

A PHONOLOGY OF GWAMA

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ABSTRACT

Gwama is one of the least described Nilo-Saharam language of the Koman subgroup found in Ethiopia. This paper presents the results of nearly two years of phonological fieldwork on Gwama in the form of a descriptive phonology. Included are presentations of the consonant and vowel phonemes, vowel quality, vowel harmony, syllable structure and phonotactics, notable morphophonemic processes, and an overview of the tone system. The data exhibits 23 consonant phonemes and 5 short vowel phonemes with long counterparts. The study indicates that Gwama is a three level tone language. The language allows the occurrence of only two consecutive consonants in a word. However, two vowels do not occur one after the other. Since Nilo-Saharan particularly the Koman subgroup are understudied languages, this paper provides much-needed data and analysis for the furtherance of Nilo-Saharan linguistics.

Key words: Gwama, Sibilant, Nasal, Vowel quality, Formant, Vowel length, Vowel harmony, Tone level, Syllable, Phonotactics, Morphophonemic process.

1. INTRODUCTION

There are several understudied endangered languages in Ethiopia. Gwama is one of the least studied Nilo-Saharan endangered languages. This paper focuses mainly on the linguistic description of the phonology of Gwama. I investigate phonemes and allophonic variants and identify the phonological processes. These include the inventory of consonant and vowel phonemes, description of the phonemes in six categories, lists of minimal pairs, description of vowel quality, description of vowel harmony, and instances of contrastive vowel length. Then, tone and the syllable structure are described. Finally, I give an account of the morphophonemic processes. Brief discussions are given, where it is supposed to be vital, on the structural analysis of the current data in comparison with previous research works on Gwama.

1.1. Data Collection Details

All language data used for this paper was collected in Ethiopia by myself between September 2014 and April 2016. Most of the data was collected during the fieldwork in the Gwama village Zebsher and in Mao-Komo district

town Tongo.

My primary language informants were Ramadan Harun, Meko Mehandis, and Harun Kaya, mother tongue Gwama speakers from the municipal district of Tongo and Zebsher. All of them can speak Oromo [orm] and limited Amharic [amh]. Other speakers whom I consulted infrequently included Jawan Sambo, Yasin Wakene, all from Zebsher, and Amanuel Pilubel from Laki.

All recordings were made using a Sony audio recorder and processed with Audacity software.

1.2. Previous Research

There are four different research works carried out on Gwama [kmq]. They are done by Kievit & Robertson (2012), Teshome (2006), Zelalem (2005), and Siebert et al. (2002). The paper by Kievit & Robertson (2012) emphasizes on the morphology and syntax of Gwama having a few precise suggestions on the phonology. Teshome (2006) compares the phonological data of Bender (1976 & 1983) collected on Gwama and Komo. Though Gwama is discussed as a different language (Bender 1983), Teshome (2006) has depicted Gwama and

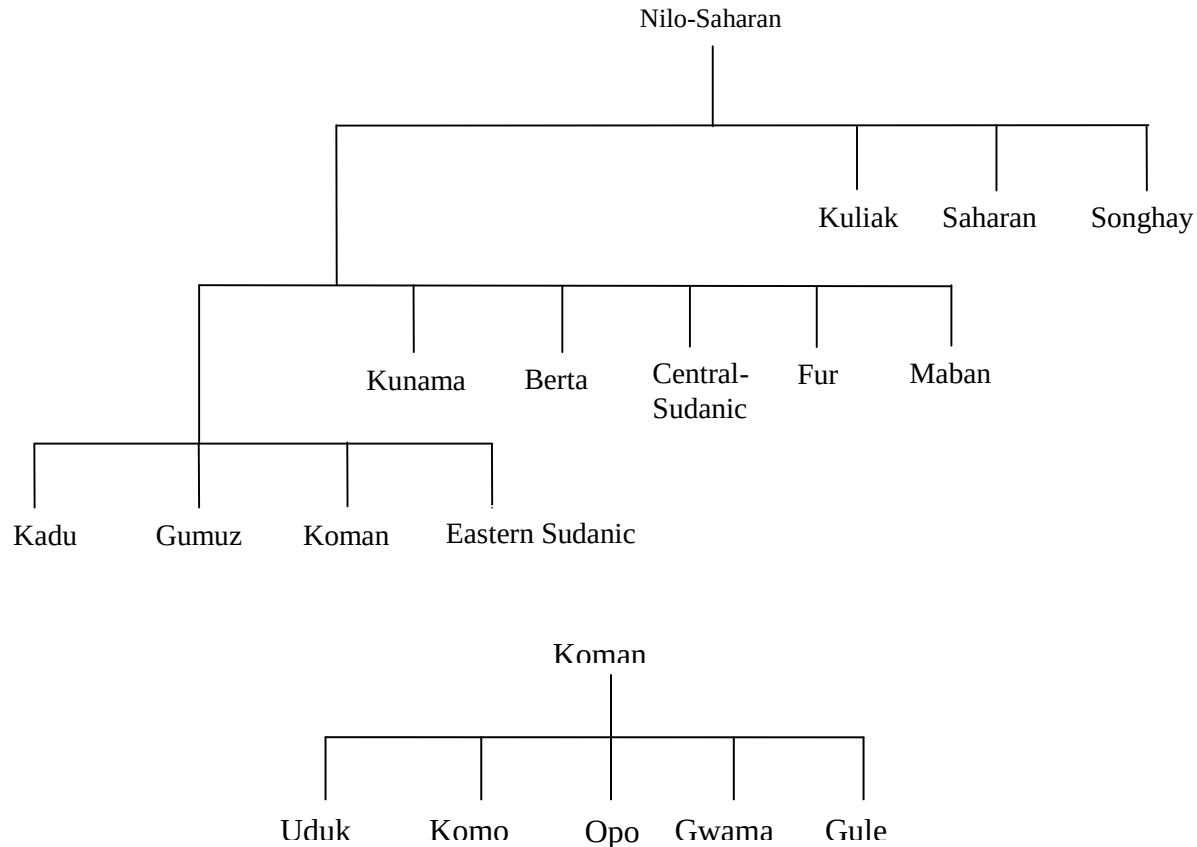
Komo as the same. The current work confirmed that Teshome's paper is a description of Komo, not that of Gwama. The other research by Zelalem (2005) presents a sketch of the grammar and lexicon of Northern Mao, who "call themselves Gwama and their language t'wa Gwama 'mouth of Gwama'" (p. 2). Even if he called them Northern Mao, the community call themselves Gwama. Siebert et al. (2002), on the other hand, have made a sociolinguistic survey and produced a 320-items wordlist to assess the status of the language. Like Zelalem (2005), they name the community Mao, which is the name of a different ethnic group.

1.3. Genetic Affiliation

Gwama, also known as Kwama in literature, is one of the five Koman groups under the Nilo-Saharan language family (Bender 1983, 1997, 2000). It is spoken in the Ethio-Sudan borderland, mainly in the Mao-Komo special district of the Benishangul-Gumuz Region of Ethiopia. The Nilo-Saharan superfamily is described as the second largest of the African languages phyla (Niger-Congo, Nilo-Saharan, Afro-asiatic, and Khoisan) in terms of the numbers of languages as well as population size (Childs, 2003). The constituent languages and groups in the family remain controversial, while Nilo-Saharan still is the least researched of the African phyla. Bender (1997) writes that the groupings and structure of the Nilo-Saharan genetic unit has not been solved yet.

Though the Koman, in which the Gwama is grouped, is said to be part of the Nilo-Saharan since Greenberg's (1963) pioneering African languages classification, different scholars have come up with different positions in different periods. Bender's (1997) classification is like that of Greenberg's original families with some sort of modification, and it is the one most exhaustively argued and also the most accepted¹. Bender's thorough and deep comparative work holds the following classification.

¹ This doesn't mean that this classification is the only and perfect one for Nilo-Saharan languages structure. I believe that further research works have to be done focusing on the classification of Nilo-Saharan languages in general and the place of the Koman groups in particular, for the center of this paper is on the descriptive part



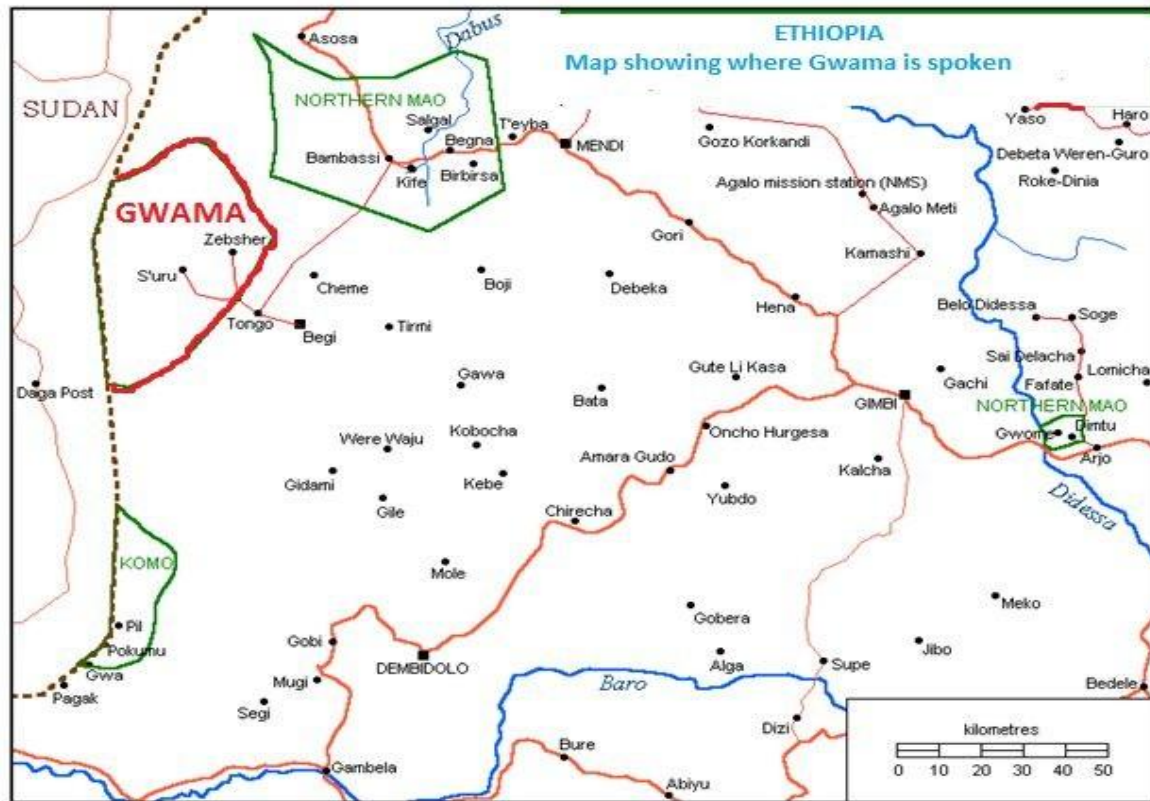
The classification given by Ehret (2001) excludes the Koman. As to Blench (2000) “One area where Bender can not be faulted is the prior publication of language data both on individual groups and reconstructions of the most important subgroups of Nilo-Saharan, notably Koman.” The Koman is a group of five languages spoken around the Ethio-Sudan borderland (Bender 1983, 1997). These are Uduk, Komo, Opo, Gwama, and Gule as shown below.

1.4. Sociolinguistics, Geographic, and Demographic Background

The ethnic Gwama lives in villages called Zebsher and S'uru found in Mao-Komo special district of Benishangul Gumuz region of Ethiopia. Since the people live with Komo, Ganza, and Oromo, many of them are able to speak additional languages. They are particularly bilingual in Oromo, language of the

overwhelming majority in the area. The Ethnologue lists the endangerment level as “6a”, meaning the language is used vigorously in all generations but remains unstandardized (Lewis 2014). The ethnic Gwama call themselves Gwama and their language t’wa Gwama, meaning ‘mouth or language of the Gwama’.

The population size has not been precisely expressed in documents. The ethnologue estimates 15,000 (Lewis, 2014). Bender (1983), on the other hand, writes 10,000. According to the Ethiopian Central Statistical Authority, in the 1994 population and housing census report, the ethnic Gwama are only 140. Of the mentioned total population in the census report, only 99 are mother tongue speakers. In my observation during fieldwork, I noticed that children, adults, and elders use the language in day-to-day activities as well as cultural events. It is thus being transferred across generation.



The location where the Gwama inhabit (Adopted from Kievit and Robertson 2012)

2. CONSONANTS

Linguists, who have conducted researches on Gwama, in different periods, came up with varying numbers of consonant phonemes. Bender (1983), to begin with, in his investigation on the proto-koman phonology, has introduced 22 consonant phonemes. Zelealem (2005), on the other hand, has found 24 adding the velar nasal /ŋ/ and the palatal nasal /ɲ/ to Bender's proposition. The most recent work by Kievit and Robertson (2012)

introduced 21 consonant phonemes. They exclude the labiodental fricative /f/, the glottal stop /ʔ/ and the palatal nasal /ɲ/, which were part of Zelealem's (2005) consonant phoneme list. The present data contains 23 consonant phonemes that are all similar to the work of Zelealem, but the labiodental fricative /f/. This figure is based on a collection of more than 1,700 wordlist and 5 fully interlinearized texts.

Inventory consonant phoneme in the current data

Manner of articulation		Bi-labial	Alveolar	Palatal	Velar	Glottal
Plosives	Vl	p	t		k	ʔ
	Vd	b	d		g	

Ejectives		p̥	t̥		k̥	
			s̥			
Fricatives	Vl		s	ʃ		h
	Vd		z			
Nasals		m	n	ɲ	ŋ	
Liquids	Lateral		l			
	Trill		r			
Approximants		w		y		

The above phonetic chart reveals a total of seven plosives, four ejectives, four fricatives, four nasals, two liquids and two glides.

The phoneme /f/ does not occur in the language system, but in *fjánzá* ‘shin’ as an allophone of /p/. /p/ occurs only sporadically at initial and medial positions like *ɲà* ‘goat’ and *íɲi* ‘heart’. /ŋ/ has never been observed initially (see also Bender, 1983 & 1997 and Zelealem, 2005).

The glottal stop /ʔ/ occurs at medial and final positions, though not often, in words like *íʔif* ‘to sleep’, *màn-ʔif* ‘became ripe’, *áʔè* ‘this’, *dáʔ* ‘butter’, and *jás-ʔif* ‘place to

sleep on’. It should be noted that this phoneme is infrequent at initial and final positions.

The most frequently occurring consonant phonemes are sonorants and obstruents. Though all of the obstruents are observed in all positions, /b/ appears very rarely word finally. In a similar vein, the labial and palatal glide /w/ and /j/, respectively, are very rare word finally. The phoneme /h/ does not appear word finally. It has been attested initially and medially in limited instances. All the above phonemes are discussed below.

2.1. Plosives

Six plosive consonant phonemes that include /p/, /b/, /t/, /d/, /k/, and /g/ are discussed in here.

/p/: It is a phoneme with the phonetic realization [p], [f], [p^h], [ɸ] and [b]. /p/ occurs in all environments as shown in 1 below.

(1) Initial		Medial		Final	
pà:rà	‘hut’ lá:ɸá	‘handicapped’	súp		‘breast’
fjánzá	‘shin’	kwápá	‘ring’	súp	‘heap pás’
‘laugh’		gápá	‘belly’	ú:p ^h	‘head’
p ^h ù	‘spit’	á:ɸá	‘uncle’	áɸ	‘carve; arrange’
pà:já	‘a large, earthenware’	kjápá	‘small; narrow’	kwáp ^h	‘horn’
pàmbá	‘drum’	átāpá	‘to suffer’	kéb	‘hear’

The phoneme /p/ is acoustically distinguishable by either the presence of aspiration or lenition. Word-initially it is most

commonly realized as a strongly aspirated [p^h]. Word-medially and finally, /p/ freely varies between [p^h~ɸ~f~b]². It is realized as [b] in continuous speech.

/b/: It is a phoneme with the phonetic realization [b] and [β]. /b/ occurs in all environments as shown in example 2.

(2) Initial		Medial		Final	
bídó	‘sheep’	gabala	‘table’	gub	‘lake’
bámbé	‘sweet potato’	búlbút	‘dust’	tab	‘follow’
bít	‘bird’	tìmbí	‘cove’	kàlàb	‘(be) sad’
búlbút	‘dust’	tjābá	‘belt’	keleβ	‘to ride a horse or donkey’
ɓà:ɓá	‘father’	ánùɓá	‘talking drum’	wākāβ	‘a sort of fruit’

/t/: It is a phoneme with the phonetic realization [t], [t^h] and [t̪]. /t/ occurs in all environments as shown below.

(3) Initial		Medial		Final	
tám	‘honey’	útè	‘that’	pít	‘vagina’
tà:ŋá	‘bamboo’	titeŋ	‘wrong’	sìt	‘person’
t ^h wáŋás	‘chest’	pétì	‘bad or difficult’	mít	‘stumble’
t ^h wáŋá	‘quarrel’	bì:tì	‘mead’	kút	‘to cut’
tò:tó	‘to take’	nà:tá	‘year’	wét	‘kind/type’
tù:tó	‘liver’	átón	‘those’	ʃùt	‘to whistle’

The phoneme /t/ is heard word initially as aspirated [t^h] as in *t^hwáŋás* ‘chest’ and *t^hwáŋá* ‘quarrel’. Word initially, medially, and finally, /t/ may appear as [t̪] like *tù:tó* ‘liver’, *nà:tá* ‘year’, and *ʃùt* ‘to whistle’.

/d/: It is a phoneme with the phonetic realization [d] and [d̪]³. /d/ occurs in every environment, but only two instances are attested word finally.

(4) Initial	Medial	Final
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² Freely varying phonemes are illustrated in here.

p^hjánzá~ɸjánzá~fjánzá ‘shin’

á:p^há~á.ɸá~á:fá ‘uncle’

áp^h~áɸ~áf ‘carve;arrange’

In continuous speech, word finally, the phoneme /p/ is heard as [b] as in: kéb-

ná-kéb

hear-1SG.SBJ.PRF-RED.

‘I have heard.’

³ /d/ phonetically heard as [d̪] in words like *há:ɖníkò* ‘big’.

dáʔ	‘butter’	àndùrè	‘cat’	gàmad ⁴	‘pleased/happy’
dalàs	‘compound’	kódò	‘underwear’	dùd	‘arm’ dà:gá
	‘half; moderate’	há:ɖníkò	‘big (in size)’		
dá:ŋá	‘wrong’	àlgà:dá	‘plate;pot’		
dágá	‘to cross (a river)’	àndūré	‘cat’		

As illustrated above /d/ is attested only in two instances, of the one thousand and seven hundred and more list of words, at word final position.

/k/: It is a phoneme with the phonetic realization [k] and [k^h]. /k/ occurs in all environments.

(5)	Initial		Medial		Final	
	kò	‘put’	ká:ká	‘grandmother’	ík ^h	‘you’
	kónò	‘chair’	kókì	‘cheek’	pák	‘shoe’
	k ^h ù	‘sorrow; grief’	bák ^h ē	‘field’	bák ^h	‘hair’
	kìkjátá	‘female’	bó:kó	‘strong mead’	dák ^h	‘done; end up’
	ká:gá	‘bitter’	ó:kó	‘grinding stone’	málák ^h	‘spoon’

/g/: It is a phoneme with the phonetic realization [g] and [ŋ]. It occurs in all environments, but only two lexemes are recorded word finally as shown in 6.

(6)	Initial		Medial		Final	
	gá:ǰá	‘digging stick’	dúgì	‘knee’	álmáng	‘mango’
	gàbálá	‘table’	dágá	‘stem/log’	ǰig	‘name’
	gámbù	‘flute’	bòbóngó	‘frog’		
	góm	‘to remember’	kìgím	‘kneel’		
	gà:ǰá	‘digging stick’	kwágá	‘fear’		

2.2. Sibilants

Gwama has four phonemic sibilants. In (7), I give evidence for a four-way contrast among the fricatives between voiceless, voiced, ejective, and palatalized fricative. The only anomaly in the distribution of these sibilants is the lack of /z/ word-finally.

(7)	Initial		Medial		Final	
/s/	sì	‘weight’	sisi	‘green’	kas	‘wind’
/z/	zí	‘eye’	zi:zi	‘to search’	unattested	
/s/	sí	‘rat’	mi:sí	‘sweet’	kus	‘dry’
/ʃ/	ǰí	‘to see’	ǰíǰí	‘sharp’	kaǰ	‘to close’

In a lexical item, speakers manifest free variation between [s~z], example of which is *sisi~zizi* ‘green’. In a reduplicated word like *gunz-ā-guns* ‘tiger’, free variation between [s~z] is recorded.

⁴ a loan from Afan Oromo

2.3. Nasals

The recorded nasal sounds of Gwama are /m/, /n/, /ɲ/ and /ŋ/. All are attested in all positions except /ŋ/, which is not attested word initially. In (8) below, I give examples of contrasting lexemes among the nasals.

(8)	Initial		Medial		Final	
/m/	mán	‘children’	í:mí	‘cow’	tìm	‘taboo’
/n/	nán	‘to decide’	ínì	‘here’	ɲín	‘arrow’
/ɲ/	ɲán	‘beggar’	íɲì	‘heart’	ílɲɲ	‘wail; ululate’
/ŋ/	Unattested	‘to see’	kìɲí	‘to chop’	dilɲ	‘ear ring’

There are two points here that need to be addressed, namely the evidence that [ɲ] is a separate phoneme /ɲ/ versus a coalescence of /ng/, and similarly the evidence that [ɲ] is a separate phoneme /ɲ/ versus consonant cluster /nj/.

Regarding the status of /ɲ/, I argue first that there is systematic justification for defining it as a separate phoneme. A three-way place of articulation contrast has been shown. What has to be noted is that a lack of this phone in the word-initial position can be an indication that it has a different phonemic status than the other nasals. Second, there is lexical evidence that /ɲ/ as a single consonant contrasts with the NC clusters /ŋk'/ and /ŋg/, as shown in (9). There is therefore little plausibility for suggesting [ɲ] is a coalescence of /n/ plus a velar consonant.

(9)	/ɲ/	wá:ɲá	‘hen’	u:ɲu	‘tail’
	/ŋk'/	gó:ŋkó	‘skin’	ɲu:ŋk'	‘guinea fowl’
	/ŋg/	wāŋgí	‘distress’	ɲu:ŋgu	‘whip’

Regarding the status of the phoneme /ɲ/, the same arguments apply. The phoneme has revealed a three-way contrast as can be seen in 8. It should however be noted that this phoneme has limited frequency, being attested in only fourteen of the over one-thousand seven hundred items in my data corpus. Of the fourteen, only two are recorded word-initially and only three are recorded word-finally.

2.4. Ejectives

This series consists of four phonemes. These are /p/, /t/, /k/ and /s/.

/p/: This phoneme appears in all environments as shown in 10 below.

(10)	Initial		Meial		Final	
	pá:ɲũ	‘widow’	àlpánzá	‘lizard’	dúmp	‘to plaster’
	pás	‘to resume’	épi	‘expensive’	háp	‘she’

píkin ‘ash’ gābŋpá ‘holiday’ kúmp ‘fingernail’

In reduplicated lexemes, the phoneme /p/ freely varies with [b], as illustrated in 11.

(11)	kūmb-ba-kūmp	sùb-nì-sùp	tób-nì-tóp
	sip-3PL.SBJ.PRF RED	suck-3MSG.SBJ.PFV.RED	drink-3MSG.SBJ.PFV.-RED
	‘They have sipped.’	‘He sucked.’	‘He drank.’

In word -final position like fāp ‘to hit’ , kúmp ‘fingernail’ , and kóp ‘smel’, the ejective /p/ is realized as the voiceless unreleased stop [p], which coincides with a wider pattern of final devoicing and deglottalization in the language.

/t/: This phoneme appears in all positions as can be seen in 12 below.

(12)	Initial	Medial	Final
	tá:dá ‘bake; fry’	kántá ‘ugly’	mít ‘hand’ tābāl
	‘stopper; plug’ tòtó	‘black’ kát	‘loose’ tagám ‘stutter’
		tíí ‘hoof’	kàt ‘cheap’ tájá
	‘messenger’ tífáfilá	‘snail’ kùmút	‘five’
	tíjě ‘neighbor’	bétánjá ‘blanket’	sònt ‘foot’

Like the labial ejective, /t/ is realized as a voiceless unreleased [t] in the final position.

/k/: This velar ejective occurs in all environments as shown below.

(13)	Initial	Medial	Final
	kā ‘to eat (meat)’	hókóf ‘dimple’	búk ‘to jump’
	kálá ‘swamp grass’	jákás ‘leaf’	múfūk ‘soup’
	ká:li ‘to allow’	kùkút ‘cough’	sɪŋk ‘smoke’
	kà:já ‘to deceive’	sɪŋkó ‘spice (of coffee)’	ʃù:ŋk ‘guinea fowl’
	káj ‘stir’	tākáf ‘to cut open (fruit)’	sɔŋk ‘foot’

As expected, this phoneme displays very similar pattern to the alveolar and labial ejectives. In the final position, the glottal ejective /k/ is realized as a voiceless unreleased [k].

/s/: This phoneme is recorded in all environments⁵.

⁵ Phoneme /s/ has been discussed under sibilants and contrasting evidences are given in 7.

(14)	Initial		Medial		Final	
	sěré	‘clean’	bésín	‘four’	bás	‘milk’
	sé	‘ear’	gé:sé	‘to devalue’	bús	‘be choked’
	sám	‘blodd’	hàsí	‘stamp (of foot)’	démēs	‘beltch’
	sáns	‘root’	kàsí	‘rag’	gōlkós	‘throat’
	séwán	‘moon’	mì:sí	‘sweet’	hìjnis	‘wrinkle’

2.5. Liquids and Semivowels

There are four phonemes for liquids and semivowels in Gwama: the alveolar lateral /l/, the alveolar trill /r/, and the palatal and labiovelar semivowels /j/ and /w/. Of these, the phonemic distinction between [l] and [r] is probably the hardest to distinguish. In certain lexical items, the two sounds appear to be in free variation word-finally. In addition, [r] is not attested in the initial position.⁶ Thus the clearest contrast is found word-medially, where there are several near-minimal pairs attested in my data corpus. This evidence for a phonemic contrast between /l/ and /r/ is given in 15.

(15)	Initial		Medial		Final	
/l/	lá:p ^h á	‘handicapped’	deri	‘saliva’	dùkúl	‘log’
	lógón	‘wall’	hála	‘earthenware’	hòngól	‘loose’
/r/	Unattested		di:li	‘praise’	bùndùr	‘gun’
			horá	‘bowl’		‘bed’
					àngár	

In (16), I give evidence of contrast for the semi-vowels /w/ and /j/. I have analyzed these phonemes as consonants in all positions, including the coda where they could be alternatively analyzed as the V2 of a diphthong. It should however be noted that /w/ does not occur word finally.

(16)	Initial		Medial		Final	
/w/	wákî	‘to remove’	há:wá	‘yawn’	Not attested	
	wé	‘to dress’	bwánzá	‘youth’		
/j/	jáki	‘sweat’	á:já	‘know’	dúj	‘to buy’
	jé	‘sow’	bjántá	‘blow’	kàj	‘day’

2.6. Glottal Consonants

There are only two glottal consonants in Gwama, the stop /ʔ/⁷ and the fricative /h/, which contrast word-medially. Phoneme /ʔ/ does not appear word-initially, and /h/ is not recorded word-finally. Both phonemes have very limited number of distribution and frequency of occurrence. For example, there are only three lexemes of the phoneme /h/ at word medial position. In 17 below, I give evidences of contrasting lexemes of the glottal phonemes.

⁶ The local people are heard using a loan word *rəkina* ‘problem’, whose origin is Oromiffaa.

⁷ Kievit and Robertson (2012) do not include phoneme /ʔ/ in their inventory list.

(17)	Initial		Medial		Final
/ʔ/	Unattested		kòŋʔúp	‘pillow’	dáʔ ‘butter’
			íʔiʃ	‘to sleep’	jiʔ ‘hum’
/h/	há:ŋá	‘vulture’	dóŋhi	‘cock’	
	há:ŋká	‘bow’	úháj	‘he’	Unattested

The occurrence of /ʔ/ in medial position seems as an epenthetic phoneme since two vowels do not occur consecutively in Gwama. For example, the lexeme *kòŋʔúp* ‘something that serves as a pillow’ is a compound word formed from *kòŋu* ‘chair’ and *úp* ‘head’. When these two lexemes form the new noun *kòŋʔúp*, phoneme /ʔ/ is used as epenthesis.

2.7. Minimal and Near-Minimal Pairs

The following list contains examples of minimal and near-minimal pairs exhibited in Gwama. The contrasting phonemes are shown in the pairs of lexemes.

(18)	/t/-/t/	t'wá	‘mouth’	/w/-/b/	wás	‘fish’
		twá	‘forehead’		bás	‘milk’
	/z/-/ʃ/	zì	‘eye’	/m/-/n/	má	‘we’
		ʃí	‘teeth’		ná	‘mother’
	/s/-/t/	swí	‘house’	/d/-/b/	dó:kó	‘potato’
		twí	‘try’		bó:kó	‘mead’
	/k/-/s/	ké	‘low’	/t/-/d/	túʃ	‘urine’
		sé	‘ear’		dúʃ	‘rope’
	/n/-/ɲ/	ná	‘mother’	/m/-/ɲ/	í:mí	‘cow’
		ɲá	‘goat’		í:ɲí	‘heart’
	/b/-/p/	bít	‘bird’	/k/-/g/	pò:kó	‘skirt’
		pít	‘vagina’		pò:gó	‘river’
	/b/-/g/	bí	‘what’	/j/-/w/	jás	‘earth’
		gí	‘work’		wás	‘fish’
	/k/-/k'/	kwí	‘elephant’	/p/-/p'/	pi	‘nape’
		kwí	‘to trap’		pí	‘bark of a tree’
	/t/-/t/	twá	‘mouth’	/l/-/m/	dó:ló	‘pumpkin’
		twá	‘forehead’		dó:mó	‘waist’
	/t/-/d/	tá:ŋá	‘bamboo’	/t/-/d/	dúʃ	‘testicle’
		dá:ŋá	‘be wrong’		dúd	‘arm’
	/ʃ/-/s/	ʃáŋá	‘bright’	/s/-/s/	gé:sé	‘to devalue, or undermine’
		sáŋá	‘harp’		gé:sé	‘millet’
	/n/-/ɲ/	nán	‘talk; news’	/s/-/t/	páns	‘hatchet; axe’
		ɲán	‘to beg’		pánt	‘to make wall by mud’

3. VOWELS

Bender (1983), Zelealem (2005) and Kievit and Robertson (2012) have included the Gwama vowels in their research reports. In this regard, Bender (1983) writes that the Proto-Koman languages had five vowel systems. He specifically depicted that the Gwama has distinctive long vowels. Zelalem (2005) has identified five short vowel phonemes along with their long counterparts. These are /i/, /e/, /a/, /u/ and /o/. Kievit and Robertson (2012), on the other hand, referring to Hellenthal and Kutsch (2011), write seven basic vowels which include two [-ATR], /i/ and /u/, and five [+ATR], /ɪ/, /ɛ/, /ʊ/, /ɔ/ and /a/. In the present data five short vowels and corresponding number of long vowels, similar to Bender (1983 and 1997) and Zelealem (2005), are identified⁸.

Contrastive Vowel List

i, i:	u, u:
e, e:	o, o: a, a:

The most recurring vowels are the back vowels /u/ and /o/; and the least recurring one is the mid front vowel /e/. All vowels appear in all environments. The following two sub-sections strengthen this point.

3.1. Short Vowels

In Gwama, short vowels occur in all environments as shown below.

(19)	Initial		Medial		Final	
/i/	íjá	‘where’	bíj	‘to shiver’	písi	‘be hungry’
	ískù	‘sesame’	bísán	‘star’	pí	‘nape’
	ínì	‘heart’	bít	‘bird’	sì	‘weight’
	íliŋ	‘to hunt’	bì	‘wipe off’	sìndí	‘sort of antelope’
/e/	én	‘to improve’	dérì	‘saliva’	àʔé	‘this’
	élēm	‘be happy’	démés	‘to belch’	bámbé	‘sweet potato’
	épi	‘be expensive’	gēl	‘herd’	dùzé	‘pipe’
	étá	‘be far’	sép	‘sword’	hé	‘to admit’
/a/	àpìló	‘goiter’	bādi	‘scar’	bójá	‘colour’
	āngār	‘bed’	bāké	‘field’	gjá	‘hoe’
	án	‘menstruation’	bák	‘hair; feather’	kjápa	‘narrow; small’
/u/	úp	‘to clean; polish’	ánùbá	‘talking drum’	tú	‘long; tall’
	ùj	‘anus’	dúd	‘arm’	kú	‘to cry; weep’
	ús	‘fart’	bùndùr	‘gun’	lámūnú	‘lemon’

⁸ In the current data, the central vowel ranging between /ɛ/ and /ə/ (i.e. /ä/), which Zelalem (2005) describes, is not identified. Instead, the examples listed in his work (“bāk ‘hair’, s’āwan ‘moon/month, k’äf ‘red’ and wārr ‘child’”) have been examined as s’ēwán ‘moon’, bāk ‘hair’, káf ‘red’ and wāl ‘child’.

	úgú	‘tail’	būlbút	‘dust’	kùsùnù	‘chin’
/o/	ōkō	‘grain grinder’	átōn	‘those’	bìdó	‘sheep’
	ómó	‘to praise’	bók	‘marriage’	bùbótó	‘yogurt’
	órgá	‘elephantiasis’	bótìn	‘to mix’	bòbóngó	‘frog’
	ólpiná	‘to respect’	sónk	‘foot’	kó	‘to roast’

Below I give evidence of contrast between these vowel phonemes, in (20a) comparing the high front, mid front, and low vowels /i, e, a/, and in (20b) comparing the high back, mid back, and low vowels /u, o, a/.

(20) a. Minimal and Near-Minimal pairs between /i, e, a/ Initial

			Medial		Final	
/i/	ínì	‘here’	pít	‘vagina’	sí	‘rat’
/e/	én	‘be patient’	pètì	‘bad’	sé	‘ear’
/a/	án	‘menstruation’	pát	‘touch’	sá	‘potter’s kiln’

b. Minimal and Near-Minimal pairs between /u, o, a/ Initial

			Medial		Final	
/u/	ù:jú	‘maize sprout’	búk	‘jump’	kú	‘to cry’
/o/	ó:jó	‘cloth’	bók	‘marriage’	kó	‘to roast’
/a/	á:já	‘know’	bák	‘hair’	kà	‘to eat meat’

3.2. Long Vowels

Long vowels occur in all positions.

(21)	Initial		Medial		Final	
/i:/	í:já	‘water’	kì:ndí	‘hernia (umbilical)’	kì:	‘to look after’
	ì:tí	‘monkey’	kì:sí	‘near’	kí:	‘gallbladder’
	í:mì	‘cow’	mì:mí	‘mosquito’	pí:	‘to fall’
/e:/	é:	‘yes’	dé:pé	‘to indicate’	ké:	‘to sweep’
	é:jé	‘false banana’	hè:jé	‘to harvest’	jé:	‘to slough’
/a:/	á:já	‘to know’	hà:ɲká	‘bow’	ná:	‘to fetch firewood’
	á:pá	‘uncle’	bá:zá	‘springbok’	sá:	‘to apply ointment’
/u:/	ú:p	‘head’	bú:jù	‘fart’	bú:	‘deep hole’
	ú:gú	‘gourd’	dú:lù	‘cane’	kú:	‘mourning’
/o:/	ó:jó	‘cloth’	dò:zò	‘to learn’	kó:	‘mountain’

ó:kó	‘grinding stone’	dò:pó	‘idle; lazy’	mó:	‘to conquer; to win’
ó:fó	‘to reconcile’	dó:mó	‘waist’	pó:	‘to bark (for dog)’

Long vowels do not frequently appear word initially and finally. In other words, a large number of lexemes are attested having long vowels medially. However, of the five long vowel phonemes, the front, high vowel /i:/ has been recorded word initially and finally in many instances.

Underneath I give evidence of contrast between long vowel phonemes, in (22a) comparing the high front, mid front, and low vowels /i:, e:, a:/, and in (22b) comparing the high back, mid back, and low vowels /u:, o:, a:/.

(22) a. Minimal and Near-Minimal pairs between /i:, e:, a:/

Initial			Medial			Final
/i:/	í:	‘full’	kí:fí	‘gourd’	kì:	‘to look after’
/e:/	é:	‘yes’	ké:jé	‘to undermine’	ké:	‘to sweep’
/a:/	á:tá	‘medicine’	ká:sí	‘painting’	ná:	‘to fetch (firewood)’

b. Minimal and Near-Minimal pairs between /u:, o:, a:/

Initial			Medial			Final
/u:/	ù:jú	‘maize sprout’	gú:ŋú	hyena	tú:	‘spit’
/o:/	ó:jó	‘cloth’	gó:ŋk’ó	skin	tó:	‘to caress’
/a:/	á:já	‘know’	gá:ŋó	mule	sá:	‘be engaged’

3.3. Contrastive Vowel Length

Vowel length contrast is one of the features observed in Nilo-Saharan languages (Stirtz, 2011). In the current data, length contrast has been exhibited in nearly all vowel phonemes as shown below.

(23)	Initial		Medial		Final	
/i/ /i:/	íjǎ	‘where’	bít	‘bird’	pí	‘give birth’
	í:jǎ	‘water’	bí:tí	‘mead’	pí:	‘to fish’
/e/ /e:/	ésēs	‘mumble’	ǰéré	‘law’	ké	‘smell’
	é:ǰé	‘sort of food’	ǰé:né	‘aunt’	ké:	‘to sweep’
/a/ /a:/	/ájǎ/	‘obstruction’	kagá	‘container’	ná	‘mother’
	/á:jǎ/	‘to know’	kà:gá	‘bitter’	ná:	‘to fetch (firewood)’
/o/ /o:/	ókò	‘grinding stone’	góló	‘sort of metal’	kó	‘roast’
	ó:fó	‘reconcile’	gó:ló	‘granary’	kò:	‘mountain’

/u/ /u:/	úlù	‘clear’	kúzi	‘heel’	jù	‘saw’
	ú:ŋú	‘tail’	kù:zí	‘ten’	jù:	‘to make taut’

3.4. Vowel Quality

Acoustic measurements of first and second formants (F1 x F2) of vowels become the most widely used phenomenon to show the vowel spaces of a target language precisely and more accurately. Crothers (1978: 96) writes, “The quality of vowels with normal voicing is determined by the supraglottal resonators, and can be classified acoustically in terms of their resonant frequencies.” The centre frequency of the first two resonances (also known as formants, F1 and F2) help to classify oral vowels, he added. These frequencies depend on the tongue height and tongue position. The frequency of F1 is inversely related to tongue height and that of F2 to the tongue position. Hence, high refers to low F1; and, front unrounded means high F2.

With a view to supplement the IPA transcription, digital signals processing of the first two formants (F1 and F2) frequencies were examined to identify the vowel space. To this end, ten words representing each short and long vowel have been experimented. Doing so, the positions of vowels and their time range have been discovered.

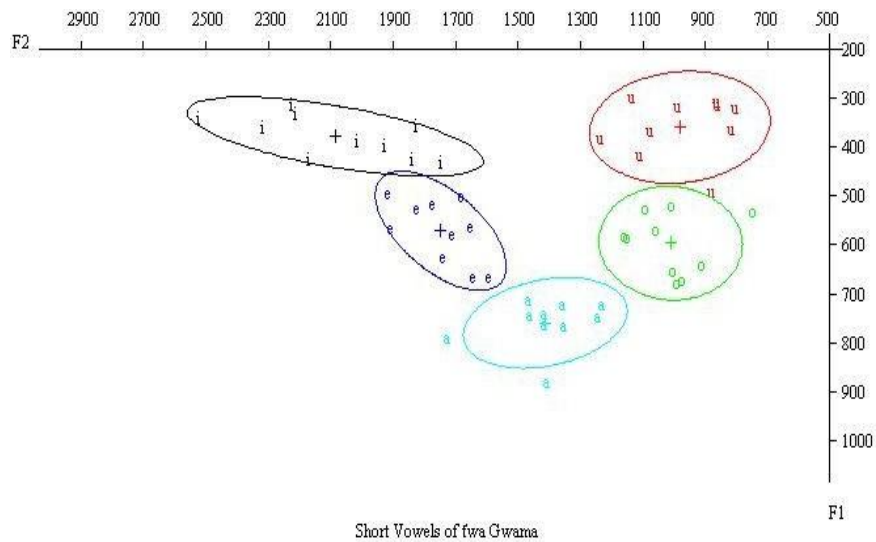
Procedure

From the set of recorded data in the fieldwork, segmentation of the audio files in Audacity and measuring the frequencies of F1 and F2 in kilohertz (kHz) were made in PRAAT. This software has also helped to manipulate the duration of the vowels in milliseconds (ms). To minimize the influences of neighboring consonants, mid points of the most stable portions of the vowels were identified. In such a manner, all the 50 short vowels formants were examined. The frequencies of each vowel formant pairs then entered into JPlot to produce plot chart. The same procedure has been employed to the experimentation of long vowels.

The formants and durations discovered while measuring short vowels are reported in the following table.

The Frequency and duration of short vowels ranges and their averages

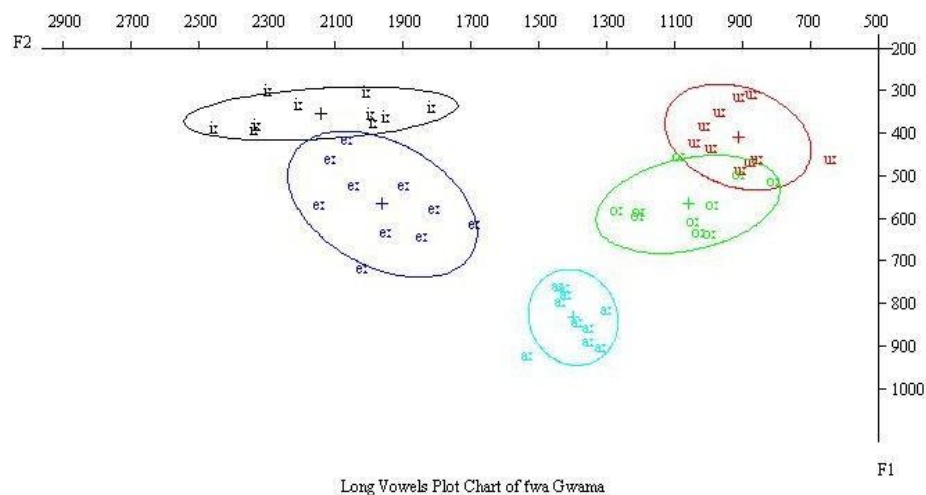
Phoneme	F1	Mean	F2	Mean	ms	Mean
i	317-433	380	1753-2531	2086	54-98	77
e	490-668	572	1599-1919	1751	53-95	72
u	302-492	361	808-1239	982	55-108	79
o	521-728	597	748-1162	1012	50-95	80
a	713-881	760	1235-1733	1414	75-116	91



Short Vowels plot chart

In sum, the result ends up with V shape as is observed in other five-vowel systems (Ladefoged 2001).

The Long vowels plot chart is also shown below. Compare the average frequency of the vowels and see their positions on the chart.



Long Vowels plot chart

Long vowels frequency and length ranges along with the averages are shown here.

Phoneme	F1	Mean	F2	Mean	ms	Mean
i:	301-394	355	1820-2460	2143	140-302	183
e:	415-718	571	1693-2149	1961	115-178	146
u:	309-487	410	648-1049	916	126-188	163
o:	456-638	568	815-1278	1062	150-205	175
a:	761-923	845	1305-1538	1399	150-208	172

The average length of long vowels is twice longer than the short ones. Acoustically, the relative positions of lax vowels are lower and more central than their tense counterparts (Crothers, 1978). Centralization of vowels can have various factors to be considered. Of which one is “contextual influence” or “contextual assimilation” (Lindblom, 1963:1774). Short vowels in closed syllables tend to be much centralized than their long counterparts (Ahland, 2012:47).

The clearly observed variation of formant frequencies is between the short and long low vowels /a/ and /a:/. Here, in addition to centralization, duration or length is a determinant factor, particularly for low vowels (Flemming, 2001; Ahland, 2012). In Flemming terms, “...producing low vowels is increasingly difficult as vowel duration is reduced, and this motivates rising of short low vowels.”

3.5 Vowel Harmony

Krämer (2003:3) defines VH as “the process where potentially all vowels in adjacent moras or syllables within a domain like the phonological or morphological word systematically agree with each other with regard to one or more articulatory features.” In other words, features that exist on vowel(s) alter the feature of the neighbouring vowel(s) on the syllable or mora.

I. Backness harmony

Backness, as one of harmony features, is examined in tri-syllabic and above nouns as shown below.

(24) Lexeme	Gloss
bùbótó	‘yogurt’
dùgùfù	‘onion’
kùlkútù	‘back part of the skull’
kùsùnù	‘chin’ bobóngó ‘frog’ bùlubúlù ‘butterfly’

In all of the words listed above, agreement of backness is observed through out each lexeme. This feature, however, has not been observed both in monosyllabic and disyllabic words.

On the other hand, tri-syllabic nouns beginning with the syllable /al-/ (briefly speaking /al-/ nouns) have shown frontness and backness harmony. This morpheme seems a loan from Arabic. The morpheme in /al-katb/ ‘the book’ (Kareem and Douglas, 2007:247) and /al-fams/ ‘the sun’ (Kambuziye, 2007:63) represent the definite article ‘the’. The other justification for reckoning such a decision emanates from the Gwama speakers interchangeable use of the lexeme *se:lja* and *al se:lja* to mean ‘local alcohol’.

(25)	Frontness	Gloss	Backness	Gloss
	àl-képè	‘pocket’	àl-mùmùn	‘dream’
			àl-p’ánzà	‘lizard’
			àl-kàpàn	‘coffin’
			àl-púkà	‘sort of container’
			àl-mùsù	‘banana’

II. Frontness and Backness of the negative prefix /da-/

The negative prefix /da-/ alters its vowel to look like the feature of the following stem (i.e. pronoun). That is, for example, the back vowel /a/ becomes a front vowel if the following stem consists of a front vowel; and if the pronoun already contains a back vowel, the vowel of the prefix shows no change. The following are examples revealing the feature of the vowel of the prefix while it is used along with personal pronouns.

(26)	Frontness	Gloss	Backness	Gloss
	dε-bε	NEG.-3M.SG.OBJ.PRO.	dá-bún	NEG.-3PL.OBJ.PRO
	dá-b	NEG.-3F.SG.OBJ.PRO.	dá-gá	NEG.-1SG.SBJ.PRO.
	dε-bí	NEG.-2SG.SBJ.PRO.	dá-má	NEG.-1PL.SBJ.PRO.

III Shortening Long vowels

A compound noun formed from an open disyllabic and a closed monosyllabic noun root shorten the long vowel or delete the disyllabic terminal vowel.

(27)	Lexical	Gloss	Surface	Gloss
	pá:kà + pwáf	‘injera’ + ‘porridge’	pákpúf	‘bread’
	kóŋò + úp	‘chair’ + ‘head’	kóŋʔúp	‘pillow’
	ká:jà + kién	‘sun’ + ‘now’	kájkén	‘day’

4. TONE

4.1. Contrastive Tone

Similar to other Nilo-Saharan language family, the Gwama shows contrastive tone. Bender (1983) has mentioned the existence of distinctive tone level, though his work is short of details as far as the amount of levels and illustrations are concerned. Zelealem (2005) writes the existence of two level tones in Gwama. Kievet and Robertson (2012), on the other hand, have examined three tone levels. Since the phonology was not their prime concern, they did not write in more detail, however. In the current data, three contrastive level tones (H, M and L) have been detected in monosyllabic words as shown below.

(28) Tone	Lexeme	Gloss	Lexeme	Gloss	Lexeme	Gloss
H	ʃǎ	‘to eat’	pí	‘fruit’	ʃĩ	‘teeth
M	ʃǎ	‘to burn’	pĩ	‘bark of a tree/hard’	ʃĩ	‘also/too’
L	ʃǎ	‘to dig’	pì	‘fall’	ʃì	‘(to) see’

The above words are distinguished only by melody.

4.2. Melodies of Nouns

For these three levels of tone, seven (of the nine possible) melodies⁹ are found for two syllable nouns. The two unattested melodies are LM and HM. The distribution of M tone is limited in the second syllable, following only M.

	H	M	L
H	HH	HM	HL
M	MH	MM	ML
L	LH	LM	LL

In 28 below, I give examples of the melodies of two syllable nouns having short vowels.

(29)	HH	LL	HL	LH	MM	MH	ML
	k’álá	tàzì	k’áṇà	tàjá	gāpā	tākí	k’āsì
	‘grass’	‘face’	‘knot’	‘messenger’	‘belly’	‘flame’	‘rag’

Two syllable nouns with long vowels exhibit only five melodies as far as the current data is concerned. Of the expected nine melodies, the four unattested ones are LM, HM, MH, and ML. The distribution of M tone is very limited in long vowels. The following illustration reveals the five melodies found in two syllable long vowels.

(30)	HH	LL	HL	LH	MM
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⁹ The tone of Gwama needs further investigation for detail analysis.

pá:ká	nà:tà	pá:jù 'widow'	pà:rà	sū:mū
'big flat bread'	'year'		'hut'	'hock'

4.3. Melodies of Verbs

Two syllable verbs exhibit seven melodies, out of the expected nine, in citation form. The two unattested melodies are MH and ML.

(31)	HH	LL	HL	LH	MM	LM	HM
	dágá	kàláb	bótìn	dịjín	kābā	hìrĩjĩ	hújĩ
	'to cross'	'sadden'	'to mix'	'lean'	'conspire'	'hire'	'crunch'

5. THE SYLLABLE STRUCTURE

The most unambiguous syllable structure of the Gwama is the patterns happening in short vowels. The syllable structures observed in the language system are V, VC, CV, CVC and CVC1C2. Monomorphemic words in most cases reveal the following pattern.

(32)	V	VC	CV	CVC	CVC1C2
	í-jí 'heart'	ík 'you'	ná 'mother'	bás 'milk'	jũnk 'guinea fowl'
	í-jà 'where'	úp 'head'	já 'goat'	bít 'bird'	sámp 'rib'

Predominantly occurring structures are CV and CVC. Relatively, the least frequent one is VC. The beginning coda of syllable pattern CVC1C2 has been found nasal sounds as in *sónk* 'foot', *símp* 'egg' and *sans* 'root'.

As discussed earlier, there is no sequence of two vowels, but length. Such a vowel sequence, as a result of length, occurs in all positions (see positions of vowel above and Zelealem, 2005). The syllable structure of long vowels is like that of short vowels. For example, *í:* 'a sort of antelope', *ú:p* 'head', *bú:* 'deep hole in the ground' and *hí:nzì* 'flower' hold the patterns V, VC, CV, and CVC, respectively. The following list summarizes the syllable pattern of words.

Syllable	Examples
V	í: antelope
CV	à-jà 'know'
CVC	à-tón 'those'
VC ₁ C ₂	ánt' 'fire'
VC ₁ -C ₂ V	àw-dí 'whose'
VC-CVC	àl-mùs 'banana'
V-CV-CV	à-ka-sà 'other'
VC-CV-CV	àl-ké-pè 'pocket'
	àl-gì-bá 'hijab'
	è: yes
	í-tì 'monkey'
	ì-lìn 'hunt'
	ís-kú 'sesame'
	àn-dù-rè 'cat'
	àl-pù-kà 'sort of container'

CV—CV	bí-dò	‘sheep’	dó:-kó	‘potato’
	bà-kè	‘desert’	dó:-mó	‘waist’
CV-CVC	bè:-s’in	‘four’	k à-kàf	‘porcupine’
	dà-làs	‘compound’	là-mùn	‘lemon’
CVC-VC	kík-ìf	‘tortoise’	ká:n-dá	‘sorghum’
	kóf-òn	‘navel’	kèl-kò	‘in the past’
CVC ₁ -C ₂ V	bám-bè	‘sweet potato’	gòŋ-gò	‘skin’
	dón-hì	‘cock’		
CV-CV-CV	bù-bò-tò	‘yogurt’	gà-bà-là	‘table’
	dù-dó:-zò	‘(to) learn’	gó-mà-kù	‘sorrow’
			kí-ke:-zì	‘male/man’
CV-CVC ₁ -C ₂ V	kì-kàm-bè	‘camel’		
CV-C ₁ C ₂ V-CV	kí-kjà-tà	‘woman’		

6. PHONOTACTICS

The Gwama system permits only two consonants in a syllable. Nearly all consonants are recorded at all positions across syllable (initial, medial and final), though their number of occurrence varies. And, a few like /ŋ/ and /ʔ/ are not observed word initially.

A consonant cluster of two is attested word finally, though in limited instances. The consonant that precedes the final one is mainly a sonorant and then another sonorant or an obstruent follows. Again, the obstruent is predominantly ejective; to mention, *soŋk* ‘foot’, *funf* ‘nose’, *sans* ‘root’, *dúmp* ‘plastered wall’, *ánt* ‘fire’, *almang* ‘mango’, *páns* ‘hatchet/axe’, *pánt* ‘to plaster’, *kwáns* ‘bridge’, *símp* ‘egg’ reveal consonant cluster of two at word final position, and the ejective at final position. Most importantly, some consonants, specifically sonorants such as /ŋ/ and /r/, do not occur word initially; if there exist, it should be loan like *rəkina* ‘problem’, which is an Oromifa word. On the other hand, sonorants, particularly /l, n and ɲ/, are attested in very few instances word initially. These are *lámúnù* ‘lemon’, *lógón* ‘wall’, *lú:lù* ‘attack’; *ná* ‘mother’, *ná:já* ‘many’, *nó:kó* ‘good;correct’, *nà:tà* ‘year’, *ní* ‘antelope’; *já* ‘goat’. The following table summarizes the distribution of consonants across syllable.

Distribution of Consonants

	Consonant	Examples
/p/	lp, kp, pj, pw	/alpuka/ 'tobacco container gourd'; /pakpuʃ/ 'bread'; /pjanza/ 'shin'; /pwans/ 'bridge'
/b/	mb, lb, bl, jb, bt tb, bt, bs, nb, tb, bk	/bambe/ 'sweet potato'; /bulbut/ 'dust'; /dujba/ 'buy'; /gabtɪp/ 'holiday'; /kikambi/ 'camel'; /kubtwasene/ 'eight'; /pambira/ 't-shirt'; /s'itbes'inotkumut/ 'nine hundred'; /wabk oʃ/ 'old'
/t/	tw, tb, tj, tk, tk, ts, td, tm,	/twa/ 'mouth'; /s iteseseɪn/ 'two hundred'; /s itsuja/ 'four hundred'; /sitdozo/ 'teacher'; /tatmit/ 'palm'
/d/	nd, nt, bld, wd, ds, dw,	/àndùrè/ 'cat'; /ant/ 'fire'; /awdi/ 'whose'; /dudsonk/ 'ankle'; /dwa/ 'girl'; /hadniko/ 'big'; /k onde/ 'horse'; /kanda/ 'sorghum'; /mitdepe/ 'index finger'
/k/	tk, kd, lk, ɲk, lg, ɲg, kj, jk, sk, kw	/alkepe/ 'pocket'; /apaɲko/ 'not one'; /gikjen/ 'now'; /isku/ 'sesame'; /kajken/ 'day'; /kelko/ 'previously'; /kwapa/ 'wing/hand';
/g/	ɲg	/gonggo/ 'skin (of animal)'; /guɲgu/ 'hyena'
/p/	lp, mp	/alp anz / 'lizard'; /dump/ 'plastered wall'
/t/	nt, tk, td, tw	/ant/ 'fire'; /mitkwam/ 'thumb'; /mitdepe/ 'index finger'; /mitwalwal/ 'little finger'
/k'/	ɲk', k'w, tk', k'	/dudsonk/ 'ankle'; /k was/ 'back part'; /ʃuɲk/ 'guinea fowl'; /s'itkuiz/ 'one thousand'; /wetnik ja/ 'how much'
/ʔ/	sʔ, ɲʔ	/jasʔiʃ/ 'mattress'; /koɲʔup/ 'pillow'
/s/	sk, sj, ws	/isku/ 'sesame'; /sjana/ 'sorghum'; /uws/ 'bind/mend'
/s'/	ns'	/s'ans/ 'root'
/z/	nz	/hinzi/ 'flower'
/ʃ/	rʃ, ɲʃ, ʃn,	/girʃ/ (borrowed) 'cent'; /ʃuɲʃ/ 'nose'; /zeʃna/ '(to) find'
/h/	Lh	/alhindi/ 'big'
/m/	lm, mb, mp, sm, tm	/almus/ 'banana'; /almang/ 'mango'; /bambe/ 'sweet potato'; /timbi/ 'covering material'; /kikambi/ 'camel'; /samp/ 'rib'; /k wasmit/ 'back of the palm'; /tatmit/ 'palm'
/n/	nd, nt, nj, nz, dn, sn, ns, kn, ɲʃ	/k onde/ 'horse'; /andure/ 'cat'; /ant/ 'fire'; /betanja/ 'blanket'; /izenzi/ 'thin'; /hadniko/ 'big'; /jsnajas/ 'root'; /kwans/ 'write'; /mukn/ 'all'; /ʃɪɲʃi/ '(to) rest'
/ɲ/	ɲg, ɲk, ɲh, ɲk	/aɲgar/ 'bed'; /apaɲko/ 'not one'; /doɲhi/ 'cock'; /soɲk/ 'foot'; /ʃɪɲk/ 'drug'
/l/	lk, lk, lw, lg, ld, lm, lp, ls, lb	/k ulk ut/ 'back part of the head'; /kelko/ 'previously/in the past'; /mitwalwal/ 'little finger'; /sulganda/ 'trouser'; /waldozo/ 'student'; /almumun/ 'dream'; /alp anza/ 'lizard'; /alselja/ 'beer (traditional)'; /bulbut/ 'dust'
/r/	rʃ (borrowed)	/girʃ/ 'cent'

/w/	k w, wɛ, sw, tw,	/k wapa/ 'ring'; /kewɛunu/ 'night'; /swaja/ 'tree'; /twaɛas/ 'chest'; /kwi/ 'elephant'; /pwaɛ/ 'porridge'; /t'wa/ 'mouth'; /dwa/ 'girl'; /gwas/ 'buffalo'
	kw, pw, tw, dw,	
/j/	jk, kj, wj, gj, pj,	/kajken/ 'day'; /kikjata/ 'woman/female'; /swja/ 'two'; /pingjana/ 'coffee cup'; /pjanza/ 'shin'; /fujdin/ 'rope'; /betanja/ 'blanket'; /dujba/ 'buy'
	jd, nj, jb	

As discussed earlier, a sequence of two consonants is permissible at medial and final positions (see also Zelealem, 2005). The cluster mainly contains a sonorant plus another sonorant or a sonorant followed by an obstruent (notice the above table).

7. LABIALIZATION AND PALATALIZATION

Gwama does not allow vowel sequences, hence whenever a sequence like /ua/ and /ui/ occur, the consonant that occur preceding it becomes labialized (see also Zelealem 2005). This process has been examined in ten obstruents. These are /p, t, k, b, d, ɸ, t, k, s, and ʃ/. Labialized consonants are mainly found in front of either /i/ or /a/, but not the rest. In continuous speech, the /i/ has been exhibited as /e/ in words like *kwé* '(to) dig'. A list of labialized consonants is illustrated below.

(33) Labialized C.	Lexeme	Gloss	Labialized C.	Lexeme	Gloss
pw	pwáɛ	'porridge'	pw	pwakama	'aunt'
tw	twa	'forehead'	t'w	t'wa	'mouth'
kw	kwápà	'wing'	k'w	k'was	'back part'
bw	bwaɛa	'snake'	sw	swájá	'tree'
dw	dwá	'girl'	ɸw	ɸwaɛa	'bracelet'

Secondly, a palatal glide has been attested following obstruents such as /p, t, k, s/ and /s/. Besides, such a consonant-palatal glide sequence is observed in sonorants /l/ and /n/ word medially, though solely in a single lexeme each (*alselja* 'local beer' and *betanja* 'blanket'). In all cases, the following vowel that appears next to the glide is /a/. The following table illustrates obstruent- palatal glide sequence.

(34) palatalized C.	Lexeme	Gloss	palatalized C.	Lexeme	Gloss
pj	pjanza	'shin' 'thigh'	k'j	k'japa	'narrow' 'kid'
tj	tjaɛa	'female;woman'	s'j	s'jata	'sorghum'
kj	kikjata		sj	sjana	

In sum, the labialized and palatalized phonemes can be classified in their manner of articulation. These are labialized stops /p^w, t^w, k^w, b^w/ and /d^w/, labialized ejective /p^w, t^w/ and /k^w/, and labialized fricatives /s^w and ɸ^w/; and, palatalized stops, ejectives and fricatives.

8. MORPHOPHONEMIC PROCESSES

8.1. Insertion

In Gwama, a sequence of two consonants initially and a cluster of three consonants medially and finally is not permissible. Hence, when such sequences appear in lexemes as well as in morpheme boundaries, either /i/ or /ə/ is added. Zelealem (2005) has also written that one of the epenthetic vowels that keep the system of permissible consonant cluster is /ə/. This vowel (as can be seen below) has been inserted as epenthetic if the following syllable consists a back vowel.

The other identified epenthetic vowel is /i/. It is a frequently used vowel while disallowed sequences of consonants appear in speech. Though there are exceptional cases, it is more frequent with surrounding syllables that consist in front vowels.

(35)	Lexeme	Gloss	Lexeme	Gloss
	kiwiss	'(to) stand'	kəwfunu	'evening'
	minɪɟfa	'food'	təsugun	'night'
	ɟɪnk'i	'drug'	təb	'(to) follow'
	ɟɪnɟ	'(to) rest'	mənmaza	'become (to be) tired'
	gɪɾɟ	'cents'	s'əbala	'fig tree'
	sɛ:s kin	'one'	əɟgər	'bed'
	bɪlɛ	'like/seem'	sulɡandəɡugut	'shorts'
	ɟɪsnajas	'root'	ɡunzəɡuns	'tiger'

At morpheme boundaries, deletion of final vowel of the preceding morpheme is a common feature in Gwama. Nouns formed in this normal process may come up with a cluster of three consonants medially, which the system does not permit. Hence, there comes an epenthetic vowel. A classic example is given above, and it could be good to show the formation process bit by bit.

(36)	Lexeme	Gloss	Surface	Gloss
	sulɡanda + gut	'trouser + short'	sulɡandəɡugut	'shorts'

To sum, epenthetic vowels that are recorded in the current data are high central unrounded /i/ and lax mid central /ə/. The former usually goes with front vowels, and the later is observed with back vowels.

8.2. Deletion

The other common phenomenon of the Gwama morphophonemic process is deletion of vowels as well as consonants at morpheme boundaries. The causes of this process in vowels emanates from the impermissible sequence of vowels other than length. Look at instances below.

(37)	Lexical pwàkámà-a-ná sister-GEN.-1SNG.POSS. 'my sister'	Surface p'wàkám-à-ná
	swì-gàrá-apaŋ house + school + no 'There is no school.'	swì-gàrá-àpáŋ
	ʃò:ʃò-ó:jó bag-cloth 'bag made of cloth'	ʃóʃ-ójó
	kóŋò- ú:p chair-head 'pillow'	kóŋ-up

Notice the last two examples above; as discussed earlier; following deletion of vowel another phenomenon has come up. That is, casting vowel length out (see also Vowel Harmony section). Again, something weird process is observed in the word *áj-mj-áj* 'we know'. It is composed of two lexemes. Here, the deletion appears in the last vowel phoneme of the first lexeme *ájá* 'know' and in the reduplicated one. The /i/ in *mì* 'we' becomes a glide /j/ because the system does not allow a cluster of two vowels.

8.3. Vowel change

As stated in the previous sections, whenever a sequence of vowel like /ua/ and /ui/ appears in a word the preceding vowel is changed to a glide (see also Zelealem, 2005). At morpheme boundaries, change of such vowels is observed as illustrated below¹⁰.

(38)	Lexical t'wá+ t'wá swí+ átá	Gloss mouth + RED house + medicine	Surface t'ùt'wá sùjàtá	Gloss 'Talk!' 'clinic; hospital'
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8.4. Assimilation

In Gwama, consonant phoneme assimilation is observed at morpheme boundary. For instance,

(38)	Lexical	Gloss	Surface	Gloss
	sít + dó:zó	person + (to) teach	siddó:zó	'student'
	tát + swì	stomach + house	tásswì	'floor'
	mən + k úndù	PST + finish	məŋk'úndù	'finished'
	s'éwán + bés'in	month + four	s'éwám-bés'in	'December'

¹⁰ This particularly occurs while words are formed via reduplication or by joining two nouns together.

As can be seen above, two lexemes forming a noun reveal an assimilation of the beginning consonant of the second lexeme. If a voiceless alveolar is followed by a voiced alveolar or a sonorant, the voiceless alveolar becomes assimilated; a bilabial nasal becomes a velar nasal while the following phoneme is velar; and an alveolar nasal becomes a bilabial nasal if the starting phoneme of the following lexeme is a bilabial one.

9. CONCLUSION

This paper has presented a description of the phonological system of Gwama, least studied Nilo-Saharan language. The phoneme inventory included 23 consonants and 5 vowels along with their long counterparts. Three levels of contrastive tone have been presented. The tone system however needs further thorough investigation that reveals tone predictability. The vowel harmony system has been described from three angles: backness in tri-syllabic nouns, frontness and backness of the negative prefix /da-/ and shortening of long vowels. Finally, the phonological processes (insertion/epenthesis, deletion, vowel change and assimilation) indicate that consonant cluster of two is permissible only at medial and final environments. A cluster of two initially and three medially or finally make the epenthetic vowel /i/ or /ə/ to be inserted. Likewise, two consecutive vowels are not permitted to appear in all environments. As a result, successive occurrence of /ua/ and /ui/ becomes /wa/ and /wi/, respectively; and, the cluster of /ia/ has been examined as /ja/.

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