Aspects of Ethiopian Komo (morpho)phonology

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This paper presents the first comprehensive analysis of the phonological system of Komo (Koman of Western Ethiopia), including the tone system and morphophonological processes in the verb involving deictic directional morphology. The consonant inventory contains plain, ejective, implosive stops and an ejective affricate in three places of articulation. Komo has a seven-vowel inventory with Advanced Tongue Root (ATR) contrast in the high vowels and a typologically rare bi-directional ATR harmony system. Komo displays anticipatory [+ATR] harmony as well as progressive [–ATR] harmony, which, when taken together, call into question the notion of a single "dominant" ATR feature value in an ATR harmony system.

1 Introduction

Komo (also known as Koma, ISO 693-3 code *xom*) is a little-described endangered language spoken along the Ethiopia, Sudan and South Sudan border.[1] Determining the population of Komo speakers at present has been challenging for several reasons. Lewis et al.'s (2015) estimates (10,000 in Sudan and 5,000 in Ethiopia) date back to 1976 and the most recent Ethiopian census data from 2007, citing 15,000 ethnic 'Komo' in Ethiopia, groups together speakers of Komo and the related Koman language Gwama (FDCREPC 2008). In Ethiopia, speakers of Komo and Gwama identify ethnically as "Komo" yet recognize they speak two mutually unintelligible languages (Yehualashet 2008, Küspert 2015). Henceforth, "Komo", will refer specifically to speakers of the Komo language, which can be found in two main areas in Ethiopia, the Mao-Komo special *woreda* (district) of the Benishangul-Gumuz Regional State and in Gambella, the capital of the Gambella Regional State and in a nearby village.[2]

In the Mao-Komo special *woreda*, which extends westward to the border of South Sudan, the majority of Komo speakers live in remote enclaves scattered along the border, communicable only by footpaths. Historically, communities residing in these borderlands, including the Komo, have lived in a continuum of subjection and migration (Meckelburg 2015:23), the result of being traded as slaves, a practice which dates back to the 19th century in this region (Corfield 1938:129). This was also witnessed in the late 1800's by the Dutch traveller Juan María Schuver, who visited Komo villages in the Sudan (James et al. 1996). The slave trade led to cultural and social subjugation, which resulted in forced migration and fragmentation of the people groups of the Ethio-Sudan borderlands for decades. Slave trading of the Komo and other minority groups of this area continued well into the 1930s (Meckelburg 2015). More recently, due to the current federal policy

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[2]The author has also conducted fieldwork in Gambella and the nearby village of Pokung, where approximately 200 Komo reside amongst a much larger Anywa and Oromo population in the surrounding area. An Ethiopian official working in the Gambella Ministry of Education quoted a total population of 350 Komo in the Gambella Regional State.

towards ethnic diversity in Ethiopia, the Komo people, along with other minority populations inhabiting remote areas of western Ethiopia (e.g. Gwama and Opo), have undergone resettlement to villages nearer to larger towns. This process is ongoing and is increasing language shift in these communities to more dominant languages.

In Ethiopian villages, the Komo typically live among other ethnicities and intermarriage with these groups is common. In the Benishangul-Gumuz Regional State, Komo often intermarry with Gwama, Oromo and to a lesser extent, speakers of Dana.[3] In the Gambella State, Komo mostly live among the Anywa, Oromo, Nuer and Opo. Komo native speakers are by and large multilingual in Ethiopia, as they often learn the languages of the larger people groups they are in contact with. The contrary is almost never found. The current panorama in Ethiopia leads the present author to suggest that Ethiopian Komo is a highly endangered language, as many of its speakers are assimilating to neighboring dominant cultures and languages.

There has been ongoing controversy over the internal structure of the Koman family as well as its affiliation to the larger Nilo-Saharan phylum. This is evidenced as far back as Corfield (1938) and Tucker and Bryan (1966), who struggled with auto-determined and external nomenclature for the Koman groups they encountered, as well as the significant dialectal variation among clans speaking Koman languages.[4] Externally, Koman languages have traditionally been classified within the Nilo-Saharan phylum (Greenberg 1963). Bender (1991, 1994) places Koman coordinate with Gumuz, Kadu, and the East Sudanic branch within what he calls the 'core' group within Nilo-Saharan. By contrast, Ehret (2001) reconstructs Koman as one of two primary splits from Proto Nilo-Saharan.[5] Dimmendaal (2011), the most conservative, maintains Koman as an independent family until more extensive grammatical information becomes available. This paper does not directly address the external classification issue but the phonological analysis in the paper is an important step for any subsequent studies.

The Koman languages as a whole were largely undescribed until recently. The only comprehensive work on Komo is a short grammatical sketch by a missionary in the Sudan (Burns 1947). Burns' pioneering work, both in terms of phonetics/phonology and morphosyntax, laid the groundwork for Bender (1983, 1994), who examined Komo within a Koman perspective employing prior data and his own field notes. Subsequently Kutsch-Lojenga & Otero (2011) provided a brief refinement of Komo phonology. While Negash (2015) provides a cursory phonological analysis, the work differs significantly from the current analysis, primarily in the vowels and tone. The major aims of this paper are to clarify analytical anomalies and provide a comprehensive overview of the major (morpho)phonological processes. The data for this paper come from roughly twenty months of fieldwork spread over various trips beginning in 2011 and continuing to the present. The current database contains over 3500 roots, 35 analyzed texts and countless verb paradigms.

[3]It is unclear at this point whether Dana should be classified as a variant of Opo or a distinct language in its own right, given the lack of data. A cursory examination of wordlists reveals that the Dana data collected by the author correspond to what Corfield (1938:129) called the "Buldiit" dialect/variant of modern-day Opo. Further, Dana pronominal and bound pronominal morphology shows variation from Opo (Otero 2016).

[4]Komo speakers are also purported to inhabit the town and the surrounding areas of Yabus (10°33'N 34°17'E), located in the south Blue-Nile State of Sudan (Burns 1947). Theis (1995) estimates 5000 in Sudan. All of the Ethiopian Komo consultants consider Yabus Komo to be mutually intelligible with Ethiopian Komo, albeit with some differences in the independent pronouns and certain lexemes. Sudanese Komo is unfortunately outside the scope of this paper.

[5]Ehret uses mostly data from Uduk, which incidentally displays the most complex sound system of all of the attested Koman languages (Bender 1994).

This paper is organized as follows: the contrastive consonant inventory is discussed in §2. Contrastive vowels and ATR harmony are treated in §3. Syllable structure and ambiguous sequences are examined in §4 and contrastive tone melodies in monomorphemic roots and in polymorphemic inflected verbs are discussed in §5. Lastly, morphophonological processes in the verb are discussed in §6.

2 Consonants

The Komo contrastive consonant inventory contains 23 phonemic consonants (Table 1).[6] There is a three-way contrast for plosives in the bilabial, alveolar and velar places of articulation and a three-way contrast in manner of articulation, which includes plain, ejective and implosive stops. This inventory is largely consistent with previous analyses of Komo, with the exception of the velar nasal and the glottal stop, which are of marginal status.[7]

		Bilabial	Alveolar	Palatal	Velar	Glottal
Plosive	plain	p b	t d		k g	(ʔ)
	ejective	p’	t’		k’	
	implosive	ɓ	ɗ			
Fricative			s z	ʃ		h
Affricate	ejective		s’			
Nasal		m	n		(ŋ)	
Lateral			l			
Trill/Flap			r			
Approximant		w		y		

Table 1. Komo contrastive consonant inventory

2.1 Marginally phonemic consonants: the velar nasal [ŋ] and the glottal stop [ʔ]

I consider the glottal stop /ʔ/ and the velar nasal /ŋ/ marginally phonemic consonants in the inventory due to their very limited distribution. Both the velar nasal and the glottal stop can occur phonetically in predictable environments: the glottal stop can occur before a word-initial vowel presumably to satisfy syllable onset requirements and the velar nasal can surface as a homorganic nasal before a velar stop. But there are instances where both the glottal stop and the velar nasal are phonemically contrastive segments discussed below. Burns (1947) only mentions the velar nasal as an allophone of the alveolar nasal assimilating to a following velar consonant.

[6]See Appendix 1 for evidence of consonant contrast in initial, medial and final position.

[7]Burns (1947) and Bender (1971:261) propose an identical consonant inventory to the current analysis with the exception of the velar nasal, which is not contrastive in their analyses. Similarly, Negash (2015) includes the velar stop but lacks the velar nasal and Yehualashet (2008) presents a 24-consonant inventory which lacks a bilabial implosive but includes a phonemic velar nasal, glottal stop and a voiceless bilabial fricative – the latter of which I consider to be an allophonic surface realization of intervocalic /b/.

The velar nasal occurs in two positions, word-internally and word-finally, where it may or may not alternate with the alveolar nasal (Table 2).[8] Word internally, the velar nasal occurs in two distinct environments: intervocalically, where it is marginally contrastive as very few near-minimal pairs exist; or as a homorganic nasal assimilating in place to a following velar stop across morpheme boundaries. In word-final position, the velar nasal [ŋ] can alternate with the alveolar nasal [n] in some lexemes but not all, an alternation that varies across different speakers.[9] It is difficult to know for certain whether or not the word-final velar nasal is the result of a prior homorganic [NC_{velar}] sequence from which the velar stop was lost over time. In total, there are only about twenty instances of an unconditioned velar nasal in my data.

VŋV	pɛ́ŋī	[pʰɛ́ŋī]	‘flatland’
	báŋá	[báŋá]	‘game (trad.)’
	lĭŋí	[lĭŋí]	‘hill passage’
	lāŋú	[lāŋú]	‘tree (sp.)’
	nàbɔ̀ŋà	[nàbɔ̀ŋà ~ nàbɔ̀ŋgà]	‘pelican’
ŋG	hʊ̀ngì	[hʊ̀ŋgì]	‘(they) with...’
	zɛ̀ŋzɛ̀ŋ	[zɛ̀ŋzɛ̀ŋ]	‘stringed instrument’
	hánkúr	[hə́ŋkúr]	‘He left (sth./s.o)’
ŋ#	wɔ̀lɔ́ŋ	[wɔ̀lɔ́ŋ ~ wɔ̀lɔ́n]	‘hare’
	dìlíŋ	[dìlíŋ]	‘earring’

Table 2 Intervocalic, homorganic and word final velar nasals

Although also of marginal status, the glottal stop appears to have a larger presence in the phonological system than the velar nasal. Before discussing the contrastive instances of the glottal stop, the predictable phonetic realization of glottal stop is explained.

First, there is phonetic glottal stop epenthesis before word-initial vowels. This epenthetic glottal stop is non-contrastive and has a gradient phonetic realization across speakers (Table 3). Vowel initial words are not altogether common in Komo and one possible explanation of epenthesis of the glottal stop is to satisfy certain syllable onset requirements. Thus far there do not appear to be any co-occurrence restrictions regarding word-initial glottal stop epenthesis and vowel or tone.

[8] All Komo data is presented phonemically unless indicated otherwise. Phonetic data is in brackets. Following Africanist norms, the grapheme <y> represents IPA palatal glide /j/ and <s’> represents the voiceless alveolar ejective affricate. Other symbols are used in accord with the IPA standard. Abbreviations are as follows: APPL=applicative, DD=deictic directional, EX=exclusive, IN= inclusive, F=feminine, M=masculine, NH=non-human, NEG= negative, O= object, REDUP= reduplication, PL=plural, PLU=pluractional, SG=singular. Tone: v́=(H)igh, v̄=(M)id, v̀= (L)ow, v̂=(F)alling, v̌=(R)ising.

[9] Speakers have not formed a consensus as to which segment they feel is the “correct” form in words where there is a [n ~ ŋ] alternation. This variation requires further investigation.

ɔ̀ʃ	[ʔɔ̀ʃ]	‘stone’	āt	[ʔāt^{h}]	‘child’
īnà	[ʔīnà]	DEM	ù̀m	[ʔù̀m]	2PL
úl	[ʔúl]	‘call’	ɛ̄g	[ʔɛ̄g]	‘limp’

Table 3 Phonetic glottal stop epenthesis in vowel-initial words

There is a handful of monomorphemic verb roots that display what appears to be a contrastive word-final glottal stop. These CVʔ verb roots behave like CVC roots when they occur with inflectional morphology. To illustrate, near minimal pairs inflected with the deictic directional suffix /-í/ DDØ are seen in Table 4.[10] In this paradigm, verb roots ending in a consonant take the DDØ suffix /-í/ realized as [i] before bound pronominal suffixes that only consist of a consonant (e.g. 3SG.M /-r/). By contrast, roots that end in a vowel take the DDØ suffix realized as zero.[11] In a near minimal pair, the verb /yàʔ/ ‘vomit’ takes the /-i/ form of the DDØ suffix, whereas /yà/ ‘go.SG’ takes the zero form of the suffix.

yàʔ	[yàʔ]	‘vomit.SG’	yàʔ-í-r	[yəʔír]	‘He vomits’
yà	[yà]	‘go.SG’	yà-∅/í-r	[yār ~ yər]	‘He goes’
bɔ̀ʔ	[bɔ̀ʔ]	‘hide.SG’	bɔ̄-ī-r	[bōʔīr ~ bōīr]	‘He hides’

Table 4 Contrastive word-final glottal stops in verbs

In some roots, there is an alternation between the presence and absence of a glottal stop, as seen in the inflected verb /bɔʔ/ ‘hide’ (Table 4). Further, a very small portion of synchronically monomorphemic lexical roots exhibit a phonetic intervocalic glottal stop (Table 5). In natural speech, the intervocalic glottal stop can also be elided and is thus creating a lack of phonological contrast for the glottal stop in this position.

bāʔɔ̄	[bāʔɔ̄ ~ bāɔ̄]	‘young woman’	wɛ̀ʔí	[wɛ̀ʔí ~ wɛ̀ī]	‘grinding stone’
yàʔɔ́	[yàʔɔ́ ~ yàɔ̄]	‘rainy season’	yàʔwí	[yàʔwí ~ yàwí]	‘gazelle’

Table 5 Noun roots with intervocalic glottal stops

2.2 Aspiration and lenition: Plain stops and fricatives

As seen in Table 1, stops contrast for three points of articulation (bilabial, alveolar and velar), as well as for four laryngeal features (voiceless, voiced, ejective and implosive).[12] The allophonic realizations for these eleven plosives are discussed below.

[10]Komo deictic directional suffixes are highly productive and polyfunctional morphemes, which code the *direction* or *path* of motion on translational motion verb roots and display Associated Motion on roots that do not express motion in their inherent lexical semantics (cf. Payne & Otero 2016).

[11]The [+high, +ATR] vowel /-í/ in the DDØ suffix causes [–high, –ATR] root vowels to surface as [+ATR] allophones as seen in [yəʔír] ‘He vomits’ where the /a/ root vowel is realized as [ə]. For open syllable roots, there appears to be dialectal variation as ‘He goes’ surfaces as either [yār] or [yər], the latter form indicates the presence of the /-í/ DDØ suffix and the former does not. The only evidence for the difference across speakers at present is regional: Komo speakers in Gambella prefer the [yər] forms while those in the Benishangul-Gumuz region prefer the [yār] type.

[12]The exception to the three-way contrast is the lack of a velar implosive, which incidentally is not found in any of the living Koman languages.

First, the bilabial and alveolar implosives have a limited distribution, occurring only in word-initial position where they are realized as traditional implosives, with ingressive air following an oral release.[13] Second, plain voiceless stops are phonetically aspirated in word-initial and word-final position. Intervocalically, voiceless stops can be realized with aspiration or they can also lenite to voiceless fricatives. Third, voiced stops are realized with a delayed release before a pause. Aspiration is thus a key phonetic cue that distinguishes voicing in plain stops both word-initially and word-finally. Word-initial and word-final phonetic realizations in plain voiced and voiceless stops are seen in Table 6.

	Word-initial			Word-final		
/p/	pá	[pʰá]	'hoof, shoe'	kɔ̀p	[kʷɔ̀pʰ]	'upper arm'
/t/	tùʃ	[tʰùʃ]	'cotton, thread'	āt	[ˀātʰ]	'child'
/k/	kíʃ	[kʰíʃ]	'cocoyam'	sʾík	[sʾíkʰ]	'rat'
/b/	bàr	[bàr]	'hip, waist'	dɔ̀b	[dʷɔ̀b ~ dʷɔ̀bˉ]	'lion'
/d/	dìn	[dìn]	'lake'	dùd	[dùd ~ dùdˉ]	'elbow'
/g/	gwà	[gwà]	'elephant'	zùg	[zùg ~ zùgˉ]	'guinea fowl'

Table 6 Allophones of word-initial and word-final stops and fricatives

Intervocalically, it is common for the voiceless stops to lenite and weaken to fricatives (Table 7), creating non-contrastive free variation among the allophones of /p/ ([p, pʰ, ɸ]), /t/ ([t, tʰ]) and /k/ ([k, kʰ, x]). Plain voiced stops can also lenite intervocalically surfacing as the voiced fricatives and tap [β, ɾ, ɣ]. Intervocalic lenition of plain voiceless and voiced stops is non-categorical and gradient across speakers, more evident in casual or fast speech.

/p/	pèpí	[pʰèpí ~ pʰèpʰí ~ pʰèɸí]	'leaf'
/t/	pātí	[pʰātí ~ pʰātʰí]	'liver'
/k/	sàkú	[sàkú ~ sàkʰú ~ sàxú]	'grandfather'
/b/	gībā	[gībā ~ gīβā]	'people'
/d/	mādā	[mādā ~ māɾā]	'place'
/g/	làgá	[làgá ~ làɣá]	'shelf'

Table 7 Allophones of intervocalic plain stops

[13]Negash (2015:24) proposes a contrastive voiceless bilabial implosive, though I have not found any evidence for this phoneme in the Komo system. A factor that may have led Negash to propose a contrastive voiceless implosive is the fact that some Komo consultants in his study are in fact L1 speakers of Gwama (Koman). Gwama lacks an implosive series (cf. Hellenthal & Kutsch Lojenga 2011, Kievet & Robertson 2012) and in my experience with Komo and Gwama speakers, many Gwama who speak Komo realize implosive consonants in Komo as voiceless, often confusing the implosive with a voiceless ejective in the Komo orthography.

2.3 Lenition and neutralization: Implosives and ejectives

The implosives have a limited word-initial distribution and do not display any significant allophonic variation. As such, implosive consonants will not be discussed further in this section. The ejectives, on the other hand, are not restricted within the word and display both categorical and free phonetic variation. "Categorical variation" here refers to an ejective phoneme which has particular allophonic realizations in specific environments and within specific types of words. Free variation refers to allophones created via common phonetic processes, namely intervocalic lenition and word-final articulation without a glottal release.

Word-initially, the ejectives are always articulated with glottal release. Word-medially, the ejectives /pʼ, tʼ, kʼ, sʼ/ can either be released, or weaken to voiced allophones [b, d, g, z], respectively. [14] Word-finally, there is variation between released and unreleased ejective allophones. The behavior suggests an intermediate process of deglottalization in word-final position across place of articulation: the bilabial is the most affected, followed by the alveolar and lastly the velar ejective.

Fallon (1998:193) claims that crosslinguistically, deglottalization of ejectives is a natural type of lenition, often resulting in neutralization with stops. Deglottalization occurs most commonly in coda position and it is more common for ejectives to neutralize with voiceless stops. In the related Koman language Gwama, Goldberg (2015) describes ejective neutralization with voiced stops in medial position and complete neutralization with both voiced and voiceless stops in word-final position.

In Komo monomorphemic roots, intervocalic ejectives have an audible release, clearly contrasting with other plosives, as seen in the near minimal triplets in Table 8. Further, speakers have very little confusion identifying intervocalic ejectives and discriminating them from plain stops in monomorphemic roots.

/pʼ/	gùpʼí	[gùpʼíʔ]	'stew'	**/tʼ/**	tʼùtʼúm	[tʼutʼum]	'fold'
/b/	gùbí	[gùbíʔ]	'hut'	**/d/**	tùdúk	[t^hùdúk^h]	'dry out'
/p/	kùpú	[k^hùp^hú]	'cane'	**/t/**	tútút	[t^hút^hút^h]	'crossroads'
/kʼ/	lɔ̃kʼɔ̀	[lɔ̃kʼɔ̀]	'monkey'	**/sʼ/**	kìsʼísʼì	[k^hìsʼísʼìʔ]	'charcoal'
/g/	lɔ̀gɔ́n	[lɔ̀gɔ́n]	'wall'	**/z/**	gìzá	[gìzáʔ]	'money'
/k/	lūkà	[lūk^{h}àʔ]	'basket'	**/s/**	kísí	[k^hísíʔ]	'pocket'

Table 8 Plain stop and ejective contrasts: near minimal triplets

In monomorphemic noun roots, word-final ejectives are also only released (Table 9). There is no allophonic alternation with an unreleased ejective pronunciation for the ejectives in noun roots word-finally.

[14]Impressionistically, both the ejectives and implosives are realized with a very low intensity burst in natural speech concurrent with what Burns (1947:7) observed in Sudanese Komo: "the implosives and ejectives are all lightly made, there are no violent sounds in the language".

/p’/	k’ʊ́p’	[k’ʊ́p’]	‘head’	/t’/	lɛ̀t’	[lɛ̀t’]	‘tongue’
	wàp’	[wàp’]	‘warthog’		kwànt’	[kwànt’]	‘scar’
/k’/	ʃùmàk’	[ʃùmàk’]	‘bone’	/s’/	s’às’	[s’às’]	‘chest’
	lɔlɔ̀k’	[lɔlɔ̀k’]	‘brain’		yìs’	[yìs’]	‘hide (n)’

Table 9 Pronunciation of word-final ejectives in Noun roots

Monomorphemic verb roots, by contrast, exhibit a different pattern word-finally (Table 10). Word-final sibilant ejectives are released [s’]. The alveolar and velar ejectives /t’, k’/ are in free variation with unreleased allophones [t̚, k̚] and the bilabial ejective /p’/ is unreleased [p̚].[15]

	ʃáp’	[ʃáp̚]	‘hit, slap’		hát’	[hát’ ~ hát̚]	‘stomp’
/p’/	s’ūp’	[s’ūp̚]	‘dip’	/t’/	ʃút’	[ʃút’ ~ ʃút̚]	‘stuff into’
	wɔ́p’	[wɔ́p̚]	‘slurp’		mʊ̀t’	[mʊ̀t’ ~ mʊ̀t̚]	‘scoop out’
	k’wàk’	[k’wàk’ ~ k’wàk̚]	‘gossip’		has’	[has’]	‘wash’
/k’/	s’ɪ̄k’	[s’ɪ̄k’ ~ s’ɪ̄k̚]	‘be sour’	/s’/	ɓís’	[ɓís’]	‘be strong’
	wàʃík’	[wəʃík’ ~ wəʃík̚]	‘boil’		gʊ̀s’	[gʊ̀s’]	‘swallow’

Table 10 Pronunciation of word-final ejectives in Verb roots

In polymorphemic inflected verbs, intervocalic ejectives exhibit considerable allophony. For instance, /t’, k’/ can be realized as [t’, k’] or as unaspirated [t, k]. By contrast, /s’/ largely retains its glottal release, being realized as [s’], though weakening to [z] also occurs.[16] The bilabial ejective /p’/ is very frequently, if not always, realized as [b] in natural fast speech.[17] The data in Table 11 show the verb roots seen in Table 10 inflected with the morpheme /-í/ DDØ, followed by the person marker /-r/ 3SG.M or /-n/ 3SG.N.

	ʃáp’	[ʃəbír]	‘He hits.’		hát’	[hət’ír ~ hətír]	‘He stomps.’
/p’/	s’úp’	[s’úbír]	‘He dips.’	/t’/	ʃút’	[ʃút’ír ~ ʃútír]	‘He stuffs.’
	yīp’	[yībír]	‘He spears.’		mʊ̀t’	[mʊ̀t’ír ~ mʊ̀tír]	‘He scoops out.’
/k’/	s’ík’	[s’ík’ín ~ s’ígín]	‘It is sour.’	/s’/	hás’	[hɔ́s’ír ~ hɔ́zír]	‘He chews.’
	wàʃík’	[wəʃìk’ín]	‘It boils.’		ɓís’	[ɓís’ír ~ ɓízír]	‘He is strong.’
					gʊ̀s’	[gʊ̀s’ír ~ gʊ̀zír]	‘He swallows.’

Table 11 Pronunciation of intervocalic ejectives in inflected verbs

In sum, word-final ejectives in monomorphemic noun roots behave distinctly from word-final ejectives in monomorphemic verb roots. Noun roots preserve the laryngeal feature while in verb roots, ejectives are optionally unreleased word-finally and neutralize with voiced non-ejective

[15]Interestingly, the only verb roots ending in a velar ejective /k’/ in my database are seen in Table 10.
[16]These are impressionistic claims that require quantitative analyses which are beyond the scope of this paper.
[17]When a /p’/-final verb is inflected, the speakers I have worked with categorically reanalyze the stem as containing /b/, not /p’/. This is specific only to the bilabial ejective on verb roots.

allophones intervocalically. One observation is that Komo noun roots do not ever occur with suffixes or enclitics while verb roots are frequently inflected with vowel-initial suffixes. The following Table 12 contains a complete distribution of the allophones of the stops and sibilants in word-initial, intervocalic and word-final positions.

	#__	V__V	__#		#__	V__V	__#
/p/	p, p^h	p, p^h, ɸ	p^h	/s/	s	s	s
/t/	t, t^h	t, t^h	t^h	/z/	z	z	z
/k/	k, k^h	k, k^h, x	k^h	/sʾ/	sʾ	sʾ, z	sʾ
/b/	b	b, β	bˀ	/pʾ/	pʾ	pʾ, b	pʾ, pˀ
/d/	d	d, ɾ	dˀ	/tʾ/	tʾ	tʾ, t, d	tʾ, tˀ
/g/	g	g, ɣ	gˀ	/kʾ/	kʾ	kʾ, g	kʾ, kˀ

Table 12 Allophones of stops and sibilants in word-initial, medial and final positions

3 Vowels

3.1 Contrastive vowel inventory

Komo has seven contrastive vowels /i, ɪ, ɛ, a, ɔ, ʊ, u/ (Table 13). Members of this inventory are partially distinguished by the feature of Advanced Tongue Root (ATR), where phonemic ATR contrast occurs in the high vowels. Three [–high, +ATR] vowels [e, o, ə] occur on the surface as allophones of /ɛ, ɔ, a/, respectively, as a result of anticipatory [+ATR] harmony (see §3.2 for discussion). Evidence for the 'basic' status of [–ATR] is the fact that the vowels [e, o, ə] do not occur in monosyllabic monomorphemic roots and only occur in a specific environment which contains a [+high, +ATR] vowel /i, u/.[18] Burns (1947) proposes a ten-vowel inventory including seven oral vowels /i, e, ɛ, a, ɔ, o, u/ and three nasal vowels /ĩ, ɛ̃, ã/.[19] Nasal vowels, if they are indeed phonemic, are at best marginally phonemic and are always followed by a nasal consonant.

	[+ATR]		[−ATR]		
+HIGH	i	u	ɪ	ʊ	+HIGH
-HIGH	[e]	[o]	ɛ	ɔ	-HIGH
	[ə]		a		

Table 13 Komo oral vowel inventory (allophones in brackets)

[18]Negash's (2015) nine vowel /i, e, ɛ, ɨ, ə, o, ʊ, u/ system is untenable under this and prior analyses of Komo (cf. Kutsch-Lojenga & Otero 2011, Otero 2013). Negash does not provide any evidence for phonemic [–HIGH, +ATR] vowels [e, ə, o], considered allophones in my analysis, nor is there any evidence for a mid vowel [ɨ].
[19]Burns' (1947) /e, o/ correspond to /ɪ, ʊ/ respectively in the current analysis.

Evidence for a seven-vowel phonemic inventory is seen in the following (near) minimal pairs in Table 14 where first tier contains data contrasting the front vowels and /a/ and the second tier shows contrast in the back vowels and /a/.

/i/	ʃít	'braid'	kíʃ	'cocoyam'	yǐ	'water'	īʃ	'sleep.PL'
/ɪ/	ʃít	'whistle'	kǐʃ	'cheek'	yī	'horn'	īʃ	'body'
/ɛ/	ʃɛ̄t	'antelope'	kɛ́ʃ	'roast'	yɛ́	'slice'	ɛ̄r	'be prepared'
/a/	ʃàtàr	'be angry'	kàʃ	'take out of'	yà	'go.SG'	áʃ	'war'
/u/	túl	'gourd'	ʃùg	'wake up'	ùʃ	'eat.PL'	t'ùmá	'fist'
/ʊ/	tʊ̀l	'be tall.PL'	ʃʊ̀g	'palm (sp.)'	ʊ̄ʃ	'refuse'	tʊ̀mà	'tobacco'
/ɔ/	tɔ̀l	'be fat.SG'	ʃɔ̀g	'leg, foot'	ɔ̀ʃ	'stone'	tɔ̄m	'spear'
/a/	tálá	'back'	ʃàk	'fish (v.)'	áʃ	'war'	tàmbá	'tree (sp.)'

Table 14 Phonemic vowel contrast in (near) minimal sets

A plot of the Komo vowel space reproduced here from Olejarczuk, Otero & Baese-Berk's (2016) study is seen in . The study measured a total of 6,815 total vowel tokens in a variety of consonantal environments extracted from 1,636 utterances produced by twelve adult male L1 Komo speakers. A total of 6,815 vowels (including those in the verbs and in the surrounding words) were measured at the midpoint for F1and F2.[20] Formants were measured manually using Praat software (Boersma 2002) and normalized using the Lobanov procedure to account for physiological differences across the speakers (Kendall & Thomas 2010). The ellipses in the vowel plot indicate regions within 1 standard deviation of the means. All plots collapse across prosodic and segmental environments. F1 was the most reliable correlate, where [+ATR] vowels had significantly lower F1 than their [–ATR] counterparts, which is consistent with other acoustic studies of languages with ATR harmony (e.g. Fulop et al. 1998, Guion et al. 2004).[21]

[20]Tokens that deviated in F1 or F2 from the within-speaker category means by more than 3 standard deviations were thrown out. There were 103 such tokens (1.5%), leaving a total of 6,712 vowels for analysis.

[21]I am indebted to Paul Olejarczuk for the acoustic measurements, custom Praat scripting, statistical analyses, as well as to Melissa Baese-Berk for overall dedication and commitment to the Komo ATR production and perception project. See Olejarczuk, Otero & Baese-Berk (*in prep*) for a more in-depth acoustic analysis.

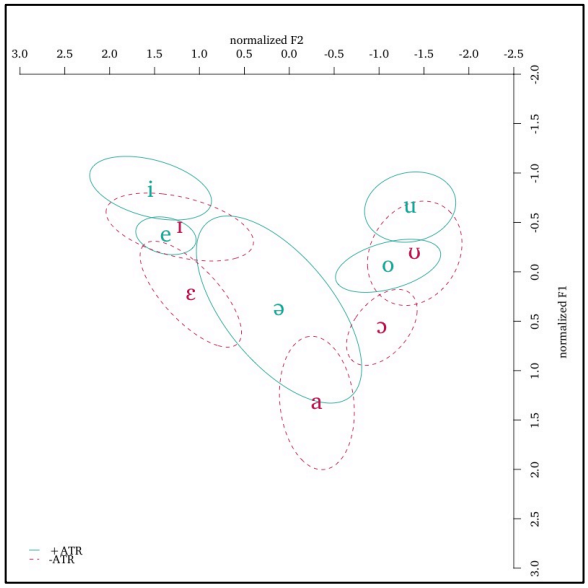

Figure 1 Komo acoustic vowel space (Olejarczuk, Otero & Baese-Berk 2016)

3.2 [ATR] Harmony

Advanced tongue root [ATR] harmony systems are often found in the Niger-Congo and Nilo-Saharan languages of sub-Saharan Africa (Casali 2008:497). Casali's (2003) typological survey of 110 languages found a direct correlation between the phonemic vowel inventory and the type of ATR harmony system displayed. The specific criterion is whether or not the phonemic ATR contrast is in the high vowels. Languages like Komo, which have phonemic ATR contrast in the high vowels, overwhelmingly display [+ATR] 'dominant-recessive' harmony (Casali 2008:520). In this system, the feature [+ATR], considered 'dominant', spreads to 'recessive' [–ATR] vowels in a particular phonological domain (most often the word). Komo does in fact display this kind of [+ATR] dominance; but I show that the overall system also allows for [–ATR] spreading.

In fact, Komo has a highly productive and typologically unusual ATR harmony system that displays two distinct types of ATR assimilatory processes. The first process exemplifies [+ATR] dominant-recessive harmony and is anticipatory (leftward spreading), occurring in monomorphemic roots as well as in polymorphemic verbs. The second type is progressive (rightward spreading) [–ATR] harmony, where only high [–ATR] root vowels spread the [–ATR] feature to high [+ATR] suffix vowels. This paper summarizes Otero's (2015) analysis and provides acoustic evidence by Olejarczuk, Otero and Baese-Berk (2016) to support the claims of an underlying seven vowel system and two distinct ATR harmony processes.[22]

Komo displays two categorical ATR harmony processes that are opposite both in terms of the ATR feature that spreads as well as the direction of the spreading. These processes are seen primarily in inflected verbs, as Komo lacks productive morphological processes on the whole outside of the verb. The verb roots in Table 15 contain [–high, –ATR] vowels /ɛ, a, ɔ/. Notice that

[22]The term ATR here particularly refers to the phonological processes and makes no direct claim as to the articulatory gestures involved in producing the contrast. Recognition here must be given to Burns (1947:5), as he noted some type of vowel assimilation processes as a marked feature of Komo where, "The vowels ɛ, a and ɔ are so affected, when followed by a close fronted vowel (i or e), or back u."

the root vowels remain [–ATR] when preceding a [–ATR] vowel in a suffix, whether it's [+high, –ATR] /ʊ/ as seen in the first set or [–high, –ATR] /a/ in the second. In these data, the entire domain remains harmonic for the [–ATR] feature, and [–high, –ATR] root vowels co-occur with [–ATR] suffix vowels.

V	Root	Root-DD1-3PL			Root-1SG		
ɛ	kɛ́ʃ	kɛ́ʃ-ú-n	[kɛ́ʃún]	'They threshed'	kɛ́ʃ-á	[kɛ́ʃá]	'I thresh'
	gɛ̄m	gɛ̄m-ú-n	[gɛ̄mún]	'We weeded'	gɛ̄m-á	[gɛ̄má]	'I weed'
a	sās	sās-ú-n	[səsún]	'They greeted'	sās-á	[sāsá]	'I greet'
	bàb	bàb-ú-n	[bàbún]	'They buried'	bàb-á	[bābā]	'I bury'
ɔ	gɔ̄g	gɔ̄g-ú-n	[gʷɔ̄gún]	'They nibbled'	gɔ̄g-á	[gʷɔ̄gá]	'He nibbles'
	kɔ́p	kɔ́p-ú-n	[kʷɔ́pún]	'They baled'	kɔ́p-á	[kʷɔ́pá]	'I bale'

Table 15 [-high, -ATR] Verb roots and inflected verbs

The first type of harmony spreads [+ATR] leftward from a [+high, +ATR] vowel /i, u/ to a [–high, –ATR] vowel /ɛ, a, ɔ/ , causing the latter to surface as [e, ə, o] [+ATR] allophones.[23] To illustrate [+ATR] harmony, Table 16 contains the same verb roots seen in Table 15, now inflected with suffixes containing a [+high, +ATR] vowel /i, u/. The result is anticipatory (leftward) [+ATR] dominant harmony, as the underlying [–high, –ATR] vowels /ɛ, a, ɔ/ in the roots become [+ATR] [e, ə, o] before [+high, +ATR] /i, u/. Notice also that the harmony is directionally constrained as the [+ATR] feature does not spread rightward to the 1PL.IN suffix vowel /a/ at the right edge of the word.

V	Root	Root-DD2-1PL.IN			Root-DDØ-3SG.M		
ɛ	kɛ́ʃ	kɛ́ʃ-úk-à	[kɛ́ʃúkà]	'We threshed'	kɛ́ʃ-í-r	[kɛ́ʃír]	'He threshes'
	gɛ̄m	gɛ̄m-úk-à	[gɛ̄múkà]	'We weeded'	gɛ̄m-í-r	[gɛ̄mír]	'He weeds'
a	sās	sās-úk-à	[səsúkà]	'We greeted'	sās-í-r	[səsír]	'He greets'
	bàb	bàb-úk-à	[bəbúkà]	'We buried'	bàb-í-r	[bəbīr]	'He buries'
ɔ	gɔ̄g	gɔ̄g-úk-à	[gōgúkà]	'We nibbled'	gɔ̄g-í-r	[gōgír]	'He nibbles'
	kɔ́p	kɔ́p-úk-à	[kópúkà]	'We baled'	kɔ́p-í-r	[kópír]	'He bales'

Table 16 Anticipatory [+ATR] harmony in inflected verbs

Anticipatory [+ATR] harmoy in Komo not only occurs across morpheme boundaries but it is also evidenced in roots. Table 17 contains disyllabic monomorphemic noun and verb roots in which [+high, +ATR] vowels /i, u/ in the second syllable spread the [+ATR] feature value leftward to the [–high, –ATR] vowels of the first syllable.

[23]Monosyllabic (C)V(C) verb roots are by far the most prevalent in my database. As such, the discussion of ATR harmony in this paper is limited to disyllabic (mono- and polymorphemic) words.

ɛ	bèzí	[bèzí]	‘be thin’
	mètí	[mètí]	‘chase’
a	pātí	[pətí]	‘liver’
	gàbút	[gəbút]	‘gruel’
ɔ	kɔ́sí	[kósí]	‘bread (trad.)’
	gɔ̀dùm	[gòdùm]	‘sow’

Table 17 [+ATR] harmony in monomorphemic roots

The second ATR harmony process is what distinguishes Komo from Casali’s (2003, 2008) typology. This process only involves the high vowels and spreads [–ATR] *rightwards* from a [+high, –ATR] /ɪ, ʊ/ root vowel to a [+high, +ATR] suffix vowel /i, u/. In Table 18, the [+high, +ATR] vowels in the DD2 and DDØ suffixes (*-úk* and *–í* respectively) assimilate to [–ATR] after [+high, –ATR] root vowels. Note that the harmony targets are the same suffix morphemes (containing the same suffix vowels) that triggered [+ATR] harmony in the environment seen in Table 18.

V	Root	Root-DD2-1PL.IN			Root-DDØ-3SG.M		
ɪ	ʃít	ʃít-úk-à	[ʃítúkà]	‘We whistled’	ʃít-í-r	[ʃítír]	‘He whistles’
	zìl	zìl-úk-à	[zìlúkà]	‘We twisted’	zìl-í-r	[zìlír]	‘He twists’
ʊ	pūk	pūk-úk-à	[pūkúkà]	‘We crossed’	pūk-í-r	[pūkír]	‘He crosses’
	bùd	bùd-úk-à	[bùdúkà]	‘We unthatched’	bùd-í-r	[būdīr]	‘He unthatches’

Table 18 Progressive [–ATR] harmony in inflected verbs

To illustrate that not only root vowels can trigger [–ATR] spreading, the data in Table 19 show the same verb roots seen in Table 15, now inflected with /-ó/ DD1 followed by /-í/ 2SG. There are two phonetic outcomes in this case. The vowel /ʊ/ of the DD1 morpheme can either be realized as a bilabial glide [^{w}], presumably to avoid vowel hiatus, or /ʊ/ can be completely elided. What is relevant to the discussion of harmony is that in both cases, the [–ATR] feature of /ʊ/ is spread rightward to the following underlyingly [+ATR] vowel /i/ in the 2SG morpheme, causing it to surface as [–ATR] [ɪ]. Notice that in these data, the domain of harmony surfaces as entirely [–ATR].

V	Root	Root-DD1-2SG		
ɛ	kéʃ	kéʃ-ú-í	[kéʃ^{w}í ~ kéʃí]	‘He threshed’
	gɛ̄m	gɛ̄m-ú-í	[gɛ̄m^{w}í ~ gɛ̄mí]	‘He weeded’
a	sās	sās-ú-í	[sās^{w}í ~ sāsí]	‘He greeted’
	bàb	bàb-ú-í	[bāb^{w}í ~ bābí]	‘He buried’
ɔ	gɔ̄g	gɔ̄g-ú-í	[gɔ̄g^{w}í ~ gɔ̄gí]	‘He nibbled’
	kɔ́p	kɔ́p-ú-í	[kɔ́p^{w}í ~ kɔ́pí]	‘He baled’

Table 19 CV$_{[-high, -ATR]}$C verb roots inflected with DD1 /-ó/ and 2SG /-í/

Table 20 displays roots containing [+high, +ATR] vowels inflected with the same morphology as the verbs in Table 19, [–ATR] /-ó/ DD1 followed by [+ATR] /-í/ 2SG. The data in Table 20 show how [–ATR] spreads rightwards from /ʊ/ to /i/ as seen in Table 19, but crucially the [–ATR] feature does *not* spread leftwards to the potential [+high, +ATR] root vowels /i, u/. In this environment, the phonological word remains disharmonic for the ATR feature.

V	Root	Root-DDØ-2SG		
i	gìz	gìz-ú-í	[gìz^{w}í ~ gìzí]	'Enter (towards *me*)!'
	kíʃ	kíʃ-ú-í	[kíʃ^{w}í ~ kíʃí]	'Harvest (towards *me*)!'
u	wús'	wús'-ú-í	[wús^{w}í ~ wúsí]	'Close (towards *me*)!'
	dùb	dùb-ú-í	[dùb^{w}í ~ dùbí]	'Dig (towards *me*)!'

Table 20 $CV_{[+high, +ATR]}C$ verb roots inflected with DD1 /-ó/ and 2SG /-í/

To summarize, both ATR harmony processes in Komo are directionally constrained: [+ATR] harmony spreads leftward while [–ATR] harmony spreads rightward. Furthermore, the domain of harmony is limited to the word and only spreads to the vowel of the adjacent target syllable as seen in (1) where [+ATR] harmony occurs in the inflected verb and does not spread to the potential vowel targets in the preceding or the following word.[24]

(1) [hàr ʃəbīr k'áw]
hàr ʃāp'-ī-r k'áw
3SG.M hit-DDØ-3SG.M dog
'He hits/is hitting a/the dog.'

The data in Table 16 exemplify Casali's (2003, 2008) typology for African languages with ATR contrast in the high vowels, displaying what can be characterized as anticipatory [+ATR] dominant harmony. He observes that one common characteristic of [+ATR] dominant harmony is the presence of underlyingly [+ATR] affixes (typically suffixes) that cause [–ATR] root vowels to assimilate to [+ATR]. In Komo, the [+ATR] vowels /i, u/ seen in the DD2 and DDØ suffixes behave as prototypical *triggers* of [+ATR] harmony in one environment, yet non-prototypically become *targets* of [–ATR] spreading in another. While Casali (2008) finds that it is extremely common for languages with this vowel inventory to display [+ATR] dominance, he also notes that these languages may have a few cases of [–ATR] spreading. Casali refers to this as "superficial [–ATR] dominance", and argues that it is only found in limited circumstances within a [+ATR]-dominant system. Baković (2000) calls such exceptions "dominance reversals", and claims that they are unproductive and restricted to a few idiosyncratic morphemes. The facts of Komo resist such "rule-and-exception" accounts; both ATR processes are extremely productive and appear to be phonologically conditioned. This apparent symmetry calls into question the typological validity of the notion of ATR "dominance".

[24]See Otero (2015:217-218) for further data and discussion.

4 Syllable structure

A template of the Komo syllable is seen in Figure 2. I discuss the unambiguous syllable types (CV and CVC), complex codas (CVNC) and vowel-initial syllables in §4.1. Glides are treated in §4.2, by first describing phonetically conditioned labialization and palatalization then moving onto complex onsets (CGV, CGVC) in §4.3. Lastly, consonant clusters within polysyllabic words and across syllables types are examined in §4.4.

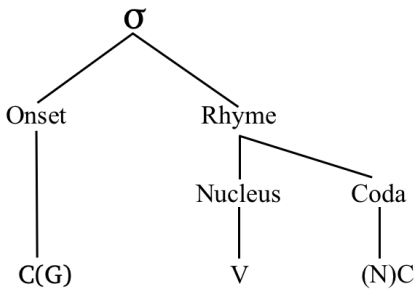

Figure 2 Komo syllable template

4.1 Unambiguous syllable types and complex codas

By far the most common and most unambiguous syllable type in monomorphemic words are CV and CVC (Table 21). Every consonant in the phonemic inventory can occur as an onset of a word-initial CV/CVC syllable.[25] Any consonant, with the exception of implosives /ɓ, ɗ/ and the glottal fricative /h/ can occur as codas of a word-final CVC syllable. Syllable nuclei in the CV and CVC shapes are always vocalic elements that function as tone bearing units.[26] Complex codas in monomorphemes are restricted to having a nasal consonant as the first of a two consonant NC coda. CVNC syllables are restricted to word-final position while CV and CVC syllables can occur both word-medially and word-finally.

CV	ɓî	‘eye’
	zā.gà	‘name’
CVC	bùʃ	‘belly’
	mɔ̀l.t’á	‘satchel’
CVNC	ʃūnk’	‘tendon, vein’
	tɔ̄ns’	‘squirrel

Table 21 Common unambiguous syllable types

Vowel initial syllables with V and VC shapes are also attested, though at a much lower frequency than CVC and CV syllable types.[27] In word-initial position a vowel-initial syllable may occur with a phonetic glottal stop [ˀV], as discussed in §2.1. This suggests that glottal stop epenthesis may be a strategy employed to derive a more common CV(C) syllable shape from a

[25]The exception is the velar nasal [ŋ], whose phonemic status is debatable; see §2.1 for discussion.
[26]Vocalic nuclei can occur with level or contour tones. See §0 for further discussion of tone.
[27]Approximately 20 VC syllables and 2 V syllables comprising monomorphemic words or clitics occur in the lexical database.

vowel-initial syllable to satisfy a phonotactic constraint of a consonant in syllable onset position word-initially.[28]

4.2 Glides: Phonetic labialization and palatalization

In Komo, glides can occur both phonetically and phonologically, and this has led to differing analyses in prior research. Burns (1947:3) asserts that all of the 23 consonants in the phonemic inventory can be labialized or palatalized word-initially but it is unclear whether he is positing phonologically-contrastive consonant phonemes, consonant allophones, or sequences of two separate consonants. Bender (1983:261), proposes non-phonemic labialized allophones [p^w, t^w, s'^w, $ʃ^w$, k^w, g^w, k'^w] restricted to word-initial position. In discussing complex onsets, Negash (2015) mixes predictable, phonetically-conditioned labialized and palatalized consonants with phonological consonant-glide (CG) onsets. I first discuss the predictable phonetic result of coarticulation from the following vowel onto a preceding consonant (i.e. "allophones" of the consonants) and then move on to complex onsets of the CG type. Lastly, I discuss ambiguous sequences.

There is non-contrastive labialization and palatalization occurring on word-initial consonants only in environments containing the mid vowels /ɛ, ɔ/. Phonetic labialization of a word-initial consonant occurs when followed by the mid back round vowel [ɔ, o], and similarly conditioned palatalization occurs with consonants preceding [ɛ, e]. Consonants which do not participate in these processes are nasals, liquids and semi-vowels. Examples of phonetic palatalization and labialization are in Table 22.

bɛ̌s	[$b^ɣ$ɛ̌s ~ bɛ̌s]	'dream	pɔ́g	[p^wɔ̰g]	'back'
dɛ̀s'ɛ̀	[$d^ɣ$ɛ̀s'ɛ̀ ~ dɛ̀s'ɛ̀]	'insect (sp.)'	dɔ̀ʃ	[d^wɔ̀ʃ]	'stand.SG'
s'ɛ́m	[$s^ɣ$ɛ́m ~ s'ɛ́m]	'be sweet'	sɔ́k	[s^wɔ́k^h]	'sit.PL'
kɛ́m	[$k^ɣ$ɛm ~ kɛ́m]	'pierce'	kɔ̀gɔ́	[k^wɔ̀gɔ́]	'music'
tɛ́l	[$t^ɣ$ɛ́l ~ tɛ́l]	'nail'	t'ɔ́ʃ	[t'^{w}ɔ́ʃ]	'roast'

Table 22 Phonetic palatalization and labialization examples

It is important to underscore that the above-mentioned processes are strictly the phonetic result of coarticulation. There is no evidence for phonemic contrast between "labialized" and non-labialized consonants before the vowel /ɔ/ ([ɔ, o]) (e.g. "*k^wɔ*" vs. "*kɔ*") and likewise is there no contrast between "palatalized" and non-palatalized consonants before /ɛ/ [ɛ, e] (e.g. "*s'^{ɣ}ɛ*" vs. "*s'ɛ*"). Prior descriptions of Komo have transcribed some of the sequences in Table 22 as if they were phonemic Cw/Cy sequences.[29] Thus the predictable phonetic labialization and palatalization do not have any bearing on the canonical CV and CVC syllable types.

[28]The V syllable type is mostly limited to grammatical morphemes. These grammatical morphemes only occur before other words, and to a certain extent, can be considered bound proclitics.

[29]There are only <kwo> word-initial sequences (as opposed to <ko>) in Grottanelli's (1946) Komo wordlist. Burns (1947), transcribes the high-frequency word /sɔk/ 'sit/COP' as <swɔk> and Negash (2015) refers to 'Komo' as <kwɔm>.

4.3 Consonant-glide onsets

While the previous section showed how two particular vowels cause phonetic labialization and palatalization in word-initial consonants, I interpret these as a single consonantal phoneme in a simple syllable onset. The only complex onsets in Komo consist of an initial consonant followed by either a labiovelar approximant /w/ or a palatal glide /y/. Furthermore, the vowel /a/ is always the syllable nucleus of a Cy onset. Cw onsets occur primarily with /a/ as the nucleus, though there are few exceptions discussed below.[30] The near minimal pairs in Table 23 provide evidence for complex onsets, again restricted to word-initial syllables.

twáy	'hunger'	tà	COP
ʃwà	'dance'	ʃá	'eat.SG (soft food)'
syángā	'fish (sp.)'	sángà	'tomorrow'
zyālá	'fish (sp.)'	zālázālá	'tree (sp.)'
kwál	'steal'	kál	'pour from small vessel'
gwà	'elephant'	gà	'termite hill'
k'wà	'rock hyrax'	k'à	'eat.PL (hard food)'

Table 23 CV ~ CGV near minimal pairs

Complex onsets containing a labio-velar approximant (CwV) are headed by all attested phonemic stops and fricatives except for the bilabial implosive /ɓ/ and the voiceless bilabial ejective /p'/. The CyV sequence is much more limited and the attested C-glide sequences in word-initial position are seen in Table 24.

Cw			Cy		
tw	twáy	'hunger'	by	byànzā	'morning star'
dw	dwāg	'drag'	s'y	s'yán	'tinderstick'
kw	kwál	'steal'	zy	zyālá	'fish, sp.'
k'w	k'wàt'	'tick'	ky	kyāl	'be silent'
gw	gwà	'elephant'	gy	gyàlá	'roast (over fire)'
ɗw	ɗwàkàɗwàkà	'kidney'			
t'w	t'wàrárà	'African thrush'			
sw	swà	'be big'			
s'w	s'wàngá	'mushroom, sp.'			
ʃw	ʃwà	'dance'			
ʔy	ʔyámūn	'seed'			

Table 24 Word-initial CGlide sequences with /a/ nuclei

[30]Interestingly, Killian (2015:23-24) proposes a complete series of labialized consonants (C^w) only occurring before /a/ in Uduk, the language most closely related to Komo.

A peculiar phenomenon is the existence of a word-initial, phonetically palatalized glottal stop [ʔʸ]. I interpret this as a glottal stop followed by a palatal glide sequence occurring before the vowel /a/, which patterns consistently with the data in Table 24.[31] The palatalized glottal stop is found in three words, [ʔʸámōn] 'seed', [ʔʸāmàʔ] 'sorghum' and the verb [ʔʸákʰ] 'go.DD2', which appears to be a form of the motion verb 'go.SG' /yà/ that has been lexicalized with the Deictic Directional morpheme /-úk/ (DD2). A full paradigm for the defective verb [ʔʸák] is seen in Table 25. Notice that the palatalized glottal onset surfaces phonetically in the 1st person forms when the vowel of the second syllable is [a], but not in the rest of the paradigm when /a/ surfaces as [ə] as a result of anticipatory [+ATR] harmony.

1SG	ʔʸák-Ø-á	[ʔʸákʰá]	'I go/ went.'
2SG	ʔʸák-Ø-í	[ˀəkʰí]	'You go/went.'
3SG.M	ʔʸák-í-r	[ˀəkʰír]	'He goes/went.'
3SG.F	ʔʸák-í-pˀ	[ˀəkʰípˀ]	'She goes/went.'
3NH	ʔʸák-í-n	[ˀəkʰín]	'It goes/went.'
1PL.IN	ʔʸák-Ø-à	[ʔʸákʰà]	'We go/went.'
1PL.EX	ʔʸák-Ø-án	[ʔʸákʰán]	'We go/went.'
2PL	ʔʸák-í-m	[ˀəkʰím]	'You all go/went.'
3PL	ʔʸák-í-n	[ˀəkʰín]	'They go/went.'

Table 25 Full paradigm of verb ʔyák 'go'

Taking word-initial consonant-glide sequences into account, three additional syllable types can be derived (Table 26). These syllable types pattern with the unambiguous types Table 21 in that CG onset syllables allow a simple coda CGVC and a complex CGVNC coda. Further, CG onset syllables distribute like CV syllables in that CGV and CGVC can occur word-medially and CGVNC can only occur word-finally. There are no instances of a word final CGV syllable in which the glide element is a palatal glide /y/.

CGV	gwà	'elephant'
	ʃwà	'dance'
CGVC	dwàg	'raise, lift'
	sˀyán	'tindersticks'
CGVNC	kwàntˀ	'scar'
	byànsˀá	'wasteland'

Table 26 C-glide complex onset syllable types

There is a handful of high-frequency words that don't follow the general patterns described above for the distribution of syllables within a word. The exceptions are words that largely contain

[31]Many speakers insisted that the word-initial palatalized glottal stop [ʔʸ] was not the 'same sound' as a word-initial palatal glide [y] and should have a different orthographic representation. Other speakers said the sounds were 'a bit different' but representing them with a single grapheme was acceptable.

a high, front vowel in the nucleus, a contour tone and a complex Cw onset. Table 27 contains words with complex onsets followed by a vowel with a level tone (CGV) as compared to words with a vowel with a contour tone (CGV̌). Notice that the nuclei of the proposed CGV syllable types can contain a high, front vowel /i, ɪ/ as well as /a/.

CGV [i, ɪ]		CGV̌ [i, ɪ]		CGV̌ [a]	
kwì	'chief'	kwǐ	'fall (intr.)'	twǎ	'mud'
zwì	'antelope'	ʃwǐ	'beer'	kwǎlá	'throwing stick'
pwī	'burnt area'	ʃwǐ	'rope, vine'	kwǎngá	'pumpkin'
kwíʃí	'skin (v.)'				

Table 27 Word-initial CG onsets before high, front vowels

While examining Semitic languages of Ethiopia, Goldenberg (2013:77-78) observes "[...] a general tendency of Ethiopian languages to decompose *u* into its components, viz. labiality or rounding and syllabicity (^{w} +V), and then to lose concomitant labiality when following a non-labializable consonant (C + V), but retain it when following a labializable (*k', x, g* or *k*) consonant (C^{w}+V)." Comparative data from related Koman languages reveals the vocalic origin of certain ambiguous sequences. For instance, a CGV̌ sequence containing a high, front vowel quality in the nucleus in Komo, e.g. *ʃwǐ* 'beer' has cognates containing /u/ as a vowel nucleus in related languages- *sū* in Uduk, *ʃʊ̈l* in Highland Gwama and *sùn̰* in Dana, which suggests a vocalic origin for some synchronic Komo labialized Cw onsets, specifically in this case when occurring with a contour tone and a high, front vowel nucleus. Further, Cw sequences in Komo occur frequently with "labializable" /k, g, k', ʃ/ as the initial consonant and less so with /s, t, s'/. Further investigation and comparative evidence is needed.

4.4 Consonant clusters

The previous sections described consonant clusters in tauto-syllabic onsets and tauto-syllabic codas. Hetero-syllabic sequences of two distinct consonants (C_1C_2), are somewhat rare in isolated monomorphemic words.[32] Table 28 contains hetero-syllabic consonant sequences (C_1C_2) across syllables within monomorphemic words.[33] On the whole nasals and liquids form the initial consonant in a sequence followed by sibilants. Initial stops are rare and limited to the few examples in the table, some of which are place names that may not be of Komo origin. No medial or final clusters containing the following consonants in first position were found: /p, p', ɓ, d, t', ɗ, k, g, k', z, h, w, y, ʔ/.

[32]Reduplicated forms (a small subset of the database) have been excluded.
[33]A period <.> is used to indicate a syllable break.

p	pk	ʃàp.kā.rá	‘Shapkara’
b	bʃ	zɛ́b.ʃɛ̀r	‘Zebsher’
t	tk	gwàt.kár	‘forked pole’
s’	s’k	bīs’.kī.rí	‘bird, sp.’
s	st, sk	bă̆s.tɛ̄	‘biscuit’
ʃ	ʃm, ʃk	túʃ.kír	‘heart/organ’
m	mp, mb, mp’, mt, ms,	dàm.bɛ́r	‘syphilis’
n	nt, nd, nt’, ng, nk’, ns, nz, ns’	hàn.k’á bàn.t’ʊ́	‘bow (n.)’ ‘enset’
l	lb, lt’, lk, lg, lk’, lm	gă̆l.k’ún dɔ̀l.bá	‘clavicle’ ‘now’
r	rk, rg, rk’, rs, rʃ, rm, rw	gàr.wɛ́ʃ pă̆r.ʃá	‘partridge’ ‘horse’

Table 28 Consonant sequences in monomorphemic words

5 Tone

Komo displays three level tones as well as rising and falling contour tones. Overall, tone is quite stable in Komo: there is no evidence of downstep or downdrift in prosodic words or even across longer sentences and virtually every underlying tone and tone melody surfaces faithfully. The functional load of tone is moderate in the lexicon, more present in the verbal system where verbs can be subcategorized into classes by their tonal behavior. Further, many verb roots can also be tonally suppletive in number. In §5.1, I briefly discuss contrastive tone melodies in monomorphemic nouns and then move on to verbs in §5.2, where the discussion focuses on outlining the general patterns for verb tone classes and highlighting some anomalies in the system.

Burns (1947) claims there are four level tones in Sudanese Komo but I find no evidence, either phonetic or phonological, to support this in Ethiopian Komo. The current analysis proposes three level tones: (L)ow, (M)id and (H)igh. Phonemic contrast for the three level tones in monosyllabic words is seen in the near minimal monomorphemic triplets in Table 29.

L	s’ɑ̀s’	‘chest’	kɔ̀p	‘upper arm’
M	s’ɔ̄s’	‘be small.PL’	kɔ̄p’	‘antelope (sp.)’
H	s’ɑ́s’	‘ant (sp.)’	kɔ́p	‘bale out’

Table 29 Near minimal monomorphemic level tone triplets

There is ample phonological data to show contrast among the three level tones (cf. Appendix B). The acoustics also confirm these findings as the F0 values of the three level tone categories are significantly distinct from each other. The mean and standard deviation of the fundamental frequencies for each of the three level tones were measured from a total of 6,815 vowel tokens extracted from 1,636 utterances produced by twelve male L1 Komo speakers. The data were taken

from Olejarczuk, Otero & Baese-Berk's (2016) study following the same methodological protocols seen in the acoustic measurements of the vowels (see §3). F0 values were normalized by dividing each token's F0 by the speaker's mean F0 across all vowels. Results are seen in Figure 3.[34]

Tone	mean F0	standard deviation
L	0.86	0.07
M	0.97	0.08
H	1.12	0.10

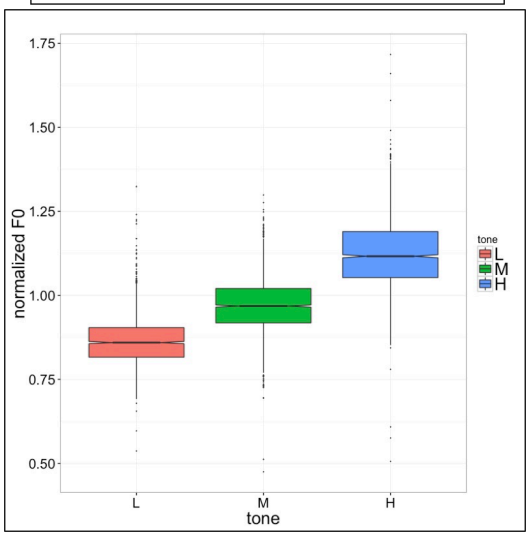

Figure 3 Fundamental frequency measures for the three level tones

Komo also displays (R)ising and (F)alling contour tones in monosyllabic monomorphemic roots as well as across morpheme boundaries in polymorphemic words, which can be monosyllabic or polysyllabic. In polymorphemic words, the contour tones can be analyzed as consisting of phonemic level tones. There does not appear to be more than one contrastive or rising tone in monomorphemic words. To be explicit, there are no minimal pairs of two falling tones (e.g. HL vs. HM) nor for rising tones (e.g. LM vs. LH).

yī	M	'axe	ɓì	L	'mountain'
yǐ	R	'water'	ɓî	F	'eye'
dā	M	Q	bā	M	DEM
dâ	F	'mother'	bǎ	R	'father'

Table 30 Contour tone contrasts in monomorphemic roots

[34]I am grateful to Paul Olejarczuk for help with measurement and statistical analysis. He notes the following, "To test whether the three tones differed significantly in normalized F0, a mixed effects linear regression was fit to the data, with random intercepts for both subjects and items as well as within-subject slopes for tone. The model revealed that both M and H tones featured significantly higher F0 than the L tone (M vs. L: $\beta = 0.09$, *S.E.* = 0.01, $t(20.35) = 8.51$, $p < 0.0001$; H vs. L: $\beta = 0.23$, *S.E.* = 0.01, $t(14.83) = 24.33$, $p < 0.0001$). A subsequent planned comparison revealed that H was significantly higher than M ($\beta = 0.19$, *S.E.* = 0.01, $t(105.43) = 17.99$, $p < 0.0001$). In other words, all of the differences apparent were statistically significant."

5.1 Tone in nouns

All of the possible combinations of the three level tones, which comprise a total of nine tone patterns, are exhibited in disyllabic nouns (Table 31). There do not appear to be any restrictions with regard to consonants and tonal combinations as both voiced and voiceless consonants occur before all three of the tone levels. Out of the data in Table 31, the word-level tone combinations L.M, L.H, M.L, M.H, H.L, H.M can be extrapolated.

	L		**M**		**H**	
L	kʾɔ̀lɔ̀	‘hand’	màkɔ̄	‘poison’	mɔ̀lt̕á	‘satchel’
	tʊ̀mà	‘tobacco’	gàbūt	‘gruel’	t̕ʊ̀má	‘fist’
M	ɓīsʾà	‘crocodile’	kāmā	‘maize’	t̕ɛ̄t̕íʃ	‘pot’
	kʊ̄mà	‘path’	ʃākā	‘herd’	ɓāmít	‘woman’
H	kʾásʾì	‘ground’	kákā	‘thorn’	sʾílít	‘thatch’
	dúzɛ̀	‘pipe’	pʾípʾīʃ	‘ant’	párá	‘hut’

Table 31 Tone melodies in disyllabic nouns

Monomorphemic words with more than two syllables are not common on the whole in Komo. The tonal patterns found in trisyllabic monomorphemic nouns are varied and some are rarer than others. Nonetheless, 26 of the 27 possible combinations are attested, with the exception of H.M.M (Table 32).

	_._.L		_._M		_._H	
L.L	L.L.L		L.L.M(.H)		L.L.H	
	kàgʊ̀mà	‘molar’	gàlìmʊ̄t̕á	‘cuckold’	pʊ̀lànî	‘dust’
L.M	L.M.L		L.M.M		L.M.H	
	tànānà	‘heel’	mìʃīgī	‘mourning’	gàrgārí	‘lizard (sp.)’
L.H	L.H.L		L.H.M		L.H.H	
	gʊ̀tʊ́lʊ̀	‘chin’	lìt̕ímān	‘point’	kàʃílá	‘kindling’
M.L	M.L.L		M.L.M		M.L.H	
	t̕ātɔ̀mɔ̀	‘door’	bālàlāk’	‘centipede (sp.)’	māyìgí	‘brother in law’
M.M	M.M.L		M.M.M		M.M.H	
	dīsʾīnà	‘pimple’	bābālūwā	‘fish (sp.)’	zālālá	‘fish (sp.)’
M.H	M.H.L		M.H.M		M.H.H	
	kālúwà	‘fish eagle’	būbáʃɛ̄	‘nightjar’	bāt̕ʊ́rsá	‘woodpecker’
H.L	H.L.L		H.L.M		H.L.H	
	gúlàlà	‘hawk’	píkʊ̀lī	‘hornbill’	búlbʊ̀tú	‘bird (sp.)’
H.M	H.M.L		H.M.M		H.M.H	
	gúlīlà	‘tree (sp.)’	–		písākɔ́	‘firefly’
H.H	H.H.L		H.H.M		H.H.H	
	kándúlà	‘mud wasp’	kánásʊ̄	‘seven’	síkíná	‘intestines’

Table 32 Tone patterns in trisyllabic nouns

To generalize across the tone patterns on trisyllables, if a sequence of two identical tones followed by a distinct tone (e.g. L.L.H) can be analyzed as underlyingly L.H in autosegmental terms following the Obligatory Contour Principle (OCP), then a total of 12 contrastive patterns can be analyzed (L.M.L, L.M.H, L.H.L, L.H.M, M.L.M, M.L.H, M.H.L, M.H.M, H.L.M, H.L.H, H.M.L, H.M.H).

5.2 Tone in verbs: Tone classes and disyllabic roots

Tone has a heavier functional load in verbs, which is seen on the root level as well as in polymorphemic inflected verbs. Monosyllabic (C)V(C) verb roots are the predominant shape, though disyllabic CVCV(C) also occur.

Tone in Komo is rather stable overall, meaning that surface tone is almost always equivalent to the underlying tone, but there is an exception. In order to illustrate this, I examine monosyllabic verb roots. Monosyllabic verb roots fall into strict verb classes based on two criteria: the underlying tone of the verb root and how the root behaves tonally when inflected with DD and bound pronominal suffixes. The vast majority of monosyllabic verb roots occur with all three level tones (L, M, H).[35] Every finite verb must take one of three Deictic Directional (DD) suffixes, all of which contain a H tone vowel (Table 33). This suffix is followed by a bound pronominal suffix, most often realized as a consonant, which indexes an argument on the verb. The resulting shape of a verb with a monosyllabic root but also inflecting for a single argument is CVCV(C), containing two vocalic nuclei, each of which is a tone bearing unit.

DDØ	**DD1**	**DD2**
/-í/	/-ú/	/-úk/

Table 33 Deictic-Directional suffixes

Four tone classes emerge when examining monosyllabic roots across the three DD paradigms. This is specifically due to the behavior of a particular subset of L tone roots when occurring with DDØ. Table 34 schematizes the tone classes by examining the underlying tone of monosyllabic verb roots as compared to the disyllabic inflected forms across the three DD paradigms when inflecting a single argument. Class L_1, M and H roots (L, M and H tones respectively), retain their root tone when inflected across the three DD paradigms. Class L_2 roots also have a L tone when inflected with DD1 and DD2 but crucially when inflected with DDØ, the expected L.H pattern surfaces as M.M as seen in the shaded area in Table 34.

Class	Root Tone	DDØ **root**-sfx	DD1 **root**-sfx	DD2 **root**-sfx
L_1	L	**L**-H	**L**-H	**L**-H
L_2	L	**M**-M	**L**-H	**L**-H
M	M	**M**-H	**M**-H	**M**-H
H	H	**H**-H	**H**-H	**H**-H

Table 34 Tone patterns in inflected verbs indexing a single argument

Table 35 provides Komo data to illustrate the tone analysis schematized in Table 34. The tone classes are indicated in the first column, followed by the root tone of the verb and a verb root from each class. The last four columns contain verbs inflected across the three deictic directional paradigms indexing a single argument (employing the 2PL suffix /-m/). Notice that the underlying

[35]There are a few rising and falling tone monosyllabic roots but they have been left out of this analysis for simplicity.

L tone root in *kèd* 'push' (Class L_2) surfaces as M.M when inflected with DDØ as indicated in the shaded portion.

Class	Tone	Root	DD∅ /-í/	DD1 /-ú/	DD2 /-úk/	Gloss
L_1	L	dùm	dùmím	dùmúm	dùmkúm	'You all hit'
L_2	L	kèd	kēdīm	kèdúm	kèdkúm	'You all push(ed)'
M	M	tɔ̄n	tōním	tɔ̄núm	tōnkúm	'You all pass(ed)'
H	H	ɓúg	ɓúgím	ɓúgúm	ɓúgːúm	'You all wait(ed)'

Table 35 Class I-III verbs indexing 2PL across the three Deictic Directional paradigms

The tone classes also hold when a verb indexes two arguments (Subject and Object), and ultimately creates a trisyllabic word. Surface tone behavior follows the patterns outlined in Table 34.[36] Class L_2 verbs are M.M in the DDØ paradigm. Consider the following data that show the verb *kàn* 'bury' indexing two arguments on the verb: 3SG.M acting upon 1SG /-āk/, which is underlyingly M tone. Notice that the DDØ form (shaded) surfaces as M.M(.M) while DD1 and DD2 are both L.H(.M).

DDØ	kàn-í-r-āk bury-DD∅-3SG.M-1SG	[kānīrāk]	M.M.M	'He buries/ed me'
DD1	kàn-ú-r-āk bury-DD1-3SG.M-1SG	[kànúrāk]	L.H.M	'He buried me'
DD2	kàn-úk-r-āk bury-DD2-3SG.M-1SG	[kànkúrāk]	L.H.M	'He buried me'

Table 36 Class L_2 verb root indexing two arguments in the three DD paradigms

The data show that not all L tone verb roots surface as L (as Class L_2 roots surface as M when occurring with DDØ), and not all DDØ surface as H (as DDØ surfaces as M with Class L_2 roots). Therefore, not only does the behavior of class L_2 roots occurring with DDØ necessitate more complex underlying tones, but the underlying tones of the remaining classes must be reexamined as well as these roots do not change when inflected with DDØ. While an in-depth analysis of tone is beyond the scope of this paper, what is important for the current discussion of surface tone patterns is that there are four tone classes. These four tone classes hold and remain contrastive in other aspects of Komo verb tonology.

Disyllabic verbs also occur in the lexicon and like disyllabic nouns, all of the nine possible tone combinations are exhibited (Table 37). Disyllabic verbs inflect like monosyllabic verbs, taking directional and person-indexing suffixes.

[36]The final tone in the trisyllabic verb, on the vowel of the bound pronominal suffix that indexes the second argument (the Object in this case), is underlyingly M tone.

L.L	hèrèt’	‘crunch (e.g. bone with teeth)’
L.M	lìlī	‘sink’
L.H	gwàrás’	‘scratch quickly’
M.L	ʃɛ̄lɛ̀l	‘be wall-eyed’
M.M	pālāk	‘break off (e.g. cracked wood)’
M.H	tū̄mpúʃ	‘be bent’
H.L	s’ɔ́gɔ̀t	‘pinch quickly (with fingernails)’
H.M	gɛ́līm	‘be crisscrossed’
H.H	k’ɔ́lís’	‘pinch’

Table 37 Tone patterns in disyllabic verbs

5.3 Tonal suppletion in verbs: Number distinction

A large portion of verb roots, largely if not exclusively intransitive verbs, are tonally suppletive in number. The distinction is realized across the behavior of the four tone classes (even if not evident by the tone of the root alone), as not all L tone roots behave similarly when inflected. Thus, one particular tone class marks singular subjects while an opposing class marks plural subjects. Taking into account the four tone classes, nine of the ten possible combinations attested are seen in Table 38. The lack of an M (SG)/ L_1 (PL) combination may be due to insufficient data rather than a system-internal restriction. Interestingly there is no instance of an opposition within the L class of verbs (L_1 / L_2), which may suggest greater category affinity.

Tone Class				
SG	PL	SG	PL	
L_1	M	zàr	zār	‘walk fast’
L_2	M	kùt	kūt	‘be short’
L_1	H	wà	wá	‘be broken’
L_2	H	pès’	pɛ́s’	‘laugh’
M	L_1	---	---	---
M	L_2	kū̄n	kù̄n	‘be bent’
M	H	ɛ̄r	ɛ́r	‘be prepared’
H	L_1	pɛ́l	pɛ̀l	‘be red’
H	L_2	ɓís’	ɓìs’	‘be strong’
H	M	wás’	wās’	‘feel pain’

Table 38 Monosyllabic verbs: SG/PL tone class suppletion

Disyllabic verb roots also display tonal suppletion in number as seen in Table 39. Number distinctions on the root level and/or tonally suppletive number on the root level in verbs is also attested in related Koman languages (e.g Opo, Smolders 2017).

Root tone				
SG	PL	SG	PL	
L.L	L.H	yìlàt	yìlát	‘be dizzy, swerve’
L.L	M.H	bʊ̀bàn	bʊ̄bán	‘be aslant’
L.L	H.H	kɔ̀nɔ̀n	kɔ́nɔ́n	‘snore’
L.H	M.H	zùgúm	zūgúm	‘rinse mouth’
L.H	H.H	pàlí	pálí	‘flirt, chat’
H.M	M.H	zílīn	zīlín	‘have lines’
H.H	L.L	p’áť á	p’àť à	‘be white’
H.H	L.H	hápá	hàpá	‘fail, be absent’

Table 39 Disyllabic verbs: SG/PL tone suppletion

6 Morphophonological processes

6.1 Metathesis, elision and voicing: /-úk/ DD2

This section examines the particular behavior of the Deictic Directional morpheme *-úk* (DD2) and its allophones [-úk /ʊ́k, -kú /kʊ́, -k, -ʷk].[37] Recall that a finite verb takes bound pronominal suffixes following the Deictic Directional suffix. The particular allomorph of *-úk* (DD2) is largely conditioned by the shape of the following bound pronominal. When there is no bound pronominal morphology on the verb, DD2 always surfaces as *-úk.* This is seen in an Auxiliary construction, which contains a fully inflected auxiliary verb followed by a verb root inflected with a Deictic Directional [AUX-BP-(BP)-(BP) V-DD]. In this construction, seen in (2)-(4), the DD2 morpheme always surfaces as either [*-uk*] or [*-ʊk*], regardless if the verb root is consonant or vowel-final.

(2) ú-ná-g-áp’-ī ʃèr-úk
INT-1SG-BEN-3SG.F-3SG.NH sweep-DD2
‘I will have swept it for her.’

(3) bāʃ-g-ìn sìg-úk
NEG-1SG-3SG.NH hear-DD2
‘I haven’t heard it.’

(4) bāʃ-g-ìn ʃá-úk
NEG-1SG-3SG.NH eat.SG-DD2
‘I haven’t eaten it.’

[37]While there is some synchronic evidence for positing *-úk* as an ‘underlying form’ of the morpheme, this does not come without its theoretical implications. Assuming that speakers hold a mental representation of a given form is not the task at hand here and assuming so often obscures diachronic processes that may have given rise to synchronic forms. As such, I use ‘underlying form’ here to mean the *internally-reconstructed form*.

Process rules for deriving allomorphs of /-úk/ are seen in Table 40. Metathesis of /-úk/ occurs before consonant-initial suffixes (i), and vowel-deletion or residual labialization occurs before a suffix containing /a/ that is either (H)igh or (M)id tone (ii).

i.	-úk → -kú / __ +C
ii.	-úk → -k ~ -ʷk / __+a (H or M tone)
iii.	-úk → -úk (elsewhere)

Table 40 Process rules for *-úk* (DD2)

Table 41 contains a full paradigm of a consonant-final verb *ìʃ* 'sleep' occurring with the Deictic Directional morpheme /-úk/ (DD2) inflected with bound pronominal suffixes indexing the subject. When the bound pronominal suffix consists of a consonant, *-úk* surfaces as [-kú] as seen in 3SG.M/F, 3NH, 2PL and 3PL. Presumably, *-úk* metathesizes to avoid a sequence of three consonants in these cases. When the bound pronominal suffix following /-úk/ contains a vowel that is M or H tone, *-úk* surfaces as [-k] (1SG, 2SG, 1PL.EX). The [-k] allomorph also alternates with [-ʷk] before a mid or high tone /-a/ suffix in 1SG and 1PL.EX. The phonologically unpredictable behavior of /-úk/ is seen when the verb is marked with 1PL.IN. In this case, /-úk/ always surfaces as [-úk]. Whether or not this has to do with the fact that the 1PL.IN morpheme is low tone -(n)à or whether there is a diachronic explanation remains to be investigated, though there is no other evidence of tone or tone melodies constraining segmental structure in Komo.

1SG	ìʃ-úk-á	[ìʃ**k**á ~ ìʃʷká]	'I slept'
2SG	ìʃ-úk-í	[ìʃ**k**í]	'You slept'
3SG.M	ìʃ-úk-r	[ìʃ**kú**r]	'He slept'
3SG.F	ìʃ-úk-p'	[ìʃ**kú**pˀ]	'She slept'
3NH	ìʃ-úk-n	[ìʃ**kú**n]	'It slept'
1PL.IN	īʃ-úk-à	[īʃ**úk**à]	'We slept'
1PL.EX	īʃ-úk-án	[īʃ**k**án ~ īʃʷkán]	'We slept'
2PL	īʃ-úk-m	[īʃ**kú**m]	'You all slept'
3PL	īʃ-úk-n	[īʃ**kú**n]	'They slept'

Table 41 Paradigm of *ɪʃ* 'sleep' inflected with the DD2 suffix /-úk/

Further evidence of the allomorphic behavior of /-úk/ is seen in open syllable roots (Table 42). Notice that the bilabial offglide is present in 1SG in the verbs [ʃóʷká] 'I sewed' and [dĩʷká] 'I was angry', but not [bʷɔ̀ká] 'I hid', where the initial consonant is phonetically labialized. When the verb is inflected with *–(n)à* 1PL.IN, the vocalic element in /-úk/ can assimilate to the vowel of the root and a contour tone can emerge if the vowel of the root is not H tone. When inflected with *-r* 3SG.M, /-úk/ metathesizes to [-kú].

1SG	ʃɔ́-úk-á	[ʃóʷká]	H.H	‘I sewed’
	ɗī-úk-á	[ɗīʷká]	M.H	‘I was angry’
	bɔ̀-úk-á	[bʷɔ̀ká]	L.H	‘I hid’
1PL.IN	ʃɔ́-úk-à	[ʃóːkà]	H:.L	‘We sewed’
	ɗī-úk-à	[ɗīúkà]	MH.L	‘We were angry’
	bɔ̀-úk-à	[bʷɔ̄kà]	LM.L	‘I hid’
3SG.M	ʃɔ́-úk-r	[ʃókúr]	H.H	‘He sewed’
	ɗī-úk-r	[ɗīkúr]	M.H	‘He was angry’
	bɔ̀-úk-á	[bʷɔ̀kúr]	L.H	‘He hid’

Table 42 Allomorphs of /-úk/ on open syllable verb roots

When the final consonant of a verb root is a voiced stop or voiced fricative, a following contiguous voiceless velar stop of the metathesized DD2 suffix [-kú] becomes voiced (Table 43). Notice that the bilabial nasal can also cause voicing assimilation but the alveolar nasal, lateral and trill do not.

/b/	bàb-úk-r	[bəbgúr]	‘He buried/planted’
/d/	kèd-úk-r	[kèdgúr]	‘He pushed’
/g/	tɔ́g-úk-r	[tógːúr]	‘He tasted’
/z/	gìz-úk-r	[gìzgúr]	‘He entered’
/m/	dùm-úk-r	[dùmkúr ~ dùmgúr]	‘He punched’
/n/	kán-úk-r	[kəŋkúr]	‘He buried (s.o)’
/r/	ʃír-úk-r	[ʃírkúr]	‘He hung’
/l/	p’ɛ́l-úk-r	[p’élkúr]	‘He was white’

Table 43 Voicing of /úk/ DD2 in verbs

Verb roots ending in ejectives behave similarly to those ending in voiced stops. Word-medially, ejectives are realized as voiced stops and cause the adjacent voiceless velar stop of the [-k(u)] allomorph to become voiced (Table 44). The sibilant ejective is realized as a voiceless ejective, and as such, does not participate in the voicing assimilation process.

/p’/	ʃáp’-úk-r	[ʃə́bgúr]	‘He hit’
	k’áp’-úk-á	[k’ábgá]	‘I chopped’
/t’/	mùt’-úk-r	[mùdgúr]	‘He scooped’
	hát’-úk-á	[hádgá]	‘I flattened (sth.)’
/s’/	pès’-úk-r	[pès’kúr]	‘He laughed’
	bàs’-úk-á	[bàs’ká]	‘I tossed (sth.)’

Table 44 Ejective-final verb roots inflected with /-úk/ DD2

In §0 I discussed the distinct phonetic behavior of ejectives in monomorphemic noun and verb roots. Word-final ejectives are realized with glottal release in noun roots as opposed to verb roots.

Intervocalically, the ejective phonemes are realized with a glottal release in monomorphemes. But in polymorphemic verbs with inflectional morphology, the ejective and voiced stop contrast can often be neutralized. There also appears to be a cline in terms of how the ejectives are realized. The sibilant ejective /s'/ is almost always realized as an ejective, followed by the alveolar and velar ejectives /t', k'/ which alternate with voiced stops. The bilabial /p'/ has a wider range of allophones and has neutralized with /b/ word-medially in inflected verbs. This peculiar phonetic behavior of ejectives, specifically the bilabial ejectives, is also reported for related Koman languages.[38]

6.2 Consonant gemination in verbs: DD2 /-úk/

Consonant length is not a contrastive phonemic feature in Komo nor has it been reported in any other Koman language to date. However, heterosyllabic consonant gemination, a rare phenomenon in Komo, can occur within stems and across morpheme boundaries and is the result of morphophonological processes, namely metathesis, elision and partial reduplication which conspire such that the resulting surface forms contain a geminate consonant. The full word forms containing "geminate" consonants can ultimately contrast with non-geminate forms as minimal or near minimal pairs. Gemination in verbs can be seen in two environments: when a verb root ending in a velar stop is inflected with the /-úk/ DD2 suffix, and in verb stems that employ partial reduplication to code the pluractional.

The data in Table 41 show that certain morphophonological processes occur in verbs inflected with the suffix /-úk/ (DD2). When the inflected verb is formed by a root with a final velar consonant (C)VK, the result of these processes can create a sequence of contiguous velar stops, which in turn, is pronounced as a single geminate consonant. If other environmental factors, such as tone and vowel harmony align, length can be the only contrastive feature between inflected verbs (with roots that end in a velar stop). The data in Table 45 show pairs of verbs that contrast only in length. Notice that the vowel has elided in the forms inflected with the DD2 morpheme /-uk/. The result is a sequence of velar stops, which results in contrastive length when compared to the same verb inflected with DDØ.[39]

pūk-Ø-á	cross-DDØ-1SG	[pūkā]	'I cross (river)'
pūk-úk-á	cross-DD2-1SG	[pūkːá]	'I crossed (river)'
sɔ́k-Ø-án	sit.PL-DDØ-1PL.EX	[sʷɔ́kán]	'We sit'
sɔ́k-úk-án	sit.PL-DD2-1PL.EX	[sʷɔkːán ~ sókːán]	'We sat'
ɓúg-Ø-á	wait-DDØ-1SG	[ɓúgá]	'I wait'
ɓúg-úk-á	wait-DD2-1SG	[ɓúgːá]	'I waited'

Table 45 Velar consonant gemination in verbs inflected with /-úk/ DD2 compared to DDØ

Similar contrast in length is seen in some verbs inflected for 3SG.M (Table 46). In these data, verb roots ending in a velar stop inflected with /-úk/ DD2 contrast in length with those inflected with /-ó/ DD1. Note that the stem vowels do not surface identically for the ATR feature in 'He sows'. In the pairs, 'He crosses' and 'He waited', the only phonological contrast is length. In these

[38]Goldberg (2015) shows very similar behavior in Gwama. Killian (2015:31) proposes spirantized allophones of ejectives intervocalically as well as unreleased ejective allophones word-finally in Uduk. Kebebw (2010) gives evidence for contrastive ejectives and implosives intervocalically and word-finally in Opo but does not provide any specific information on their phonetic realizations in these positions. van Silfhout (2013) provides a similar analysis for Opo but cites the absence of word-final implosives as a distributional restriction.

[39]The vocalic variation in the verb stem [ɔ ~ o] for some speakers is evidence of some residual [+ATR] feature of /-úk/, which causes the underlying /ɔ/ in *sɔk* 'sit' to assimilate to [+ATR] [o].

examples, the [−ATR] feature of the root vowel spreads to the [+ATR] /u/ vowel of the DD2 morpheme /-úk/, causing the vowel to surface as [ú]. As such the sequences contain identical vowels and the pairs only contrast in length.

yɛ̀k-ú-r	sow-DD1-3SG.M	[yɛ̀kúr]	'He sows (towards me)'
yɛ̀k-úk-r	sow-DD2-3SG.M	[yɛ̀kːúr]	'He sows (towards you)'
pūk-ú-r	cross-DD1-3SG.M	[pūkúr]	'He crosses (towards me)'
pūk-úk-r	cross-DD2-3SG.M	[pūkːúr]	'He crosses (towards you)'
ɓúg-ú-r	wait-DD1-3SG.M	[ɓúgúr]	'He waited (at another location)'
ɓúg-úk-r	wait-DD2-3SG.M	[ɓúgːúr]	'He waited (and left)'

Table 46 Velar consonant gemination in verbs inflected with /-úk/ DD2 compared to /-ú/ DD1

6.3 Consonant gemination in verbs: Pluractional

Pluractional derivations can be employed to express actions as happening to many subjects or to many objects, or it can describe events as occurring repeatedly or habitually (Newman 1990). As such, the pluractional is commonly considered a property that codes verbal number or rather, multiplicity of a verbal event. In Komo, the pluractional is expressed by morphological derivation which involves a partial reduplication of the verb root. Monomorphemic monosyllabic verb roots in Komo have a CV or CVC shape.[40] In the bare form (without any inflectional morphology), roots with a CVC shape reduplicate the final root consonant, after an epenthetic high [−ATR] vowel [ī]. Those roots with a CV shape reduplicate the first (i.e. only) consonant, followed by [ī] (Table 47).

Root shape	Partial reduplication	Example	Gloss
C_1VC_2	C_1VC_2-ɪC_2	gàs → gàs-īs	'celebrate' → 'celebrate profusely'
C_1V	C_1VC_1-ɪ	yà → yà-yī	'go.SG → 'wander aimlessly'

Table 47 Pluractional derivation

The newly derived pluractional stem is able to inflect regularly with Deictic Directional morphology and bound pronominal suffixes. When the pluractional stem is inflected, deletion of the epenthetic vowel /ī/ occurs. As a result of the deletion, two identical consonants occur in sequence, pronounced as a geminate. In (5a) the derived pluractional verb is in the bare form following an auxiliary, as compared to (5b) where gemination occurs since the epenthetic vowel [ī] has deleted (but not before spreading the [−ATR] feature to the morpheme /-í/ DDØ).

(5) a. bāʃ-í-r yìs-īs [yìsīs]
NEG-DDØ-3SG.M circle-REDUP.PLU
'He doesn't circle around (continually).'

b. yìs-īs-í-r [yìsːír]
circle-REDUP.PLU-DDØ-3SG.M
He circles around (continually).'

[40]The research to date shows only monosyllabic verbs undergoing this partial reduplication process.

Contrast between geminate and singlelton consonants involving the pluractional derivation is seen in Table 48 with the nominalizing enclitic *=āgí*.

lɔ̀l = āgí	[lɔ̀lāgí]	'to pat'	wàd = āgí	[wādāgí]	'to turn (intr.)'
lɔ̀l-īl = āgí	[lɔ̀lːāgí]	'translation'	wàd-īd = āgí	[wàdːāgí]	'to swivel round and round'

Table 48 Gemination in nominalized verbs

7 Conclusion

This paper is the first comprehensive examination of the core phonology of the Ethiopian variety of Komo, an endangered language of the Koman family. One notable feature of the Komo consonant system is the apparent deglottalization of ejectives, which results in voiced obstruents word-medially and unreleased obstruents word-finally. Surface contrast in consonant length, a feature that is not considered phonemically contrastive in the language, arises from morphophonological processes in the verb. Komo displays a phonemic seven-vowel inventory with ATR contrast in the high vowels, which is supported by acoustic measurements of over 6,000 vowels taken from twelve native speakers. One of the most unusual aspects of Komo phonology is the bi-directional ATR harmony system. The Komo system questions the notion of a single "dominant" ATR feature within an ATR harmony system, as the same vocalic elements that are *triggers* of anticipatory [+ATR] spreading in one domain can also be *targets* of progressive [-ATR] spreading in another.

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Appendix A: Evidence for consonant contrast

p : b

initial

pá	'shoe, sandal'	bà	'be wide'
pàm	'touch, feel'	bám	1SG.POSS
pút	'plaster'	būt	'grasshopper (sp.)'
pít	'vagina'	bìt	'discard'

intervocalic

púpúʃ	'tree (sp.)'	bùbūʃ	'tree (sp.)'
ʃìpá	'knife'	yībā	'man'

final

ùp	'bathe'	ùb	'feed'
ťàp	'spit (v.)'	táb	'kick'

p : p'

initial

pɛ̀l	'untie'	p'ɛ́l	'be red'
pàs'	'soak'	p'àʃ	'tree (sp.'

intervocalic

púpúʃ	'tree (sp.)'	nàp'úʃ	'soft, silky'

final

kɔ̀p	‘upper arm’	kɔ̀p’	‘eland antelope’
íp	‘drink.SG’	yīp’	‘spear, inject’

p : ɓ[41]

initial

pàs’	‘soak’	ɓàs’	‘be hot’
pú	‘decay, rot’	ɓú	‘be pregnant’

p : m

initial

púʃ	‘sand’	mùʃ	‘draw water’
pá	‘shoe’	mà	‘do’

intervocalic

kùpú	‘cane’	kūmú	‘clitoris’
dúpɛ̀	‘skirt (trad.)’	dùmɛ̀	‘tree (sp.)’

final

páp	‘defecate’	pàm	‘touch
ʃɛ́p	‘tree (sp.)’	ʃɛ́m	‘stuff, pack in’

p : w

initial

pūd	‘wind’	wùd	‘fox (sp.)’
pàg	‘swim’	wàg	‘jeer, slander’

intervocalic

yīpāl	‘young man’	yīwáy	‘healer

final

káp	‘move fire’	k’áw	‘dog’

p’ : b

initial

p’àʃ	‘tree (sp.)’	bàʃ	‘blood’
p’īn	‘ashes’	bīní	2SG.POSS

[41]Note: there are no implosives in word-final position.

intervocalic

gùp'í	'stew'	gùbí	'house, hut'

final

bíp'	3SG.F.POSS	bìb	'cow'

p' : ɓ

initial

p'ís'	'rub hands together'	ɓís'	'be strong.SG'
p'àʃ	'tree (sp.)'	ɓàs'	'be hot'

b : ɓ

initial

bà	'be wide'	ɓà	'nape'
bɔ̀l	'stretch'	ɓɔ́l	'be good'

b : m

initial

bùl	'drum'	mùl	'hair'

intervocalic

kúbá	'pillow'	kūmà	'path, road'
s'ābà	'traditional healing'	s'āmà	'bird (sp.)'

final

dàb	'be fragrant'	dàm	'honey'
bàb	'bury'	bàm	'move together'

b : w

initial

būt	'grasshopper (sp.)'	wŭt	'ostrich'

final

dàb	'be fragrant'	dàw	'baboon'

m : n

initial

màʃ	'marriage'	nàs'	'grind (wet)'

intervocalic

ámà	'there'	ánà	1SG.INCLUSIVE

final

tɔ̄m	‘spear’	tɔ̄n	‘pass, overtake’
súm	‘pound in’	sùn	‘point at, show’

m : w

initial

mādā	‘place’	wādá	‘fox (sp.)’
mālà	‘saliva’	wàlá	‘hide (of animal)’

final

dàm	‘honey’	dàw	‘baboon’

t : d

initial

tūt	‘return, reply’	dùt	‘elbow’
tɛ́n	‘slap, strike’	dɛ̀n	‘count, read’

intervocalic

wātá	‘be like, similar to’	wādá	‘fox (sp.)’

final

būt	‘grasshopper (sp.)’	bʊ̀d	‘unthatch’

t : t’

initial

tā	‘be, exist’	t’ā	‘mouth, language’
tín	‘fight, war (v)’	t’ìn	‘stretch’

intervocalic

pàtàgí	‘to crawl’	p’àt’àgí	‘ to be white, clean’

final

kàt	‘convince, lobby’	k’át’	‘be easy’
dɔ̀t	‘ask’	dɔ̀t’	‘squat’

t : ɗ

initial

táb	‘kick’	ɗàb	‘adhere’
tɛ́	‘sun’	ɗɛ́	‘one’
tíʃ	‘sing and play’	ɗìʃ	‘be near’

t : n

initial

tɛ́g	‘not acknowledge.SG’	nɛ́k	‘Hammerkopf’
tā	‘be, exist’	ná	‘feel hopeless’

final

kát	‘cause trouble’	kàn	‘bury’

t : r

initial

tít	‘roughen (stone)’	rìtá	‘hyena’

intervocalic

kàtàkàtà	‘whisper’	kàrá	‘fish (sp.)’

final

bát	‘duck (sp.)’	bàr	‘lower back’
būt	‘grasshopper (sp.)’	bùr	‘ventilate, fan’

t : l

initial

tūs	‘push’	lùs	‘hide sth.’
túút	‘crossroads’	lùtút	‘come free and fall’

intervocalic

lītī tɔ̄m	‘shooting star’	līlí	‘sink (v.)’

final

bìt	‘toss’	bìl	‘root’

t : s’

initial

ták	‘surpass’	s’ák	‘burn’
tás’	‘smith’	s’ás’	‘ant (sp.)’

intervocalic

dìtīn	DEM.DIST	dīs’īn	‘pimple’

final

wŭt	‘ostrich’	wús’	‘shut’
dɔ̀t	‘ask’	dɔ̀s’	‘suck’

t’ : d

initial

ťàʃ	‘salt’	dàʃʊ́	‘snake (sp.)’
ťúť	‘freckle, spot’	dùd	‘elbow’

intervocalic

káťāgí	‘be soft’	kádán	‘fish (sp.)’

final

ťúť	‘freckle, spot’	dùd	‘elbow’
háť	‘clear, flatten’	hàd	‘pull’

t’ : ɗ

initial

ťús’	‘choke’	dūs’	‘urinate’
ťíʃ	‘finely grind’	ɗĭʃ	‘be near.PL’

t’ : s’

initial

ťús’	‘choke’	s’ús’	‘scratch’
ťádà	‘bake’	s’ábà	‘tree (sp.)’

final

dɔ̀ť	‘squat’	dɔ̀s’	‘suck’
háť	‘clear, flatten’	hás’	‘ruminate, chew cud’

d : ɗ

initial

dàb	‘be fragrant’	ɗàb	‘adhere’
dɛ̌	‘thing’	ɗɛ́	‘one’
dɔ̀l	‘cry out’	ɗɔ̀	‘carry many things’

d : n

initial

dì	DEM.PROX.1	nì	DEM.PROX.2
dɔ̄kɔ̄	‘potato (sp.)’	nɔ̀gɔ́	‘worm (sp.)’

intervocalic

dàdāgí	‘to complain’	dànāgí	‘to growl’

final

dàd	‘refuse sth.’	dàn	‘menstrual cycle’
bʊ̀d	‘unthatch’	bʊ́n	3PL.POSS

d : r

initial

dīdà	‘lance, spear’	rìtá	‘hyena’
dɔ̄kɔ̄	‘potato (sp.)’	rɔ̀kɔ́n	‘corner’

intervocalic

dīdà	‘lance, spear’	dìrà	‘fish (sp.)’
kādán	‘fish (sp.)’	kàrá	‘fish (sp.)’

final

ùd	‘hit’	ùr	‘be barren’
hàd	‘pull’	hàr	3SG.M

d : l

initial

dàm	‘honey’	làm	‘strain (e.g. food)’
dʊ̀	‘inhabit (temporarily)’	lʊ̀	‘sprout (v.)’

intervocalic

mādā	‘place’	mālà	‘saliva’

final

bʊ̀d	‘unthatch’	bʊ̀l	‘drum’
tɔ̄d	‘abort’	tɔ̄l	‘be fat.PL’

r : l

initial

rɔ́kɔ̀n	‘corner, angle’	lɔ̀gɔ́n	‘wall’
rìtá	‘hyena’	lítì	‘flute’

final

bár	‘heron’	bál	‘in order to’
tɔ̀r	‘slaughter, decapitate’	tɔ̀l	‘be fat.SG’

s : z

initial

sà	‘very, very much’	zà	‘dig’
sès	‘delineate, mark on ground’	zèz	‘set in sights, measure’

intervocalic

bàsá	‘be good’	màzá	‘be tired’

final

sès	‘delineate, mark on ground’	zɛ̀z	‘set in sights, measure’

s : s’

initial

sī	‘bowl, pot’	s’í	‘diarrhea’
sās	‘greet’	s’às’	‘chest’
sès	‘delineate, mark on ground’	s’ès’	‘termite’

final

kīs	‘tree (sp.)’	kís’	‘light fire’
hās	‘wash (sth.)’	hás’	‘ruminate, chew cud’

s : ʃ

initial

sī	‘bowl, pot’	ʃì	‘rain (v.)’
sá	‘tree’	ʃá	‘eat.SG (soft food)’

in CC sequence

ískír	‘squirrel (sp.)’	túʃkír	‘heart, internal organ’

final

yìs	‘circle, encircle’	yìʃ	‘penis’
tūs	‘force feed’	tùʃ	‘cotton, thread’

s’ : z

initial

s’í	‘be black’	zì	‘be green’
s’ú	‘river’	zù	‘pour’

intervocalic

bās’ú	‘snake (sp.)’	yàzú	‘friend’

final

gwàs’	‘buffalo’	gwàz	‘men’
wás’	‘bite’	wùz	‘fish (sp.)’

s’ : ʃ

initial

s’ɛ̀	‘shuck’	ʃɛ̀	‘tooth’
s’ǎk	‘burn’	ʃàk	‘catch fish (trad.)’

intervocalic

wàs’āgí	‘bite, pain’	wàʃíkāgí	‘boil’

final

dɔ̀s’	‘suck’	dɔ̀ʃ	‘stand.SG’
wàs’	‘fish’	wàʃ	‘wife’

k : g

initial

kíʃ	‘cocoyam’	gìʃ	‘hole’
kàm	‘brother’	gàm	‘find, meet’
kúsʾ	‘be dry, infertile’	gùsʾ	‘swallow’

intervocalic

ɓākān	‘sister’	bágà	‘jerrycan’
kákā	‘thorn’	kágá	‘cackle’

final

ʃɔ̄k	‘move away, migrate’	ʃɔ̀g	‘leg, foot’
ták	‘overtake, surpass’	tàg	‘forehead’

k : k’

initial

kī	‘horn (of animal)’	k’í	‘remove shell’
kàm	‘brother’	k’àm	‘feel’

final

s’ík	‘rat, mouse’	sʾīkʾ	‘be sour’
ʃúk	‘land, alight’	ʃūnkʾ	‘vein, tendon’

k : h

initial

kàm	‘brother’	hàm	‘yawn.PL’
kàū	‘bring’	hàū	‘come.SG’

g : k’

initial

gī	‘with’	kī	‘horn (of animal)’
gàm	‘find, meet’	k’àm	‘feel’

final

sìg	‘listen, hear’	s’ɪ̄k’	‘be sour’
ʃùg	‘palm tree (sp.)’	ʃʊ̄nk’	‘vein, tendon’

Appendix B: Evidence for tone contrast: (near) minimal pairs

monosyllabic

L		**H**	
ày	2SG	áy	‘remain, stay’
s’ɔ̀s’	‘be few, small.PL’	s’ɔ́s’	‘scratch’
twày	‘not sleep’	twáy	‘hunger’
bʊ̀m	‘sugarcane’	bʊ́m	3PL.POSS
sà	‘very’	sá	‘tree’

L		**M**	
s’ɔ̀s’	‘be few, small.PL’	s’ɔ̄s’	‘be few, small.SG’
bà	‘be wide’	bā	DEM / POSS
dìʃ	‘mushroom (sp.)’	dīʃ	‘three’
yàʔ	‘vomit.SG’	yāʔ	‘vomit.PL’

M		**H**	
bāl	‘beehive’	bál	‘in order to’
wʊ̄l	‘together’	wʊ́l	‘miss mark’

F		**M**	
ɓî	‘eye’	ɓī	‘mountian’

R		**H**	
kɪ̌l	‘cattle egret’	kíl	‘star’

R		M	
ʃǐt	‘tree (sp.)’	ʃīt	‘wrinkle (on skin)’

R		L	
bă	‘father’	bà	‘wake’
zǐ	‘excrement’	zì	‘be green.SG’

disyllabic

L.H		L.L	
zàmá	‘walk gracefully’	zàmà	‘wound’

L.M		M.H	
mɛ̀ʔī	‘food’	mɛ̄ʔí	‘goats’

M.L		M.H	
mātà	‘perhaps’	mātá	‘hunt’

M.H		L.H	
ʃɛ̄ʔí	‘kale, collard greens’	ʃɛ̀ʔí	‘teeth’

H.M		L.H	
kákā	‘thorn’	kàká	‘grandmother’