A Phonology of Ganza (Gwàmì Nánà)

Joshua Smolders
SIL International

Ganza is a previously undescribed Omotic language of the Mao subgroup, and is the only Omotic language found primarily outside of Ethiopia. This paper presents the results of nearly a year of phonological fieldwork on Ganza in the form of a descriptive phonology. Included are presentations of the consonant and vowel phonemes, syllable structure and phonotactics, notable morphophonemic processes, and an overview of the tone system. Some interesting features of the phonology highlighted in this paper include the existence of a nasalizing glottal stop phoneme, lack of phonemic vowel length, a lexically determined vocalic alternation between ja~e, and the existence of "construct melodies" in the tone system. Given that both Omotic languages in general and especially the Mao subfamily are understudied, this paper provides much-needed data and analysis for the furtherance of Omotic linguistics.

1. Introduction

In spite of over forty years of research in Omotic languages and numerous calls for descriptive papers and reference grammars (Hayward 2009:85) to date not a single descriptive paper has ever been published on the Ganza language. Over the past decade many other previously under-described Omotic languages have been covered, such as Dizin (Beachy 2005), Dime (Mulugeta 2008), Sheko (Hellenthal 2010), and Bambassi Mao (Ahland 2012). Several others were known to be in process during the composition of this paper, including Ganza's closest relations Hoozo (Getachew 2015) and Sezo (Girma 2015). Ganza, nevertheless, remains functionally undescribed (see §1.2 for previous research).

In this paper I present an initial phonology of Ganza, including a description and analysis of consonant and vowel phonemes, word structure, notable morphophonemic processes, and the tone system. The paper is structured as follows: In the remainder of this introduction I detail the methods, persons, and organizations involved in this research (§1.1-§1.2), then discuss the small body of previous research (§1.3), the genetic classification of the language (§1.4), and the most current sociolinguistic, geographic, and demographic information available. In §2 I give a description of and evidence for the consonant phonemes (§2.1-§2.5) and then discuss the status of consonant length (§2.6). Likewise for the vowels I describe the phonemes (§3.1) and discuss a certain case of vocalic free variation (§3.2), the status of length (§3.3), diphthongs (§3.4), and the limited attestation of vowel assimilation (§3.5). Next I describe the shape of the word in terms of syllable structure (§4.1) and phonotactics (§4.2). In §5 I highlight two morphophonemic phenomena of particular interest, namely the stem allomorphy of a subset of nouns and verbs via final-vowel elision and vocalic alternation (§5.1), and the interaction of final-vowel elision, voice and manner assimilation, and final devoicing in suffixes and clitics (§5.2). Finally, I briefly cover the tonal system, describing the phonemic tone levels (§6.1), prominent tonal phenomena (§6.2), and the basic tone melodies attested on nouns (§6.3) and verbs (§6.4). Abbreviations and references are given after the conclusion in (§7).

1.1 Data Collection Details

All language data used for this paper was collected in Ethiopia by myself between June 2014 and June 2015. Most of the data was collected during four two-week sessions in Addis Ababa and one two-week session in Assosa, the rest being collected on a two-day trip to the Ganza villages in the Yabeldigis and Penshuba municipal districts.[1]

My primary language informants were Abdurman Bitu and Mengistu Abdulahi, two mother-tongue Ganza speakers from the municipal dstrict of Yabeldigis. Both men are also able to speak Gwama [kmq], some Oromo [orm], and limited Amharic [amh]. The initial language session was conducted with a translator who spoke with the Ganza in Gwama and with myself in Amharic and English. After this it was determined that the informants' Amharic and my growing capacity in Ganza would be sufficient for the remaining sessions. Other speakers whom I consulted infrequently included Siwar Bitu, Aya Buna, Hawa Yelke, and Simbara Biya, all from Yabeldigis, as well as Pidan and Dergu (father names unknown) from Penshuba.

All recordings were made using a USBpre microphone and processed with Audacity software and feature the voice of Abdurman Bitu.[2] All acoustic analyzes were done with SIL Speech Analyzer software.

1.2 Acknowledgements

This research was made possible by partnership with the Canada Institute of Linguistics, Addis Ababa University, and SIL Ethiopia, to whom I give my deepest thanks. I would like to thank the paper reviewers, whose comments and corrections helped significantly improve this paper, and my colleagues in the SIL Ethiopia linguistics department for their continuous feedback on my analysis. I would like to acknowledge my colleagues at SIL Ethiopia who assisted with the administrative aspects of the aforementioned research sessions, and Ramadan Haaron, a native Gwama speaker from Tongo who assisted as an interpreter for the first session. I also thank the Benishangul-Gumuz Regional State Ministry of Culture and Tourism and the officials in the Mao-Komo Special *woreda* (administrative district) for their co-opration during my visit to the Ganza villages. Finally I would like to thank my primary Ganza informants, Abdurman Bitu and Mangistu Abdulahi, for their patience, hard work, and amiability throughout the duration of the project, and the rest of the Ganza speakers involved for their cheerful participation.

1.3 Previous Research

In a 2007 survey proposal written by SIL Ethiopia, previous research on Ganza is described as almost entirely "coincidental to studies of other languages" (Magnusson *et al* 2007:1). This absence of original research presents a unique opportunity for documentation and analysis, which is the ambition of this paper. To my knowledge, the following is an exhaustive account of the published and unpublished works produced on the language:

A discussion of the classification and distribution of the Mao and Komo languages, including Ganza, was published recently by Küspert (2015). Prior to this a sociolinguistic survey of the Ganza, Komo, and "Baruun be Magtole" was conducted by SIL which included a wordlist of approximately two-hundred tokens (Krell 2011). Several other wordlists also exist, including an unpublished wordlist of around one hundred tokens and a short phonological and morphological description by Reidhead (1947), a wordlist of fifty tokens by James (1965), and an unpublished and unanalyzed African Comparative Word List of approximately seventeen-hundred words collected by David Ford (2013) from SIL Ethiopia (which I used with permission as a

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[1] The majority of the research sessions were held in Addis Ababa due to administrative and financial considerations.
[2] All recordings were made with a sampling rate of 48kHz, 16-bit format.

springboard for elicitation of my own data). An older work done by Burns in 1950 (as cited in Magnusson *et al* 2007) contained a language map which included the Ganza. Ganza is also mentioned in several broader works on Omotic language (see Hayward 2003 and Bender 2003). Finally, and perhaps most surprisingly, in the course of my research I encountered an unpublished manuscript entitled *A Ganza Language Learning Manual* by Loriann Hofmeister, a former SIM worker in Sudan (2010).[3] Though not a technical linguistic manuscript, this document contained some important glimpses into the syntax and morphology of the language as well as providing some basic vocabulary and a few texts. In addition, after contacting Hofmeister, I was able to obtain several other unpublished documents including demographic reports (2009), an excel sheet dictionary of approximately five-hundred items (also used as a basis for elicitation of my own data), and several other texts and recordings. From my research it appears that there are several dialectcal differences between the Reidhead and Hofmeister varieties of Ganza and that of my informants from Ethiopia.

1.4 Genetic Classification

Ganza (ISO 639-3 [gza]) is a Mao language of the Omotic family found in western Ethiopia and south-eastern Sudan (not to be confused with eastern South Sudan). According to the Ethnologue, its full classification is *Afro-Asiatic, Omotic, North, Mao, West, Ganza* (Lewis 2014), though I suspect along with Bender (2000:180) and Ahland (personal communication) that further inquiry will result in its reclassifiction as a sister language of Bambassi. The remainder of this section is a summary of the history of the Omotic family and Mao sub-family.

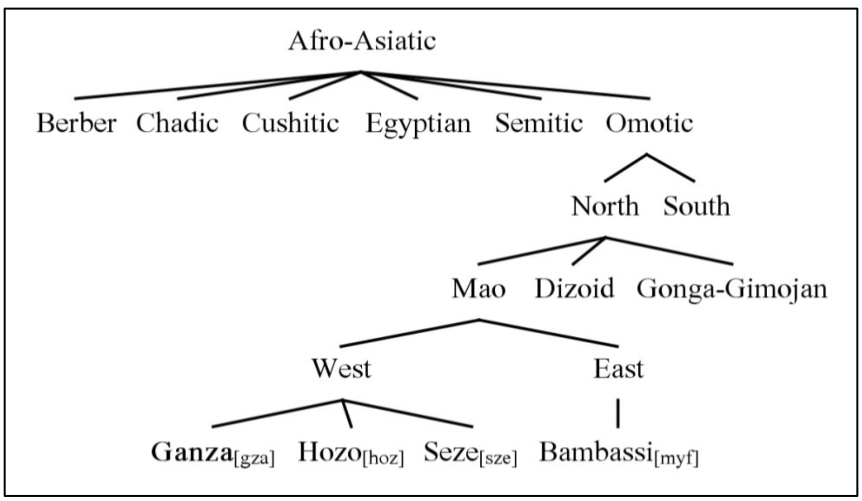

Figure 1 – Mao classification, adapted from Lewis (2014).

Omotic has been described as the "weakest" or "most divergent" language family of the Afro-Asiatic phylum (Fleming 1976:299) and for the past fifty years it has also remained one of the most under-studied (Bender 2000:1). Originally called "West Cushitic" and classified as a branch of Cushitic, Fleming (1969, 1974) proposed that it be reorganized as a primary branch of Afro-Asiatic called "Omotic", a name chosen in reference to the Omo river valley (Bender

[3] Special thanks to Dr. Michael Ahland for pointing me to this resource.

1975:39).[4] More recently scholars such as Thiel (2006, 2012) have questioned whether Omotic can even rightly be classified as Afro-Asiatic, maintaining that to date "no convincing arguments have been presented in favour of this *Afroasiatic Affiliation Hypothesis*" (2012:369).

Within Omotic the Mao sub-family (Bender's O8) is the most "data deficient" (Bender 2000:179, 221) and "undocumented" (Bender 2003:266) of all the sub-families, thus making its classification within Omotic problematic. In Figure 1, Mao is shown under "North Omotic" parallel to the Dizoid and Gonga-Gimojan sub-families in accordance with the Ethnologue's classification (Lewis 2014). In both Bender (2003:1) and Hayward (2003:242), however, it is proposed as a primary branch of Omotic (see Figure 2 and Figure 3 below). It is not my intention in this paper to support any particular one of these classifications, only to address the lack of documentation which causes difficulty in classification.

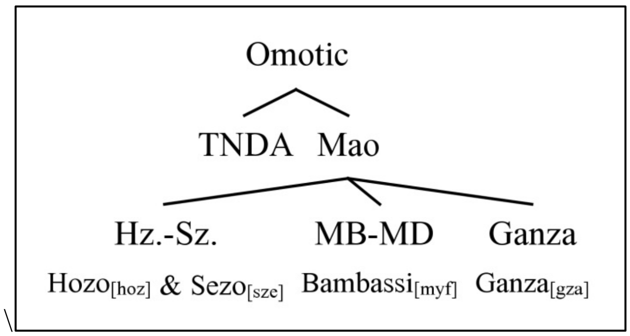

Figure 2 - Mao classification, adapted from Bender (2003:1).

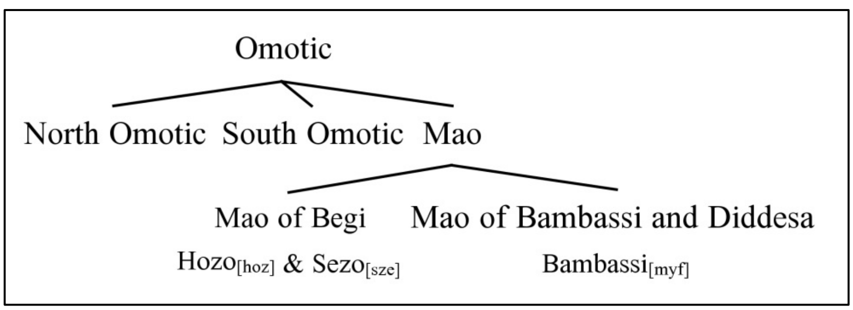

Figure 3 - Mao classification, adapted from Hayward (2003:242). Ganza is not mentioned in this work.

The name "Mao" bears some historical baggage. Originally it was used to refer to the language now known as Anfillo [myo], then classified as a Koman language of the Nilo-Saharan phylum but now determined to be an Omotic language of the Kefoid sub-group (Bender 2000:179). The name is now most commonly used in reference to the sub-group of Omotic containing Hoozo, Sezo, Bambassi, and Ganza, as in Hayward and Bender above. This seems to be an appropriate usage given that in Sezo *mawa* means 'peoples' (Bender 2000:179), in Hoozo *móó* means 'person' (Getachew 2015:2), and in Bambassi *màw* is used as an unparsable autonym for all four languages of the group— namely Bambassi /màw-és ꜜaːts’-è/ 'Mao language', Hoozo and Sezo /bègí màw-és aːts’-è/ 'Mao language of Begi', and Ganza /sówès màw-es aːts’-è/ 'Mao

[4] Interestingly, though the Ganza are the Omotic group farthest removed from the Omo river, their word for 'river' is [wáꜜmá] or [ʔóꜜmá], a possible cognate of and perhaps a clue as to the origin of the name "Omo".

Language of Sowes' (Ahland 2012:7). While I have not found a definite cognate of *mawa* or *màw* in Ganza, there is an unparsable element meaning something like 'person' found in the words /màlá↓/ 'toddler', /màmà↑/ 'child', /màlí↓/ 'son', and /màkí↓/ 'daughter'.[5]

1.5 Sociolinguistic, Geographic, and Demographic Background

The Ganza are a small yet linguistically viable language group. This is to say that the language is being transmitted to the next generation and the people are generally proud of their linguistic and cultural heritage (Krell 2011:14). The Ethnologue lists their endangerment level as "6a", meaning the language is used vigorously in all generations but remains unstandardized (Lewis 2014). The Ganza's autonym is /gwàmì↑/ and they call their language /gwàmì↑ nánà/ meaning 'mouth of the Gwami'. According to the people themselves the term "Ganza" is a name given to them by Arabic speakers of Sudan (Krell 2011:10).[6] Although the Ganza live in an Oromo speaking area of Ethiopia and are adjacent to the Berta, Gwama, Komo, and Uduk language groups (see Figure 4 below), most Ganza consider themselves to be functionally monolingual (Krell 2011:13). According to my experience and that of Hofmeister (2009) this holds true, with only a select number of Ganza speakers utilizing a trade language such as Gwama, Sudanese Arabic, Uduk, Komo, Afan Oromo, or very rarely Amharic.

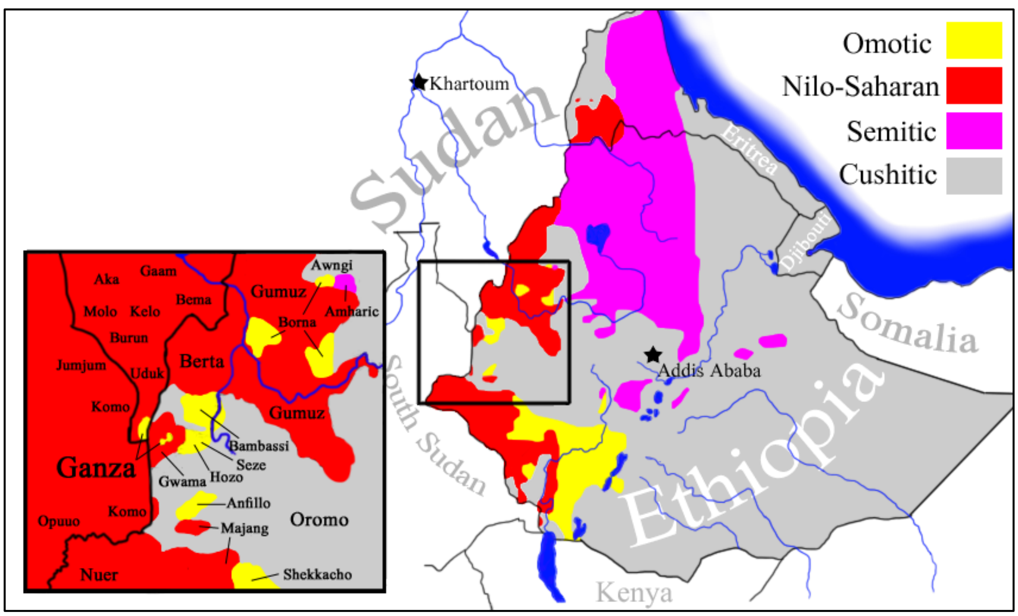

Figure 4 – The geo-political and linguistic environment of the Ganza.[7]

The Ganza are presently a cross-border group, dwelling in both the Blue Nile region of Sudan (Kurmuk District, between the Yabus and Daga rivers) and in the extreme western parts of the Benishangul-Gumuz region of Ethiopia. They are the only Omotic language whose primary

[5] Evidence that these words are indeed old compounds can be seen in the behaviour of their tonal melodies.

[6] In this paper I have chosen to use continue using the exonym "Ganza" in order to avoid confusion with other language groups of the region such as the Uduk [udu], who also use the autonym "Gwami" (Krell 2011:10), and the similar-sounding Gwama [kwq].

[7] This map was produced by myself from a synthesis of the information available via the Ethnologue (Lewis 2014) and my own findings regarding the whereabouts of the Ganza. It contains no copyrighted material.

population is found outside of Ethiopia. On the Sudan side, they inhabit the villages of Damo (Dahmoh), Gondollo, Cape, Hilla Jadid, Bogida, Dash, Bulu Bulu, Belatuma (not to be confused with the Uduk village of the same name), Labatz, Musa Ollo, Lakai, Gwasha, Papan, Duga Belle (or Tugubele), Tukul Ha'a, Mushura, Darsuma (Darsoma), Namu, Hilla Ful, and Boto Ka'a (Hofmeister 2009). In addition to these Krell reports two villages by the names of Korbum and Yeshkab (Krell 2011:10). On the Ethiopian side they are reported to live in Yamasala (Krell 2011:10) but when I visited the Mao-Komo Special *woreda* the Ganza there reported that in Ethiopia they are only found in Yabeldigis and Penshuba.[8]

Although the precise population of the Ganza is still unknown, it seems that they are much more numerous than previously thought. Recent estimates based on linguistic surveys have ranged between three-thousand (Krell 2011) and five-thousand four-hundred (Jordan *et al* 2004), with around four-hundred of these living on the Ethiopia side and the balance in Sudan. These numbers are a far cry from previous estimates of "150-170 strong men" and "nearly extinct" (Bender 2000:179). This range is confirmed by a synthesis of Krell's, Hofmeister's, and my own data. Krell reported that in the village of Doma alone there were approximately five-hundred twenty-two people (Krell 2011:11). However, Krell only seemed to be aware of five Sudanese villages and one Ethiopian. Hofmeister, on the other hand, has verbal reports from Ganza speakers in Sudan who compared twenty other villages to the village of Gondollo (Hofmeister 2009). Neither Hofmeister nor Krell mention the two villages where my informants live, Penshuba and Yabeldigis, which from my investigation have populations of sixty to one-hundred twenty and two-hundred to three-hundred respectively. Thus, by my calculation in Figure 5 below, the Ganza have a minimum population of two-thousand six-hundred ten and are potentially as numerous as five-thousand two-hundred twenty. The total Ethiopian population, however, remains very small at only two-hundred sixy to four-hundred twenty people.

	Villages	Relative Size Reported to Hofmeister	Estimated population per village	# of Villages	Total
Sudanese Population	Damo	> Gondollo	500+	1	500
	Gondollo, Cape, Hilla Jadid	= Gondollo	300~400	3	900~1,200
	Bogida, Dash, Bulu Bulu, Belatuma, Labatz, Musa Ollo, Lakai,	< Gondollo "few"	50~100	7	350~700
	Gwasha, Papan, Duga Belle, Tukul Ha'a, Mushura, Darsuma, Namu, Hilla Ful, Boto Ka'a, Korbum, Yeshkab,	*unknown*	50~200	12	600~2,400
Ethiopian Population	Yabeldigis	-	200~300	1	200~300
	Penshuba	-	60~120	1	60~120
				Total estimated population of Sudan and Ethiopia:	2,610~5,220

Figure 5 – Estimated population of the Ganza based on synthesised data from Hofmeister (2009), Krell (2011), and my own data.

[8] The GPS coordinates for Yabeldigis are (9.555039, 34.413569) and for Penshuba are (9.545867, 34.335819).

2. Consonants

In this section of the paper I present lexical, acoustic, and morphophonemic evidence for the consonant phonemes of Ganza and their allophones. Note that all phonemic data is demarcated by /slashes/, whether in the paper body or examples, but that phonetic data is demarcated by [brackets] in the body only. Thus the non-demarcated data in the examples should be understood as phonetic. Figures follow these same conventions unless indicated otherwise (as with the phoneme charts found in Figure 6 and Figure 17).

Ganza has an inventory of twenty-three phonemic consonants, and like many Omotic languages it maintains a three way contrast in its oral stops and sibilants between voiceless, ejective, and voiced features. It also follows the areal pattern of many Omotic and Nilo-Saharan languages of southern Ethiopia in that, while having a modest set of four ejectives, no pharyngeals or uvular stops are found (Fleming 1976:307). Figure 6 below is a chart of these phonemic consonants, excluding allophones.

		BILABIAL	ALVEOLAR	PALATO-ALVEOLAR	PALATAL	VELAR	GLOTTAL
STOPS	VOICELESS	p	t			k	
	EJECTIVE	p’	t’	[9]		k’	
	VOICED	b	d			g	ʔ
	NASAL	m	n			ŋ	ʔ̃
FRICATIVES	VOICELESS		s	ʃ			h
	EJECTIVE		s’				
	VOICED		z				
LIQUIDS	LATERAL		l				
	TRILL		r				
SEMIVOWEL		w			j		

Figure 6 – Ganza consonant phoneme inventory.

[9] Hofmeister (2010) notes the existence of a phoneme "ch" (IPA [tʃ]) with both "aspirated" and "unaspirated" varieties. In her dictionary, all attestations of "ch" are found in the consonant cluster "chy". In my data, cognates are consistently produced with the sequence /k’j/, such as Hofmeister's /chyo/ 'body' which my informants gave as /k’jóò/.

2.1 Oral Stops

In (1) I give evidence for a three way voiceless-ejective-voiced phonemic contrast in the labial stops.

(1)

	Word-initial		*Word-medial*		*Word-final*	
/p/	**pʰ**ùbá	'disease'	ʔá**pʰ**à	'uncle'	sé**pʰ**	'roof'
/p’/	**p’**ùkʰì	'red honey'	p’á**b**í ~ p’á̰**b**ḭ	'gathering'	ʃwàʃà**p**	'tarantula'
/b/	**b**ùbá	'male'	ʔá**b**à ~ ʔá**β**à	'sun'	dò**p**	'lion'

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 [pʰ]. Word-medially and finally (and occasionally word-initially) /p/ freely varies between [pʰ~ɸ~f], as illustrated in (2). As C_1 in a consonant cluster, this phonemes is also realized as an unaspirated [p]. This [pʰ~ɸ~f] correspondence is an extremely common feature of both Omotic languages and western Ethiopian languages in general.

(2) *Free variation of [pʰ ~ ɸ ~ f]*

pʰùbá ~ **ɸ**ùbá ~ **f**ùbá	'disease'
ʔá**pʰ**à ~ ʔá**ɸ**à ~ ʔá**f**à	'uncle'
ʔá**pʰ** ~ ʔá**ɸ** ~ ʔá**f**	'eye'

Figure 7 below gives spectrograms of /p/ in each of the three positions, illustrating the strong aspirated release in the initial, and fricativization in the medial and final evidenced by spectrally diffuse aperiodic energy.

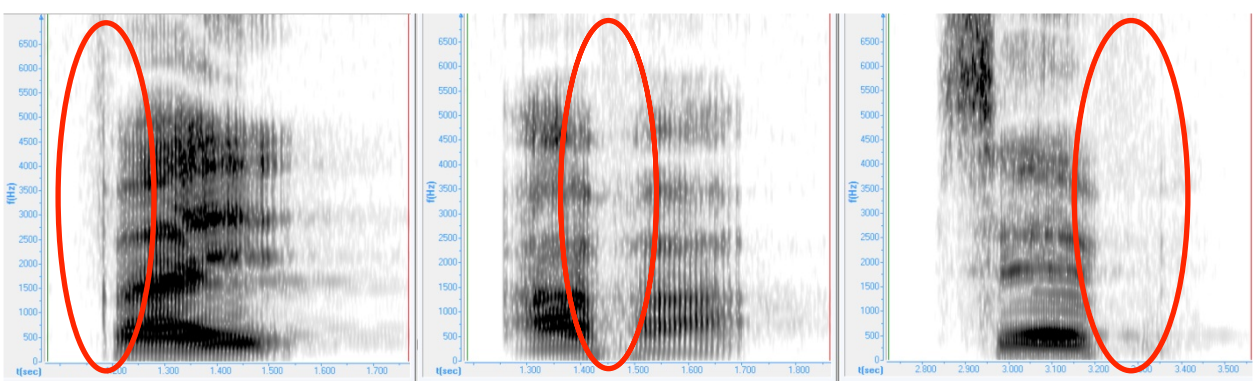

Figure 7 - Spectrograms for [**pʰ**áꜜí] 'heavy', [ʔá**ɸ**à] 'uncle', and [sé**ɸ**] 'roof' respectively.

The ejective and voiced labial phonemes are harder to distinguish from each other, especially in non-initial positions where contrast is nearly neutralized. This is true in general of the ejective-voiced contrast in Ganza, but the labial stops are the most difficult to distinguish.[10] In the word-initial position the contrast is easily perceptible, with the /b/ phoneme having substantial prevoicing and the /p'/ phoneme having none.[11] /p'/ in the initial position often does not have a strong ejective release, however, being realized instead as a voiceless unaspirated [p] followed by a creaky quality on the vowel.

Word-medially, both the /b/ and /p'/ phonemes are realized with voicing. While my informants sometimes produced /p'/ with a very slight implosive quality [ɓ], it was not obvious or consistent enough to rely on as a contrastive feature. Thus, the only substantial perceptive cues to distinguish the two phonemes in this position are the presence of very slight fricativization of /b/ and creakiness on the vowel following /p'/. In all other respects they are identical. In word-final position the ejective /p'/ and the voiced /b/ are both realized as the voiceless unreleased stop [p], which coincides with a wider pattern of final devoicing and deglottalization in the language. The underlying voiced or voiceless feature of these consonants is revealed when the nominal marker /-di/ is applied.[12] Here the final consonant of the noun root becomes the C_1 of a consonant cluster, as in (3). Since /b/ is underlyingly voiced the initial consonant of the /-di/ suffix remains voiced. However, since /p'/ is underlyingly voiceless the initial consonant of the /-di/ suffix assimilates, resulting in the consonant cluster [pt] (see also §5.2).

(3)	*Word-final devoicing / deglottalization*		*C_1 in a consonant cluster (noun + /-di/)*	
/b/	dô**p**	'lion'	dó**bd**ì	'the/a lion'
/p'/	ʃwàʃà**p**	'tarantula'	ʃwàʃà**pt**í	'the/a tarantula'

Figure 8 below gives spectrograms of /b/ in each of the three positions, illustrating the substantial prevoicing in the initial, voicing in the medial, and devoicing in the final. Compare them with Figure 9 which gives spectrograms of /p'/ in the same positions, showing a clear lack of prevoicing or aspiration in the initial, voicing in the medial, and deglottalization in the final. The presence of creaky quality in the vowels is not visible on these spectrograms.

[10] This is possibly an areal feature of the languages found at the convergence of Ethiopia, Sudan, and South Sudan, as difficulty in distinguishing non-initial ejective and voiced stops is also attested in the neighbouring Nilo-Saharan language of Gwama (Justin Goldberg & Anne-Christie Hellenthal, personal communication).

[11] According to my measurement of three iterations of ten tokens, the initial /b/ has an average voicing onset time (VOT) of 0.086ms.

[12] While at first glance these morphemes (i.e. /-di/ NM, /-gi/ NM.F, and /-gu/ NM.PL) might appear to be definite markers, I have elected to gloss them as "nominal markers". This term is vague enough to account for their varied behaviour, but it will likely have to be revised after more research. The nominal markers can be used with nouns in isolation (e.g. /gáŋá-**di**/ 'a/the donkey') and to indicate plurality (e.g. /gáŋá-**gu**/ 'some/the donkeys'). They are obligatory in demonstative phrases and must agree with gender/number (e.g. /ʔìgí nákà gàŋà-**gi**/ 'that (F) big donkey'). They are generally required in simple predicates of existence (e.g. /gáŋá-**di**=bo/ 'it is a donkey'). They are used to nominalize verb stems (e.g. /kwáꜜá-**di**=ga ákúm=bo/ 'to come is good'), and they are required at the end of relative clauses (e.g. / kwàgá p'àp'ì ábà-**di** / 'the day of gathering pumkins'). I have not glossed /-di/ as masculine because it functions as the default (least marked) of the three morphemes and because, unlike the others, it has no phonological correspondance with proniminals (cf. /–gi/ NM.F, /=gi/ 3F.SBJ, and /kííꜜ/ 3F; cf. /-gu/ NM.PL, /=gu/ 3PL.SBJ , and /kúꜜú/ 3PL).

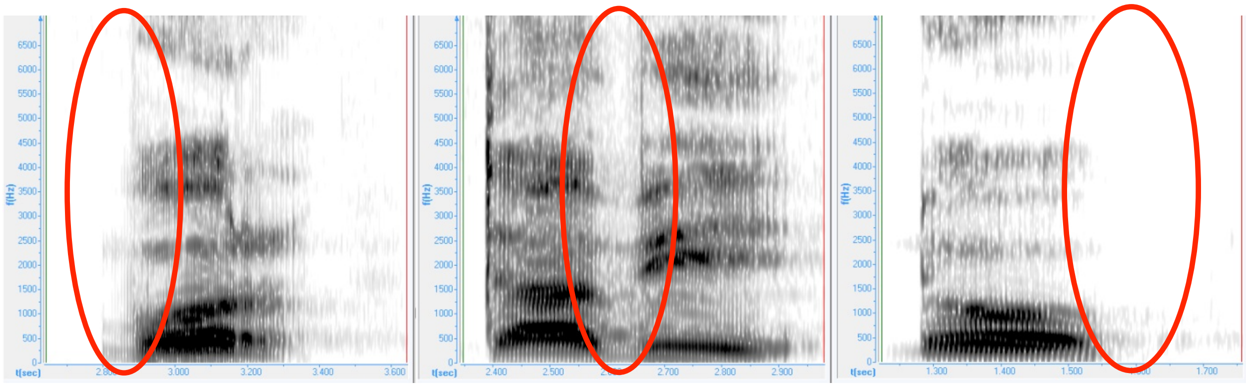

Figure 8 – Spectrograms for [**ɓ**éè] 'yellow billed kite', [ťàβî] 'oil', and [ɗô**p**] 'lion' respectively.

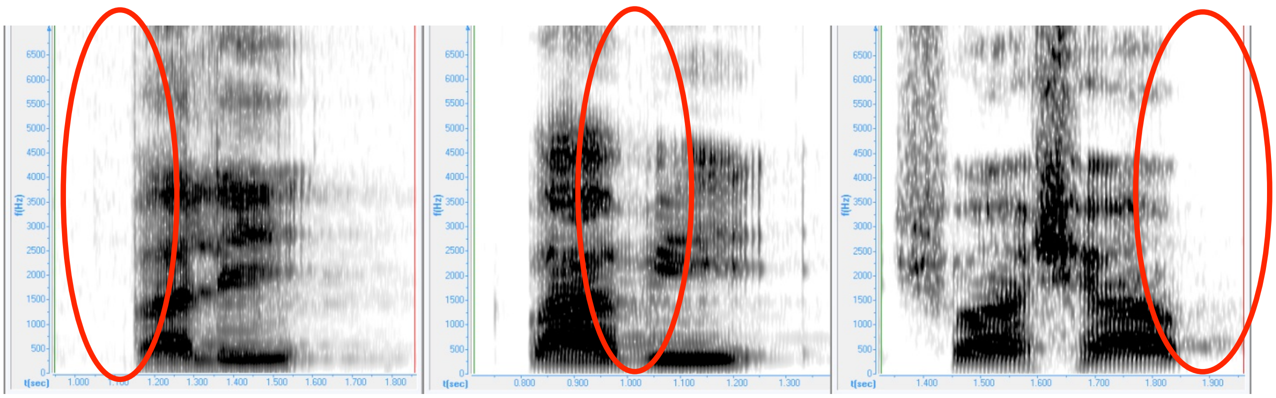

Figure 9 – Spectrograms for [**p’**àlì] 'girl', [p’ą̃**b**į́] 'gathering', and [ʃwàʃà**p**] 'tarantula' respectively.

The alveolar oral stops behave much like the labial stops, only the contrast between non-initial ejective /t’/ and voiced /d/ is more obvious and there is little if any lenition of the voiceless /t/. In (4) I give evidence for a three way phonemic contrast in the alveolar stops.

(4)	*Word-initial*		*Word-medial*		*Word-final*	
/t/	**tʰ**ókʰó	'foot'	ʔá**tʰ**á	'breast'	bà**t** ~ bà**tːʰ**	'goose'
/t’/	**t’**óɗó	'black'	pʰá**d**à ~ pʰá**ɗ**ą̀	'deer'	ʃê**t**	'buffalo'
/d/	**d**òkʰò	'friend'	kʰúꜜ**d**á ~ kʰúꜜ**ɾ**á	'thatch'	kʰìkʰìmí**t**	'ground hornbill'

The phoneme /t/ is realized with distinct aspiration and a clear lack of voicing in all positions. In the final position it is sometimes realized as an unreleased voiceless stop, making it indistinguishable from /t’/ or /d/, but unlike these a given token will freely vary between the unreleased [t] and a long aspirated [tːʰ]. In Figure 10 below I give spectrograms of this phoneme in the three positions. As can be seen, the characteristic features of the initial and medial realizations are voicelessness and a high energy release, and in the final position a significantly longer consonant with final aspiration.

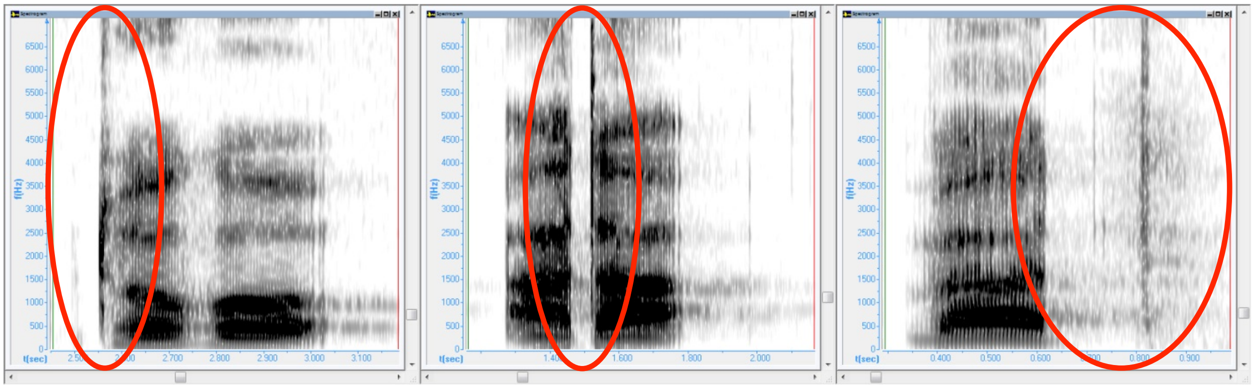

Figure 10 – Spectrograms for [**tʰ**ókʰó] 'foot', [ʔá**tʰ**á] 'breast', and [bà**t:ʰ**] 'duck' respectively.

Like the labial phonemes, in the initial position /t'/ and /d/ are distinct from each other by the presence of prevoicing in the latter.[13] Furthermore, /t'/ is distinguishable from /t/ by the intensity of its release, which shows significantly less aperiodic energy, and also by the creaky quality present on the following vowels. Also like the labials, /t'/ and /d/ are both realized as a voiceless unreleased [t] in the final position, but when placed in a consonant cluster they display different behaviour, as shown with the addition of the nominal marker /-di/ in (5).[14] Notice that adjacent to /t'/ the suffix /-di/ also fully assimilates in manner (see also §2.6 examples (25) and (26), and §5.2 examples (48) and (49)).

(5)	*Word-final devoicing / deglottalization*		*C_1 in a consonant cluster (noun + /-di/)*	
/d/	kʰìkʰìmí**t**	'ground hornbill'	kʰìkʰìmí**ddì**	'the/a ground hornbill'
/t'/	ʃê**t**	'buffalo'	ʃé**tt'**ì	'the/a buffalo'

In the medial position, /d/ and /t'/ both have voicing features. They are distinguished however in that /t'/ is realized like a weak implosive [ɗ] or preglottalized [ˀd], whereas /d/ is rhoticized, often being realized as the alveolar tap [ɾ]. In Figure 11 and Figure 12 I give spectrograms for these two phonemes in the three positions. Notice especially in comparing [pʰá**ɗ**à] and [kʰú**ꜜd**á] that the former shows no sonorant energy except for the voicing visible in the fundamental frequency, whereas the latter shows weak sonorant energy across the spectrum as well as a sharp fall in the fourth formant (F4), a strong characteristic of rhotics.

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13 According to my measurement of three iterations of ten tokens, the initial /d/ has an average VOT of 0.068ms.

14 Further environments can help distinguish /tʰ/, /t/, and /d/ in the final position, such as the addition of the comitative suffix /-in/, in which case the phonemes display their medial characteristics.

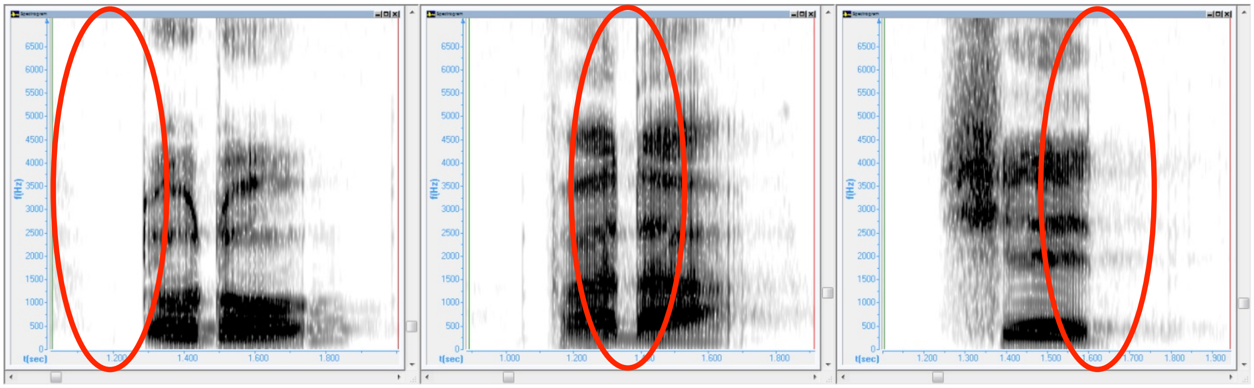

Figure 11 – Spectrograms for [**t’**óɗó] 'black', [pʰá**ɗ**à̰] 'deer', and [ʃê**t**] 'buffalo' respectively.

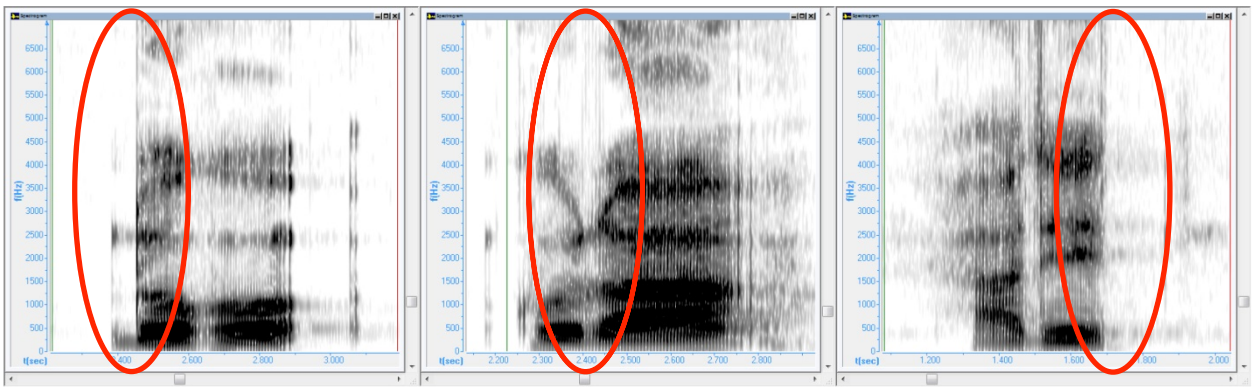

Figure 12 - Spectrograms for [**d**òkʰò] 'friend', [kʰú˖**ɾ**á] 'thatch', and [hà**d**ìt] 'metal' respectively.

Continuing on to velar stops, in (6) I give evidence for a three way phonemic contrast. In (7), I again show the differentiation of word-final /k’/ and /g/ by their differing behaviour in a consonant cluster, where C_2 assimilates the voicing feature of C_1.

(6)		*Word-initial*		*Word-medial*		*Word-final*	
	/k/	**kʰ**àbû	'bird'	kʰá**kʰ**í	'white'	hàwè**kʰ**	'flock'
	/k’/	**k’**ágà	'cheek'	k’á**g**áʃ ~ k’á**ɠ**á̰ʃ	'porcupine'	mà**k**	'fox'
	/g/	**g**áŋá	'donkey'	kwà**g**á	'pumpkin'	ô**k**	'hat'

(7)		*Word-final devoicing / deglottalization*		*C1 in a consonant cluster (noun + /-di/)*	
	/k’/	mà**k**	'fox'	mà**kt**í	'the/a fox'
	/g/	ô**k**	'hat'	ó**gd**ì	'the/a hat'

As expected these phonemes display very similar patterns to the alveolars and labials. There is double release burst of the /k/ phoneme in the initial position, and either strong aspiration or slight fricativization in the medial and final positions. These characteristic can be seen in the spectrograms given in Figure 13. With the /k’/ phoneme there is intervocalic voicing and slight implosiveness, as seen in figure Figure 14, as well as a corresponding creaky quality on a following vowel. Finally with the /g/ phoneme there is significantly more sonorant energy in the upper formants intervocalically and devoicing word-finally, as seen in Figure 15.

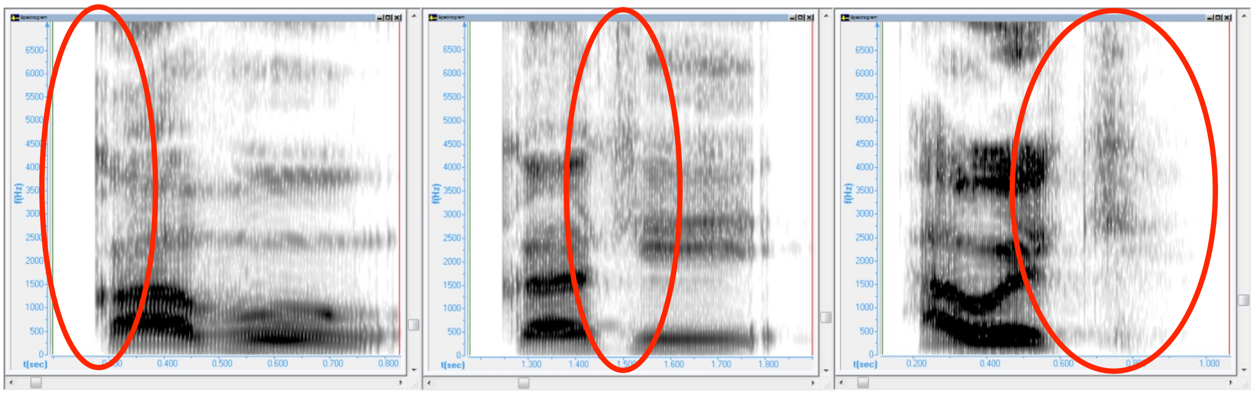

Figure 13 - Spectrograms for [**kʰ**àbû] 'bird', [kʰá**kʰ**í] 'white', and [hàwè**kʰ**] 'flock' respectively.

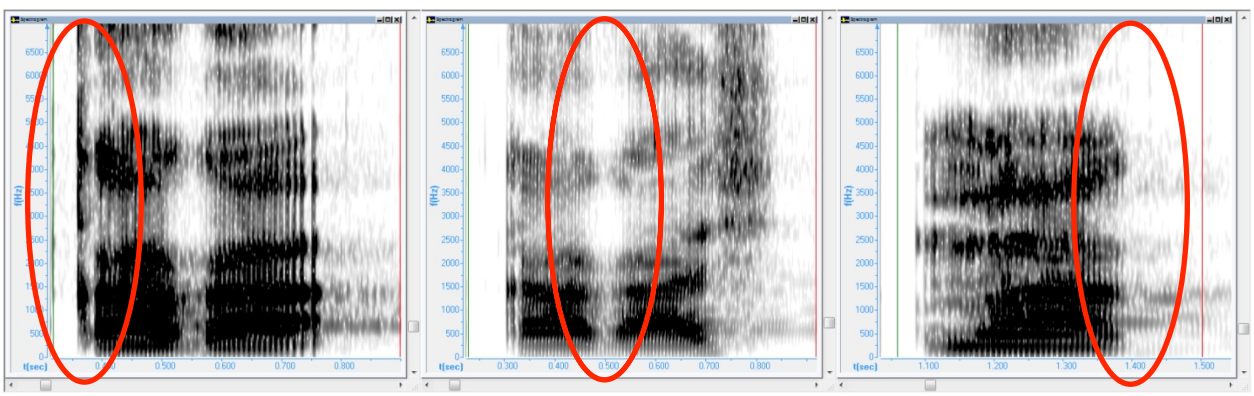

Figure 14 - Spectrograms for [**k’**ágà] 'cheek', [k’á**ɠ**áʃ] 'porcupine', and [mà**k**] 'fox' respectively.

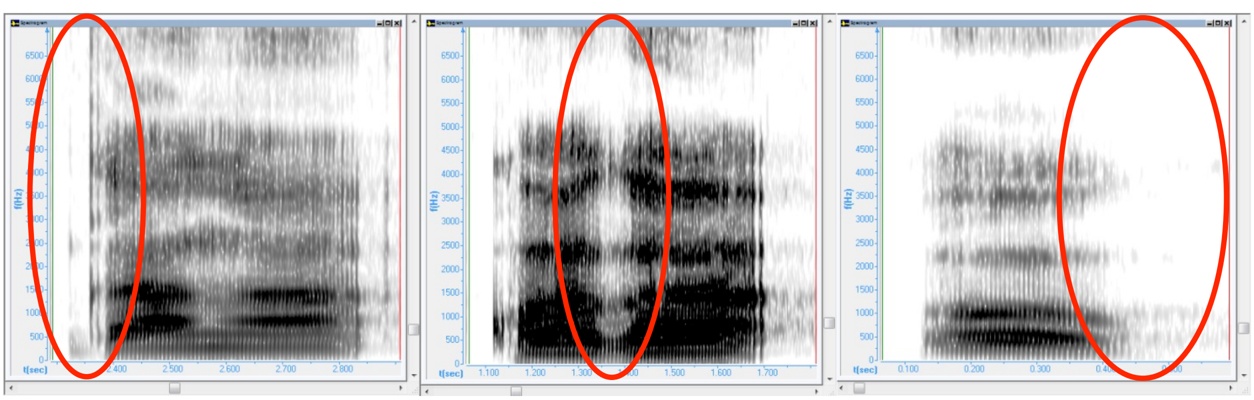

Figure 15 - Spectrograms for [**g**áŋá] 'donkey', [kwà**g**â] 'pumpkin', and [ô**k**] 'hat' respectively.

2.2 Nasal Stops

In Ganza the nasal stop phonemes are fairly straightforward, with corresponding phonemes to each place of articulation attested in the oral stops (including glottal, as will be discussed in §2.5). In (8) I give evidence of a three way contrast among the nasal stops.

(8)		*Word-initial*		*Word-medial*		*Word-final*	
	/m/	**m**àmà	'child'	wá꜌**m**á	'river'	gìrî**m**	'dim'
	/n/	**n**á꜌ná	'word'	kʰá꜌**n**á	'dog'	mìsgìrí**n**	'sand grouse'
	/ŋ/	*unattested*		wà**ŋ**à	'chicken'	k'wàrì**ŋ**	'drawing'

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

Regarding the status of /ŋ/, I argue first that there is systematic justification for defining it as a separate phoneme. In the oral stops there is a three way place of articulation contrast, and it is natural that the nasal stops would match this pattern. While it is true that a lack of this phone in the word-initial position may be a general indication that it has a different phonemic status than the other nasal stops, this distribution pattern is shared by two of Ganza's closest relatives, Bambassi Mao (Ahland 2012) and Sezo (Girma 2015). Second, there is lexical evidence that /ŋ/ as a single consonant contrasts with the NC clusters /ŋk'/ and /ŋg/, as shown in (9). There is therefore little plausibility for suggesting [ŋ] is a coalescence of /n/ plus a velar consonant.[15]

(9) *Evidence of contrast between /ŋ/ - /ŋk'/ - /ŋg/.*

/ŋ/	ʔà**ŋ**à	'sorghum'	sí**ŋ**ô	'cloud'
/ŋk'/	ʔí**ŋ**꜌k'á	'to do'	k'á**ŋk'**ó	´'spoon'
/ŋg/	ʔì**ŋ**gì	'this (feminine)'	sá**ŋg**ô	'stringed instrument'

Regarding the status of the cluster /nj/, the same arguments apply to the opposite effect. First, there is no systematic justification for a palatal nasal /ɲ/ given a complete lack of non-sonorant palatal consonants (excepting the palato-alveolar /ʃ/, which will be discussed in §2.3). Second, /nj/ has extremely limited distribution and frequency, being attested in only three of the over one-thousand items in my data corpus. These are given in (10). Further, two of these three words are likely onomatopoeic forms, representing a bird call and a cat cry.

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[15] It is perhaps diachronically true that /ŋk/ coalesced to /ŋ/ given that the cluster [ŋk] is unattested. However, intervocallically /ŋ/ does not appear to have any greater acoustic length than the other nasal phonemes, which might be expected of a historical coalescence. I am thus satisfied with a synchronic explanation where /ŋ/ is a separate phoneme and /ŋk/ and /ŋg/ are neutralized to [ŋg] through voicing assimilation.

(10) *All attested occurrences of /nj/*

ʔíꜜɲjá ~ ʔíꜜɲá	'to refuse' [16,17]
ɲják^{h} ~ ɲák^{h}	'kingfisher (bird)'
ɲjàú ~ ɲàú	'cat'

For cross-linguistic comparison I have included Figure 16 below showing the attestation of the nasal phonemes in Ganza's linguistic neighbours. As can be seen, among the Omotic group /ɲ/ is never attested as a phoneme and /ŋ/ is attested in two of the three other Mao languages, giving strong typological justification for my analysis. Among the non-Omotic groups, both phonemes are attested but /ŋ/ is by far the more common.

	Language	/m/	/n/	/ŋ/	/ɲ/	Source
Omotic	Bambassi Mao [myf]	✓	✓	✓	-	Ahland 2012
Omotic	Hoozo [hzo]	✓	✓	-	-	Getachew 2015
Omotic	Sezo [sze]	✓	✓	✓	-	Girma 2015
Omotic	Borna ("Shinasha") [bwo]	✓	✓	-	-	Joswig 2008
Omotic	Anfillo [myo]	✓	✓	-	-	Debela & Girma 2005
Omotic	Shekkacho ("Moča") [moy]	✓	✓	-	-	Leslau 1959
Non-Omotic	Gwama [kmq]	✓	✓	✓	-[a]	Kievit & Robertson 2012
Non-Omotic	Komo [xom]	✓	✓	✓	-	Teshome 2006
Non-Omotic	Oromo [orm]	✓	✓	-	✓	Mohammed & Zaborski 1990
Non-Omotic	Bertha [wti]	✓	✓	✓	-[b]	Neudorf & Neudorf 2007
Non-Omotic	Gumuz [guk]	✓	✓	✓	✓[c]	Ahland 2004

[a] In Gwama [ɲ] is described as a phoneme by Zelealem (2005) but only as present in one lexical item [ɲa] 'goat'. Like Ganza, this is very likely onomatopoetic (Hellenthal 2005).

[b] In Bertha [ɲ] is analyzed as an allomorph of /ŋ/ before front vowels.

[c] In Gumuz [ɲ] is only a fully realized phoneme /ɲ/ in the Yaso and Sirba Abbay dialects. In all other dialects is analyzed as an allophone of /ŋ/.

Figure 16 – Attestation of nasal stops as fully realized phonemes in languages geographically proximate to Ganza.

2.3 Sibilants

Ganza has four phonemic sibilants. In (11) I give evidence for a four-way contrast among the fricatives between voiceless, voiced, ejective, and palatalized fricatives. The only anomaly in the distribution of these sibilants is the lack of /z/ word-finally.[18]

[16] One of the reviewers of this paper questioned whether this could possibly be onomatpoeic, or ideophonic, with relation to the Ganza interjection for "no!" Given that the interjection is /hàj/, I do not consider this likely.

[17] Throughout this paper I have glossed the reference form of Ganza verbs with the English infinitive for two reasons: first because this verb form in Ganza may be used in similar ways to an infinitive (e.g. as a nominalized verb), and second to disambiguate English glosses (e.g. 'to refuse' (verb) versus 'refuse' (noun)).

[18] The underlying voicing quality of all final consonants for nouns were tested by adding the nominal marker /-di/. No expected *[zzi] or */z+di/ sequence was found in my data corpus.

(11)		*Word-initial*		*Word-medial*		*Word-final*	
	/s/	**s**ásá	'bite'	sá**s**ô	'monkey'	k^{h}í**s**	'purse'
	/z/	**z**ólèŋ	'shrew'	zá**z**ò	'twin'	*not attested*	
	/s'/	**s'**álò	'worm'	s'á**s'**à	'fat (thick)'	k^{h}ù**s'**	'flower'
	/ʃ/	**ʃ**òʃó	'bag'	ʃá**ʃ**î	'rope'	k^{h}í**ʃ**	'forest'

/ʃ/ is likely a historical coalescence of /s/ and /j/ which has now become an independent phoneme. There are two lines of evidence for this. First, in certain lexical items speakers manifest free variation between [s~ʃ] when preceding front vowels, examples of which are given in (12). This suggests that /s/ has a tendency towards palatalization before front vowels.

(12) *Instances of free-variation between [s ~ ʃ]*

nì**s**í~nì**ʃ**í 'how many?'

sísô~**ʃ**ísô 'within'

Second, the presence of an old palatal onglide can be detected in the allomorphic stem of certain words. As will be discussed further in §5.1, in many Ganza words there is an allomorphic correspondence between the sequence /ja/ and the vowel /e/. This correspondence is also true of certain words containing the sequence /ʃa/, suggesting that at one point the phonemic sequence was /ʃja/ or /sja/. Compare the examples given in (13).

(13) *Allomorphic correspondence between /ʃa/ and /ʃe/.*

ʃáŋk'â → **ʃé**ŋk' 'rock' cf. k'**já**bá → k'**é**b 'to hear'

One final comment needs to be made regarding Hayward's observation of "Sibilant Harmony", which claims that in Omotic languages palatal (including palato-alveolar) and non-palatal sibilants do not co-occur in well-formed roots (Hayward 1986). Besides the tendency for /s/ to palatalize as mentioned in (12), this holds true for Ganza. Actually, the generalization can be extended to ejective features as well. Thus while we find that word roots intermingle /s/ and /z/ freely, /s'/ and /ʃ/ do not co-occur with any other sibilant but themselves.

2.4 Liquids and Semivowels

There are four phonemes for liquids and semivowels in Ganza: 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. Also [r] is not attested in the initial position.[19] Thus the clearest contrast is found word-medially, where there are several near-

[19] This is also the case with Bambassi Mao, but whereas in Mao [l] is only attested word-initially in one lexical item (Ahland 2012) in Ganza there are various examples. Many other Omotic languages also lack [r] in the initial position, such as Sheko, Dizin, Bench ("Gimira", see Haywad 1990:1-67), as well as the neighbouring Nilo-Saharan language Gwama.

minimal pairs attested in my data corpus. This evidence for a phonemic contrast between /l/ and /r/ is given in (14).

(14)	*Word-initial*		*Word-medial*		*Word-final*	
/l/	**l**ìŋí	'ditch'	k'ù**l**á	'anus'	gúmbì**l**	'robe'
	láꜜgúlágù	'elder'	mà**l**í	'son'	twáŋꜜgá**l**	'elephant'
/r/	*not attested*		kʰú**r**à	'ball'	gábî**r**	'sheep'
			mà**r**ì	'in-law'	ʔáŋgâ**r**	'bed'

In (15) I give evidence of contrast for the semi-vowels /w/ and /j/. For the present I have analyzed these phonemes as consonants in all positions, including the coda where they could be alternatively be analyzed as the V_2 of a diphthong (see §3.4).

(15)	*Word-initial*		*Word-medial*		*Word-final*	
/j/	**j**éʃô	'rainy season'	wá**j**à	'ear'	pʰâ**j**	'heavy'
/w/	**w**ígì	'snake'	ʔá**w**à	'grinding stone'	hâ**w**	'go'

2.5 Glottal Consonants

A very interesting feature of Ganza's consonant system is found in the glottal consonants. Phonetically speaking there are only two glottal consonants in Ganza, the stop [ʔ] and the fricative [h], which contrast word-initially and to a lesser extent word-medially. However, the word-medial glottal stop can be further subdivided by its behaviour into a plain glottal stop /ʔ/ and a nasal glottal stop /ʔ̃/. This nasal glottal phoneme is identified by the presence of unmotivated (lexical) nasalization on both on the preceding and following vowels.[20] In (16) I give evidence for phonemic contrast between these three glottal phonemes.

(16)	*Word-initial*		*Word-medial*	
/ʔ/	**ʔ**âw	'say'	sá**ʔ**à	'goat'
/ʔ̃/	*not attested*		sã̀**ʔ**ĩ̂	'bead jewelry'
/h/	**h**âw	'go'	sá**h**ánà	'dish'

The glottalic consonants differ significantly in their distribution patterns from the other consonantal phonemes: First, none of the three phonemes appear unambiguously word-finally. The oral stop does appear syllable-finally in allomorphic stems where there is final-vowel elision, such as in /wáꜜʔá/ → [wéʔ] 'run' (see §5.1). It also appears word-finally in one lexical

[20] The association of nasalization with glottal consonants is often referred to as *rhinoglottophilia* and has been observed in several languages such as Lao, Thai, Lahu, Lisu, Gurage, and even certain dialects of English (Matisoff 1975). Ahland writes more extensively about this phenomenon as it occurs in Mesmes, a West Gurage language of Ethiopia (2006). Ganza is a particularly interesting case, however, since the nasal feature is not a predictable (phonetic) process but a rather an unpredictable (lexical) one. That is to say, there are two phonemic glottal stops: one causing rhinoglottophilic nasal spread both rightward and leftward, and the plain oral glottal stop.

item, /lěʔlěʔ/ 'continuously', which appears to some sort of reduplicated form. There are also a few lexical items where I suspect the /ʔ̃/ phoneme occurs syllable finally, for example /màʔ̃t'á꜒/ 'sugar cane' which is phonetically realized as [mã̀ɗẫ] and can be contrasted with non-nasalized /má꜒t'áʃ/ 'bone', phonetically [má꜒ɗǎʃ].

Second, /h/ has an extremely limited medial distribution. It is found in only four lexical items, three of which are likely borrowings and the fourth having an anomalous nasal feature akin to that found on the glottal nasal.[21] /ʔ/ and /ʔ̃/ on the other hand show a significant number of contrasts, as shown in (17).

(17) *Further word-medial attestations of /ʔ/ and /ʔ̃/.*

sáʔà	'goat'	sã̀ʔî̃	'bead jewelry'
háʔī	'death'	hã́ʔã̀	'water'
háʔō	'war'	k'jã̀ʔã́	'egg'
jóʔó	'thing'	nã́ʔĩ̀	'daughter'
kʰáʔà	'house'	mã̀ʔĩ̀	'to rip in two'
nàʔà	'very'	dã̀ʔĩ́	'hammer'
ʔòʔò	'grandmother'	p'ṍʔṍ	'Cheleda baboon'
tʰáʔà	'still (not yet)'	zĩ̀ʔĩ́~zĩ̀ĩ́	'green'
k'wáʔàs'	'kudu (deer)'	sẽ̀ʔẽ́	'to not comply'

Third, the primary contrast between /ʔ/ and /h/ can be found word-initially.[22] Proof for this can be seen when an open-syllable morpheme is placed to the left of the verb stem. In this environment a word with an initial /ʔ/ is realized as an intervocalic [ʔ] whereas an initial /h/ is phonetically deleted, resulting in vowel hiatus. In (18) and (19) I give an example of this using the minimal pair /háw/ 'go' and /ʔáw꜒/ 'say' set in the basic affirmative verb clause , which begins with the affirmative particle /hàꜛ/ plus a subject clitic followed by the verb root and a verbal clitic.[23, 24]

[21] The suspected borrowed words are [sáhánà] 'dish' from Arabic صَحْن [sˤaħn] or Amharic ሳሕን [sahɨn] 'dish', Ganza [jòm àlàhát] 'Sunday' from الأحد [al ʔaħad] 'Sunday', and [báhàn] 'barren' possibly from Amharic መኻን [mɛhan] 'barren'. The anomalous nasalized word is [mã́hĩ̀] 'feline'.

[22] This is also the case in Sezo (Girma, personal communication). For Bambassi Mao, Ahland has analyzed the initial glottal as a predictable epenthetic consonant which satisfies an onset requirement (2009:5). Ganza could also be analyzed this way, but presently I prefer a phonemic analysis.

[23] Finding a good gloss for the morphemes /=bo/ and /=na/ proved to be a difficult task, and thus for the present I have labeled them rather ambiguously as "verbal clitics". Initially I had glossed /=bo/ as "stative" and /=na/ as "existential" to reflect their copula-like behaviour in which they attach directly to a noun to form a statement of identity or quality (e.g /p'jàlá꜒-di=bo/ [p'jàlátpò] 'it is a star'). These glosses did not hold up to scrutiny, however. At this point in fact, other than a few cases where my speakers preferred one of the two morphemes over the other, they seem to function identically: they appear in both positive and negative clauses, factual and hypothetical clauses, non-future and future clauses; they are found in past-perfect and present-continuous clauses; they are disallowed in the imperative, interrogative (both polar and content questions), and jussive moods. Thus more research is needed to determine the meaning of these morphemes.

(18) *Intervocalic deletion of /h/*

/**h**áw/ 'go' → hàgá**áw**bô

/hà˺ = ga háw = bo /

AFF=3M.SBJ go=VC1

'he goes'

(19) *Intervocalic preservation of /ʔ/*

/**ʔ**áw˻/ 'say' → hàgá**ʔáw**bò

/hà˺ = ga ʔáw˻ = bo /

AFF=3M.SBJ say=VC1

'he says'

It could be argued that this pattern actually shows contrast between the glottal fricative phoneme /h/ and an onsetless vowel. The presence of the glottal found in situations such as (19) could then be attributed to glottalic epenthesis rather than preservation. However, if this were the case, I would expect both /háw/ and */áw˻/ to display glottal epenthesis intervocalically, since after the deletion of the [h] the two environments would be identical.

One final thing to mention regarding the glottal consonants is that in two high-frequency lexical items I observed alternation between the oral glottal stop [ʔ] and the voiced velar stop [g]. First, in (20a) the third-person subject clitic /=ga/ freely varies between [ga~ʔa] in connected speech. Second, as in (20b) I observed a pronunciation difference between my two speakers in their word for 'thing', the one using [jóʔó] and the other [jógó].

(20) a. *Free-variation between [g ~ ʔ]*

hà**g**á ná˻kʰábô ~ hà**ʔ**á ná˻kʰábô

/hà˺ = **g**a ná˻ká = bo /

AFF=3M.SBJ big=VC1

'it is big'

b. *Lexical alternation between [g ~ ʔ]*

jó**ʔ**ó ~ jó**g**ó 'thing'

2.6 Consonant Length

Having just described the consonantal phonemic inventory of Ganza it is fitting to discuss the status of consonant length before moving on to vowel phonemes. The presence of phonemic gemination in the consonant system is a well-known feature of the Ethiopian Language Area (Crass & Meyer 2008:231), thus it cannot be ignored in any phonological description of an Ethiopian language. This is especially true when it is claimed to be absent, as I do here.

While long consonants can be found in Ganza, they are not lexical (phonemic). I contend this because long consonants are only ever found at a morpheme boundary intersecting a consonant cluster. In particular, they are found in the following two environments:

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[24] Throughout this paper I have translated this verb frame, as well as its negative counterpart, in the simple present (e.g. "he goes", "he says"). In most cases, however, it is also possible to translate this with the simple past (e.g. "he went", "he said").

a. $C_\alpha\ ]_\mu C_\alpha \rightarrow C{:}_\alpha$ - long consonants are found at the morpheme boundary between a consonant-final lexical stem or suffix and a suffix or enclitic beginning with the same consonant.
b. C_1[+ALVEOLAR, -NASAL] $]_\mu$ C_2[+ALVEOLAR, -NASAL] $\rightarrow C{:}_1$ - long consonants are found at the morpheme boundary between a consonant-final stem ending in an oral alveolar consonant and a suffix or enclitic also beginning with an oral alveolar consonant. In this case the second alveolar consonant in the cluster fully assimilates to the first.

A good example of environment (a) is the morpheme boundary between the negative suffix /-ánꜜ/ and the verbal clitic /=na/ in negative verb constructions. This is an interesting situation because the primary contrastive cue between the negative and positive forms of the verb here could be analyzed as consonant gemination. Examples of this are given in (21), (22), and (23).

(21) ʔàsìtká gàrà**n**à cf. ʔàsìt gàráá**nn**à
/ʔàsìꜛ-di=ga gàrà=**n**a/ /ʔàsìꜛ-di gàrá-á**n**ꜜ=**n**a/
person-NM=3M.SBJ sit.SG=VC2 person-NM sit.SG-NEG=VC2
'the person sits' 'the person does not sit'

(22) hàgá úʃì**n**à cf. ʔúꜜʃíá**nn**à
/hàꜛ=ga úʃì=na/ /ʔúʃì-á**n**ꜜ=na/
AFF=3M.SBJ tie=VC2 tie-NEG=VC2
'he ties' 'he does not tie'

(23) hàgá sàs**n**à cf. sásáá**nn**à
/hàꜛ=ga sàs=na/ /sásá-á**n**ꜜ=na/
AFF=3M.SBJ old=VC2 old-NEG=VC2
'he is old' 'he is not old'

I do not consider consonant length here to be the main cue of negation for several reasons. First, the primary contrastive feature appears to be tonal. Not only does the negative suffix /-ánꜜ/ bear a conspicuous H tone,[25] but the negative mood also causes the verb root to take its *citation tone melody* as opposed to its *construct melody* (which is used with /=na/ in the affirmative). For definitions of *citation* and *construct melodies* see §6. Second, when /-ánꜜ/ is combined with other verbal morphology, such as the imperative suffixes in (24), the primary contrastive cue cannot be consonant length since there is no doubled consonant.

(24) gàráʃ cf. gàrááꜜ**n**éʃ
/gàrá-éʃ/ /gàrá-á**n**ꜜ-**é**ʃ/
sit.SG-IMP.SG sit.SG-NEG-IMP.SG
'sit!' 'don't sit!'

[25] Hofmeister describes this as an "accented syllable" (2010:19).

A good example of environment (b) is found at the morpheme boundary between a noun root which ends in an alveolar or palato-alveolar oral consonant and the nominal marker /-di/. Here the /d/ of the suffix fully assimilates in manner and voicing to the final consonant in the noun root, forming a long consonant. A contextualized example of this is given in (25) followed by examples in (26) with each of the oral alveolar phonemes.

(25)	ʔìntʰì	gábírrì	ʔàgá	nákʰànà
	/ʔìntìꜛ	gábírꜜ-di	hàꜛ=ga	nákà=na/
	DEM.PROX	sheep-NM	AFF=3M.SBJ	big=VC2
	'this sheep, he is big'			

(26)	*Isolation*		*Manner assimilation of /-di/ suffix*	
/r/	gábî**r**	'sheep'	gábí**rr**ì	'the/a sheep'
/l/	jàwǐ**l**	'hyena'	jàwì**ll**í	'the/a hyena'
/t/	hàdì**tʰ**	'metal'	hàdì**ttʰí**	'the/a metal'
/d/	kʰìkʰìmí**t**	'ground hornbill'	kʰìkʰìmí**ddì**	'the/a ground hornbill'
/t'/	ʃê**t**	'buffalo'	ʃé**tt'**ì	'the/a buffalo'
/s/	gàmì**s**	'shirt'	gàmì**ss**í	'the/a shirt'
/ʃ/	k'óꜜŋó**ʃ**	'hunchback'	k'óꜜŋó**ʃʃ**í	'the/a hunchback'
/s'/	gíŋgìlí**s'**	'lovebird'	gíŋgìlí**ss'**í	'the/a lovebird'

Since both these environments are found at morpheme boundaries it is safe to say that Ganza does not utilize consonant length phonemically. This is not to say that the length is entirely unperceived by the native Ganza speaker, but rather that since it is unattested in monomorphemic words it is non-contrastive in the Ganza phonology.

3. Vowels

In this section of the paper I describe and discuss the five vowel phonemes of Ganza. I also address the unpredictable (lexical) free-variation between [wa~o], the lack of phonemic long vowels, the phonemic composition of diphthongs, and one small attestation of vowel harmony.

3.1 Vowel Phonemes

As can be expected of an Omotic language, Ganza has a system of five phonemic vowels contrasting high and mid front-unrounded vowels, high and mid back-rounded vowels, and a single low vowel. Figure 17 is a chart of these phonemic vowels, excluding allophones.

	FRONT	BACK
HIGH	i	u
MID	e	o
LOW	a	

Figure 17 – Ganza vowel phoneme inventory.

Below I give evidence of contrast between these vowel phonemes, in (27a) comparing the high front, mid front, and low vowels /i, e, a/, and in (27b) comparing the high back, mid back, and low vowels /u, o, a/.

(27) *a. Minimal or near-minimal pairs between / i, e, a /*

	Word-initial		*Word-medial*		*Word-final*	
/i/	ʔ**í**nsá	'tree'	s’**í**lí	'to add'	ʔáns’**í**	'month'
/e/	ʔ**é**nsó	'request'	s’**é**lé	'to be clean'	jìlàns’**é**	'wildcat'
/a/	ʔ**á**nꜜs’ó	'rain'	s’**á**ló	'worm'	ʔàns’**à**	'gold'

b. Minimal or near-minimal pairs between / u, o, a /

	Word-initial		*Word-medial*		*Word-final*	
/u/	ʔ**ú**lú	'rattle'	ʃ**ú**ꜜmú	'to be leftover'	kʰùg**ú**	'owl'
/o/	ʔ**ó**lò	'puddle'	ʃ**ó**ꜜmó	'python'	kʰóg**ò**	'hill'
/a/	ʔ**à**là	'friend!'	ʃ**à**má	'to be tired'	kʰág**à**	'possession'

For the purposes of acoustic description Figure 18 below shows the average and median first formant (F1) and second formant (F2) measurements for these vowels. For each vowel I measured twenty tokens, ten in which the target vowel was between consonants and ten in which the vowel was word-final. As much as possible, tokens were chosen in order to represent a variety of tone and onset consonants. Measurements were taken from the second repetition of the token in a given recording, and at approximately one-third of the way into the duration of the vowel.

	F1 average	F1 median	F2 average	F2 median
/i/	355	354	2092	2120
/e/	484	482	1896	1867
/u/	380	375	986	962
/o/	487	473	941	916
/a/	694	689	1395	1385

Figure 18 – Average and median formant values for Ganza vowels given in hertz (Hz).

When the raw numbers are plotted on a formant chart, as in Figure 19 below, the classic V of a five-vowel system is evident, but with one aberration: there is significant overlap in realizations of /o/ and /u/.

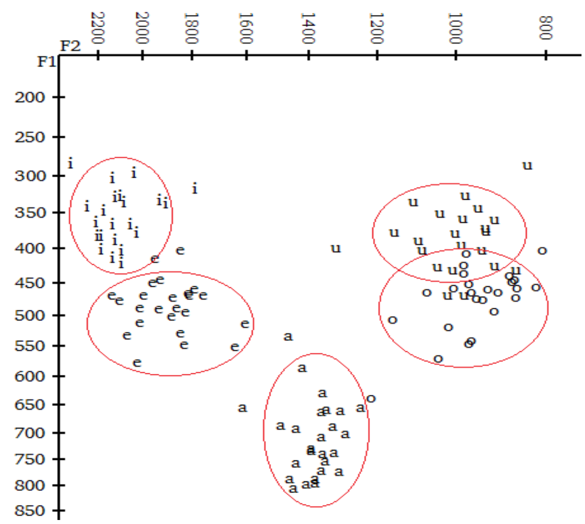

Figure 19 - Vowel formant plot of one-hundred Ganza lexical items.

3.2 A Case of Unpredictable Vocalic Free Variation

There is a curious feature of Ganza's vowel phonology in which free variation exists between [wa~ʔo] for a certain set of words beginning with /wa/ but is absent in all other words beginning with /wa/. For the items in (28a), I received both phonetic variants of the words from both of my language helpers when the words were elicited in isolation. Compare these with (28b) in which there is no attested free variation. In addition, when the average F1 and F2 values of the [w] in the (a) items were measured they turned out to be significantly different from those of [w] in the (b) items.[26]

[26] For the items in (28a) measurements of all three repetitions of each word yield an average F1 of 613Hz and F2 of 1050Hz. When measured in the same way the items in (28b) yield an average F1 of 480Hz and average F2 of 924Hz.

(28) *a. Items with [wa ~ ʔo] free variation.*

wáꜜmá ~ **ʔó**ꜜmá	'river'	wáꜜsí	'meat'
wáɗà ~ **ʔó**ɗà	'insult'	wàʃàl	'hare'
wápʰà ~ **ʔó**pʰà	'cave'	wáŋà	'ensete'
wájà ~ **ʔó**jà	'ear'	wàŋà	'chicken'

b. Items with no variation.

I see two probable explanations for this unpredictable and asymetrical variation. The first is a diachronic hypothesis in which the proto vowel inventory did not contain /o/, but rather /o/ developed historically from the coalescence of /wa/. After /o/ was established as a phoneme, new combinations of /ʔua/ or /wa/ resulted in the non-varying /wa/ items. The varying /wa/ items, then, would be higher frequency words which preserved the old /wa/ instead of coalescing. The second hypothesis is synchronic, in which the /w/ semivowel is actually underlyingly two different vowel onsets. Thus, while non-varying items such as [wàŋà] 'chicken' begin underlyingly with /ʔua/, varying items such a [wáꜜmá ~ ʔóꜜmá] 'river' begin underlyingly with /ʔoa/. I do not attempt here to make an argument for one of these cases over the other.

Analogous to [wa~ʔo], Ganza also has an alternation between [ja~e]. Like the [wa~ʔo] variation, this only occurs in certain lexical items. However, as will be explained further in §5.1, this is predictable stem allomorphy, not free variation as with [wa~ʔo].

3.3 Vowel Length

Like consonant length, contrastive vowel length is a common feature of Ethiopian languages. In Omotic languages especially it is expected that the five phonemic vowels will each have long counterparts. I was thus surprised to discover that Ganza does not have a clear contrast between long and short vowel phonemes. Instead, Ganza has predictable utterance-final vowel lengthening and a set of monosyllabic words with double vowels.

Acoustically speaking, Ganza has three significantly different phonetic levels of vowel length. The first and shortest level corresponds to the standard short vowel. The second, slightly lengthened set corresponds to utterance-final lengthened vowels. The third and longest level corresponds to all monosyllabic open-syllable free words (i.e. CVV, Cw/jVV). Figure 20 gives the average and median duration for each vowel phoneme in these three environments as found in isolated words.

	Default short		Utterance-final		CVV words	
	average	median	average	median	average	median
/i/	126	125	208	196	335	347
/e/	140	129	231	227	348	325
/u/	106	100	197	216	304	304
/o/	124	126	203	194	335	335
/a/	120	124	180	180	340	329

Figure 20 – Average and median duration of vowels in three environments, given in milliseconds (ms).

These numbers are somewhat exaggerated compared to connected speech. However, comparative measurements of vowel lengths within a single sentence still attest three phonetic lengths corresponding to these three environments.

For the purpose of phonemic analysis it is the third level of length that is most interesting. While the utterance-final lengthening can be dismissed as a predictable (phonetic) process,[27] the question is whether this very limited set of CVV words are sufficient grounds for claiming that vowel length is contrastive. In (29) I list all the words I have found to date that contain these long vowels.[28]

(29)

a. *CVV nouns*		b. *CVV verbs*		c. *CVV pronouns*	
k'jóò	'body'	kʰáꜜá	'to work'	tʰìì	1SG
kʰáà	'labour'	máꜜá	'to eat'	mùù	1PL
níꜜí	'father'	kʰòó	'to carry'	jéé	2SG
náꜜá	'mother'	ʃáá	'to see'	kʰíꜜí	3F
bàâ	'father'	kʰwáꜜá	'to come'	kʰúꜜú	3PL
sáꜜá	'woman, wife'	t'óꜜó	'to come'		
ʔòò	'grandmother'	t'áꜜá	'to drip'		
s'wíꜜí	'hip'	k'áá	'to eat meat'		
k'àà	'new thing'	k'àà	'to be new'		
t'éꜜé	'hornbill'	k'éꜜé	'to seem'		
béè	'black kite'				
p'wíì	'type of tree'				
sîì	'wax'				

Like long consonants, I analyze these vowels as double vowels, not long vowels, which have arisen from the historical elision of a consonant. That is to say, [k'jóò] 'body' should be analyzed as /k'jóò/ not /k'jôː/, and likely came from a source word */k'jóCò/. As for the identity of the elided consonant, I hypothesize that [aa] items came from an elided [h], [oo] and [uu] from an elided [w], and [ee] and [ii] from an elided [j]. Below are outlined various evidences which lead me to this conclusion:

a. All monosyllabic free words are heavy syllables.

The attested profiles on monosyllabic words are CVV, CCVV, CVC, CCVC, CVCC. Since there are no CV noun or verb roots for a CVV word to contrast with, length contrast is essentially neutralized in monosyllabic free words. It is likely that originally all noun and verb roots were minimally disyllabic, and that CVV and CVC stems were formed through historical syncope and apocope respectively (see §5.1 for evidence of this occurring synchronically).

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[27] I analyze this as an utterance-final mora which associates to the nearest vowel to the left (i.e. within the phrase).

[28] Throughout this paper I represent vowel length with doubled vowels (e.g. [aa]) instead of the standard IPA colon (e.g. [aː]).

b. Most CVV words are high frequency tokens.

With a few exceptions, the above words are all extremely high-frequency tokens. Since high-frequency tokens undergo phonological reduction faster than other words, they tend to be the locus of such phonological irregularities (Bybee 2004:113). It is therefore plausible that the elision of a consonant would occur in Ganza in these high-frequency tokens while not occurring in other, less frequent items (cf. /tìʔìꜛ/ 'to protect' and /tììꜛ/ '1SG').

c. Most CVV words have a CV allomorph.

In the verb system, CVV verbs predictably shorten to CV in certain grammatical frames, essentially displaying the same allomorphic pattern of certain CVʔV verbs which elide to CVʔ (see §5.1). Likewise, when the independent pronouns function as possessives they take a short form, as illustrated in (30).[29]

(30)	sùdánsà	háwssí	t'élꜜbó,	tìì	cf.	tì	gáŋà
	/Sùdánꜜ-sa	háw-sa=di	t'élꜜ=ꜛ=bo,	tììꜛ/		/tìꜛ	gàŋà/
	Sudan-DIR	go-PURP=1SG.SBJ	want=IRR=VC1	1SG		1SG.POSS	donkey
	'I want to go to Sudan'					'my donkey'	

d. Tonal melodies on monosyllabic noun and verb roots give evidence that they were originally disyllabic.

If these roots were originally monosyllabic I would expect to find only /L/ and /H/ citation melodies attested. However, for the CVV verbs and pronouns there are three attested citation melodies— /HꜜH/, /H/, and /LH/— and for the CVV nouns there are four— /HꜜH/, /Hꜜ/, /LHꜜ/, and /Lꜛ/. The specifics of this will be discussed further in §6, but for the moment it is sufficient to say that these melodies are more complex than would be expected on monosyllabic roots and that they bear no differences to the melodies attested on disyllabic roots.

e. [h], [w], and [j] are unattested in the proposed environments of elision.

There is only one attestation of an intervocalic [h] in non-borrowed words, /máhì/ 'feline', but this is not between homorganic vowels and sometimes surfaces with a suspicious nasal feature [mấhĩ̀]. Also, as was shown in §2.5 example (18), when [h] is found intervocalically at a morpheme boundary it deletes. Similarly, there are no attestations of [w] between two back-rounded vowels or [j] between two front-unrounded in well-formed roots (i.e. *[owo, uwu, uwo, owu], *[eje, iji, eji, ije]). It is plausible then that these consonants historically elided in these environments resulting in double vowels.

[29]Since the independent pronouns are most often used in emphatic right or left detached positions, it is unclear to me whether the length found in the independent pronouns is actually due to the utterance-final lengthening or to a lexical double vowel environment. It is also possible that these forms are /tij/ /muw/, /kij/, and /kuw/ respectively.

f. At least four high-frequency tokens have been observed to form a double vowel after undergoing stem allomorphy.

When modified, the words /wájà/ 'ear' and /kwájà/ 'place' take the allomorphic forms /wéè/ and /kwéè/ respectively, as shown in (31) and (32). Here we actually observe the formation of a double vowel via stem allomorphy (see §5.1), with the sequence /aja/ becoming /ee/.

(31)	wájà	'ear'	cf.	tʰì wéè	'my ear'	

(32)	kʰwájàtkà	náꜜkʰábô	cf.	ʔìtʰí	kʰwéétkà	náꜜkʰábô
	/kwájà-di=ga	náꜜká=bo/		/ʔìtí	kwéè-di=ga	náꜜká=bo/
	place-NM=3M.SBJ	big=VC1		DEM.DIST	place-NM=3M.SBJ	big=VC1
	'the place is big'			'that (far) place is big'		

Similarly the verbs /háw/ 'go' and /ʔáwꜜ/ 'say' take the allomorphic forms /hááꜜ/ and /ʔááꜜ/ in certain grammatical environments, as in (33), suggesting the proto-roots */hawa/ and */ʔawa/.

(33)	hàdí	ʔáwnà	cf.	hàdí	ʔááꜜgwánà
	/hàꜛ=di	ʔáwꜜ=na/		/hàꜛ=di	ʔááꜜ-gwáꜜ=na/
	AFF=1SG.SBJ	say=VC2		AFF=1SG.SBJ	say-PFV=VC2
	'I say'			'I have said'	

From these evidences I conclude that instances of long vowel found in Ganza are doubled vowels rather than phonemically long vowels which contrast with phonemically short vowels. Further, I hypothesize that these double vowels have their source in the historical elision of a consonant, most likely [h] or [ʔ] in the case of [aa], [j] in the case of [ii] and [ee], and [w] in the case of [uu] and [oo].

3.4 Diphthongs

Phonetically, Ganza has only two diphthongs, [au] and [ai]. However, phonemically these are best analyzed as consonant codas /aw/ and /aj/, counterparts to the onglides /wa/ and /ja/. Examples of these are given in (34).

(34)	*Semivowel Onglides*			*Semivowel Codas*		
	/wa/	k'**wá**ɗà	'to swallow'	/aw/	kʰ**áꜜú**	'to roast'
		pʰ**wá**ɗá	'naked-neck chicken'		ɲj**àú**	'cat'
	/ja/	t'**jáꜜ**lá	'to want, seek'	/aj/	pʰ**áì**	'to be heavy'
		s'**já**ná	'dry season'		wùʃ**áì**	'francolin (bird)'

The main reason for analyzing these as consonant codas is that they behave as such in terms of syllabification and tone distribution. For example, when elicited in isolation the verb /ʔáwꜜ/ 'say' is realized as [ʔáù], with the /HL/ melody surfacing as falling tone spread over the diphthong. When this verb is elicited in context, however, the L is not realized on the /w/ coda but instead delinks, either causing downstep as in (35a), or reattaching to a following toneless morpheme as in (35b). Thus, except when elicited in isolation these phones do not serve as tone-bearing units (TBU). Also, when the morpheme following /ʔáw꜌/ begins with a vowel, the /w/ coda is reassigned as the onset of that morpheme, as in (36). If this were a true diphthong I would expect further evidence of vowel hiatus.

(35) *a. L delinks from /w/ causing downstep* *b. L delinks from /w/ and attaches to /=bo/*

nótnà	ʔáw꜌lé	hàdí	ʔáwbò
/nó꜌-di = na	ʔáw꜌-lé/	/hà꜍ = di	ʔáw꜌ = bo/
what-NM=2SG.SBJ	say-Q	AFF=1SG.SBJ	say=VC1
'what did you say?'		'I say'	

(36) */w/ coda is reassigned as syllable onset when followed by /-án꜌/*

tìì	ʔá꜌wánnà
/tìì꜌	ʔáw꜌-án꜌ = na /
1SG	say-NEG=VC2
'I do not say'	

The strongest counterevidence to my above conclusion is that when the future suffix /-sa/ and a subject clitic are added to a verb root ending in a diphthong, the morphophonemic processes which take place seem to treat that coda like a vowel. As will be discussed in §5.2, the suffix /-sa/ will elide its final vowel and merge with the clitic if the verb root to which it attaches ends in an open-syllable. This is exactly what occurs in (37) where /ʔáw꜌-sa=ga=na/ 'he will say' is realized as [ʔáw**skà**nà] and not *[ʔáw**sàgà**nà], suggesting that the phonology treats the coda of /ʔáw꜌/ as a vowel.

(37) ʔáwskànà
/ʔáw꜌-sa = ga = na/
say-FUT=3M.SBJ=VC2
'he will say'

However, the phonology does not treat coda of /ʔaw꜌/ like a vowel with the addition of a VC suffix, such as the imperative marker /-éʃ/. Elsewhere, when this morpheme attaches to a verb root ending in an open-syllable the vowel of the suffix will elide. In the case of these diphthongs, however, this is not true. Thus, as shown in (38), /ʔáw꜌-éʃ/ 'say!' is realized as [ʔáw꜌éʃ] and not *[ʔá꜌úʃ].

(38) ʔá꜌wéʃ
/ʔáw꜌-éʃ/
say-IMP.SG
'say!'

3.5 Vowel Assimilation in the Accusative Suffix

One final aspect of the Ganza vowel system which should be touched on, if only briefly, is the presence of vowel harmony. While this system on the whole cannot be characterised as "harmonic", there is one context which I have observed thus far where there is long-distance assimilation of vowel features. This is when the accusative suffix /-lì/ attaches to the personal pronouns, as shown in (39). In this environment the default /i/ vowel of the suffix will fully assimilate with the vowel of the pronoun, or in some cases will elide altogether. For the second-person plural there is metathesis, but this is anomalous in the phonology of Ganza.

(39)	/tìꜛ-lì/	→	tìlíꜜ	1SG-ACC
	/jé-lì/	→	jélè	2SG-ACC
	/kjánáꜜ-lì/	→	kjánálꜜ	3M-ACC
	/kíꜜ-lì/	→	kílì ~ kílꜜ	3F-ACC
	/mùꜛ-lì/	→	mùlúꜜ	1PL-ACC
	/nàmꜛ-lì/	→	nàmíl	2PL-ACC
	/kúꜜ-lì/	→	kúlù ~ kúlꜜ	3PL-ACC

4. The Shape of the Word

Having established the phonemes of Ganza, I now give an account of the structure of the word, in particular what constitutes a well-formed root. To begin I describe the attested syllable structures found in free words, making generalizations about them and giving an example of the maximal syllable. Next I briefly describe the syllable patterns attested in bound morphemes. Finally, I look at the distribution patterns of the individual consonant phonemes in terms of word-position and adjacency in consonant clusters, and from this derive phonotactic generalizations about the language.

4.1 Syllable Structure

Compared to other Mao languages the syllable patterns attested in Ganza are notably complex. For example, Bambassi Mao only unambiguously exhibits CV and CVC syllable profiles (plus their geminate vowel counterparts) in its monomorphemic words (Ahland 2009:18), whereas Ganza has a wide attestation of both complex onsets and codas. In Figure 21 below I give examples of all attested syllable profiles in both monosyllabic and polysyllabic free words in Ganza. Notice especially the complementary distribution of single and double vowels in open-syllables, with the former only occurring in polysyllabic words and the latter only in monosyllabic words. It should also be noted that there are static restrictions for Cw/jV syllables, with Cj occurring only before /a e o/ and Cw only before /a e i/.

Syllable Profile	Monosyllabic Free Words		Polysyllabic Free Words	
CV	*not attested*		**wá**.ꜜsí	'meat'
CwV	*not attested*		**k’wà**.ɗí	'head'
CjV	*not attested*		**kjà.**lá	'Colobus monkey'
CVV	**béè**	'black kite'	*not attested*	
CwVV	**p’wîì**	'type of tree'	*not attested*	
CjVV	**k’jóò**	'body'	*not attested*	
CVC	**màk**	'fox'	**ʃìl**.ká	'chin fat'
CjVC	**ɲjákʰ**	'kingfisher'	**bján.**s’à	'fishhook'
CwVC	**s’wék**	'sorghum'	**ʃwàm**.ba̰	'armpit'
CVNC	**ʔúns’**	'to crawl'	**k’óns’**.ꜜk’ól	'noise'

Figure 21 – Syllable profiles of free words in Ganza.

From these attested profiles we can derive the following generalizations about well-formed roots in Ganza.

a. "Require Onset" – All syllables must have an onset. Apparent vowel-initial words actually begin with the glottal stop phoneme /ʔ/ in the underlying form.[30]

b. "Require Bimoraic Word" – Free words are minimally bimoraic (i.e. heavy syllables). Thus all monosyllabic words must have a heavy syllable, with either a doubled vowel (C(w/j)VV) or a coda (C(w/j)VC).

c. "Permit Codas" – Simple codas are permitted in all positions.

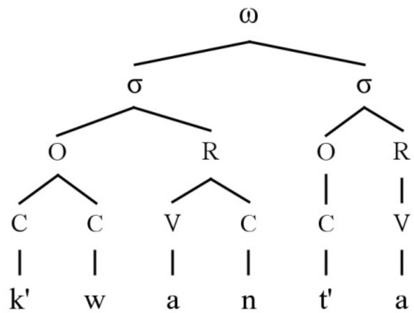
d. "Permit Onglides" – Complex onsets are allowed if the second consonant of the cluster is a semivowel (Cw/j).

e. "Permit NC in Rhyme" – Complex codas are allowed if the first consonant of the cluster is a nasal (CVNC).

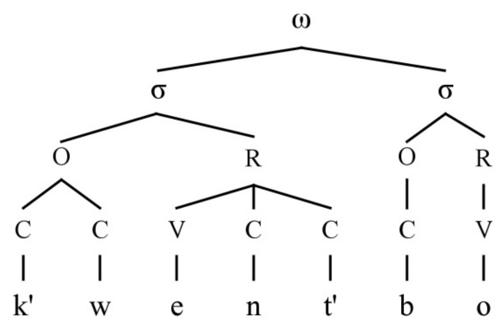
While the largest syllable found Ganza roots is Cw/jVC or CVNC, the maximal syllable is actually Cw/jVNC. This occurs when there is final vowel elision (see §5.1) in a Cw/jVN.CV root. This process can be seen in (40) and (41), where the root /k’wánt’à/ 'far' takes the allomorphic stem /k’wént’ꜜ/ when the verbal clitic /=bo/ is attached.

[30] Alternatively, all word-initial glottals could be analyzed as epinthetic consonants that serve to satisfy the onset requirement. See also discussion in §2.5 and footnote 22.

(40) /k’wánt’à/ 'far'



(41) /k’wént’ꜜ = bo/ '[it] is far'



Unlike free words, bound morphemes in Ganza are all monosyllabic, never contain double vowels, and may be onsetless. Attested syllable profiles on suffixes are CV, VC, and V. The CV and VC type suffixes will elide to C, however, when attached to an open-syllable (i.e. /CV-CV/ → [CV-C] and /CV_1-V_2C/ → [CV_1-C]).[31] The two V suffixes however, namely the interrogative /-é/ and the locative /-o/, behave in two different ways. The former elides entirely when attached to an open syllable (i.e. /CV_1-é/ → [CV_1]) whereas the latter causes final vowel elision on the stem to which it attaches (i.e. /CV-o/ → [C-o]). Clitics only have one attested syllable profile, CV, and never undergo vowel elision (see also §5.2).[32]

4.2 Phonotactics

The following chart (Figure 22) shows the attested distribution of each consonant phoneme within free word stems in the following positions: word-initial simple onset, complex onset with /w/, complex onset with /j/, intervocalic, C_1 in a consonant cluster with an oral consonant, C_1 in a consonant cluster with a nasal consonant, C_2 in a consonant cluster with an oral consonant, C_2 in a consonant cluster with a nasal consonant, and word-final simple coda. These data are taken from my analyzed wordlist, which contains around 1100 entries for free words. It should be noted that in the chart C stands for oral consonants but does not include the semivowels /w/ and /j/. A plus symbol (+) indicates that the occurrence is well attested, whereas a numeral indicates only one or two instances. A minus symbol (-) and dark shaded cell indicates that the occurrence is not attested in any data. For consonant clusters, an asterisk (*) indicates that the sequence is not attested in roots but may be found across morpheme boundaries within stems (e.g. in

[31] One exception is the negative marker /-ánꜜ/, which does not trigger vowel elision.

[32] One exception is the perfect marker /gwáꜜ/, produced as [gwá] by some speakers and as [gá] by others. It is unclear at this point whether this auxiliary is a free word or a clitic. If, as I suspect, it is a recent grammaticalization of /kwáꜜá/ 'come', then it is likely to be a clitic. However, unlike most of the other clitics this morpheme bears a complex tonal melody /HL/.

compounds or with derivational morphology). Similarly, an exclamation mark (!) indicates the sequence is not attested in native roots but may be found in borrowed words. These are last two categories are partially shaded.

	#_V	_w	_j	V_V	_C	_N	C_	N_	_#	Attested Consonant Clusters		
										Attested in Native Roots	*Roots, Morpheme Boundaries (*)	*Roots, Borrows (!)
/p/	+	+	+	+	-	*	!	+	+	pw, pj, mp,	pk, pm, np	rp
/p’/	+	+	+	+	*	-	-	+	+	p’w, p’j, mp’	p’t	
/b/	+	2	1	+	-	-	!	+	+	bw, bj, mb		rb
/t/	+	+	+	+	1/*	*/!	*/!	*/!	+	tw, tj, tk	tp, pt, kt, tm, tn, nt	rt, tn, nt
/t’/	+	+	+	+	*	-	2	+	+	t’w, t’j, nt’, lt’, rt’, ʔ̃t’	tt’	
/d/	+	1	-	+	-	-	-	+	+	dw, nd		
/k/	+	+	+	+	-	-	+	-	+	kw, kj, sk, s’k, ʃk lk, tk	zk, pk, ʃkw, zkw	rk
/k’/	+	+	+	+	-	-	+	+	+	k’w, k’j, ŋk’ sk’, s’k’, ʃk’, lk’, ns’k’, jk’		
/g/	+	+	+	+	-	-	+	+	+	gw, gj, ŋg, zg, lg, ŋgj	mg	rg
/m/	+	+	2	+	+	-	*/!	-	+	mw, mj, mb, mp, mp’	mg, mʃ, pm, tm, lm	lm
/n/	+	-	+	+	+	-	*/!	-	+	nj, nd, nt’, ns, ns’, nz, ns’k’	np, nt, tn, ns’k, nzj	tn, nt
/ŋ/	-	-	-	+	+	-	-	-	+	ŋk’, ŋg, ŋgj		
/r/	-	-	-	+	1/!	-	-	-	+	rt’		rp, rb, rt, rk, rg
/l/	+	*		+	+	*/!	*	-	+	lt’, lk, lk’, lg	lm, lw, ls, ʔl	lh, lm
/s/	+	+	1	+	+	-	*	+	+	sj, sw, ns, sk, sk’,	ls, ss	
/z/	+	1	+	+	1/*	-	-	+	-	zw, zj, zg, nz	nzj, zkw	
/ʃ/	+	+	-	+	+	-	*	*	+	ʃw, ʃk, ʃk’	wʃ, mʃ, ʃh, ʃkw	
/s’/	+	+	+	+	+	-	-	+	+	s’w, s’j, ns’, s’k, s’k’, ns’k’		
/ʔ/	+	-	-	+	*	-	-	-	2		ʔw, ʔl	

	#_V	_w	_j	V_V	_C	_N	C_	N_	_#	Attested Consonant Clusters		
										Attested in Native Roots	*Roots, Morpheme Boundaries (*)	*Roots, Borrows (!)
/ʔ̃/	-	-	1	+	1	-	-	-	-	ʔ̃j, ʔ̃t’		
/h/	+	-	-	1/!	-	-	!/*	-	-		ʃh	lh
/w/	+	-	-	+	*	-	+	+	+	pw, p’w, bw, tw, t’w, dw, kw, k’w, gw, mw, sw, zw, ʃw, s’w	ʔw, lw, wʃ, ʃkw, zkw	
/j/	+	-	-	+	2	-	+	+	+	pj, p’j, bj, tj, t’j, kj, k’j, gj, mj, nj, zj, sj, s’j, jk’, ʔ̃j, ŋgj	nzj	

Figure 22 - Consonant phoneme distribution patterns of Ganza.

From these data we can make the following generalizations about Ganza phonotactics:

a. Well-formed roots do not permit an oral consonant to precede a nasal in consonant clusters.

Except for in borrowed words and at morpheme boundaries, oral consonants never precede a nasal consonant in a consonant cluster; *CN is disallowed. This is true both of clusters across a syllable break and within complex codas.

b. Well-formed roots do not permit heterorganic places of articulation in nasal-oral consonant clusters.

In Ganza's free word roots all NC clusters are homorganic with respect to place of articulation, with the exception of semivowel onglides. Since, however, heterorganic NC and CN clusters are attested across morpheme boundaries and in borrowed words, there is no active process of place assimilation.

c. Sibilants and velar stops have the most liberal distribution patterns.

Aside from a few restrictions in consonant clusters, the phonemes /s, s’, k’/ and /g/ have the strongest attestation across the phonotactic environments defined above. Similarly, /k, z/ and /ʃ/ are also well attested in nearly all environments. They have only a few limitations compared to their counterparts, namely */ŋk/ (see footnote 15), */ʃj/ and */nʃ/ (which would be expected if /ʃ/ is indeed an old coalescence of /sj/ as proposed in §2.3), and the odd lack of /z/ word finally.[33]

[33] There is an element /ház/ which appears in several words such as /házgá/ 'morning', /házkórò/ 'evening', and /házó/ 'year' (possibly /ház-ó/ 'morning-LOC' ?). While I have not as yet been able to elicit this item in isolation, it does suggest that /z/ originally may have had a word-final distribution.

d. Velar oral consonants exhibit the widest range of heterorganic consonant clusters.

In particular, the voiceless /k/ and ejective /k'/ velar phonemes are found adjacent to a variety of alveolar consonants, especially as C_2. Also /k'/ and /g/ are the only oral stops found in triadic consonant clusters, namely /ns'k'/ and /ŋgj/.

e. The alveolar trill is almost exclusively found in consonant clusters in borrowed words.

All noun and verb roots which attest /r/ in a consonant cluster are borrowed words, mostly from Arabic. The one exception to this is the word /jàrt'à/ 'arrow', which may or may not be borrowed from a neighbouring language.

5. Morphophonemic Processes

In this section I describe two interesting morphophonemic phenomena found in Ganza. The first is the stem allomorphy of certain noun and verb stems via final vowel elision and vocalic alternation. This phenomenon is especially relevant in light of the wide-attestation of final vowel elision in other Mao languages (Ahland 2009 & Girma 2015). The second phenomenon is the convergence of final vowel elision, final-devoicing, voicing assimilation and manner assimilation in stacked suffixes and clitics. As will be shown, it appears that these processes apply to suffixes, clitics, and roots at different stages of the phonological derivation, thus lending support to a serial theory of phonology (e.g. the Theory of Lexical Phonology (Kiparsky 1982, 2000)) rather than a simultaneous theory (e.g. standard Optimality Theory (Prince & Smolensky 1993)).

5.1 Final Vowel Elision and Vocalic Alternation Stem Allomorphy

Probably the most interesting feature of Ganza phonology, and one that has already been alluded to in this paper, is the process of stem allomorphy which occurs in a subset of nouns and verbs in certain grammatical environments. This stem allomorphy takes two forms in Ganza: elision of the final vowel, and vocalic alternation. The former is expected given that final vowel deletion is attested in all other Mao languages (Ahland 2009:16, Girma 2015, Getachew 2015:60). Ganza is unique, however, in that this elision only occurs in particular grammatical environments and only for a subset of nouns and verbs.[34] The second type of allomorphy is a vocalic alternation [ja~e] or [wa~e] and is also only attested in a subset of nouns and verbs. Hayward wrote about an alternation between *a ~ i* attested in several North Omotic languges and questioned whether the same phenomena is found in the Mao languages (Hayward 1991:539). While Hayward's alternation and the alternation found in Ganza are phonetically similar, the two phenomena are not likely related since their locus and conditions are so divergent, the former affecting verbal inflectional morphemes and the latter noun and verb roots under certain grammatical conditions.

[34] Because this process is morphologically conditioned (as opposed to phonologically) and because the elision occurs in the underlying form (not simply the surface realization), it may be appropriate to call it "final vowel deletion" or "apocope" instead of "elision".

The two types of stem allomorphy are not mutually exclusive. Indeed, Ganza noun and verb roots can be divided into three categories: those which have no allomorphy, those which undergo final-vowel elision (hereafter FV-Elision), and those which undergo both FV-Elision and vocalic alternation (hereafter V-Alternation).[35, 36]

The nouns are the simplest to describe in terms of the distribution of stem allomorphs. Simply put, if a noun is modified in any way, whether by a determiner, adjective, possessor, or the like, it will take its allomorphic form. Examples of this are given below in (42), (43), and (44) showing the differing behaviour of nouns with no allomorphy, nouns with FV-Elision, and nouns with FV-Elision and V-Alternation respectively.

(42) *No-allomorphy* [37]

p’jàlâ	'star'	**wàŋà**	'chicken'
p’jàlátpò	'it is a star'	**wàŋà**tpô	'it is a chicken'
ʔìtʰí **p’jàlà**dì	'that star'	ʔìtʰí **wáŋá**dì	'that chicken'
náꜜkʰá **p’jàlà**	'big star'	náꜜkʰá **wáŋá**	'big chicken'
náꜜkʰá **p’jàlà**tpò	'it is a big star'	náꜜkʰá **wáŋá**tpò	'it is a big chicken'

(43) *FV-Elision*

tʰámâ	'fire'	**kʰálà**	'porridge'
tʰámátpò	'it is a fire'	**kʰálà**tpò	'it is a porridge'
ʔìtʰí **tʰám**dî	'that fire'	ʔìtʰí **kʰál**lì	'that porridge'
náꜜkʰá **tʰám**	'big fire'	kʰárá **kʰál**	'hot porridge'
náꜜkʰá **tʰám**dìpò	'it is a big fire'	kʰárá **kʰál**lìpò	'it is a hot porridge'

(44) *FV-Elision & V-Alternation*

t’jámà	'grave'	**wáŋà**	'ensete'
t’jámàtpò	'it is a grave'	**wáŋà**tpò	'it is ensete'
ʔìtʰí **t’ém**dì	'that grave'	ʔìtʰí **wéŋ**dì	'that ensete'
náꜜkʰá **t’ém**	'big grave'	náꜜkʰá **wéŋ**	'big ensete'
náꜜkʰá **t’ém**dìpò	'it is a big grave'	náꜜkʰá **wéŋ**dìbò	'it is big ensete'

---

[35] There are some notable patterns regarding the final vowel and its elision: /a/ is by far the most common final vowel for both nouns and verbs, but /i, e, u/ and /o/ are all also attested. Both stems with duplicate vowels (e.g. /wígì/ 'snake', /támáꜜ/ 'fire') and stems with differing vowels (e.g. /kàpí/ 'small bird' /sásóꜜ/ 'monkey') are attested in disyllabic nouns and verbs. FV-elision is well attested in duplicate-vowel stems (e.g. /jéꜜpé~jépꜜ/ 'to cry', /támáꜜ~tamꜜ/ 'fire'). Stems with differing vowels which undergo FV-elision, however, always end in /a/ (e.g. /dúʃà~dúʃꜜ/ 'cotton'). Thus, FV-Elision of /i, e, u/ and /o/ in disyllabic stems with differing vowels is unattested.

[36] Two exceptions to this pattern are /t’wáŋk’ì ~ t’wéŋk’ì/ 'scorpion' (which undergoes V-Alternation with no FV-Elision) and /tjóꜜtó~tétò/ 'hunger' (which undergoes the unique alternation [jo~e] with no FV-Elision).

[37] In §5.2 I discuss the reduction of /-dí/ to [-t] when attached to an open syllable. In careful speech, however, the full form of /-dí/ is sometimes pronounced, especially when used in conjunction with demonstratives, which was the case with the data [ʔìtʰí p’jàlàdì] 'that star' and [ʔìtʰí wáŋádì] in example (42).

This behavior can also be seen in compounds, where all morphemes except the head (leftmost) will take an allomorphic form. For example the word for 'West' /ʔábà-gìz-kwéè/ [ʔábàgìzkwéè] is a three-word compound from the words /ʔábà/ 'sun', /gìzá/ 'to enter', and /kwájà/ 'place'. The second morpheme undergoes FV-Elision from /gìzá/ to /gìz/, and the third morpheme undergoes both FV-Elision and V-Alternation from /kwájà/ to /kwéè/. Furthermore, if another modifier is added, such as a demonstrative pronoun, the head noun will also take its allomorphic form. For example, taking the words /kárá/ 'hot' and /kálà/ 'porridge', the phrase /kárá kálꜜ/ [kárá kál] can be formed and the second morpheme takes its allomorph. When the proximal demonstrative /ʔìntìꜛ/ is appended the phrase becomes /ʔìntìꜛ kàr kálꜜ/ [ʔìntì kár ꜜkál] 'this hot porridge' and both morphemes take their allomorphic form.

The verb system presents a much more complex pattern with regard to stem allomorphy. In Figure 23 I give the environments I have elicited to-date in which the full stem of a verb is used and in which the allomorphic stem is used.

FULL STEM		ALLOMORPHIC STEM	
Conditional	/-n/	VC1	/=bo/
Non-Final SS	/-p/	VC2	/=na/
Non-Final DS	/-l/	Nominalized	/-di/
Serial verb	-	Imperative	/-éʃ/, /-èm/
Jussive	/kwámàn/	Future	/-sa/
Negative	/-ánꜜ/	Purpose	/-sa/
Neg. Imperative	/-ánꜜ/ + /-éʃ/, /-èm/	Polar Question	-
Perfect	/-gwáꜜ/	Content Question	/-e/
		Relative Clause	/-di/
		Continuous auxiliary	/gàráꜜ/
		Reason	/-di/ + /kódò/

Figure 23- Environments for stem allomorphy in Ganza verbs.

It is difficult to determine if there is an overarching semantic or grammatical condition for when a stem will take its full form or take its allomorph, and I have no definite opinion. With both negatives, conditionals, and jussives using the full stem and interrogatives, futures, and purpose using the allomorphic stem, a realis-irrealis division is unlikely. A negative-affirmative division is also obviously untenable. My current hypothesis is that this is in fact a morphological condition, not a grammatical or semantic one.

The following examples in (45) (46) and (47) show the patterns for each of the three types of verbs: those with no-allomorphy, FV-Elision, and FV-Elision plus V-Alternation respectively.

(45) *No allomorphy: /p’áp’í/ 'to gather'*

VC1	hàgá **p’ábḭ́**bô	'he gathers'
VC2	hàgá **p’àbḭ̀**nà	'he gathers'
Negative	**p’ábḭ́**ánnà	'not gather'
Nominalized	**p’ábḭ́**tká ák^{h}úmbô	'it is good to gather'
Imperative	**p’ábḭ́**ʃ	'gather!'

	Neg-Imperative	**p’ábḭ́**áꜜnéʃ	'don't gather!'
	Conditional	hàná **p’àbḭ̀**ngà ák^{h}úmbô	'it is good if you gather'
	Non-Final	hàgú **p’ábḭ́**pgú k^{h}wáꜜábô	'having gathered they came'
	Serial verb	hàdí **p’ábḭ́** ʃíꜜníbô	'I gathered and worked'
	Perfect	hàdí **p’ábḭ́**gwábò	'I have gathered'
	Future	**p’àbḭ̀**smùbô	'we will gather'
	Purpose	**p’àbḭ̀**ssì k^{h}wáꜜábô	'I come to gather'
	Polar Question	hàmá **p’àbḭ̀**?	'are you gathering?'
	Content Question	nómà **p’ábḭ́**?	'what are you gathering?'
	Relative Clause	**p’àbḭ̀** ábàtkà k^{h}wáꜜábô	'the day of gathering is come'
	Jussive	k^{h}wámàn k^{h}wàgá **p’ábḭ́**	'let us gather our pumpkins!'

(46)	*FV-Elision: /káꜜpá/ 'to take'*		
	VC1	hàgá **k^{h}ápꜜ**bô	'he takes'
	VC2	hàgá **k^{h}áp**nà	'he takes'
	Negative	**káꜜp^{h}á**ánnà	'not take'
	Nominalized	**k^{h}ápꜜ**tígá ák^{h}úmbô	'it is good to take'
	Imperative	**k^{h}áꜜp^{h}**éʃ	'take!'
	NegImperative	**k^{h}áꜜp^{h}á**áꜜnéʃ	'don't take!'
	Conditional	hàná **k^{h}áp^{h}à**ngà ákúmbó	'It is good if you take'
	NonFinal	hàgú **k^{h}áꜜp^{h}á**pgú k^{h}wáꜜábô	'having taken they came'
	Serial verb	hàdí **k^{h}áꜜp^{h}á** háwbô	'I take and go'
	Perfect	hàdí **k^{h}áꜜp^{h}á**gwábò	'I have taken'
	Future	**k^{h}áp^{h}**sàdìbô	'I will take'
	Purpose	**k^{h}áp^{h}**sàdì k^{h}wáꜜábô	'I come to take'
	Polar Question	hàná **k^{h}áp^{h}**?	'are you taking (it)?'
	Content Question	nónà **k^{h}áꜜp^{h}**é?	'what are you taking?'
	Relative Clause	**k^{h}áp^{h}** ꜜábàtkà k^{h}wáꜜábô	'the day of taking is come'
	Jussive	k^{h}wámàn **k^{h}áꜜp^{h}á**	'let us take!'

(47) *FV-Elision & V-Alternation: /wáná/ 'to thread (beads)'*

VC1	hàgá **wén**bô	'he threads'
VC2	hàgá **wèn**nà	'he threads'
Negative	**wáná**ánnà	'not thread'
Nominalized	**wén**dígà ák^{h}úmbô	'it is good to thread'
Imperative	**wén**éʃ	'thread!'
NegImperative	**wáná**áꜜnéʃ	'don't thread!'
Conditional	hàná **wànà**ngà ákúmbó	'it is good if you thread'
NonFinal	hàgú **wáná**pgú k^{h}wáꜜábô	'having threaded they came'
Serial verb	hàdí **wáná** s'jérbò	'I thread and sew'
Perfect	hàdí **wáná**gwábò	'I have threaded'
Future	**wèn**sàdìbô	'I will thread'
Purpose	**wèn**sàdì k^{h}wáꜜábô	'I come to thread'
Polar Question	hàná **wèn**?	'are you threading?'
Content Question	nónà **wén**é?	'what are you threading?'
Relative Clause	**wèn** ábàtkà k^{h}wáꜜábô	'the day of threading is come'
Jussive	k^{h}wámàn mù sấʔĩ̀ **wáná**	'let us thread our beads!'

5.2 Serial Application of Vowel Elision, Voice-Manner Assimilation, and Word-Final Devoicing and Deglottalization.

Another interesting phenomenon in Ganza morphophonemics is the interaction between the processes of vowel elision, voicing and manner assimilation, and word-final devoicing and deglottalization. As has been illustrated already in §2.1, voiced oral stops devoice word-finally and ejective oral stops deglottalize. Also illustrated was the rightward-spreading voicing assimilation in consonant clusters formed at a morpheme boundary. These were discussed in terms of identifying the underlying voiced or ejective feature of a word-final /b/ /d/ and /g/ versus /p'/ /t'/ and /k'/. In addition, in §2.6 I discussed how oral alveolar consonants which are adjacent at a morpheme boundary display rightward spreading manner assimilation, creating a long or doubled consonant. These processes are highly productive and often complementary or concurrent. They also interact with another process of vowel elision, different from that described in §5.1 but mentioned briefly in §4.1, in which certain suffixes elide their vowel if attached to an open-syllable (hereafter SV-Elision). The interplay of these processes results in some interesting situations when suffixes and clitics are stacked. Here the language appears to deal with suffixes, clitics, and roots at different stages of the phonological derivation. I discuss two of these situations below.

The first case is with the nominal marker /-di/. When affixed to a closed syllable the initial consonant of the /-di/ suffix will assimilate the underlying voice feature of the final consonant of its host. Thus with underlyingly voiceless consonants /-di/ is realized as [ti] (48a), with underlyingly voiced oral consonants it is realized as [di] (48b), with underlyingly ejective consonants it is realized as [ti] or [t’i] if the host is alveolar (48c), and with nasal consonants it is realized as [di] (48d). As mentioned in §2.1, because of this voicing assimilation the addition of the /-di/ suffix reveals the underlying contrast of voiced and ejective phonemes, which would otherwise be neutralized word-finally due to deglotalization and devoicing, (c.f. column 1 in (48b) and (48c)). However, because of deglottalization in this context ejective and voiceless are now neutralized for non-alveolar consonant clusters.

(48) *a.* */-di/ assimilates voicelessness with underlyingly voiceless consonants.*

/p/	ʔá**pʰ**	'eye'	ʔá**pt**i	'the/an eye'
/t/	bà**tʰ**	'duck'	bà**tt**í	'the/a duck'
/k/	swà**kʰ**	'spirit'	swà**kt**í	'the/a spirit'

b. */-di/ retains voicing with underlyingly voiced oral consonants.*

/b/	dô**p**	'lion'	dó**bd**ì	'the/a lion'
/d/	kʰìkʰìmí**t**	'ground hornbill'	kʰìkʰìmí**ddì**	'the/a ground hornbill'
/g/	ʔô**k**	'hat'	ʔó**gd**ì	'the/a hat'

c. */-di/ assimilates voicelessness with underlyingly ejective consonants.*

/p’/	ʃwàʃà**p**	'tarantula'	ʃwàʃà**pt**í	'the/a tarantula'
/t’/	ʃê**t**	'buffalo'	ʃé**tt’**ì	'the/a buffalo'
/k’/	mà**k**	'fox'	mà**kt**í	'the/a fox'

d. */-di/ retains voicing with underlyingly nasal consonants.*

/m/	gùɾù**m**	'wild pig'	gùɾù**md**ì	'the/a wild pig'
/n/	kʰàlmà**n**	'camel'	kʰàlmà**nd**ì	'the/a camel'
/ŋ/	kàrù**ŋ**	'tent'	kàrù**ŋd**í	'the/a tent'

In addition to voicing assimilation, when /-di/ is attached to a word ending in an oral alveolar consonant there is also full manner assimilation. Example (26) is here reiterated as (49).

(49) *Isolation* *Manner assimilation of /-di/ suffix*

/r/	gábî**r**	'sheep'	gábí**rr**ì	'the/a sheep'
/l/	jàwǐ**l**	'hyena'	jàwì**ll**í	'the/a hyena'
/t/	hàdì**tʰ**	'metal'	hàdì**ttʰí**	'the/a metal'
/d/	kʰìkʰìmí**t**	'ground hornbill'	kʰìkʰìmí**ddì**	'the/a ground hornbill'
/t'/	ʃê**t**	'buffalo'	ʃé**tt'**ì	'the/a buffalo'
/s/	gàmì**s**	'shirt'	gàmì**ss**í	'the/a shirt'
/ʃ/	k'ó꜌ŋó**ʃ**	'hunchback'	k'ó꜌ŋó**ʃʃ**í	'the/a hunchback'
/s'/	gíŋgìlí**s'**	'lovebird'	gíŋgìlí**ss'**í	'the/a lovebird'

When /-di/ is attached to a word ending in a vowel, however, there is SV-Elision and devoicing so that /-di/ is realized as a coda [t] (50) (see footnote 37 regarding exceptions).

(50) *SV-Elision and devoicing of /-di/ suffix.*

gáŋá**t**
/gáŋá-**di**/
donkey-NM
'the/a donkey'

When two suffixes are stacked, such as the nominal marker /-di/ and the accusative marker /-lì/, SV-Elision and devoicing is blocked for the first suffix and applied to the second (devoicing only with oral stops), as shown in (51).

(51) *SV-Elision and devoicing of /-di/ suffix blocked and SV-Elision of /-lì/ suffix applied.*

gáŋá**díl**
/gáŋá-**di-lì**/
donkey-NM-ACC
'the/a donkey (accusative)'

On the other hand, when a clitic is stacked on top of the /-di/ suffix a curious thing happens. Instead of the SV-Elision and devoicing being blocked by the addition of a word-final syllable, as would be expected, they both apply and the voiceless feature of the now elided and devoiced /-t/ spreads to the initial consonant of the clitic. Two examples of this are given in (52) and (53).

(52) *SV-Elision and devoicing of /-di/ suffix followed by voiceless spread to /=bo/ clitic.*

gáŋá**tp**ô
/gáŋá-**di** = **bo**/
donkey-NM=VC1
'it is a donkey'

(53) *SV-Elision and devoicing of /-di/ suffix followed by voiceless spread to /=ga/ clitic.*

gáŋá**tk**á	náꜜkʰábô
/gáŋá-**di = g**a	náꜜká = bo/
donkey-NM=3M.SBJ	big=VC1

'the donkey is big'

When two suffixes and a clitic are stacked, SV-Elision and devoicing is blocked for the first suffix and applied to the second, then voicing and manner are spread from the second suffix to the initial consonant of the clitic. This process can be seen when the nominal clause marking suffix /-di/, the accusative suffix /-lì/, and the first-person pronominal subject clitic /-di/ are stacked, as shown in (54).

(54) *SV-Elision of /-lì/ suffix followed by manner spread to /-di/ clitic.*

gáŋá**díllì**	kʰwés'pô
/gáŋá-**di-lì = di**	kwés' = bo/
donkey-NM-ACC=1SG.SBJ	hit=VC1

'I hit the donkey'

Several questions arise from these data: if /gáŋá-di=ga/ is realized as [gáŋátká], then why is /dôb=ga/ realized as as [dóbgà] instead of *[dópkà]. Similarly, why isn't /gáŋá-di-lì-di/ realized as *[gáŋádílìt], *[gáŋáttìdì], or *[gáŋáddìdì]? While it is not my intention to present a full analysis here, I would suggest that in order to account for this there must be a serial application of these phonological processes. In the first stage of the derivation affixes are added and elided and devoiced at the word boundary. Next clitics are added and voice-manner is spread. Finally, if no affixes or clitics have been added in the previous cycles, there is devoicing and deglottalization on roots. This schema is illustrated in (55).

(55) Suffix FV-Elision & Devoicing >> Voice &Manner Spread to Clitics >> Root Devoicing

A similar effect is seen with the directional suffix /-sa/. Like the nominal marker /-di/, when /-sa/ is attached to a word ending in a vowel the final vowel of the suffix is elided, but when attached to a word ending in a consonant SV-Elision is blocked. For this morpheme, however, SV-Elision also appears to be blocked word-finally and thus when elicited in isolation /wáꜜmá-sa / is realized as [wáꜜmásá]. These cases are illustrated in (56).

(56) a. *CVC noun + /-sa/*

súksà
/súkꜜ-sa/
shop-DIR
'to the shop'

b. *CVCV noun + /-sa/*

wáꜜmásá
/wáꜜmá-sa/
river-DIR
'to the river'

When a clitic is added to these two environments, stacking on the suffix, SV-Elision and voice assimilation occur in the one but are blocked in the other, as shown in (57). If the nominal clitic happens to start with an alveolar consonant there is also manner assimilation, as in (58).

(57) a. *CVC noun + /-sa/ + /=ga/ → [saga]*

súk**sàgà**	hááꜜgwábò
/súkꜜ-**sa = ga**	hááꜜ-gwáꜜ = bo/
shop-DIR=3M.SBJ	go-PFV=VC1
'he has gone to the shop'	

b. *CVCV noun + /-sa/ + /=ga/ → [ska]*

wáꜜmá**ská**	hááꜜgwábò
/wáꜜmá-**sa = ga**	hááꜜ-gwáꜜ = bo/
river-DIR=3M.SBJ	go-PFV=VC1
'he has gone to the river'	

(58) a. *CVC noun + /-sa/ + /=di/*

súk**sàdì**	hááꜜgwábò
/súkꜜ-**sa = di**	hááꜜ-gwáꜜ = bo/
shop-DIR=1SG.SBJ	go-PFV=VC1
'I have gone to the shop'	

b. *CVCV noun + /-sa/ + /=di/*

wáꜜmá**ssí**	hááꜜgwábò
/wáꜜmá-**sa = di**	hááꜜ-gwáꜜ = bo/
river-DIR-3M	go-PFV=VC1
'he has gone to the river'	

This is also the case with the future construction. Here the directional marker /-sa/ is repurposed as a future tense marker by attaching to a verb stem along with a subject clitic. If the verb takes an allomorphic form, thus ending in a consonant, the full form of both morphemes is preserved, as in (59a). If the verb stem ends in a vowel, however, there is SV-Elision and voice assimilation to the initial consonant of the clitic as in (59b).[38] A full paradigm of /-sa/ with the subject clitics is given in (60).

(59) a. *CVC Verb + /-sa/ + /=gi/*

t'él**ságì**bô
/t'élꜜ-**sa = gi** = ꜛ = bo/
seek-FUT=3F.SBJ=IRR=VC1
'she will search'

b. *CVCV Verb + /-sa/ + /=gi/*

p'àbḭ̀**skì**bô
/p'àp'ì-**sa = gi** = ꜛ = bo/
seek-FUT=3F.SBJ=IRR=VC1
'she will gather'

(60) *Forms of the directional-future suffix /-sa/ combined with the subject clitics.*

sadi ~ ssi	DIR/FUT=1SG.SBJ	samu ~ smu	DIR/FUT=1PL.SBJ
sana ~ sna	DIR/FUT=2SG.SBJ	sama ~ sma	DIR/FUT=2PL.SBJ
saga ~ ska	DIR/FUT=3M.SBJ	sagu ~ sku	DIR/FUT=3PL.SBJ
sagi ~ ski	DIR/FUT=3F.SBJ		

Similar questions are raised from these data as with those of the previous case study. If /wáꜜmá-di-lì/ 'the river (accusative)' is realized [wáꜜmádíl] why is /wáꜜmá-sa-di/ 'to the river + I (subject)' realized as [wáꜜmássí] and not *[wáꜜmását]? What would motivate SV-Elision in the second stacked morpheme in the former case but of the first morpheme in the latter?

[38] The origin of the H tone on the morpheme /=bo/ in this context has not been fully analyzed, but I have here glossed it here as 'irrealis' since it has only been observed in future constructions. See also example (30).

As the least these two case studies evidence that the phonology of Ganza treats suffixes, clitics, and roots differently in different environments. There are at least two types of final vowel elision: FV-Elision which applies to roots in certain grammatical environments, and SV-Elision which applies to suffixes in certain phonological environments. Clitics are exempted from both types of elision. There are also at least two types of devoicing: devoicing that applies after SV-Elision and which generates a spreadable voiceless feature, and word-final devoicing which occurs after the application of morphology. These phenomena lend considerable support to a serial theory of the application of phonological processes.

6. Tone

In this final section of the paper I give a condensed account of the Ganza tone system. The following discussion will include an overview of the phonemic tone levels and functional load of tone (§6.1), an overview of basic tonal phenomena which account for tonal behaviour (§6.2), and a description and exemplification of the *tonal melodies* found on both noun roots (§6.3) and verb roots (§6.4). For the purposes of my description I will assume such things as the autosegmental nature of tone and the existence of tonal register.[39]

6.1 Tonemes

Ganza has two phonemic tones or *tonemes*, high (H) and low (L), both of which can occur as either associated or unassociated (floating) tones in the underlying form. A floating L will cause *downstep* (also called *non-automatic downstep*) of a following H, and is attested root-internally as well as between word and morpheme boundaries. I use the symbol (ꜛ) to indicate a floating H in the underlying form, and (ꜜ) to indictate a floating L in the underlying form as well as downstep in the surface form. Unlike a floating L, I have not yet observed that a floating H causes any significant change in the tonal register;[40] it either attaches to an available *tone-bearing unit* (TBU) or is deleted. Contour tones also exist, both falling and rising, but these are only ever realized on bimoraic syllables (i.e. double vowels or utterance-final lengthened vowels) and are best treated as two separate tonemes on adjacent TBUs.

The approximate pitch difference between the tonemes when realised on the same or different registers is illustrated in Figure 24 below. The difference between a H and a L on the same register is approximately 30Hz. Register shift in Ganza is 10Hz on average, and thus the difference between H and L on a lowered register is approximately 40Hz, and between H and ꜜH is 10Hz. Since Ganza has *downdrift* (also called *automatic downstep*) in addition to downstep, there is no contrastive height difference between the sequences LH and LꜜH, as both would be realized as a LH on the same register. These measurements represent the average for a short utterance, and may change significantly over a longer utterance with multiple changes in register.

[39] Because of the autosegmental nature of tone, it is assumed here that when a word has multiple syllables in a row surfacing at the same tone level this is actually a single tone or merged tone which has associated with multiple tone-bearing units in order to satisfy the Obligatory Contour Principle (OCP). Thus the tonal melody for the word /k'úzár/ 'domestic pig' is /H/ not /HH/, and for /gùrùm/ 'wild pig' is /L/ not /LL/.

[40] The closest I have come to observing significant effects from a floating H is that words with the melody /Lꜛ/ sometimes have a slight rise on the final syllable in isolation (e.g. /jàwìlꜛ/ → [jàwìl ~ jàwǐːl] 'hyena').

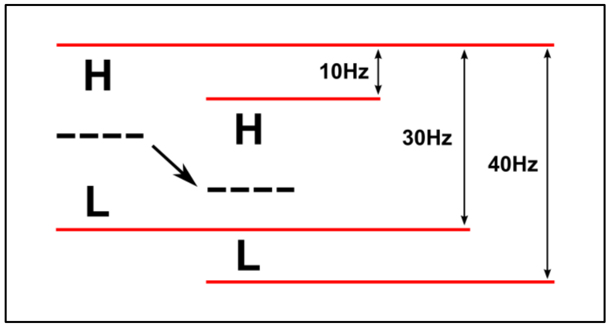


Figure 24 - Approximate height difference between Ganza tone levels in Hertz (Hz).

Tone carries a high lexical functional load in Ganza. It is a contrastive feature of noun and verb roots, as the tonal minimal pairs in (61) illustrate. It is also contrastive in various functional morphemes, for example the question morphemes /nòꜛ/ 'where' and /nóꜜ/ 'what' in (62), and the medial and distal demonstrative pronouns /ʔìtìꜛ/ 'that (near)' and /ʔìtí/ 'that (far)' in (63).

(61)	/Lꜛ/	wàŋà	'chicken'	cf.	/HL/	wáŋà	'ensete'
	/HL/	wáɗà	'to insult'		/HꜜH/	wáꜜɗá	'to distribute'
	/Lꜛ/	wàlà	'to remain'		/LH/	wàlá	'to seem'

(62) nògú pʰòlò
/nòꜛ = gu pòlò/
where=3PL.SBJ sit
'where are they sitting?'

cf. nógù pʰòlò
/nóꜜ = gu pòlò/
what=3PL.SBJ sit
'for what are they sitting?'

(63) ʔìtʰì gúrùmdì
/ʔìtìꜛ / gùrùm-di
DEM.MED boar-NM
'that (near) wild pig'

cf. ʔìtʰí gùrùmdì
/ʔìtí gùrùm-di/
DEM.DIST boar-NM
'that (far) wild pig'

I have a strong suspicion that tone also has a considerable grammatical load in Ganza, though more research is needed to determine the specifics. Up to now the only grammatical tone I have been able to observe with confidence is the L boundary tone used in the indicative mood, and possibly an irrealis H tone (see example (59) and footnote 38).[41] Contrasting tonal melodies on complementary morphemes might also be considered grammatical tone, such as the imperative suffixes /-éʃ/ 'IMP.SG' and /-èm/ 'IMP.PL' which have opposing /H/ and /L/ melodies. This is illustrated in (64) with the verb /gìzá/ (here taking the allomorphic form /gìzꜛ/).

[41] During the research sessions I conducted for this paper, grammatical categories such as transitivity, voice, and aspect were extremely difficult to discuss due to both my and my informants limited skills in our language of wider communication, Amharic. Several times I noticed tonal irregularities which, when probed, either disappeared or the semantic difference could not be sufficiently clarified.

(64)	gìzéʃ	cf.	gìzêm
	/gìzꜛ-éʃ/		/gìzꜛ-èm/
	enter-IMP.SG		enter-IMP.PL
	'come in (singular)!'		'come in (plural)!'

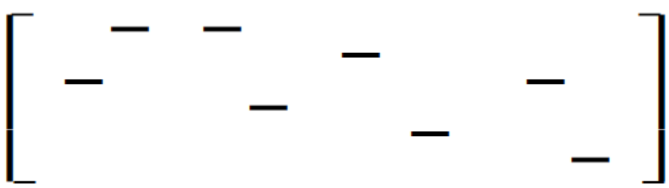
6.2 Basic Tonal Phenomena

Before describing the underlying melodies attested on noun and verb roots several foundational tonal phenomena need to be explained. These phenomena account for the various surface pitch permutations of the underlying melodies. They are as follows:

a. Downdrift

Ganza exhibits downdrift, meaning that an overt L will cause a following H to be realized on a lower register than any previous H. Thus, in the sequence /HLH/ the second H will have a surface pitch approximately 10Hz lower than that of the first. Downstep in Ganza is also "terracing" (Snider 1999), meaning that after a downstepped H a L will also be realized on a lower register than a preceding L. Again, in the sequence /LHL/ the second L will be realized roughly 10Hz lower than the first. As multiple downsteps are applied there is a downward "terracing" effect on the overall register of the utterance. This effect can be seen clearly when multiple /HL/ melody words are placed adjacent in a single phrase, as in (65) (the first data line is a spatial representation of the relative heights of surface pitch).

(65)



ʔìtʰí	nấʔȉ	ʔápʰà	kʰáʔà
/ʔìtí	náʔ̃ì	ʔápʰà	káʔà/
DEM.DIST	daughter	uncle	house

'that (far) daughter's uncle's house'

b. Construct tone melodies.

In addition to a *citation tone melody*, every noun, adjective, and verb in Ganza has an alternative tone melody which it takes in certain grammatical environments, which I will refer to as the *construct melody*. For nouns and adjectives this alternative melody is applied when the word is modified, whether by another noun, a demonstrative, a possessive pronoun, etc. This pattern corresponds exactly with that of nominal stem allomorphy described in §5.1. For verbs the construct melody is taken in differing grammatical environments (see §6.4 below), but unlike the nouns these environments do not correspond exactly to those of the verb stem allomorphy.

This phenomenon was first observed by Michael Ahland in the phonology of Bambassi Mao (2009). The term "construct melody" was first used in his dissertation (Ahland 2012) and was recommended to me by him. A similar phenomenon has also been observed by Anne-Christie

Hellenthal in Sheko, a Majoid-Omotic language (2010:123). It will be interesting to see if this feature is also attested in the other Mao languages, Hoozo and Sezo, as this will have significant bearing on the reconstruction of the Proto-Mao tone system.

c. Toneless TBUs.

Many of Ganza's bound morphemes exhibit toneless behaviour, including most nominal suffixes and all clitics. Underlyingly these morphemes have an empty TBU, and thus their surface tone is entirely dependent on the melody of the preceding tone-bearing morpheme. These toneless morphemes contrast with bound verbal morphemes such as the perfect /-gwá↓/~/-gá↓/, the negative /-án↓/, and the imperatives /-éʃ/ 'IMP.SG' and /-èm/ 'IMP.PL', which have melodies of their own.

d. Rightward-unbounded tone spread within the phonological word.

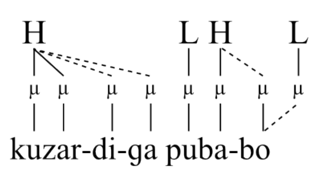
An underlying associated H or L tone of a noun or verb root in Ganza will spread rightward until blocked by another overt tone. Thus, a tone will associate with all toneless morphemes immediately to the right of the original TBU until it meets a TBU already associated with a tone. This spreading does not occur across word boundaries, but it will occur freely across both suffix and clitic morpheme boundaries. Thus the *phonological word* in this context is considered to be a headword and all its subsequent suffixes and clitics.

e. Boundary tones.

Ganza exhibits an abundance of floating tones which tend to associate with the phonological word at phrase and utterance boundaries. For example the boundary L (mentioned in §6.1) floats at the end of an indicative utterance and, in conjunction with utterance-final lengthening, produces a falling contour if adjacent to a H. Also, many of the noun and verb melodies evidence floating tones which may surface as contour tones, downstep, fully realized level tones, or delete depending on the morphological context.

These last three phenomena– toneless morphemes, rightward-unbounded tone spread, and boundary tones– can be illustrated with a single example, as in (66). Here the toneless morphemes /-di/ 'NM' and /=ga/ '3M.SBJ' are suffixed to the /H/ melody word /kúzár/ 'domestic pig', followed by the /LH/ verb /pùbá/ 'sick' and the toneless verbal clitic /=bo/. The H of /kúzár/ spreads to the toneless /-di/ and /=ga/ before being blocked by the initial L of /pùbá/. The H of /pùbá/ spreads to /=bo/, after which utterance-final lengthening generates an extra mora to which the floating boundary L associates, resulting in a falling surface tone.

(66) kʰúzárrígá pʰùbábô
/kúzár-di=ga pùbá=bo/
pig-NM=3M.SBJ sick=VC1
'the pig is sick'



6.3 Noun Tone Melodies

Based on their pairings of citation and construct melodies, Ganza simplex nouns (i.e. disyllabic monomorphemic nouns) can be divided into ten different *lexical tone classes* (hereafter LTCs). There are eight attested citation melodies— /H/, /Hꜜ/, /HꜜH/, /HL/, /LH/, /LHꜜ/, /L/, and /Lꜛ/— and three attested construct melodies— /L/, /HL/, and /Hꜜ/. Six of the eight citation melodies predictably pair with only one of the construct melodies; the two remaining citation melodies each may take one of two construct melodies. The resulting ten LTCs are illustrated in Figure 25 below. Note that for the rest of this paper I will represent LTCs with phonemic forward-slashes and a colon, with the citation melody to the left of the colon and the construct melody to the right.

Noun-LTCs		Construct Melodies		
		/L/	/HL/	/Hꜜ/
Citation Melodies	/H/	/H:L/		
	/Hꜜ/	/Hꜜ:L/		/Hꜜ:Hꜜ/
	/HꜜH/		/HꜜH:HL/	/HꜜH:Hꜜ/
	/HL/		/HL:HL/	
	/LH/	/LH:L/		
	/LHꜜ/	/LHꜜ:L/		
	/L/	/L:L/		
	/Lꜛ/			/Lꜛ:Hꜜ/

Figure 25 – Nominal lexical tone classes in Ganza based on citation and construct tone melody pairings.

In Figure 26 I give examples of each nominal LTC, first showing the underlying form of the word and then exemplifying the various surface forms of both of its citation and construct melodies. The frames given are first isolation, which shows the citation melody plus utterance-final lengthening, second suffixing of the plural nominal marker /-ɡu/, which shows the citation melody extended onto a toneless morpheme, and third the addition of the plural distal demonstrative /ʔùɡú/ (plus an obligatory /-ɡu/ 'NM.PL' suffix), which shows the construct melody by modifying the noun.

LTC	Underlying Form (Citation : Construct)		Isolation (Citation)	Plural Nominal Marker (Citation)	Plural Distal Demonstrative (Construct)
/H:L/	/gáŋá : gàŋà/	'donkey'	gáŋá	gáŋágú	ʔùgú gàŋàgù
/Hꜜ:Hꜜ/	/sásóꜜ/	'monkey'	sásô	sásógù	ʔùgú sásógù
/Hꜜ:L/	/t'úláꜜ : t'ùlà/	'dikdik'	t'úlâ	t'úlágù	ʔùgú t'ùlàgù
/HꜜH:Hꜜ/	/káꜜná : kánáꜜ/	'dog'	kʰáꜜná	kʰáꜜnágú	ʔùgú kʰánágù
/HꜜH:HL/	/sáꜜʔá : sáʔà/	'goat'	sáꜜʔá	sáꜜʔágú	ʔùgú sáʔàgù
/HL:HL/	/pát'à/	'deer'	pʰáɗà	pʰáɗàgù	ʔùgú pʰáɗàgù
/LH:L/	/mìmí : mìmì/	'mosquito'	mìmí	mìmígú	ʔùgú mìmìgù
/LHꜜ:L/	/kjàláꜜ : kjàlà/	'colobus'	kʰjàlâ	kʰjàlágù	ʔùgú kʰjàlàgù
/L:L/	/kùrù/	'genet'	kʰùrù	kʰùrùgù	ʔùgú kʰùrùgù
/Lꜛ:Hꜜ/	/wàŋàꜛ : wáŋáꜜ/	'chicken'	wàŋà	wàŋàgú	ʔùgú wáŋágù

Figure 26 - Examples of nominal lexical tone classes on disyllabic words.

In isolation it can be seen that a floating L (ꜜ) results in a falling contour tone (e.g. /sásóꜜ/ → [sásôː]). This can be attributed to utterance-final lengthening, which adds a mora to the final vowel of the noun root and allows the floating L to associate and create a contour. A floating H (ꜛ) does not consistantly produce this effect, however (e.g. /wàŋàꜛ/ → [wàŋà ~ wàŋǎː] cf. footnote 40). This is part of a larger pattern in the tonology where a floating H will delete at certain boundaries if there is no fully realized TBU for it to associate with, contrasting with a floating L which will consistantly result in a contour or downstep if not fully associated.[42]

The plural nominal marker frame reveals floating tones by providing an empty TBU for them to associate with (e.g. /sásóꜜ-gu/ → [sásógù], /wàŋàꜛ-gu/ → [wàŋàgú]). LTCs without a floating tone will simply spread the rightmost lexical tone to this empty TBU (e.g. /mìmí-gu/ → [mìmígú]). Consequently, LTCs whose citation melodies only differ by a floating tone can be clearly differentiated here (cf. /H/ and /Hꜜ/, /LH/ and /LHꜜ/, /L/ and /Lꜛ/).

Finally, the plural distal demonstrative frame differentiates LTCs with the same citation melody but different construct melodies (cf. /Hꜜ:Hꜜ/ and /Hꜜ:L/, /HꜜH:Hꜜ/ and /HꜜH:HL/). Nouns in these LTCs behave alike in environments utilizing the citation melody, but their behaviours diverge when modified by another word.

The above frames all show the citation and construct melodies with empty TBUs in the righthand environment. When the immediate righthand environment is occupied by an overt tone, however, a new set of phenomena occurs. The simple possessive construction is a helpful frame for seeing these phenomena and will be used in the examples to follow.

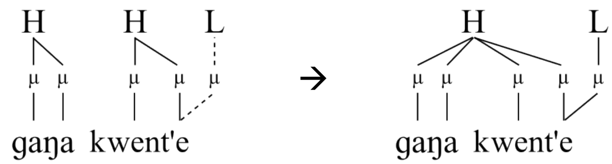
As can be expected, when two identical tonemes are placed adjacent to one another they merge in response to the *Obligatory Contour Principle* (OCP). This is illustrated in (67) and (68). In the first example the /H:L/ word /gáŋá/ 'donkey' modifies the /Hꜜ:Hꜜ/ word /kwént'éꜜ/ 'tail', the former taking its citation melody /H/ and the latter its construct melody /Hꜜ/. The two H tones merge and the final floating L creates a falling contour on the utterance-final lengthened vowel. In the second example the /L:L/ word /kùrù/ 'genet' modifies the /H:L/ word /tókó/ 'foot',

[42] There is evidence that a floating L will also delete if left floating at certain phrasal boundaries.

the former taking its citation melody /L/ and the latter its construct melody /L/. The L tones merge with each other and the boundary L.

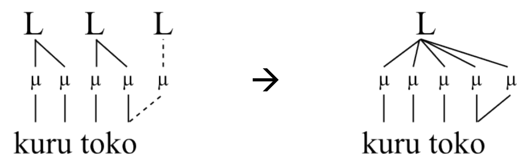
(67) *H before a H merges.*

gáŋá	k^{h}wéndɗê
/gáŋá	kwént'éꜜ/
donkey	tail
'donkey's tail'	



(68) *L before a L merges.*

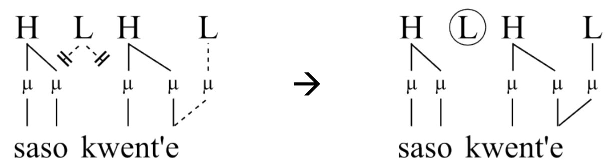
k^{h}ùrù	t^{h}òk^{h}ò
/kùrù	tòkò/
genet	foot
'genet's foot'	



When a floating L is positioned between two associated H tones, there is neither a TBU for it to associate with and nor another L to merge with. Association is blocked and the L remains floating, triggering downstep. This is illustrated in (69). Here the /Hꜜ:Hꜜ/ word /sásóꜜ/ 'monkey' modifies the /Hꜜ:Hꜜ/ word /kwént'éꜜ/ 'tail', with the floating L of the citation melody of the former causing downstep and the floating L of the construct melody of the latter being realized as a final falling contour.

(69) *Floating L before a H triggers downstep.*

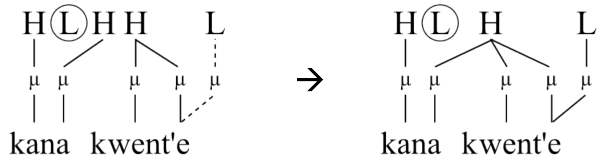
sásó	ꜜk^{h}wéndɗê
/sásóꜜ	kwént'éꜜ/
monkey	tail
'monkey's tail'	



A downstepped H placed before another H will merge, but this merged H will still remain downstepped relative to a preceding H. This is illustrated in (70), where the /HꜜH:Hꜜ/ word /káꜜná/ 'dog' modifies the /Hꜜ:Hꜜ/ word /kwént'éꜜ/ 'tail'. Because the citation melody of /káꜜná/ has downstep word-internally, it is assumed that underlyingly it has two H tones with an intervening floating L (as depicted in the autosegmental diagram).

(70) *Downstepped H before a H merges on lowered register.*

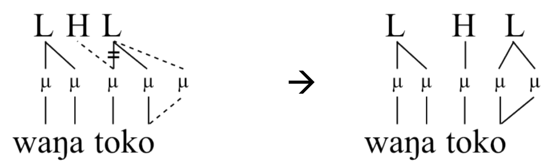
kʰáꜜná	kʰwéndɛ̂
/káꜜná	kwént'éꜜ/
dog	tail
'dog's tail'	



Finally, when a floating H is positioned before an associated L, it will spread to the TBU and delink the L. This can be seen in (71), where the /Lꜛ:Hꜜ/ word /wàŋàꜛ/ 'chicken' modifies the /H:L/ word /tókó/ 'foot'. While in most modified contexts the word /tókó/ would take its construct melody /L/ and surface as [tʰòkʰò], here it surfaces as [tʰókʰò] because of the intervening H from the citation melody of /wàŋàꜛ/. This type of delinking only occurs with a floating H and only within a constructed phrase; an associated H will not spread and delink an associated L, and a floating H will not cause delinking of a L across a phrasal boundary (i.e. it will not interfere with a citation melody).

(71) *Floating H before a L delinks L.*

wàŋà	tʰókʰò
/wàŋàꜛ	tòkò/
chicken	foot
'chicken's foot'	



Before moving on to verb tone melodies I will briefly illustrate the LTCs attested for monosyllabic nouns, which I subdivide into open and closed syllable profiles. The LTCs found on these two syllable profiles are a subset of those attested in the disyllabic nouns (eight of the ten).

Open-syllable monosyllabic nouns (i.e. CVV and CCVV) attest four of the ten LTCs: /Hꜜ:Hꜜ/, /HꜜH:Hꜜ/, /LHꜜ:L/, /Lꜛ:Hꜜ/. Examples of each of these are given in Figure 27 below. This subset is quite surprising in terms of which LTCs are not attested, for example the absence of the simple citation melodies /H/, /HL/, /L/, and /LH/, and simple construct melody /L/.

LTC	Underlying Form (Citation : Construct)		Isolation (Citation)	Plural Nominal Marker (Citation)	Plural Distal Demonstrative (Construct)
/Hꜜ:Hꜜ/	/síìꜜ/	'wax'	sîì	síígù	ʔùgú síígù
/HꜜH:Hꜜ/	/sáꜜá : sááꜜ/	'woman'	sáꜜá	sáꜜágú	ʔùgú séágù
/LHꜜ:L/	/bàáꜜ : bàà/	'father'	bàâ	bàágù	ʔùgú bààgù
/Lꜛ:Hꜜ/	/k'ààꜛ : k'ááꜜ/	'new thing'	k'àà	k'àágú	ʔùgú k'áágù

Figure 27 - Examples of nominal lexical tone classes on monosyllabic open-syllable words.

Closed-syllable monosyllabic nouns (i.e. CVC, CCVC, and CVCC) attest another four of the ten LTCs: /H:L/, /HL:HL/, /LH:L/, and /L:L/. Examples of these are given in Figure 28 below.

LTC	Underlying Form (Citation : Construct)		Isolation (Citation)	Plural Nominal Marker (Citation)	Plural Distal Demonstrative (Construct)
/H:L/	/nják : njàk /	'kingfisher'	ɲjákʰ	ɲjákkú	ʔùgú ɲjàkkù
/HL:HL/	/dób↓/	'lion'	dôb	dóbgù	ʔùgú dóbgù
/LH:L/	/màk'↑ : màk'/	'fox'	màk	màkk'ú	ʔùgú màkk'ù
/L:L/	/wàr/	'robin'	wàr	wàrgù	ʔùgú wàrgù

Figure 28 - Examples of nominal lexical tone classes on monosyllabic closed-syllable words.

Again this is an unexpected subset, since none of these four LTCs overlap with those attested on the open-syllable monomorphemes. I would have expected both profiles to have all the same LTCs, or for one to be a subset of the other. It could be argued that the /H↓:H↓/ and /HL:HL/ LTCs are in fact one in the same, since a /HL/ melody on a single syllable produces a floating L. My reason for differentiating them here is that the melody on a the bimoraic CVV profile does not behave like the /HL/ melody on a CVCV profile but instead like the /H↓/. If the melody of /síí↓/ were indeed /HL/ I would expect surface tone in the plural nominal marker frame to be *[síîgù] with a contour on the double vowel (cf. /pát'à/ → [pʰádâgù]). However, the actual surface tone is [síígù], suggesting that the L in the melody is floating and attaches causing a falling tone in isolation due to utterance-final lengthening. I have then decided to analyze /dób↓/ as /HL/ for simplicity.

As mentioned in §3.3, the complexity of the tonal melodies found on these monosyllabic morphemes leads me to believe that they developed from disyllabic proto forms. Closed-syllable monosyllabic roots likely developed from final vowel elision (*CVCV→CVC), and open-syllable from consonant elision (*CVCV→CVV). Given the complementary distribution of LTCs between the two types of monosyllabic nouns, perhaps one criterion for whether a CVCV proto-form underwent final vowel elision or consonant elision had to do with the morpheme's tonal melodies.

6.4 Verb Tone Melodies

For simplex verbs (i.e. disyllabic, monomorphemic verbs) there are six attested LTCs. There are five citation melodies— /H/, /H↓H/, /HL/, /LH/, and /L↑/— and four construct melodies— /L/, /HL/, /H↓/, /L↑/. Four of the citation melodies pair predictably with one of the four construct melodies, but the citation melody /H↓H/ forms two LTCs, pairing with either /HL/ or /H↓/ for its construct melody. A chart of these LTCs is given in Figure 29 below.

Verb-LTCs		Construct Melodies			
		/L/	/HL/	/H↓/	/L↑/
Citation Melodies	/H/	/H:L/			
	/H↓H/		/H↓H/HL/	/H↓H:H↓/	
	/HL/		/HL:HL/		
	/LH/	/LH:L/			
	/L↑/				/L↑:L↑/

Figure 29 -Verbal lexical tone classes in Ganza based on citation and construct tone melody pairings.

In Figure 30 below I give examples for each of the six LTCs. The environment chosen to show the citation melody below is the verbal construction /hà↑=ga ___=bo/, which is formed from the affirmative marker /hà↑/ the third-person singular subject clitic /=ga/ or plural /=gu/, and the verbal clitic /=bo/. The environment chosen for the construct melody is the verbal construction /hà↑=ga ___=na/, which is formed the same way only using the final verbal clitic /=na/. As far as I have been able to ascertain in my research so far, these two phrases have little if any semantic differences.

LTC	Underlying form (Citation ~ Construct)		VC1 (Citation)		VC2 (Construct Melody)	
/H:L/	/tákú ~ tàkù/	'run.PL'	hàgú tákúbô	'they ran'	hàgú tàkùnà	'they ran'
/H↓H:H↓/	/ʃí↓ní ~ʃíní↓/	'work'	hàgá ʃí↓níbô	'he works'	hàgá ʃínínà	'he works'
/H↓H:HL/	/wí↓ʃí ~ wíʃì/	'send'	hàgá wí↓ʃíbô	'he sends'	hàgá wíʃìnà	'he sends'
/HL:HL/	/tájà/	'sojourn'	hàgá tájàbò	'he sojourns'	hàgá tájànà	'he sojourns'
/LH:L/	/gàrá ~ gàrà/	'sit.SG'	hàgá gàrábô	'he sits'	hàgá gàrànà	'he sits'
/L↑:L↑/	/pòlò↑/	'sit.PL'	hàgú pòlòbô	'they sit'	hàgú pòlònâ	'they sit'

Figure 30 - Examples of verbal lexical tone classes on disyllabic non-allomorphic verbs.

The differing environments for when a verb stem will take its citation melody and when it will take its construct melody are given in Figure 31 below. As mentioned before, these environments do not correspond to the environments for when a verb might take an allomorphic form (cf. Figure 23 in §5.1). This creates a matrix of four possible verb forms: full-stem with citation melody, full-stem with construct melody, allomorphic stem with citation melody, and allomorphic stem with construct melody. Since only a subset of verb roots take an allomorphic form and since several LTCs have identical citation and construct melodies, while some verbs have all four variants some have only two and some only one. These various possibilities are illustrated in Figure 32 with the verb /swáná/ 'to count' having four stem variants, /sú↓nú/ 'to cross' having two tonal variants but no stem allomorphy, /sápá↓/ 'to burn' having two stem allomorphs but no tonal variants, and /sásá↓/ 'to bite' only ever taking one form.

CITATION MELODY	CONSTRUCT MELODY	AGREEMENT
VC1 /=bo/	VC2 /=na/	Continuous auxiliary /gàráꜜ/+
Negative /-ánꜜ/	Conditional /-n/	Non-final-DS /-l/
Imperative /-éʃ/, /-èm/	Future /-sa/	Serial verb
Neg. Imperative /-ánꜜ-éʃ/, /-ánꜜ-èm/	Purpose /-sa/	Perfect /-gwáꜜ/ + VC1/2
Jussive /kwámàn/ +	Reason /-di/ + /kódò/	
Nominalized /-di/	Polar Question	
Non-Final-SS /-p/	Relative Clause /-di/	
Content Question /-e/		

Figure 31 -Environments for construct melody in Ganza verbs.

	CITATION MELODY : CONSTRUCT MELODY			
	Four forms	Two forms (tonal)	Two forms (allomorphy)	One form
FULL STEM	/swáná : swànà/	/súꜜnú : súnúꜜ/	/sápáꜜ/	/sásáꜜ/
ALLOMORPHIC STEM	/swén : swèn/		/sápꜜ/	
GLOSS	'to count'	'to cross over'	'to burn'	'to bite'

Figure 32 – Examples of verb stem variation resulting from interaction of stem allomorphy and LTCs.

Perhaps the most surprising aspect of the distribution of the verbal tone melodies shown in Figure 31 above is the "agreement" category, where dependent forms such as the continuous auxiliaries, non-final different-subject verbs, and serial verb constructions will take either their citation or their construct melody depending on the melody of the main verb. This is illustrated in (72) and (73). These two sentences have essentially the same semantic content, but the former uses the verbal clitic /=bo/, triggering the use of the citation melody for the main verb and two preceding serial verbs, and the latter uses the verbal partical /=na/, triggering the use of the construct melody in all three verbs.

(72) *Serial verbs with citation melody: /LH/ + /HꜜH/ + /LH/*

t'úmán pʰáɗàdì p'òʃó kʰíꜜʔá jèppô

/t'úmán pát'à = di p'òʃó kíꜜʔá jèp'ꜛ = bo/

yesterday deer=1SG.SBJ chase catch kill=VC1

'yesterday I chased, caught, and killed a deer'

(73) *Serial verbs with construct melody: /L/ + /HL/ + /L/*

t'úmán pʰáɗàdì p'òʃò kʰíʔà jèp'nà

/t'úmán pát'à = di p'òʃò kíʔà jèp' = na/

yesterday deer=1SG.SBJ chase catch kill=VC2

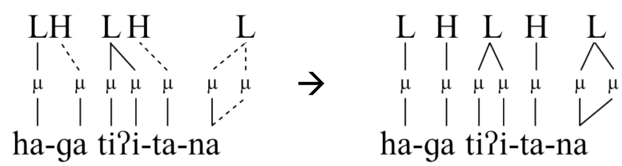
'yesterday I chased, caught, and killed a deer'

As with the nouns, the verbal melodies will react differently when placed adjacent to toneless morphemes as opposed to tone-bearing morphemes, especially in regards to floating tones. This can be seen, for example, with the addition of the toneless applicative suffix /-ta/ compared with the perfect marker /gwáꜜ/.

When a floating H of a verb root melody is adjacent to a toneless morpheme it will associate with that morpheme, as with the /Lꜛ:Lꜛ/ word /tìʔìꜛ/ 'protect' in (74). In this case there is no spreading of the H to the final morpheme /=na/, but instead the boundary L associates with it first. When placed before a morpheme with an overt H, like /-gwáꜜ/ in (75), the floating H will merge due to the OCP.

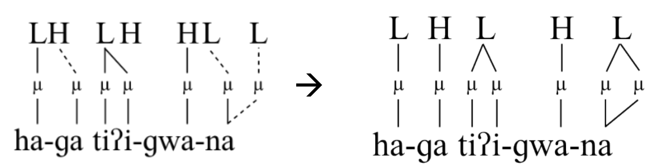
(74) *Floating H associates to toneless morpheme.*

hàgá tʰìʔìtʰánà
/hàꜛ=ga tìʔìꜛ-ta=na/
AFF=3M.SBJ protect-APL=VC2
'he protects it'



(75) *Floating H deletes or merges with following H.*

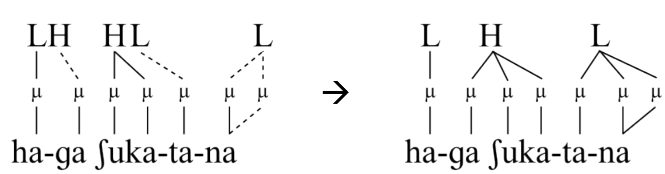
hàgá tʰìʔìgwánà
/hàꜛ=ga tìʔìꜛ-gwáꜜ=na/
AFF=3M.SBJ protect-PFV=VC2
'he has protected'



A floating L placed before a toneless morpheme will associate with that TBU, as expected. This can be seen in (76) with the /HꜜH:Hꜜ/ verb /ʃúꜜká/ 'push', here shown utilizing its construct melody /Hꜜ/. After associating, adjacent identical tones will merge. However, a floating L placed before a morpheme with an overt H will cause downstep. This is shown in (77), when /ʃúkáꜜ/ is positioned before /-gwáꜜ/.

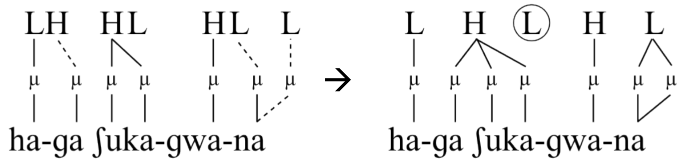
(76) *Floating L associates with toneless morpheme.*

hàgá ʃúkʰátʰànà
/hàꜛ=ga ʃúkáꜜ-ta=na/
AFF=3M.SBJ protect-APL=VC2
'he pushes it'



(77) *Floating L downsteps following H.*

hàgá ʃúk^{h}áꜜgwánà
/hàꜛ=ga ʃúkáꜜ-gwáꜜ=na/
AFF=3M.SBJ protect-PFV=VC2
'he has pushed'



7. Conclusion

In this paper I have provided a description and partial analysis of the phonological system of Ganza, a language which was previously undescribed in any published material. I presented evidence of a twenty-three consonant phoneme system, including a three way voiced-ejective-voiceless contrast in the oral stops and sibilants— a well attested feature of Omotic languages. Also included was evidence of a nasalizing glottal phoneme /ʔ̃/, which causes unmotivated (phonemic) nasality on preceding and following vowels and contrasts word medially with the oral glottal stop /ʔ/. Next I presented evidence for a five vowel phoneme system that, unlike most Omotic languages, does not utilize vowel length as a primary contrastive feature. I then looked at the structure of the word in terms of syllable structure and phonotactics. The syllable structure of Ganza in particular was shown to be much more liberal than some of its neighbouring Mao languages, with a maximal syllable of Cw/jVNC. Having laid the foundations of basic phonemic contrast and word structure, I described two prominent morphophonemic phenomena of particular relevance. The first was the allomorphy of noun and verb stems by either FV-Elision or FV-Elision and V-Alternation. While similar processes are attested in other Omotic languages, particularly FV-Elision in other Mao languages (Ahland 2009, Girma 2015), Ganza was shown to be unique in that these only apply to a subset of noun and verb roots in certain grammatical environments, not ubiquitously. The second phenomenon I described was the interplay of SV-Elision, voice and manner assimilation, and final devoicing in the stacking of suffixes and clitics on noun and verb roots. Here it was shown that the phonology makes a distinction between suffixes and clitics, and that the application of the aforementioned processes appears to happen serially, lending support to a serial theory of phonology rather than a simultaneous one. Finally, I gave an introduction to the tone system. I showed that Ganza has two tonemes— high (H) and low (L)— as well as phonemic downstep, and that these have a high functional load in the language. Next I introduced basic tonal phenomena such as downdrift, construct melodies, toneless morphemes, rightward unbounded tonal spread, and boundary tones. Most notable of these is the construct melody, a phenomenon in which a noun or verb root takes an alternate melody in certain grammatical constructions. Lastly I described and exemplified the ten lexical tone classes (pairings of citation and construct melodies) for simplex nouns and the six for simplex verbs.

This paper was designed as a first step in the description of Ganza, and more papers are planned from the data I was able to gather. Much more research is required on the language, especially in regards to the TAM system, verbal complex, syntax, and discourse features of the language. A comparative study with the dialects of Sudanese Ganza would also be beneficial, as unpublished data sources from those groups seem to indicate some phonological and syntactic differences. Finally, as Omotic is still a rather young and understudied language family and Mao the most data-deficient of all its subfamilies, this newly available data should be considered for comparative analysis and reconstruction.

Abbreviations

1	first person
2	second person
3	third person
ACC	accusative
AFF	affirmative
APL	applicative
DEM	demonstrative
DIR	directional
DIST	distal
H	high tone
IMP	imperative
IRR	irrealis
F	feminine
FV-elision	final vowel elision
FUT	future
L	low tone
LTC	lexical tone class
M	masculine
MED	medial
NEG	negative
NM	nominal marker
OCP	obligatory contour principle
PFV	perfect
PL	plural
POSS	possessive
PROX	proximal
PURP	purpose
SBJ	subject
SG	singular
SV-elision	suffix vowel elision
TBU	tone-bearing unit
VC1	verbal clitic 1 /=bo/, undetermined semantics
VC2	verbal clitic 2 /=na/, undetermined semantics
VOT	voicing onset time

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Joshua Smolders
SIL International
josh_smolders@sil.org