*cause to sweep*
	[kù≠hóón]	*fill (v)*	[kù≠hóón-ìg-ì]	*cause to fill*
	[kù≠hóʳ-ɜ̀]	*throw out*	[kù≠hóʳ-ɜ̀ŋ-ì]	*cause to throw out*
	[kò≠kòòʳ-à]	*strike*	[kù≠kùùʳ-ɜ̀ŋ-ì]	*cause to strike*
	[kù≠túún-ɜ̀]	*spit*	[kù≠túún-ús-ɜ̀ŋ-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≠tʃǐg-**íl**-ɜ̀]	*have nausea*
		---	---
		[kù-bí≠kég-**èl**-ɜ̀]	*turn head*
		[kò≠tʃɛ̌ᵐb-**ɛ̀l**-à]	*limp*
		[kò≠pág-**ál**-à]	*twist*
		[kò≠kɔ̀g-**ɔ̀l**-à]	*gnaw*
		[kù≠tòŋ-**òl**-ɜ̀]	*stagger*
		---	---
		[kù-bí≠túɾ-**úl**-ɜ̀]	*crawl*
separative	-ɔk	[kʷ≠ŏb-**óg**-àn]	*suffer*
		[kò-pí≠tɔ́l-**ɔ́g**-àn]	*listen*
		[kù≠sùl-**ùg**-ɜ̀n]	*startle, surprise*
		[kò≠pò-**ɔ̀k**]	*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.*
kʲà̰tʃ	kì≠àⁿs	*c7.house*
nʲɔ̀ŋɔ̀	nì≠ɔ̀ŋɔ̀	*c5.market*
fʲɔ̌p	fì≠ɔ́p	*c19.hoe*
kʲŭp	kì≠úp	*c7.house mouse*
mʷằjà	mɔ̀≠ájà	*c1.child*
pʷằŋ	pɔ̀≠áŋ	*c14.meat*
nʷɔ̌l	nɔ̀≠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	tò≠éhíɲà	*c13.hair*
kʷǐp	kò≠íp	*steal (v)*
kʷèjɜ̀	kò≠èj-à	*chose, pick (v)*
kʷɛ̀ⁿdà	kò≠ɛⁿd-à	*walk (v)*
kʷǒᵐb̩	kò≠ǒᵐb	*throw away (v)*
kʷɔ̀jà	kò≠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*
kònʷà	kò≠nò-à	*fall*
kònʷànà	kò≠nò-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*
kììᵐb̩	kì≠ìᵐb	*c7.lake (spring, pond)*
nìîj	nì≠îj	*c5.tooth*
nìîs	nì≠îs	*c5.eye*
kùús	kò≠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*
kòpóón	kò≠pó-ɔn	*open*
kòpòòk	kò≠pò-ɔk	*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	kò≠síèn	*to be cold*
kìsɛ̌ːn	~	kìsʲɛ̌n	kì≠sìɛ́n	*name*
kòhɔ́ːn	~	kòhʷán	kò≠hɔ́án	*to drink*
òkúːs	~	òkʷós	ò≠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*
		mìiᵐḇ	mà≠ìᵐb	*water*
1	mʊ-	mɔ̀ɔ́n	mʊ̀≠án	*baby*
		múùⁿḍ	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***
kòsʷɛ́ɾà	kò≠sʷét-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*
n̩≠sɛ́	≠H	*orphan*
mà≠ɲâ	≠HL	*food*
à≠sǎ	≠LH	*river*
kì≠kɛ̀ŋɛ̀	≠L.L	*old hoe*
n̩≠hɛ̀gɛ́	≠L.H	*egg*
m̩≠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≠nì^{m}b-ìk-ìn	L ≠L –L –L	*be seated*
	kù≠pèl-ìs-ì	L ≠L –L –L	*cause to heat*
HL	kò≠nồm	L ≠HL	*bite*
	kò≠sồt	L ≠HL	*live*
	kò≠ŋág-ìt	L ≠H –L	*swim*
	kò≠nɔ́m-à	L ≠H –L	*bite (CONT)*
	kò≠sɔ́t-àn	L ≠H –L	*live*
	kù≠fúŋ-ìk-ìn	L ≠H –L –L	*bury*
	kù≠f^{w}ék-ìs-ì	L ≠H –L –L	*lodge, cause to build*
H	kò≠sɔ́^{m}b	L ≠H	*chop*
	kò≠kɔ́l	L ≠H	*take*
	kò≠sɔ́^{m}b-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≠fúŋ-ík-ìn	L ≠H –H –L	*fan flames*
	kù≠lé^{n}d-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".

[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, e̲, a, o̲, o
	[i, e, ə, o, u]	[e, ɛ, a, ɔ, ʊ]
De Blois (1981)	i, (e),[207] ạ, o, u	(e), e̲, a, o̲, 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.

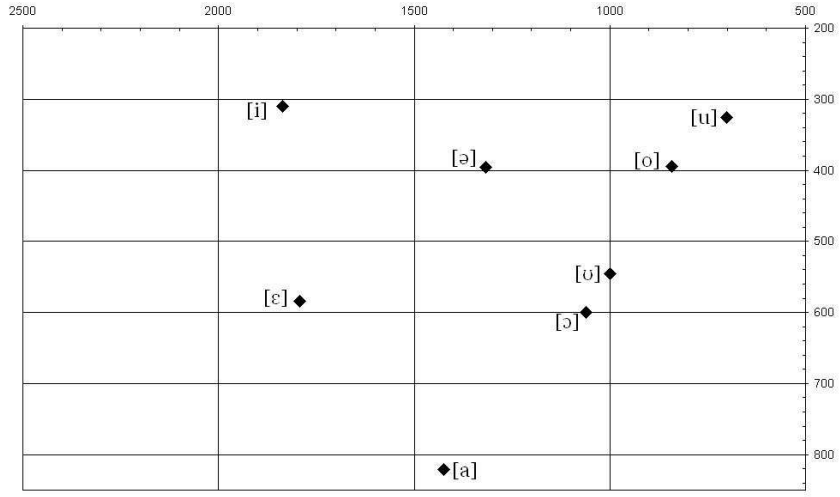


Figure 4: Averages of Nen vowels

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.

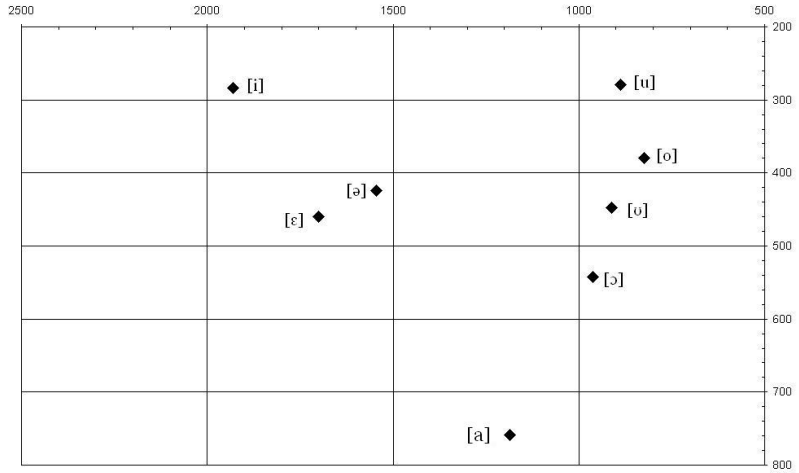


Figure 5: Averages of Maande vowels

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**ó**ː]	448/833[212]	*bamboo bed*
/tò-ñók/	/tònyók/~/tɔnyɔ́k/	[tòɲ**ɔ́**k]	522/1035	*joy*
/kì-tók/	/kidok/	[kìd**ó**k]	406.5/849.4	*navel*
/mù-sós/	/mùsós/~/mòsɔ́s/	[mòs**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, [tò-] and [mò-], 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.

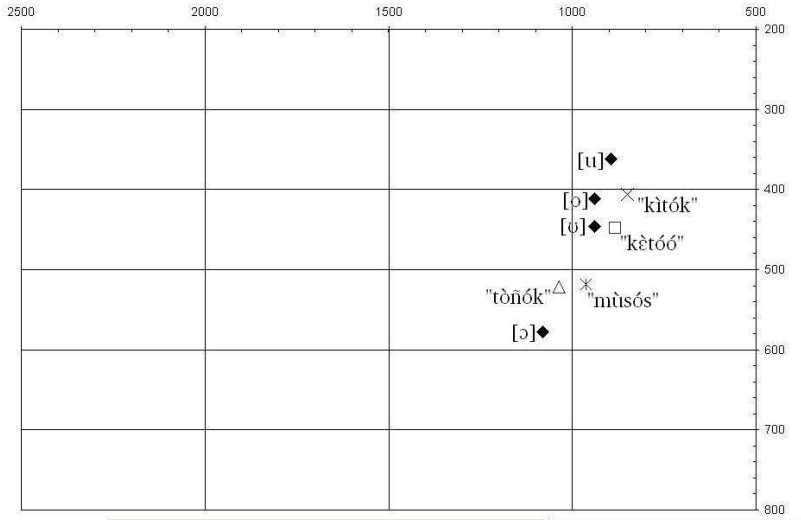


Figure 6: F1/F2 ave. in nouns with words in "o" (Phillips 1979: 89)

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***
kò≠súb-à	kù≠súb-ə̀	*pour*
kò≠kód-à	kò≠kód-à	*attach, tie*
kò≠sób-à	kù≠sób-ò	*be sweet*
kò≠kɔ́d-à	kò≠kɔ́d-ɔ̀	*cackle (v)*

The average F1/F2 frequencies of the eight contrastive vowels in Yambeta are illustrated below.

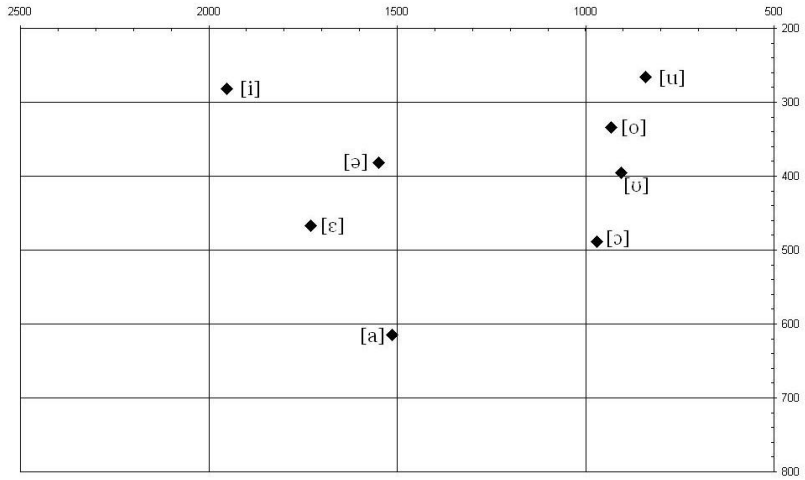


Figure 7: Averages of Yambeta vowels

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]	òŋ≠gòɾó	*foot*
	ò[hé	o-hé	ò≠hí	*moon, month*
	ù[hùwè	o-hue[218]	ù≠hùwè	*grass*
	ù[gíní	o-gíní	ù≠gíní	*firewood*
7	è[wóɾó	i-wóɾó	ì≠wóɾó	*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 **βi-**. 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**^{ŋ}g-èn-à	≠nì^{ŋ}g-ìn-à	*be soft*	≠nì^{ŋ}g-ìɾ-ìj-è	*soften*
---	≠pén-é	*paint*	≠pén-íj-è	*cause to paint*
≠ràh-à	≠ràh-à	*be long*	≠ɾèh-j-è	*make long*
≠tɔ̀^{m}b-ɔ̀	≠tɔ̀^{m}b-ɔ̀	*calm o.s.*	≠tò^{m}b-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 ◇.

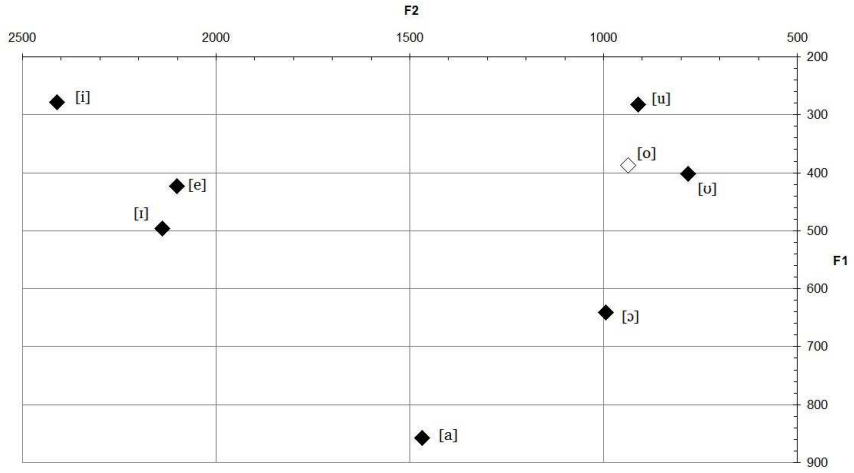


Figure 8: Averages of Tuki vowels

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≠lóⁿʧò	*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** [òjà](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] **ɔ**. 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.

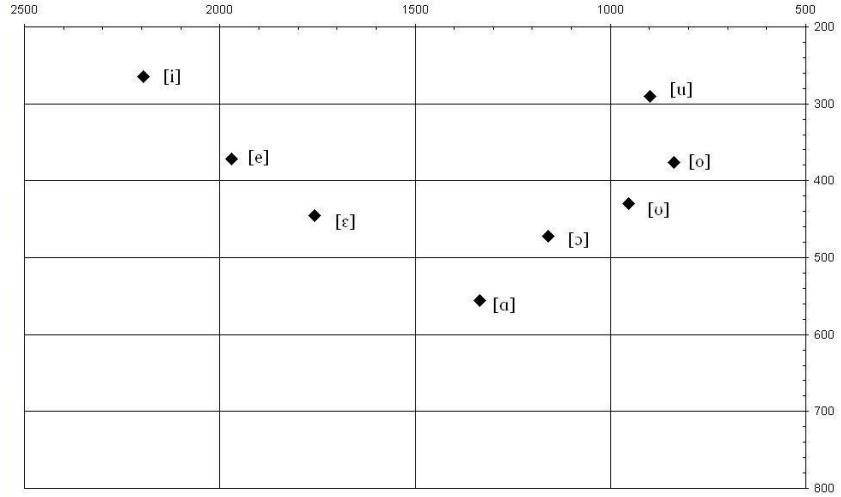


Figure 9: Averages of Gunu vowels

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.

[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.

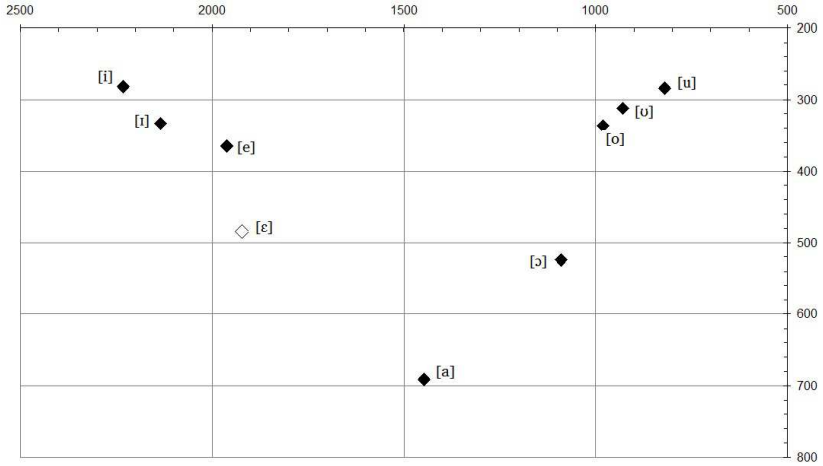


Figure 10: Averages of Elip vowels

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.

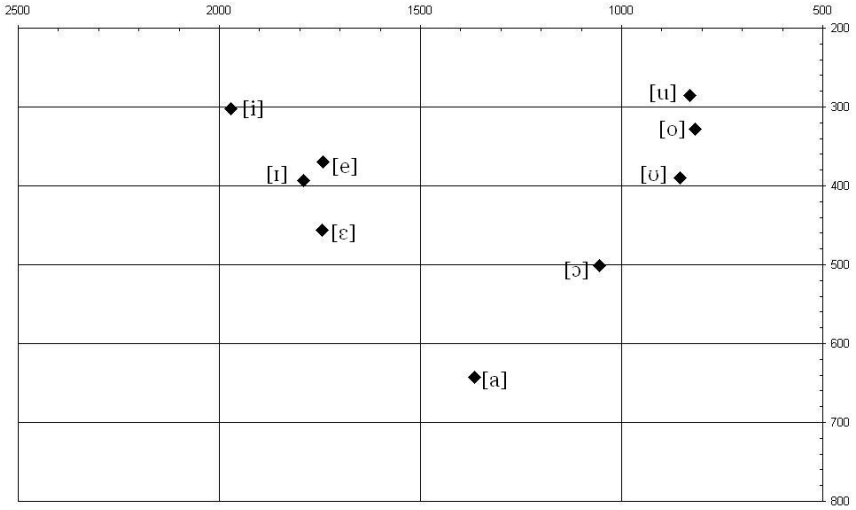


Figure 11: Averages of Mmala vowels

2.11.2.8 Yangben

The most important literature for this study is Hyman's 2003 article: "'Abstract" vowel Harmony in Kàlɔŋ:[223] A system driven account". Hyman's data and descriptive analysis are based on Paulian's 2001 3,000-entry lexicon: Lexique kàlɔŋ-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.

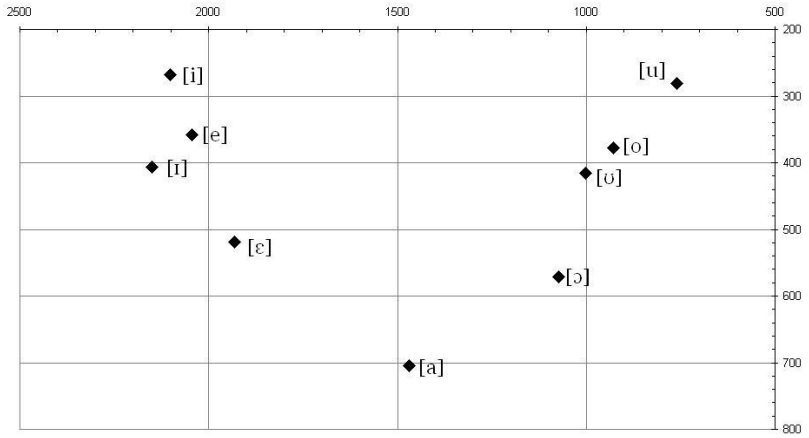


Figure 12: Averages of Yangben vowels

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] Kàlɔŋ 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.

[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.

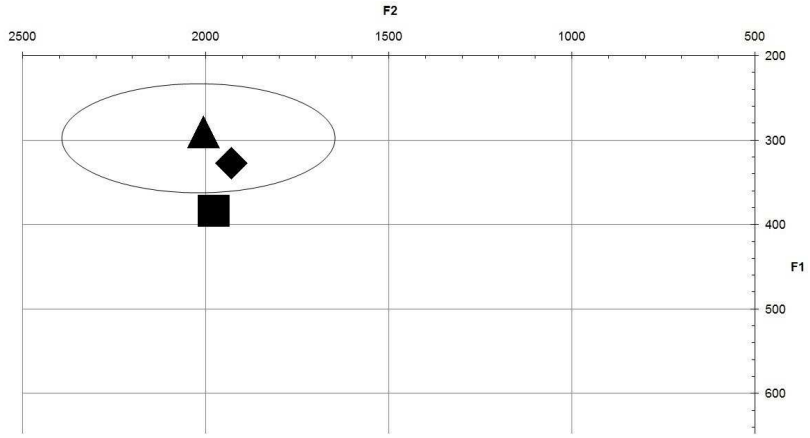

Figure 13: Averages of Mbure nouns with[i], [ɪ] and [e].

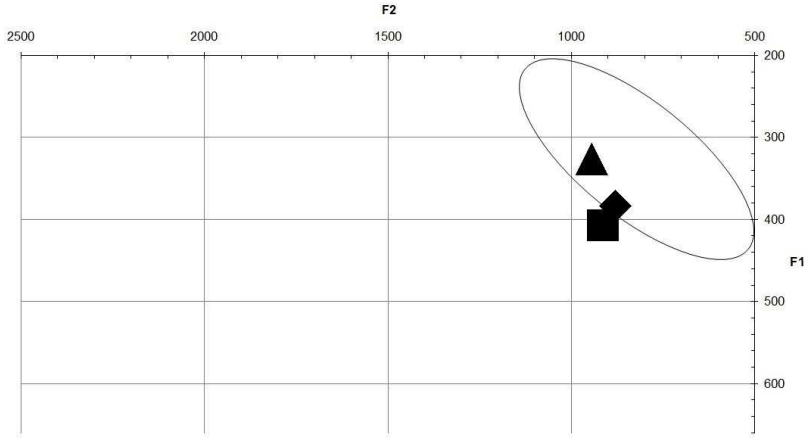

Figure 14: Averages of Mbure verbs with[u], [ʊ] and [o].

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	≠hír-ìb-à	*breathe*	---	---	sì	*land*
e	≠pél-à	*call*	ì≠tém̀bé	*be correct (n)*	sét	*duiker*
ɛ	≠sɛ́r-à	*flow*	kì≠tʃɛ̌nɛ́	*old hoe*	tɛ̂	*father*
a	≠sár-à	*chop*	kì≠tʃǎŋà	*monkey*	ták	*catfish*
ɔ	≠sɔ́d-à	*live*	ì≠sɔ̀nà	*broom*	tɔ̀k	*stomach*
o	≠sòg-à	*wash*	ì≠kòŋò	*ridge*	tók	*calf*
ʊ	≠kóg-àt	*pull*	ì≠kónà	*bean*	mà≠ɲók	*milk*
u	≠pùg-è	*close*	nú^{m}bèt^{h}	*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].

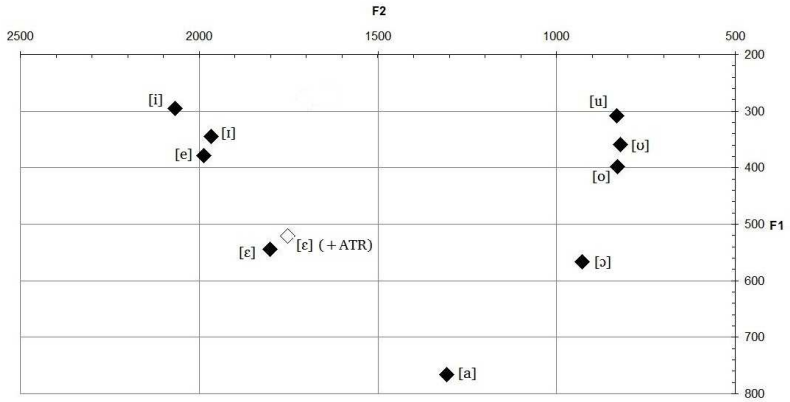

Figure 15: Averages of Mbure vowels

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 ◇.

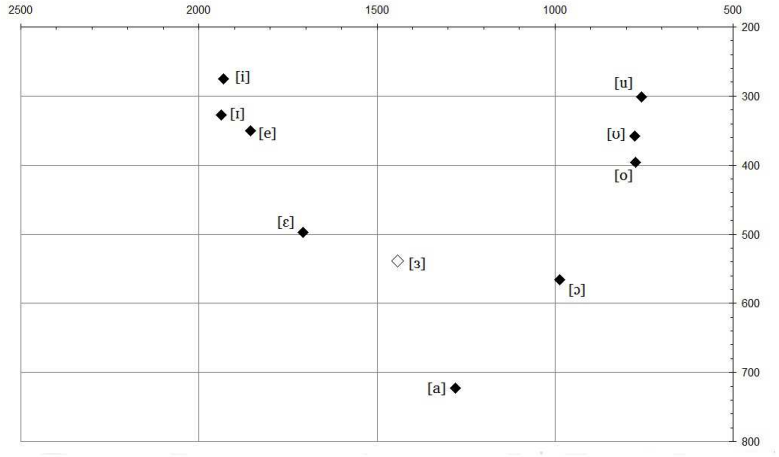

Figure 16: Averages of Baca vowels

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.