

# Aspects of Northern Mao (Bambassi-Diddesa) Phonology

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*In general terms, the phonology of Omotic languages has received little attention. This paper presents core phonological properties of an Omotic language, Northern Mao. The discussion includes inventories of contrastive consonants, contrastive vowels, an examination of the vowel space, contrastive vowel length, vowel harmony in roots, syllable patterns, sibilant harmony, and an inventory of surface tonal melodies in nouns and verbs in citation form.*

## 1. Introduction

Northern Mao, also known by the toponyms Bambassi and Diddesa, is one of the least documented Omotic languages (Bender 2000:180). A Mao language of the Omotic family, a subclass of the Afroasiatic phylum (Bender 1985; 2000; 2003; Hayward 2000), the language is spoken by an estimated 5,000 speakers (Siebert et al. 1993) living primarily in the areas around Bambassi town, especially the areas known as Muts'a and Muts'a Mado, as well as in the Dimt'u area of the Diddesa Valley in western Ethiopia (Siebert et al. 1994:9; Bender 2003). A small community of speakers may also be found outside the Mao area proper, in the town of Asosa. Northern Mao speakers refer to their own language with the autonym /mawes aats' tose/ MH↓MLL which may be translated literally as 'Mao-person-tooth-talk'. The self-name for the people themselves is /maweswole/ MH↓MM 'Mao-person-PL'. Most neighboring groups and official Ethiopian documents such as census reports simply refer to the Northern Mao and other Mao groups as [maʔo] without distinguishing among them. A complicating factor is that the name may be used to refer to at least two non-Omotic languages. The recent determination of the Mao Special Woreda (a small political designation on the level of a county in the U.S.) includes speakers of the Kwama (Nilo-Saharan) language within its borders. Kwama speakers may be found outside the towns of Zebshir and S'uru as well as further to the west, presumably across the border into Sudan. Speakers of Komo, another Nilo-Saharan language, are also frequently called Mao. This group may be found to the south of Kwama, also along the Sudan-Ethiopia border area.

The Omotic-Mao languages, all of which are closely related to Northern Mao (Bender 2003), are Hozo and Sezo (which, according to the author's consultants, are spoken south of Bambassi around Begi town in Kash Mando and Bangga Tarku k'ebeles, an administrative district below the level of woreda) and Ganza (which is spoken in the area west of Bambassi town in Boshima, Shiyo and Bergush k'ebeles). Intelligibility between Northern Mao and these languages is not high enough to allow for communication between them without the use of languages of wider communication, most typically Oromo or Amharic. This is based upon the author's observations while working in the area as well as reports by speakers. Bender also notes that Northern Mao is not mutually intelligible with Hozo-Sezo (1975:128). It remains to be seen what degree of intelligibility exists between the Hozo and Sezo varieties; they are widely considered to be different languages by their speakers.

Previously, the available data on Northern Mao have included wordlists of a few hundred words (Bender 1985, 1990, 2000, 2003; Fleming 1986; Grottanelli 1940; Siebert et al. 1993), a three-page phonological sketch (Wedekind and Wedekind 1993) and a set of morphological paradigms (Bender 2003). Baye Yimam has published the most comprehensive sketch of

Northern Mao phonology, morphology and syntax to date (2006). The phonology portion of Baye's work was based on approximately 250 words.

Issues of more general typological interest in the Northern Mao phonological system include the phenomenon of sibilant harmony which exhibits itself both as a root constraint word-internally as well as a harmony system across morpheme boundaries, vowel harmony, contrastive vowel length, a set of four ejectives including the areally rare /p'/ and a tone system with three contrastive heights. In terms of Omotic studies, this work provides the first in-depth look at the phonology of Northern Mao and thus, the first study based on a large set of data (over 3,000 words and phrases) on any of the languages of the Mao subgroup, certainly the least-studied of the three branches of the Omotic family (Bender 2000:180). Given that Mao is the least-studied subgroup within Omotic and that Omotic itself is the least studied member of the Afroasiatic family (Bender 1990:584; Hayward 2000), work on any of the Mao languages is of interest. Previously, it was not possible for historical reconstructive work to include input from large sets of data of any of the Mao languages (Bender 2000, 2003; Hayward 1988, 2000); it is likely that some of the reconstructions will either be bolstered or perhaps need to be reconsidered in light of new findings.

The data contained in this description are the result of roughly twenty months of field work in Ethiopia. Twenty-five speakers of Northern Mao have participated in this study by providing lists of words, elicited sentences and more than 8 hours of natural texts. Only those speakers who live and work within the language areas and who speak Northern Mao as a mother tongue were consulted in an attempt to lessen the effect of loss or contact with other languages. It should be noted that the language of wider communication within the Benishangul Gumuz region is West-Central Oromo while the language of government and official business is Amharic. There is also a great deal of influence from Arabic due partly to the close proximity of the Sudan border and partly to the fact that the vast majority of the Northern Mao in the Bambassi area identify themselves as Muslims and value Arabic highly. There is little to no influence of Arabic in the Diddesa area, where West-Central Oromo (primarily) and Amharic (secondarily) serve as languages of wider communication.

This work, detailing results of research<sup>1</sup> undertaken in the Bambassi, Diddesa and Asosa areas of Ethiopia, is limited in scope to an examination of the contrastive features of the phonological system as well as word-internal constraints. The discussion includes inventories of contrastive consonants, contrastive vowels, an examination of the vowel space, contrastive vowel length, vowel harmony in roots, syllable patterns, sibilant harmony, and an inventory of surface tonal melodies in nouns and verbs in citation form.

## 2. Consonants

There has been some discussion in the literature regarding the inventory of contrastive consonants. While Wedekind and Wedekind (1993:11-13) have provided a brief sketch of

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<sup>1</sup>This research is partly funded through a grant from the National Science Foundation, "Doctoral Dissertation Research: A Grammar and Interlinearized Texts of Northern Mao, an Understudied Omotic Language," under the direction of Dr. Doris Payne, University of Oregon. This work would not be possible without the support of the Benishangul-Gumuz Culture Office in Asosa and the help and support of the Mao community in Bambassi and Diddesa, especially Ato Yasin Ibrahim, Ato Mamo Shimagele, Ato Muletu Mesoba and Ato Tefera Ibrahim. The author is also indebted to the scholars at the Department of Linguistics at Addis Ababa University, who have helped to make this work possible, offering advice and support—especially Professor Baye Yimam and Drs. Hirut Woldemariam and Moges Yigezu.

various aspects of Northern Mao phonology and posit 23 consonants, Bender (2000:182) lists 24 with significant differences. Bender posits a set of voiced plosives, whereas Wedekind and Wedekind suggest these are in an allophonic relationship with the voiceless series. Wedekind and Wedekind report the existence of an alveolar implosive / retroflex, as well as a voiced post-alveolar affricate and a palatal nasal, all of which Bender notes as lacking in his data. Baye adds to the discussion, claiming the existence of the voiced post-alveolar [ʒ] (2006:168), which is usually found to be in complementary distribution with other consonants within Omotic, as is the case of [ʒ]~[dʒ] in Koyra (Hayward 1988:273).

## 2.1. Phonemic Consonants

Table 1 exhibits the full inventory of contrastive consonants found in Northern Mao. As noted in the introduction, these data are based on a collection of more than 3,000 words and phrases, as well as thirty fully interlinearized texts. There are a total of 22 contrastive consonants. The voiced plosives are indeed contrastive, as Bender suggested. While there is an alveolar implosive, its distribution is predictable relative to the ejective /t'/, as discussed below. The presence of the affricates is limited: only a single example of the voiceless post-alveolar affricate has been found in the entire set of data and this is in free variation with the /ʃ/ across the speech community; the voiced counterpart [dʒ] is more frequent, though limited entirely to borrowed words, mainly from Arabic and is thus not included in the chart below. The ejective post-alveolar affricate is also limited to borrowed words and is not included in Table 1. The palatal nasal is predictable in relation to the alveolar, which is far more frequent, as noted in the discussion below, section 2.5.2.

		<b>Bilabial</b>	<b>Alveolar</b>	<b>Post-Alveolar / Palatal</b>	<b>Velar</b>	<b>Glottal</b>
<b>Plosives</b>		p b	t d		k g	
	<b>glottalized</b>	p'	t'		k'	
<b>Fricatives</b>			s z	ʃ		h
<b>Affricates</b>				(tʃ)		
	<b>glottalized</b>		ts'			
<b>Laterals</b>			l			
<b>Taps</b>			r			
<b>Nasals</b>		m	n		ŋ	
<b>Approximants</b>		w		j		

Table 1: Contrastive Consonant Inventory

The data in Appendix A provide evidence of contrast between each of the consonants and their most phonetically similar counterparts. Since long vowels in monomorphemic words carry only a single level tone, only one tone is indicated per long vowel. These tones are represented by the letters H, M or L.<sup>2</sup>

<sup>2</sup>H, M and L notations indicate high, mid and low tones, respectively. These are the only levels which are contrastive in Northern Mao and typically are the only levels found at the level of the 'word'. Within long phrases and clauses,

## 2.2. Suspect Consonants and Those Limited to Borrowed Words

As noted above, only a single example of the affricate /tʃ/ has been found in non-borrowed words. This is found in the far-distal demonstrative /gjetʃe/ HH ‘that’. It is quite clear that this affricate has today merged with the /ʃ/ for the most part. Some speakers still produce it consistently in this one word while others alternate between the affricate and the fricative. As a result, the consonant is listed in parentheses in the consonant chart in Table 1. The other examples of post-alveolar affricates (either voiced or glottalized) are found exclusively in borrowed words:

- |     |                                  |      |  |
|-----|----------------------------------|------|--|
| (1) | <a href="#">/k'urtʃ' mank'e/</a> | H MM | ‘leprosy’, lit. ‘cutting disease’ (perhaps from ‘cut’ in Amharic). |
| (2) | <a href="#">/dʒa:nibe/</a>       | LHH  | ‘hell’ (from Arabic)   |
| (3) | <a href="#">/aldʒa:be/</a>       | LHL  | ‘charm; amulet’ (from Arabic)                                      |

Bender reports the existence of /ts/ and /dz/ in Northern Mao (2003:305). Only the ejective /ts'/ is attested as contrastive according to this author's data. In the forms where Bender reports [dz], this author finds /z/ in the speech of most speakers: in words for ‘dig’ [/hakwinza/](#) MHM and ‘hit’ [/haheza/](#) MHM. Two of the speakers consulted do exhibit the alternative [dz] in ‘hit’, though not in ‘dig.’ Since this is the only instance of this phone found thus far, and since [dz] is not found initially, the interpretation as a sequence is preferable. No example of the non-glottalized [ts] has been found.<sup>3</sup>

In terms of borrowed words, Arabic loans are found throughout the speech of those living in and around Bambassi (most typically related to names for clothing as well as religious terminology) but are not found in the speech of those speakers living in the Diddesa valley. It seems likely that the Arabic loans found in Bambassi were borrowed after the emigration to Diddesa, which is said to have occurred an estimated 60 years ago (Siebert et al. 1994:9).

## 2.3. Free Variation within /p/: [p], [f] and [ɸ]

The phoneme /p/ exhibits variation between the phones [p], [f] and [ɸ], found in every environment, initial, medial and final (final is only attested in connected speech and is thus not utterance final).

- |     |   |      |                          |
|-----|---|------|--------------------------|
| (4) | <a href="#">[puwɛ]</a> ~ <a href="#">[fuwɛ]</a> ~ <a href="#">[ɸuwɛ]</a>          | HH   | ‘traditional beer’       |
| (5) | <a href="#">[hupɛ]</a> ~ <a href="#">[hufɛ]</a> ~ <a href="#">[hɸɛ]</a>           | MH   | ‘brooding (of a hen)’    |
| (6) | <a href="#">[ʔapp'iɛ]</a> ~ <a href="#">[ʔafp'iɛ]</a> ~ <a href="#">[ʔaɸp'iɛ]</a> | M ML | ‘cousin’ (uncle's child) |

This variation is optional, and in many words all three variants are recognizable to speakers

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additional levels are detectable but are due to processes which are beyond the scope of this paper. These phenomena will be dealt with in a later paper focusing on tonal phenomena in Northern Mao.

<sup>3</sup>It should also be mentioned in this discussion of sounds which have been reported for Northern Mao, that while Fleming reconstructs \*mb as a prenasalized stop for the Mao languages, (Fleming 1986:39) there is no evidence for prenasalization in Northern Mao (i.e. no nasal-obstruent sequences occur word-initially).

as the same sound,<sup>4</sup> represented in this paper with /p/, undoubtedly the historical source (Fleming 1986; Bender 2003). Some speakers show signs of a split, where [f] is produced without variation in a small number of lexical items, as in /a:pe/ HH ‘eye’, but this is not yet spread widely throughout the community of speakers.

Fleming (1986:38) notes a ‘small tendency’ for /p/ to be expressed as its allophone [f], noted in both the Bambassi-Diddesa and Sezo varieties. Fleming reconstructs \*p which is attested in other so-called Mao varieties (including Hozoid and Sezoid) but does not reconstruct the innovative [f] (1986). In Northern Mao today, the variation is most frequent intervocalically but, as noted above, is attested in all environments, in both the Bambassi and Diddesa varieties of Northern Mao.

Baye suggests that labial stops /p/ and /b/ are weakened (spirantized) in intervocalic environments (2006:173). While the spirantization of /b/ must be a feature of the speech of some (according to Baye’s findings), it is not indicative of the entire community. The spirantized /b/, as a voiced bilabial fricative, is not attested in the data in this study, nor was it found when Baye’s data were re-elicited from this author’s Northern Mao consultants. The database used in this study yields the following results: 1) only the voiceless labial stop appears to weaken, exhibiting the fricatives [ɸ] or [f]; 2) spirantization of [p] is also attested in both initial and final environments; and 3) the relationship is best characterized as variation and not complementary distribution, as the process is not obligatory and is not found to be consistent within the speech of even a single speaker (among those consulted), much less the community.

This variation of [p], [f] and [ɸ] is found elsewhere in Omotic, as well. Rapold notes that in Benchnon, /p/ may be expressed as [p], [f] or [ɸ] in any environment (2006:73) and notes that the process appears to be optional. Variation between [f] and [ɸ] is noted in Dizin (Beachy 2005:26).

## 2.4. Glottal Stop Epenthesis

The glottal stop is predictable under a strictly phonemic analysis, as an onset to all vowels which exhibit no other onset, and is thus considered epenthetic. Unambiguous syllable patterns in Northern Mao show CV and CVC types (section 4). Where an onset is not already filled, a glottal stop is realized:

- |      |                              |     |              |  |
|------|------------------------------|-----|--------------|--|
| (7)  | <u>/ese/</u> [ʔɛ.sɛ]         | ML  | ‘person’     | epenthesis to fill onset in nominal root |
| (8)  | <u>/ha-ɪʃ-a/</u> [ha.ʔiʃ.a]  | MMH | ‘drank’      | epenthesis to fill onset in verbal root  |
| (9)  | <u>/maw-ese/</u> [ma.wɛ.sɛ]  | LHL | ‘Mao person’ | onset provided by first word in compound |
| (10) | <u>/ham-ɪʃ-a/</u> [ha.mi.ʃa] | MMH | ‘we drank’   | onset provided by prefix                 |

In both (7) and (8), the glottal stop is inserted to meet an onset requirement; in (9), the first word in the compound, /maw/ L ‘Mao’, provides the onset for /ese/ [ʔɛ.sɛ] ML ‘person’. Likewise in (10), an onset is provided by the 1PL prefix /ham-/. Some speakers occasionally maintain the glottal stop in very slow careful speech as an onset to verb roots, even when an onset is provided. This has not been attested in nouns (as in example (9)). But no speaker consulted has exhibited

<sup>4</sup>When speakers have been questioned about any of these three sounds, the response is that different speakers will use different pronunciations [p], [f] or [ɸ]. In some cases, however, speakers will produce all three variants in the same word in different utterances.

this maintenance of the glottal in verb roots consistently, even in hyperarticulated speech. The analysis of the glottal stop as an epenthetic consonant finds further support in that the glottal stop is severely limited in its distribution, only occurring word-initially in monomorphemic words and word- or root-initially in verbs carrying a vowel-final prefix. The other glottal consonant, /h/, on the other hand, may be found word-initially and intervocalically<sup>5</sup> in monomorphemic words and is considered a phoneme.

The /ha-/ prefix, as seen in (8) above, has been tentatively considered a declarative prefix on the basis of its distribution. The form is optionally found in declarative realis and irrealis verb forms as well as in polar/yes-no questions (most consistently those where the expected answer is affirmative). The prefix is obligatorily prohibited in negatives, content-interrogatives, imperatives and optatives/jussives.

## 2.5. Complementary Distribution

The major phonological processes which may be observed in Northern Mao include voicing assimilation (both voicing and devoicing), deglottalization (loss of glottalized release of stops), gemination of stops produced at the same point of articulation and nasal assimilation. Each is discussed below. The post-alveolar groove fricative [ʒ], which Baye reports and lists within his chart of contrastive consonants of Northern Mao (2006:168), must be considered an allophone of /ʃ/: Baye's data include [biʒa] 'be present' (2006:194) and [kaʒäya] 'baboon' (2006:221). This author has found [bifa] /[habiʃa](#)/ HM 'be present' (the non-past existential) and [ka:ʃaje] /[ka:ʃaje](#)/ LHL 'baboon', respectively. No speaker with whom this author has consulted produces the [ʒ] form in the same words; rather each instance is pronounced as [ʃ]. In less-careful, fast speech however, the voiced variant has been found in these intervocalic environments, in these words.

The alveolar ejective /t'/ exhibits a voiced implosive allophone [d] intervocalically. Fleming notes this phenomenon, only for Northern Mao (1986:40).

- (11) [[kjadɿ-ɛ](#)]      ML      'house'  
 (12) [[kjadɿ' kjad-a](#)]    M HM    'house house.build-PF'

In (11), the /t'/ is found in the intervocalic position before the final nominal ending [-ɛ] /-e/ while in (12), the [t'] is found in the less sonorant environment, preceding the [k] (in connected speech, final vowels of nouns are not pronounced and are limited to utterance-final and citation form environments).<sup>6</sup> The phenomenon is also noted root-internally, as in /kit'ife/ MLL 'neck' which, apart from very slow, careful speech, is pronounced [kidɿʃɛ] MLL.

In agreement with Fleming, Wedekind and Wedekind (1993:11) also report the existence of the alveolar implosive in the Bambassi variety. This author's research shows that the phenomenon is found in both Bambassi and Diddesa varieties and the relationship between the ejective and the implosive may even be seen in loanwords such as the toponym Diddesa [[dɿdɛsa](#)]

<sup>5</sup>There are minimal pairs which show the difference in behavior between the glottal stop and glottal fricative: /ham-ats'e/ [ham-] 1PL + [[ʔartɛ](#)] 'tooth/language' > [[hamats'ɛ](#)] MML 'our language' and /ham- hats'e/ [ham-] 1PL + [[hartɛ](#)] 'water' > [[hamhats'ɛ](#)] MML 'our water'. While the glottal stop is not present in the environment of another onset, the /h/ is maintained.

<sup>6</sup>Out of the 3,000 entries in the database, only 61 instances of [d] are found in comparison to 322 instances of [t'].

which in very slow careful speech is pronounced [tʰiʔɛsa] as well as [tʰidɛsa] by speakers from each area, where even the initial implosive, which is not normally found in Mao words, is reanalyzed as an ejective.

Wedekind and Wedekind suggest the implosive is retroflexed (1993). Greenberg writes, “A recurrent feature of injectives [implosives] which deserves special mention and treatment is that the injective corresponding to a noninjective dental is often retracted to the alveolar or alveopalatal position and is consistently apical, often with accompanying retroflexion” (1970:129). He continues, noting that these retroflexed implosives are quite common, “The examples in the sample were so numerous that this property can be considered normal and one may suspect that it is present in some instances without being noted in the phonetic description” (1970:129). Greenberg’s observations were supported by Haudricourt’s earlier work (1950), where it was suggested that “the tendency towards retroflexion and retraction in apical injectives...could...be attributed to the rarefaction of the air in the supraglottal cavity caused by the descending larynx. While it is not clear that the pressure difference is substantial enough to cause this (Greenberg 1970:139), it is important to note that several researchers have remarked on the frequency of the retroflex implosives which are formed posterior to the dental region.

While no palatography or linguagraphy which could aid in identifying both passive and active articulators has yet been attempted on the Northern Mao data, it is possible to note that the implosive does appear to be produced with the tongue tip slightly posterior to the alveolar ejective, in the post-alveolar region. However, retroflexion does not appear to be involved and is not observed in perturbations of the third formants of surrounding vowels, as can be seen in Figures 1 and 2, below.

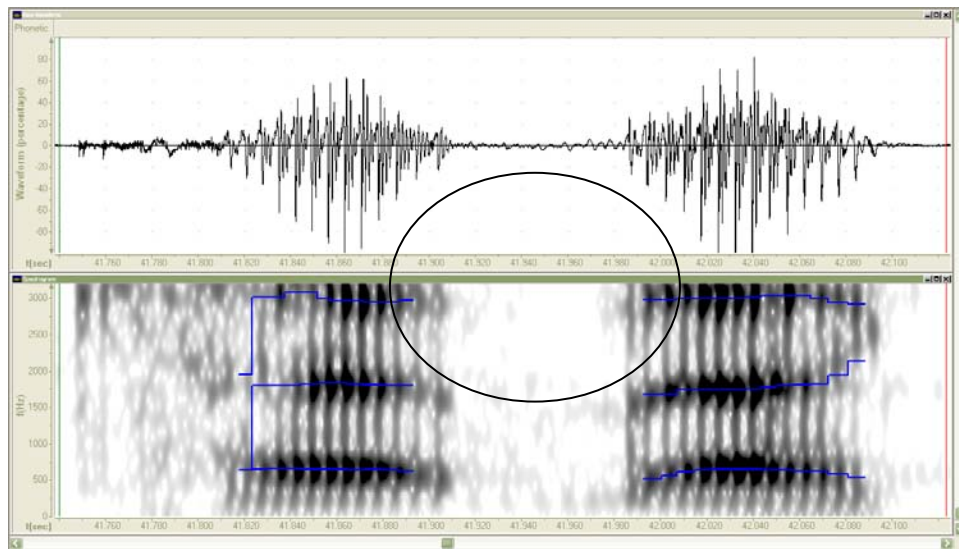


Figure 1: Wave and Spectrogram for [kjadɛ] ML ‘house’

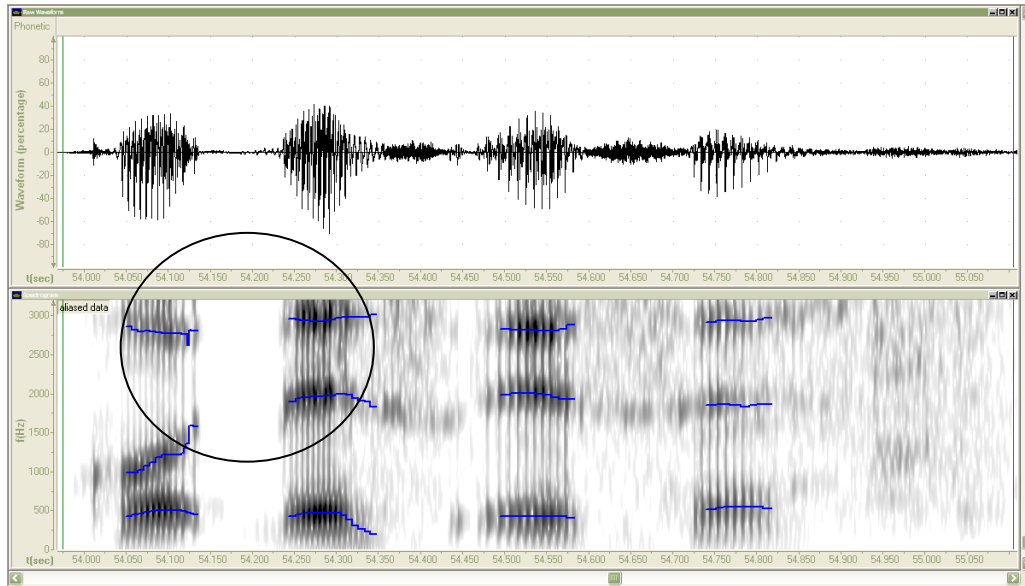


Figure 2: Wave and Spectrogram for [kod-es eε] LH↓ML ‘have-NEG.REL person’

In each case, there is no appreciable drop in the third formant which could indicate retroflexion.

### 2.5.1. Stop Sequences

When voiced stops immediately precede voiceless stops, forming a sequence, the first stop devoices, assimilating to the following stop. Consider the following examples where the final consonants of the verb root devolve before the relativizer /-te/:

(13) /ha-harab-a/ MMLH + /-te/ L > [aharap-t mimiss] MMLMLL  
 ‘be rotten’ ‘food that is rotten’,<sup>7</sup>

(14) /ha-pe:mb-a/ MLH + /-te/ L > [hape:mp-t eε] MLML  
 ‘brush off dust’ ‘the one who brushed off’

Alternatively, some speakers tend to epenthesize the /i/ before the relativizer /-t/ when it immediately follows another stop. The result in this instance is that the first stop is not devoiced.

In Northern Mao, if a glottalized consonant (ejective) is immediately followed by a non-glottalized stop, the first consonant loses its glottalized release and is pronounced as an unreleased oral stop at the same point of articulation—a case of assimilation in manner.

(15) /ak’e/ MM + /ha-tul-a/ MHM > [ʔak tul-a] MHM  
 ‘grain/corn’ ‘harvest grain/corn’

(16) /ha-int’-a/ MMH + /-te/ REL > [ʔint:ε] HL  
 ‘see’ ‘that which he

<sup>7</sup> There is a co-occurrence restriction which results in the loss of the initial [h] in the declarative prefix when the verb root begins with an [h].



saw'

In the first instance, the ejective [k'] of /ak'e/ MM 'grain/corn' is unreleased when the [k'] immediately precedes the [t] of 'harvest', /ha-tul-a/ MHM. The /ha-/ declarative marker, which is generally included in the citation forms<sup>8</sup> of verbs in Northern Mao, is not always obligatory. It is the lack of this declarative prefix that allows the final consonant of the noun to become adjacent to the initial consonant of the verb root. For an additional example, see 'harvest time' (19) below. In (16) above, the verb 'see' is relativized with the /-te/ relativizer. The result is a geminate (phonetically lengthened) [t:] without a glottalized release.

This process of loss of glottalized release is part of a more general phenomenon in Northern Mao, where initial stops in a sequence of two are generally unreleased. Of course, the involvement of loss of glottalized release is more interesting because it leads to neutralization between the ejective and oral stops in this environment. As might be expected, in CC sequences where the final C is a glottalized stop, the release of the stop is maintained and no neutralization is observed, as in the example 'nephew' (20) below. This is likely due to the fact that the consonant's release is before a vowel and not hampered by any following consonant.

As has already been seen in the data above (16), stops which are produced at the same point of articulation and which are found in sequence form a lengthened stop. Of course, these processes which involve the lack of release of the first stop in a sequence of stops, the loss of glottalization of the first stop in a stop sequence, and voicing assimilation of the first stop in a sequence actually allow for the sequence to be produced as a single long stop. Gemination is only attested across morpheme boundaries and is best understood as epiphenomenal to the processes above, which leave no alternative for phonetic production of stops in sequence when they are produced at the same point of articulation. Additional examples of this heteromorphemic gemination are provided below:

(17) /oʃke/ ML + /gombole/ HHH > [ʔoʃg:ombole] MMMM  
 'meat' 'mortar' 'meat mortar'

(18) /ha-kwind-a/ MLH + /-te/ > [kwintɛ] LL  
 'land, alight' 'that which alighted'

(19) /ak'e/ MM + /ha-kum-a/ MLH + /gise/ HH > [ʔak kum gise] MLMM  
 'grain/corn' 'cut grain' 'harvest time' 'time; season'

(20) /obe/ HL + /p'ife/ MM > [ʔop'iɛ] HML  
 'brother' 'child' 'nephew' ('brother's child')

<sup>8</sup> This citation form, while morphologically complex, is the form preferred by the author's Northern Mao consultants when making reference to a verb in conversation or in isolated elicitation. The infinitive form, which is fully nominal and exhibits a tonal melody different from finite verbs (these melodies correspond to the tone class system exhibited by other nominals) as well as the nominal post-thematic vowel /-e/, is actually the least complex form but serves as a nominal rather than verbal form in syntactic function.

While voiceless stops which are immediately followed by voiced stops do not typically undergo voicing, the voiceless / voiced stop sequence in example (17) forms a long stop which begins with a period of voicelessness and is followed by 30 ms of prevoicing before its release into the following vowel. Due to the lack of release of the first stop and the presence of prevoicing, the series may be perceived as [g:] and is transcribed as such here. The waveform and spectrogram is provided in Figure 3. Figure 4 highlights the [ʃg:o] sequence from the same file, showing the prevoicing before the release of the stop.

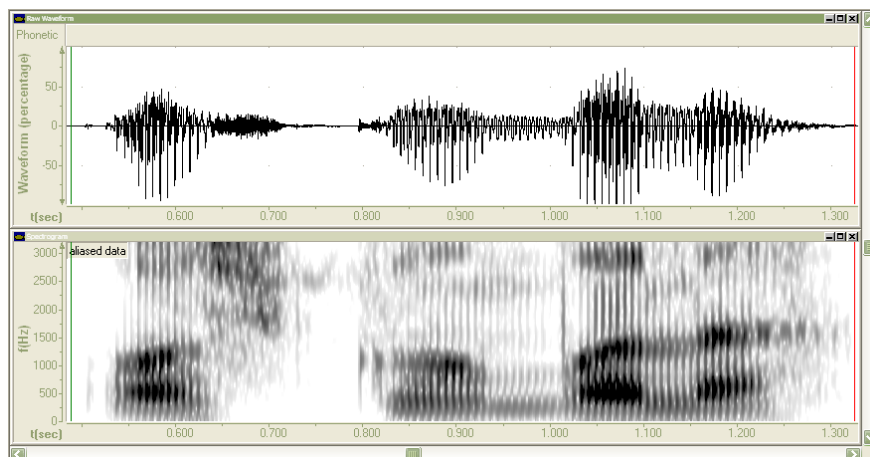


Figure 3: Waveform and Spectrogram for [ʃg:ombolɛ] MMMM 'meat mortar'

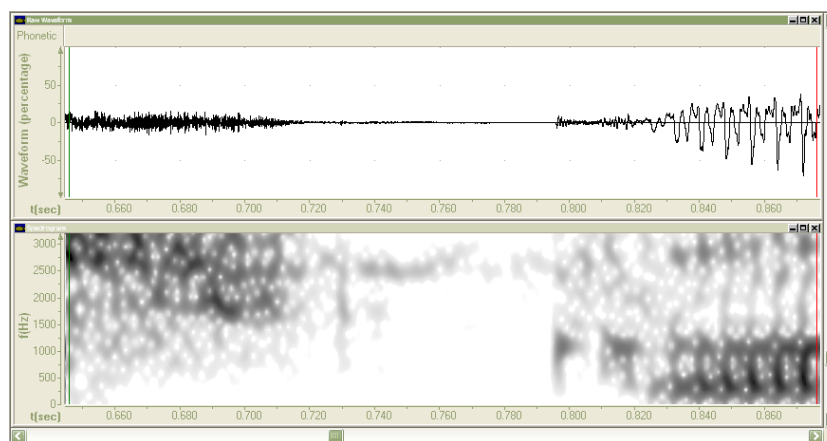


Figure 4: Waveform and Spectrogram for [ʃg:o] sequence

### 2.5.2. Nasal Assimilation

While the bilabial nasal [m] and the alveolar nasal [n] occur initially, intervocalically and root-finally,<sup>9</sup> the [m] shows no indication of involvement in assimilation and may be found preceding alveolar or velar consonants. The alveolar nasal [n], on the other hand, when preceding a consonant, is found only before alveolars, [t, t', d, s, ts', z], exhibiting assimilation to the place of the following consonant. The velar nasal [ŋ] occurs intervocalically and root-finally; before

<sup>9</sup> It is important to note that root-final consonants on nominals become word-final in connected speech, where the final /-e/ vowel of nominals is generally lost.

consonants, it exhibits assimilation to the following consonant, preceding only the velars [k, k', g].

The presence of a palatal nasal was reported by Wedekind and Wedekind (1993:21): [nú:nɨ̀nà] 'how?'. The data gathered for this study show [nu:nɨ̀nɨ̀] /nu:nin-ja/ HLL 'how is it?', where the root [nu:nɨ̀:] HL is the interrogative 'how?' followed by /-ja/, a bound copula found on most interrogatives and employed in stative verb derivations. The /-ja/ suffix whose presence triggered the assimilation which led to the root's final nasal becoming palatalized also carries the low tone of the /-a/ L question marker (some speakers lengthen the [a] vowel of the copula while others do not). This same copula is found to the right of other interrogatives pronouns: /[komis-ja](#)/ HHL 'what?', /[nat-ja](#)/ HL 'when?', /[hindet-ja](#)/ MHL 'where?'. The only other instance of a palatal nasal in Wedekind and Wedekind's wordlist is in the word [hàfá:ɨ̀nà] 'swim' (1993:25). But when checked carefully with various speakers, the nasal is velar, not palatal: /[hapa:ŋa](#)/ MMH 'swim'. Bender also notes that the nasal in 'swim' is a velar (2003:307). This author has found no data to suggest the existence of a contrastive palatal nasal.

## 2.6. Sibilant Harmony

Northern Mao, in contrast to some other Omotic languages, exhibits a smaller inventory of sibilant consonants. Hayward has suggested that Proto-Omotic likely had \*s, \*z, \*ts', ʃ, \*ʒ, \*tʃ', \*ʂ, \*ʐ, \*ç' in initial position and an additional three \*ts, \*tʃ, \*ç, in non-initial positions (1988: 292). In Northern Mao, only the following sibilants are contrastive and attested apart from loanwords: /s, z, ts', ʃ, tʃ/; of course, both [tʃ'] and [dʒ] may be added to this inventory, when loanwords are considered. As noted above, [ʒ] is only attested occasionally, as a voiced variant of /ʃ/.

It is well-known that sibilants within roots in Omotic languages tend to agree in terms of place of articulation. Hayward writes, "There is, in fact, in many languages a very strictly observed co-occurrence constraint or morpheme structure condition for roots, to the effect that co-occurring sibilants must agree with respect to palatality" (1988:287). This claim obtains for Northern Mao. Within roots, without respect to airstream mechanism, sibilants are found only at the same place of articulation. Tables 2 and 3 provide evidence, below. There are no counterexamples where sibilants of different places of articulation may be found in the same root except in the loanword /[semize](#)/ LHH 'shirt'. It should be noted, however, that due to the weak attestation of /z/, no word containing the voiced alveolar sibilant and any other sibilant has been found—apart from this loanword, where the expected harmony does not apply. Roots containing palatal sibilants are provided in Table 2 while those containing alveolar sibilants are featured in Table 3.

/ʃe:ʃe/ MM	'urine'
/ʃa:ʃe/ HL	'tendon; vein'
/ʃa:ʃe/ MH	'ade ababa flower' (yellow)
/ʃu:ʃe/ HH	'spitting'
/ʃo:ʃe/ HH	'snake'

Table 2: Sample Roots with Palatal Sibilants

<a href="#">/sewise/</a> LHL	‘young man’
<a href="#">/so:nts’e/</a> ML	‘child’
<a href="#">/su:nts’e/</a> MH	‘back (of body)’
<a href="#">/mamsese/</a> HHL	‘fair’
<a href="#">/ts’ets’e/</a> MH	‘asking (of God); praying’

Table 3: Sample Roots with Alveolar Sibilants

This phenomenon of sibilant harmony does not extend to suffixes regularly in Northern Mao. At times, in the texts collected thus far, there is some evidence that this optionally occurs in fast, connected speech: [/diʃ-es maŋk’e/](#) LH↓MM be.known-NEG.REL sickness ‘unknown disease’ sometimes pronounced [diʃ-eʃ maŋk’ɛ], where the negative relative clause marker /-ese/ HL undergoes harmony with the root. This is also seen in [\[t’oʃ-eʃ k’ets’e\]](#) HH↓MM sprout-NEG.REL land ‘barren land’. The /-ese/ negative relative clause marker is unaffected when following roots without palatals: [\[ʔe:ŋ kod-ɛs ese\]](#) MMH↓ML<sup>10</sup> heart have-NEG.REL person ‘one who doesn’t have heart’ (i.e. ‘coward’).

This phenomenon where sibilants in suffixes agree with the place of articulation of sibilants in roots appears only to be a tendency with exceptions existing, particularly in careful speech. Rapold has found a similar phenomenon, though more frequent in Benchnon, which does exhibit sibilant harmony (where a more elaborate harmony system is attested with marked sibilants imposing on less marked, requiring harmonization) where sibilants in suffixes harmonize with root sibilants only optionally and not in slow, careful speech (2006:67).

Certainly, it is clear that in Northern Mao, the nominative case marker /-iʃ/ does not exhibit any harmony with sibilants in the root noun, as in the following examples: [\[so:nts’-iʃ\]](#) ML ‘child-NOM’ and [\[es-iʃ\]](#) ML ‘person-NOM’. It may be that, as Rapold has found in Benchnon, markedness plays a role where roots with more marked<sup>11</sup> sibilants, such as palatal sibilants, impose upon less marked sibilants in suffixes (2006:67). That is, in Benchnon, sibilants in roots are preserved and do not agree with marked sibilants in suffixes nor do the more marked palatal sibilants in suffixes agree with non-palatal sibilants in roots. The smaller inventory of sibilants in Northern Mao may obscure this phenomenon, as sibilants are found only at the alveolar and palatal places of articulation. There are no alveo-palatal sibilants (as in Benchnon), and the post-alveolar /tʃ/ is found in only one word, thus far.

<sup>10</sup> The relative clause markers /-te/ and /-ese/, affirmative and negative, respectively, each carry a final low tone, which can be clearly observed in the citation form of a headless relative construction. When the relative clause is modifying a noun, however, the final vowel (the tone bearing unit) of the relative clause marker is lost (as is the case with the final vowel of all nominals), and its final L tone is in some cases (H and M tones may be downstepped while L tones merge with floating L’s and do not exhibit a downstep) preserved by causing downstep on the following noun, here indicated by ↓. The specifics related to this phenomena will be discussed in another paper detailing the results of a phonetic study of downstep phenomena, which has been co-written with Dr. Mary Pearce, University College London and SIL International and will be presented at the World Congress of African Linguistics (WOCAL 6) in August 2009.

<sup>11</sup> Here, markedness is used in the sense that palatal sibilants may be considered less common (as opposed to alveolar sibilants) in the world’s languages.

### 3. Phonemic Vowels

Northern Mao has a five vowel system, each of which also exhibits a long counterpart: /i, e, a, o/ and /u/. Examples of length contrast are attested throughout the five-vowel inventory: /int'e/ HH 'seeing' and /i:nt'e/ HL 'grunt'; /je'e/ HH 'near-distal demonstrative' and /je:'e/ HH 'honey'; /ape/ ML 'maternal uncle' and /a:pe/ HH 'eye'; /t'u'e/ LL 'strapping' and /t'u:'e/ HH 'a meeting'; /t'o'e/ HH 'sprouting' and /t'o:'e/ MH 'vomit'.

	Front	Central	Back
High	i, i:		u, u:
Mid	e, e:		o, o:
Low		a, a:	

Table 4: Contrastive Vowel Inventory

The citation form of all nouns includes the post-thematic vowel /-e/, which never exhibits contrastive length. Duration and fundamental frequency measurements of 50 words with short vowels and 50 words with long vowels show that long vowels are 1.5 to 2 times the length of short vowels. It is also clear that pitch does not necessarily rise with increased length; pitch and vowel length are wholly independent phenomena in Northern Mao.

Evidence of contrast between each of the five vowel qualities is provided in Appendix B, including examples of both short and long counterparts for each quality (except /i/ vs. /a/ and /u/ vs. /a/, since it is assumed that these are too distant from one another to be in any likely relationship).

#### 3.1. Vowel Quality

In order to describe the vowel space most accurately, measurements of the first and second formants, which show the actual place of articulation of vowels acoustically, of ten words featuring each short vowel and each long vowel have been completed.<sup>12</sup> This F2 x F1 examination of vowel space provides a more detailed account of the vowel target and variation within space than can be conveyed by IPA transcription alone. The measurement of the formant was made at the vowel mid-point to lessen the effect of consonant perturbation. The full set of words used in the study, along with each measurement, is found in Appendix C. These measurements provide the actual vowel qualities produced by speakers without relying on the transcriber's ability to determine vowel status—a phenomenon that becomes difficult as the articulatory space for vowels is difficult to gauge between languages and even between speakers with different vocal tract lengths.

Figure 5 shows the vowel space derived from acoustic measurement of the first and second formant midpoints of short medial vowels in 50 Northern Mao words.

<sup>12</sup> Of course, since nouns end in /-e/, only the non-final vowels were measured.

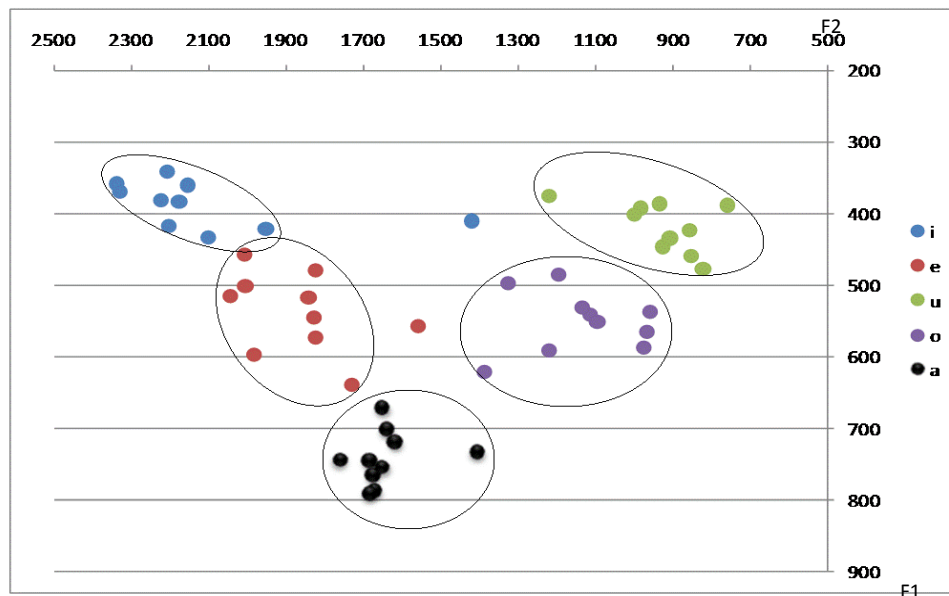


Figure 5: Plot-Chart for Short Vowels

In general, an expected V shape is visible for the five-vowel inventory in Northern Mao as is seen in other five-vowel systems (Ladefoged 2001:35,42). The ranges of the formants in Hz and length in ms are provided in Table 5.

	F1	Mean F1	F2	Mean F2	ms	Mean ms
i	341-434	388	1419-2335	2109	60-94	76
e	458-639	539	1560-2006	1864	72-113	97
u	376-478	419	759-1217	925	61-106	88
o	497-621	551	959-1385	1136	63-114	91
a	671-791	741	1405-1761	1644	71-109	89

Table 5: Ranges and Means for Formant and Length Measurements—Short Vowels

Figure 6 provides the formant chart for the long vowels. For the most part, the vowel space is quite similar to that of the short vowels, showing a lack of other vocalic phenomena such as ATR contrast.

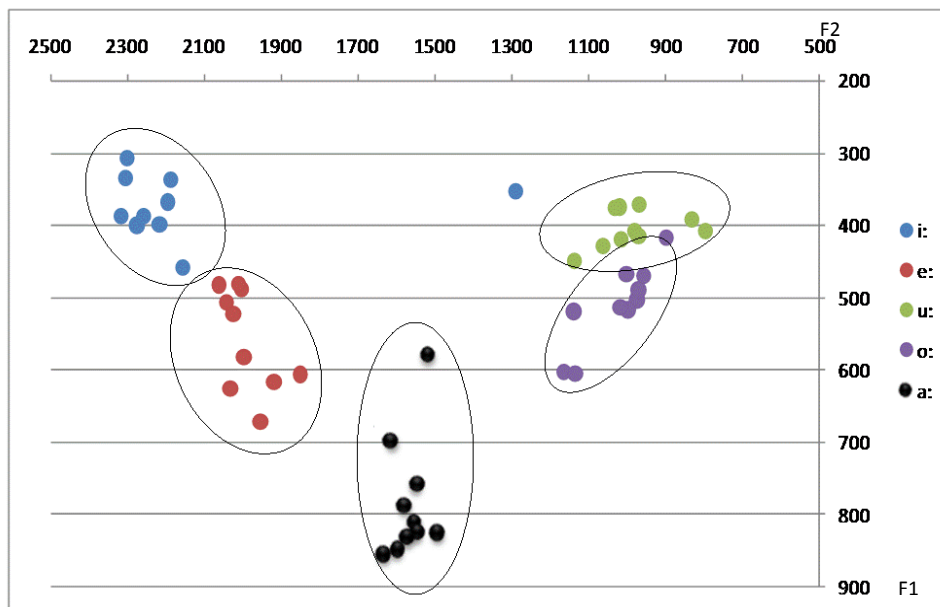


Figure 6: Plot-Chart for Long Vowels

Again, the ranges of formants for the long vowels as well as the length in ms are provided in Table 6.

	F1	Mean F1	F2	Mean F2	ms	Mean ms
i:	308-458	373	1290-2317	2151	119-216	152
e:	481-673	559	1850-2062	1989	144-208	182
u:	372-450	405	796-1136	981	169-204	186
o:	418-606	511	900-1164	1027	136-190	165
a:	579-856	782	1495-1636	1567	140-193	170

Table 6: Ranges and Means for Formant and Length Measurements—Long Vowels

In Table 5, the average length of short vowels is 88ms while the average length of long vowels in Table 6 is 171ms, a significant difference to be sure. The long high vowels /i:/ and /u:/ are: twice the length of their short counterparts, while the long vowels /e:/, /o:/ and /a:/ are well over 1.5 times the length of their corresponding short vowels.

As can be seen in the ranges and means of Tables 5 and 6, the long /e:/ vowels tend to be a bit higher and more to the front of the oral cavity than their short /e/ counterparts. As a result the short /e/ vowels tend to be phonetically closer to [ɛ] than [e] and are transcribed as such when phonetic brackets are used in this work. Baye 2006 transcribes these short vowels with the [ä], the Ethiopianist symbol which corresponds to the I.P.A.’s [ɛ]. At times, the short vowel /e/ may be realized phonetically as [e], especially in the environment of post-alveolar/palatal sounds (as seen in [di]-e[ɛ] mank’ɛ] LH ↓MM be.known-NEG.REL sickness ‘unknown disease’ and [t’o]-e[ɛ] k’ets’ɛ] HH ↓MM sprout-NEG.REL land ‘barren land’, repeated here from section 2.6 above). Since the long [e:] and short [ɛ] vowels correspond to the same phonological space (despite some phonetic differences) within the larger Northern Mao vocalic system, they are represented with

the /e:/ and /e/ phonologically. The slight differences in formant means between the short and long /e/ vowel and to a lesser extent, the short and long /o/ vowel, may be due to the increased amount of time in lengthened articulation, allowing speakers to more consistently reach the articulatory target and produce less-centralized vowels.

Some speakers exhibit an assimilatory process where the final post-thematic /-e/ vowel, which is found marking all nominals, may become [a] when the nominal root contains an /a/ vowel. This is not attested consistently throughout the entire speech community but is observable in the speech of some, where /kawe/ LL ‘top; upwards’ and /ka:we/ LL ‘griddle’ may be alternatively pronounced as [kawɛ]~[kawa] LL and [ka:wɛ]~[ka:wa] LL respectively.

### 3.2. Deletion of Final Vowels in Connected Speech

The final vowels of nouns and other word-categories are lost in connected speech. For nouns, the citation form ends with the /-e/ vowel, whether the noun is derived from a verb or not. That is, verbal nouns like the infinitive and non-derived prototypical nouns are marked the same. This final /-e/ vowel is lost in connected speech unless the word is positioned at the end of an utterance. This phenomenon may be seen in various examples which are provided above (6, 12, 15, 16, 19) and (20). In the case of (6), the citation form of the noun /ape/ ML ‘maternal uncle’ is not provided and is thus provided here for the sake of demonstrating the loss of the final /-e/ vowel in connected speech. Other word-categories, including for instance, adverbs of time and a special category of relator nouns, which today show signs of grammaticalization as new postpositions, also lose their final vowels ([e], [o] or [a]) in connected speech, showing the phenomenon to be phonologically rather than morphophonologically motivated.

Baye first noted the loss of these final vowels and suggested that the loss of final vowels on nouns could be due to the incorporation of ‘non-head’ nouns into larger syntactic units with their syntactic ‘heads’, forming a ‘phonological unit’ (2006:176). The text corpus used in this study, however shows that head nouns in complex noun phrases, pronouns, which are themselves syntactic noun phrases, and single nouns, which make up a simple noun phrase, drop the final /-e/ vowel in connected speech and need not be seen as phonologically nor syntactically bound to the many elements which may follow. In texts, some speakers produce the final /-e/ on nominals before pauses, but this is not consistent throughout the speech community; when nominals are found at the ends of sentences, they always carry the /-e/ vowel.

### 3.3. Epenthesis of the Vowel [i]

The epenthetic vowel in Northern Mao is the high front [i]. This may be found before the relativizer /-te/ on erstwhile verbs such as [gets’-it eɛɛ] LH ↓ ML ‘person who is beautiful’, from the verb /ha-gets’-a/ MLH ‘be beautiful’ and [nok-it munts’ɛ] HH LL ‘woman who is good’ from the verb /ha-nok-a/ MMH ‘be good’. Verbs whose roots end in an approximant, do not exhibit the epenthetic [i]: /ha-ka:w-a/ MMH ‘be white’ > [ka:w-t ware] H ↓ ML ‘clothes that are white’, nor do verbs whose roots end in a vowel: /ha-ki-a/ MH-M<sup>13</sup> ‘come’ > [ki-t eɛɛ] MML ‘person who came’. As expected, the vowel [i] is not lengthened since the requirements for epenthesis are not satisfied. In some instances, this epenthetic vowel appears internally within

<sup>13</sup> The vowel of the verb root ‘come’ is reduced to the [j] approximant in the perfective form and its H tone combines with the M tone of the final perfective suffix to form a H-M fall; this is an irregularity, and no other verb exhibits such behavior.



nouns, as in /kogʃe/ [kɔkʃɛ] ML ‘lung’ which may alternatively be pronounced [kɔgʃɛ] MLL. Only in the most careful speech does the /g/ maintain its voicing in the absence of the epenthetic vowel—the same devoicing phenomenon noted in section 2.6, above.

### 3.4. Vowel Harmony (a Root Constraint) in Tri-syllabic Nouns

Tri-syllabic noun roots show vowel place harmony in terms of backness: /kitʃife/ MLL ‘neck’; /ilife/ HHL ‘pot’; /tsʉgune/ HLL ‘squirrel’; /ugume/ HLL ‘snail’; /ʃundo:re/ LHH ‘donkey’; /ewete/ HLL ‘eavesdropping’; /tʉpile/ HLL ‘patch’; /koloole/ HLH ‘malaria’. Of course, the final post-thematic vowel /-e/, which marks the citation form for all Northern Mao nouns and is homophonous with the infinitive marker, does not participate in this root harmony. Thus, there is no vowel harmony which may be observed in bi-syllabic nouns; each of the five vowels may co-occur with the final /-e/. While the majority of Northern Mao nouns are bi-syllabic, there are noun roots which are three syllables (even seven isolated four-syllable noun roots have been found; see section 5.2.) and do exhibit an apparent constraint in which either front or back vowels may be found in roots. Northern Mao exhibits no monosyllabic nouns.

Baye (2006:180) notes the preponderance of bi-syllabic nouns in Northern Mao and hypothesized that the few tri-syllabic nouns found in his set of 250 words might be loans. The larger corpus gathered for this study has yielded far more of these tri-syllabic nouns (as well as the four-syllable nouns which are provided in Table 20, below), suggesting that while these are certainly far rarer than the bi-syllabic nouns, the tri-syllabic nouns are likely not borrowed. In these tri-syllabic nouns, unlike the bi-syllabic nouns, all but two examples of non-borrowed words<sup>14</sup> out a set of 146 attest to this root constraint in terms of front-back status of the root vowels: [kʉokʃife] HHH ‘crust’, and [kɔgine] LHH ‘sewing’.

	Front Vs in Root	Back Vs in Root
High Vowels	/dipile/ HLL ‘hem’	/kufume/ HLL ‘chin’
Mid Vowels	/gergefe/ LLL ‘wall’	/gobole/ HHH ‘window’
High and Mid Vowels	/ʃekʃife/ HHH ‘vervet monkey’	/ʃundo:re/ LHH ‘donkey’

Table 7: Vowel Harmony in Tri-Syllabic Nouns

By far the most common sort of harmony is where each of the root vowels is either /i/ or /u/. There are far fewer examples of both root vowels at the mid aperture. Thus far, for instance, only one root has been found including the back vowels /o/ and /u/, provided in Table 7. Finally, as is often the case in instances of harmony, the most sonorant, low vowel /a/ (in the case of Northern Mao, a low-central vowel) does not participate in the harmony system and may be shown to co-occur with each of the other vowels: /alime/ LHL ‘turban’, /hademe/ HLL ‘work’, /kʉawone/ MLL ‘dwarf’, and /kafuwe/ LHL ‘medicine’. The constraint prevents roots containing both front vowels and back vowels.

As noted above, two possible exceptions to this tendency have been found: [kʉokʃife] HHH ‘crust’, and [kɔgine] LHH ‘sewing’. These two examples may be instances of the epenthetic vowel [i] inserted between unallowable CC sequences, as noted in the variant pronunciation of /kogʃe/ [kɔgʃɛ] ML ‘lung’ in section 3.3. It may also be the case that the examples with both

<sup>14</sup> Among the speakers consulted, loanwords do not conform to any harmony specifications.

high and mid front vowels in the same root are actually instances of the epenthetic vowel [i] as well. No examples where /i/ precedes /e/ have been found out of 3,000 entries.

There is some corroborating evidence for vowel harmony observed in the allomorphy of the nominative case marker /-iʃ/.

- (21) /ine/ LH ‘mother’ > [<sup>ʔ</sup>in-iʃ ha-biʃ-a] LH MHM ‘there is a mother’  
 (22) /ese/ ML ‘person’ > [<sup>ʔ</sup>ɛs-iʃ ha-biʃ-a] ML MHM ‘there is a person’  
 (23) /alde/ LH ‘knowledge’ > [<sup>ʔ</sup>ald-iʃ ha-biʃ-a] LH MHM ‘there is knowledge’  
 (24) /mots’e/ LH ‘grass’ > [mots’-iʃ ha-biʃ-a] LH MHM ‘there is grass’  
 (25) /tuge/ HH ‘foot’ > [tug-uʃ ha-biʃ-a] HH MHM ‘there is a foot’

When this suffix attaches to front-vowel, /o/-vowel or /a/-vowel roots, the shape [-iʃ] is found. However, when the suffix attaches to roots with the /u/-vowel roots, the allomorph [-uʃ] results. Both height and backness are required for triggering harmony (the /o/-vowel roots do not trigger any vowel harmony morphophonologically); this would support the existence of the roots containing both [o] and [i] vowels (as opposed to the interpretation of [i] as an epenthetic vowel), in the discussion above.

#### 4. Syllable Structure

The most common and unambiguous syllable patterns are provided in Table 8. Phonotactics is discussed in section 4.1., below.

Unambiguous CV Pattern	Example	Gloss
CV	/ <u>po.t’e</u> / HL	‘thigh; hip’
CVC	/ <u>tal.k’e</u> / HL	‘headpad’

Table 8: Syllable Patterns involving Short Vowels

As noted in the discussion on consonants, the glottal stop is epenthized to meet the requirement of an onset as in the following: /ese/ [<sup>ʔ</sup>ɛ.se] ML ‘person’ and /alde/ [<sup>ʔ</sup>al.dɛ] LH ‘knowledge’. Thus, each of these words exhibits the CV.CV pattern.

Only three monomorphemic forms exhibiting complex codas (of the pattern CVNC) have been found out of the entire Northern Mao data set.<sup>15</sup> The first consonant in the complex coda is limited to the nasal /n/ which is then followed by either of the sibilants /ts’/ or /s/, where the following onset is either /k/ or /k’/.

<sup>15</sup> In addition to the two CVNC forms provided in Table 9, there is also the single occurrence of a CCVNC pattern, as seen in /ha.k’wins.ka/ MLH ‘knee’. Additionally, there is a variant of /am.p’i.ts’e/ LLL ‘bead’, which is pronounced as [<sup>ʔ</sup>amp’.ts’ɛ] LL—without the epenthetic vowel [i].

CV Pattern	Example	Gloss
CVNC	<a href="#">/wints'.k'e/</a> ML	'aunt' (father's sister)
	<a href="#">/kants'.k'e/</a> HL	'thorn'

Table 9: Limited CVNC Pattern

The long vowels fit within the CVV and CVVC syllable patterns, as seen in Table 10 below:

Unambiguous CV Pattern	Example	Gloss
CVV	<a href="#">/be:ze/</a> HL	'broom'
CVVC	<a href="#">/ma:l.t'e/</a> ML	'bone'

Table 10: Syllable Patterns involving Long Vowels

The VV pattern is limited to geminate (i.e. identical vowel) sequences and, despite the addition of vowel length, does not exhibit tonal contours in monomorphemic words.

#### 4.1. Phonotactics

Table 11 provides a list of consonants which may be found in initial, intervocalic and in CC sequences across syllable boundaries in isolated<sup>16</sup> monomorphemic words. Those consonants which are suspect on account of very few attestations (as in the case of [tʃ]) or their being found only in borrowed words ([dʒ, tʃʰ]) are included in the distribution chart. All consonants, except [tʃ, tʃʰ, ɲ] may be found initially. Of these, only [ɲ] never occurs as a syllable onset; that is, all other consonants may serve as syllable onsets. However, [r] is found initially only in borrowed words. There is only one example of the lateral serving as an onset /luke/ LH 'curdling'. All consonants except [dʒ] are found intervocalically.

Within CC sequences across syllable boundaries, the first consonant (i.e. the coda of the preceding syllable) may not be any of the following [p', t', k', h, ʃ, dʒ, j or w]. The second consonant in the sequence (i.e. the onset of the following syllable) may not be any of these: [tʃ, ɲ, l, r].

<sup>16</sup> Of course, when the final vowels of nominals are dropped in connected speech (as discussed above in 3.2), complex codas become far more common. Also, the noun-noun associative and noun-noun compound constructions involve nouns which are phonologically bound and where the non-final nouns do not carry their post-thematic /-e/ vowel. This greatly complicates the consonant clusters in Northern Mao. This present examination of phonotactics is limited to monomorphemic words, as noted above.

	Initial #_V	Medial V_V	Clusters C.C (across syllables)	Examples
p~f	+	+	mp, pk	ʃapkowe MHL ‘shoe’
b	+	+	mb, nb, rb, lb, bd	danbe HH ‘tradition; culture’
t	+	+	lt, rt, nt	ma:lte ML ‘fat’
d	+	+	bd, nd, ld, gd	obde HH ‘threshing floor’
k	+	+	pk, rk, sk, lk, ʃk, ŋk, kn	piʃke HH ‘whistling’
g	+	+	rg, lg, ŋg, gd	gergeʃe LLL ‘wall’
p’	+	+	mp’	amp’its’e LLL ‘bead’
t’	+	+	nt’, lt’	t’ent’e ML ‘worm’
k’	+	+	ŋk’, rk’, lk’, ts’k’	burk’e HL ‘spring (of water)’
s	+	+	ms, ns, sk, sm	mamsese HHL ‘fair’
z	+	+	nz, zn	wanzibe MLL ‘fingernail; claw’
ʃ	+	+	nʃ, ʃk	oʃke ML ‘meat’
h	+	+	--	
ts’	+	+	nts’, mts’, ts’k’	wints’k’e ML ‘father’s sister (aunt)’
tʃ (1 medial ex)	-	+	--	
dʒ (loans only)	+	-	ldʒ	aldʒa:be LHL ‘a charm’ (Arabic)
tʃ’ (loans only)	-	+	rtʃ’	kurtʃ’e HH ‘cutting’ (Amharic)
l	+	+	lb, lt, ld, lk, lg, lt’, lk’, lm, lj, lw, ldʒ	p’elk’e MH ‘study; research’
r	+	+	rb, rt, rk, rg, rk’, rn, rm, rtʃ’	p’erk’e HH ‘a lightning flash’
	(loans)			
m	+	+	rm, lm, sm, mp, mb, ms, mp’, mts’	k’embile MLL ‘loincloth’
n	+	+	rn, zn, kn, nb, nt, nd, nt’, ns, nz, nʃ, nts’	hants’ile MLL ‘slipping; sliding’
ŋ	-	+	ŋg, ŋk, ŋk’	ʃaŋk’e HH ‘front room (of house)’
w	+	+	lw	akilwaje MMLL ‘Mao clan name’
j	+	+	lj	k’ilje MH ‘leaving’

Table 11: Consonant Distribution Chart

## 4.2. Interpretation of Labialization and Palatalization

Northern Mao exhibits an ambiguous sequence where certain obstruents may be followed by either the labio-velar [w] or palatal [j] approximants, word-initially. Consonants with a following labio-velar approximant have not been found before the vowels /u/ or /o/ but are attested before each of the other vowels. The labio-velar approximant has not been attested following the obstruents [p, b, d, p’, z, h, or ts’]. The full inventory found thus far is noted in Table 12, along with the number of times attested and the following vowels.

Consonant	Number of times attested	Following Vowels
tw	5	i, e, a
kw	13	i, e, a
gw	3	i, a
t'w	1	a
k'w	9	i, e, a
ʃw	4	i, a

Table 12: Consonants with Labio-Velar Approximants

Consonants with a following palatal approximant have not been attested before the vowels /i/, /o/ or /u/. Word-initially, they are not found following the obstruents [b, t, d, t', s, z, ʃ, h, or ts']. The full inventory is noted in Table 13, again with the number of times attested and the vowels which are found following.

Consonant	Number of times attested	Following Vowels
pj~fj	4	a
kj	6	a
gj	5	e, a
p'j	2	a
k'j	3	a

Table 13: Consonants with Palatal Approximants

There are limited instances of these consonant-approximant sequences found medially: [k'] and [k] may precede [w] while [k] and [p'] may precede the [j].

These consonant-approximant sequences are ambiguous in that they could be interpreted as a single C (that is, as a labialized or palatalized consonant), as a CC cluster, as a consonant followed by a VV sequence with [u] or [i] as the first vowel, or as a diphthong [ɥV] and [ɨV], formed with the following vowel. These phenomena are interpreted as CC clusters on the grounds that positing complex consonants would increase the consonant inventory by 11 and lead to an inventory which does not follow a principle of economy nor which exhibits natural class symmetries; that is the sets of labialized and palatalized consonants would not be found systematically distributed throughout the inventory. Additional observations, which are perhaps less convincing as phonological arguments but which are relevant to the consonant-approximant sequences, include: 1) there are no non-geminate (i.e. non-identical) VV sequences in monomorphemic words; 2) there is no evidence of diphthongs, and the distribution of the approximants would require positing five diphthongs; 3) in the vast majority of cases, they are found word-initially and when they do occur medially, consonant distribution and syllable structure suggest they must be seen as onset clusters; it might be expected that were these single Cs, they could be found more often internally—more generally distributed. All unambiguous Cs

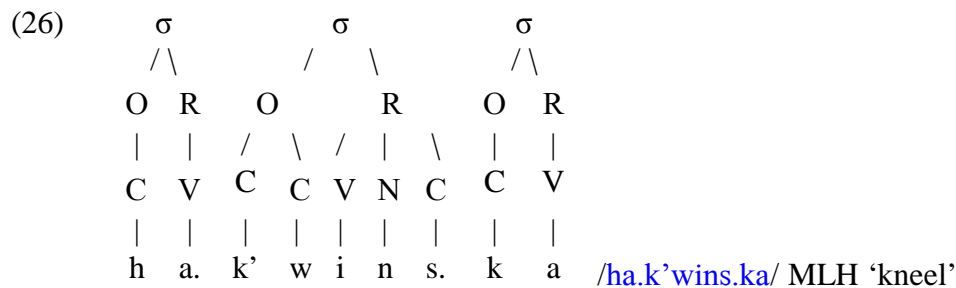
which occur initially also occur as medial onsets, apart from [dʒ], which occurs only in borrowed words.

In short, as all analyses are problematic, it is preferable to minimize the consonant inventory rather than complicate it in a nonsymmetrical, nonsystematic manner. It is the assumption of the author that more data may yield other examples of these CC clusters, where additional obstruents may be followed by either of the approximants.

It is worth noting that Rapold finds a somewhat similar situation, at least with regards to the palatalized consonants,<sup>17</sup> in *Benchnon* (Gimira-Omoti) (2006), where “all four analytical possibilities” are considered and found to be problematic (2006:102). Ultimately, a CC cluster analysis is also chosen. In general, labialized and palatalized consonants are not included in the inventory of contrastive consonants in Omotic languages, as is the case in *Benchnon* (Rapold 2006) in particular, as well as in *Maale* (Azeb 2001), *Dizin* (Beachy 2005), a wide variety of languages and reconstructed Proto-Languages (Bender 2003).

### 4.3. Maximal Syllable

Given the evidence above concerning the obstruent-approximant CC sequences, the most common maximal syllable attested in Northern Mao is CCVC, apart from the very rare example of CCVNC. This latter example may be parsed as follows:



## 5. Tonal Melodies

Northern Mao, like other Omotic languages, exhibits contrastive tone. Wedekind and Wedekind (1993:12) report the existence of two distinctive pitch levels in two-syllable words: H and L (with an allotonic M), though no discussion of the allotonic M tone is provided. Four tonal melodies are reported for two syllable words but discussion is lacking as to tonal melodies on words of more than two syllables. Baye 2006 also reports the existence of the H and L tones.

### 5.1. Three Levels of Tone

First, it is helpful to establish the levels of tone which appear to be contrastive. Contrary to Wedekind and Wedekind and Baye’s findings, current research suggests there are three levels of tone in Northern Mao. Consider the following words, which are distinguishable only by melody:

<sup>17</sup> Rapold is able to argue convincingly for an alternative analysis concerning the labialized consonants, where an alternative variant pronunciation C[uj] is analyzed as an underlying form (2006:100). No such phenomenon has been observed in Northern Mao.



pattern. While it has been well established that so-called depressor consonants may interact with tone systems in African languages (Hyman and Mathangwane 1998; Pearce 1998; Kutsch Lojenga 2000), the phenomenon is not observed in Northern Mao. Regardless of consonants involved, the full set of expected melodies is attested. Table 16 provides the full set of melodies for the most common short vowel syllable shapes.

	HH	LL	HL	LH	MM	MH	ML
<b>CV.CV</b>	/k'ets'e/ 'floor'	/kese/ 'swelling'	/kone/ 'collecting grain'	/k'ane/ 'arrangement'	/kute/ 'skin'	/kane/ 'dog'	/keze/ 'top'
<b>CVC.CV</b>	/golge/ 'throat'	/wets'k'e/ 'earthworm'	/talk'e/ 'headpad'	/belge/ 'star'	/p'erk'e/ 'flash of lightning'	/moske/ 'semen'	/t'ulk'e/ 'pit/stone (of fruit)'
<b>CVN.CV</b>	/dambe/ 'tradition; culture'	/ponse/ 'mouth'	/k'onts'e/ 'comb (of rooster)'	/ʃanj'k'e/ 'leopard'	/ent'e/ 'male'	/ints'e/ 'fear'	/konts'e/ 'face'
<b>CCV.CV</b>	/kwap'e/ 'wing'	/kwaʃe/ 'bridge'	/pjats'e/ 'plaster'	/twage/ 'bushbuck; deer'	/ʃwot'e/ 'antelope'	/k'wine/ 'wiping excrement'	/k'wile/ 'a small squash'

Table 16: Tonal Melodies of the Common Short Vowel Shapes

Syllables with nasal codas have not been found to impact surface tonal melodies (as seen in Table 16); thus, from this point forward, nasal codas will be specified only in those positions which are limited to nasals in the Northern Mao database.

Table 17 provides examples of the most common two-syllable CV shapes with long vowels. As noted in the section on syllable structure above, two-syllable nouns with long vowels exhibit the same seven melodies as two-syllable nouns with short vowels.<sup>19</sup> As noted above, M tone is found on the final vowel only when following a M tone.

	HH	LL	HL	LH	MM	MH	ML
<b>CVV.CV</b>	/p'ure/ 'apply lotion'	/p'ure/ 'flour'	/pe:ʃe/ 'slap'	/p'a:le/ 'digging tool'	/pa:le/ 'heavy thing'	/se:me/ 'finding'	/ʃa:me/ 'collard greens'
<b>CVVC.CV</b>	/ts'a:lde/ 'bone marrow'	/ge:nde/ 'rainbow'	/sa:nts'e/ 'bed'	/di:lde/ 'blessing'	/kints'e/ 'snot'	/sunts'e/ 'waist'	/ma:lte/ 'fat'
<b>CCVV.CV</b>	/ʃwe:me/ <sup>20</sup> 'shin'	/ʃwi:le/ 'canoe'	/gja:je/ 'many'	/swi:re/ 'hawk'	/gjare/ 'peace'	/kwa:ŋe/ 'shield'	/kwa:ŋe/ 'descendent'

Table 17: Tonal Melodies of the Common Long Vowel Shapes

While additional CV patterns are attested for two-syllable nouns (provided in Table 18, below), these are far less frequent than the others. In each instance, the data are too few to attest a full set of the seven melodies found in the tables above. However, it should be noted that there are no additional melodies attested in words with these syllable patterns; gaps in the melodic inventory are assumed to be accidental.

<sup>19</sup> While it may be expected that phonetic contours would exist when a long vowel with H tone precedes a syllable carrying low tone, this is not the case. There are, in fact, no contour tones in monomorphemic words.

<sup>20</sup> A variant pronunciation of this word does not exhibit the [w] approximant: [ʃe:me].



Syllable Type	HH	LH	ML
CCVN.CV	<a href="#">/kjambe/</a> ‘penis’		<a href="#">/kjambe/</a> ‘hunting’
CCVVN.CV	<a href="#">/kwint’e/</a> ‘hair’	<a href="#">/gwint’e/</a> ‘sweeping’	
CVNC.CV			<a href="#">/wints.k’e/</a> ‘aunt’ (father’s sister)
CCVNC.CV		<a href="#">/k’wins.ke/</a> ‘kneeling’	

Table 18: Tonal Melodies of Rare Two-Syllable Shapes

Three-syllable nouns are less common than two-syllable nouns in Northern Mao and they exhibit a wider variety of surface melodies; a full 12 different surface melodies have been attested in the set of 146 three-syllable nouns: three level melodies (HHH, MMM, LLL), three melodies where the pitch rises across the word (LHH, LLH, MHH), three melodies where the pitch falls (HLL, HHL, MLL), two melodies where the pitch rises and then falls (LHL, MHL) and one melody where the pitch falls and then rises (HLH). Important generalizations regarding this melodic inventory include 1) the lack of MML and MMH melodies, a notable absence while both LLH and HHL are found and 2) the only melody attested with all three pitch levels present is MHL. Thus, the M tone is lacking in some distributions where we do find H and L attested, just as was the case with the two-syllable nouns.

Unlike the two-syllable nouns, there is no single syllable pattern of three-syllable words which exhibits all twelve of the melodies attested. Thus, the number of tokens of each melody by syllable type is provided in Table 19 and an example of each is provided in Appendix D. The syllable patterns are arranged by frequency of occurrence in the database.

Syllable Pattern	HHH	LLL	HHL	HLL	HLH	LHH	LLH	LHL	MMM	MHH	MHL	MLL	Total
CV.CV.CV	8	7	2	12		17		23	6	1	1	6	83
CVC.CV.CV	5	3	2	7	7		1		3		4	7	39
CV.CVV.CV		2			1			4					7
CV.CVC.CV			1				2	1			1		5
CCV.CV.CV	2			1				1			1		5
CVV.CV.CV	1							1				1	3
CVC.CVV.CV						1		1					2
CCVN.CV.CV	1											1	2

Table 19: Surface Melodies of Three-Syllable Nouns by Shape

It is not possible at this point to say with any certainty that the gaps in Table 19 are ‘accidental’. It is, however, assumed that this is the case—that these gaps are due to the overall small inventory of tri-syllabic words. It is admitted, though, that these gaps may be due to tonal phenomena which have yet to be discovered.

Only seven examples of four-syllable nouns have been found. No clear indication of borrowing or internal morphology is present in these examples.

Syllable Shapes	Example	Melodies Attested
CV.CV.CV.CV	<a href="#">/alat'ime/</a> 'ring (of finger)'	MHML
	<a href="#">/anegere/</a> 'big drum'	LLHL
CV.CVN.CV.CV	<a href="#">/ts'amengile/</a> 'porcupine'	MMLL
	<a href="#">/ts'erenk'et'e/</a> 'leech'	LHML
CV.CVV.CV.CV	<a href="#">/haba:lage/</a> 'adultery'	MMLH
CCV.CV.CVV.CV	<a href="#">/k'wek'ila:ke/</a> 'chameleon'	MLLL
CCVC.CV.CVV.CV	<a href="#">/k'jan'ila:pe/</a> 'kidney'	HLLL

Table 20: Tonal Melodies of Four Syllable Nouns

### 5.3. Tonal Melodies of Verbs in Citation Form

The citation form of the verb is marked with the declarative /ha-/ prefix and the perfective /-a/ suffix. There are three tonal melodies found on verbs in this citation form, regardless of syllable pattern: MHM, MMH, MLH, where the initial M corresponds to the declarative prefix. These melodies then allow for roots with a surface H, M or L tone. The tone of the suffix is H underlyingly; the M tone is the result of a downstep due to a floating root-final L tone. A few examples of verbs in their citation form, their surface melody and the surface melodies of corresponding nominal forms<sup>21</sup> are provided in Table 21, below.

Citation Verb	Tone	Gloss	Citation Noun	Melody	Gloss	Modified Noun Melody
<a href="#">/hakasa/</a>	MMH	'cook'	<a href="#">/kase/</a>	HH	'cooking'	MM
<a href="#">/hakowa/</a>	MLH	'sit'	<a href="#">/kowe/</a>	HH	'sitting'	LL
<a href="#">/hake:wa/</a>	MHM	'wound'	<a href="#">/ke:we/</a>	MM	'a bruise, wound'	ML
<a href="#">/hakesa/</a>	MHM	'swell'	<a href="#">/kese/</a>	LL	'swelling'	ML
<a href="#">/hakola/</a>	MMH	'speak'	<a href="#">/kole/</a>	HL	'speech'	ML
<a href="#">/hakura/</a>	MLH	'smoke meat'	<a href="#">/kure/</a>	HL	'smoking meat'	LL
<a href="#">/hak'ofa/</a>	MLH	'cut'	<a href="#">/k'ofe/</a>	LH	'cutting'	LL
<a href="#">/hakuʃa/</a>	MHM	'wash'	<a href="#">/kuʃe/</a>	MH	'washing'	ML
<a href="#">/hakjamba/</a>	MHM	'hunt'	<a href="#">/kjambe/</a>	ML	'hunting'	ML

Table 21: Tonal Mapping Between Verbs and Nouns

It is clear here that there is not a simple relationship between the surface melodies of verbs and nouns in these data. The following generalizations, however, may be drawn: 1) nouns with the melodies HH and HL relate to verbs with either MMH or MLH melodies 2) nouns with the melodies LL, MM, ML, and MH relate only to verbs with the melody MHM; 3) nouns with the melody LH correspond to the verbal melody MLH 4) the verbal melody MMH is found in

<sup>21</sup> These verbal nouns are considered nominal due to their overlapping syntactic distribution with more prototypical nouns. For instance, the verbal nouns can be modified by other nouns in common noun-noun constructions. Additionally, they tend to occur in highly integrated, nominalized modality (same-subject) complements, some purposive constructions as well as deverbal nominalizations (agentive and instrumental, for example).

correspondence with nominal melodies HH and HL and with nothing else. This is unlike the other two melodies found with the set HH and HL; they may be found in verbs with MLH melodies. These generalizations are represented in Table 22, below.

<b>Nominal Melodies</b>		<b>Verbal Melodies</b>
HH, HL	-----	MMH, MLH
MM, MH, ML, LL	-----	MHM
LH	-----	MLH

Table 22: Melodic Correspondences Between Nouns and Verbs

Thus, nouns with HH citation melodies may correspond to either of two different verbal melodies. The same is true of HL citation melody nouns. This splitting of the HH and HL melody classes is attested in various subsystems and must be the result of historical processes which have given rise to the tone classes today.

The final column of Table 21 provides the melody of the nominal form when it is modified (i.e. by another noun, a relative clause, etc.). The seven melodies found on nouns in citation form collapse into three melodies when the noun is modified: MM, ML and LL. The modifying noun maintains its citation melody. While this sort of phenomena involving both syntax and morphology is beyond the scope of this phonological study, it warrants mentioning on the grounds that it further supports the notion that nouns with the citation melody HH may be split into two classes, those which become MM (H1) and those which become LL (H2), when modified. These two classes relate to the verbal melodies perfectly: H1 nouns exhibit MM modifying melodies and MMH verbal melodies; H2 nouns exhibit LL modifying melodies and MLH verbal melodies. This same division into classes can be undertaken for the HL nouns: HL1 nouns exhibit ML modifying melodies and MMH verbal melodies; HL2 nouns exhibit LL modifying melodies and MLH verbal melodies. There are nine tone classes, one for each nominal citation melody, and an additional class for each of the HH and HL citation melodies, as observed in both the verbal citation form and the modified noun melody.

A further examination of tonal phenomena requires syntactic and morphological input that is beyond the scope of this paper, which focuses on contrastive elements within the phonological system as well as constraints within the phonological word. These phenomena as well as hypotheses as to the genesis of the tone classes will be discussed in later work.

## 6. Conclusions and Future Work

The discussion above shows that in addition to consonants and vowels, contrastive phenomena in Northern Mao also include both vowel-length and tone. Each of the five vowels in the system exhibits a long counterpart which apart from length, patterns in other ways as the short vowels: they carry only the same inventory of single level tones as do short vowels and they fit within the same syllable patterns. Three heights of contrastive tone are exhibited, but no contour tones in monosyllabic words are found.<sup>22</sup>

Two types of harmony systems are attested: 1) sibilant and 2) vocalic. The sibilant harmony system in Northern Mao is less complex, due to its smaller inventory of sibilants, than in many other Omotic languages (Hayward 1988), though it is still clear that the phenomenon operates as

<sup>22</sup> Contours may be found in polymorphemic words as in /[ha-ta-a](#)/ DECL-give-RL MLH 'give', where the root vowel and the realis morpheme /-a/ H form a geminate /a:/ with a rising L-H contour.

both a root constraint as well as harmony across morpheme boundaries. The vocalic harmony system is one of backness, where root vowels must agree without regard to height. The vowel /a/, which is a low-central vowel, does not participate in the harmony system and may co-occur in either front or back roots, as may the post-thematic vowel /-e/, which is found on the citation form of all nouns.

The data provided in this paper were gathered in the field from September 2007 to April 2009. This research project will result in analysis of the tonal system of nouns and verbs, morphology, syntax and a variety of discourse phenomena. A 3,000 entry tri-glot glossary (Northern Mao, Amharic and English) has been compiled, along with a collection of proverbs and a corpus of 30 fully interlinearized texts.

## References

- Azeb Amha. 2001. *The Maale language*. Leiden: Research School CNWS, Leiden University.
- Beachy, Marvin Dean. 2005. *An overview of Central Dizin phonology and morphology*. Unpublished Master's Thesis. University of Texas at Arlington.
- Baye Yimam. 2006. A general description of Mao. *ELRC Working Papers II/2*:166-225.
- Bender, M. Lionel. 1975. The beginnings of ethnohistory in western Wellegga: the Mao problem. *Patterns in Language, Culture and Society: Sub-Saharan Africa*. OSU Working Papers in Linguistics 19: 125-141.
- Bender, M. Lionel. 1985. Gumuz, Koman, Mao and Omotic. *Studies in African Linguistics (supplement)* 9:19-21.
- Bender, M. Lionel. 1990. The limits of Omotic. *Omotic Language Studies*, ed. by Richard J. Hayward. School of Oriental and African Studies, University of London.
- Bender, M. Lionel. 2000. *Comparative morphology of the Omotic languages*. Muenchen: Lincom Europa.
- Bender, M. Lionel. 2003. *Omotic lexicon and phonology*. (Published by author.)
- Fleming, Harold C. 1986. Mao's ancestor: consonant phonemes of proto-Mao stage one. *Proceedings of the Ninth International Congress of Ethiopian Studies* 5:26-29.
- Greenberg, Joseph H. 1970. Some generalizations concerning glottalic consonants, especially implosives. *International Journal of American Linguistics* 36:123-145.
- Grottanelli, Vinigi. 1940. *I Mao*. Centro studi per l'Africa orientale Italiana; missione etnografica nel Uollega occidentale, vol. 1. Rome: Reale Accademia d'Italia.
- Hayward, Dick. 1988. Remarks on Omotic sibilants. *Papers from the International Symposium on Cushitic and Omotic Languages, Cologne, January 6-9*, ed. by Marianne Bechhaus-Gerst and Fritz Serzisko, 263-299. Hamburg: Helmut Buske Verlag.
- Hayward, Richard J. 2000. The 'empty quarter' of Afroasiatic. *Research in Afroasiatic grammar II: Selected papers from the Fifth Conference on Afroasiatic Languages, Paris*, ed. by Jacqueline Lecarme, 241-61. Amsterdam: John Benjamins.
- Hyman, Larry M. and Joyce T. Mathangwane. 1998. Tonal Domains and Depressor Consonants in Ikalanga. *Theoretical Aspects of Bantu Tone*, ed. by Larry M. Hyman and Charles W. Kisseberth. Stanford: CSLI 195-229.
- Kutsch Lojenga, Constance 2000. Depressor Consonants in African Languages. Paper presented at Tone Symposium, Tromsö, Norway, June 5-7.
- Ladefoged, Peter. 2001. *Vowels and Consonants: An Introduction to the Sounds of Languages*. Malden, MA: Blackwell.

- Pearce, Mary. 1998. Consonants and tone in Kera (Chadic). *Journal of West African Languages* 27/1.33-70.
- Rapold, Christian. 2006. Towards a grammar of Benchnon. Unpublished Ph.D. Dissertation. The Leiden University Centre for Linguistics. Leiden University.
- Siebert, Kati, Ralph Siebert and Klaus Wedekind. 1993. Survey on languages of the Asosa-Begi-Komosha area. S.L.L.E. Linguistic Report no. 11. Addis Ababa: Institute of Ethiopian Studies, Addis Ababa University.
- Siebert, Ralph, Charlotte Wedekind and Klaus Wedekind. 1994. Third S.L.L.E. survey on languages of the Begi/Asosa area. S.L.L.E. Linguistic Report no. 15. Addis Ababa: Institute of Ethiopian Studies, Addis Ababa University.
- Wedekind, Charlotte and Klaus Wedekind. 1993. Survey on languages of the Asosa Begi-Komosha area part II. S.L.L.E. Linguistic Report no. 12. Addis Ababa: Institute of Ethiopian Studies, Addis Ababa University.

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**Appendix A****Evidence for Consonant Contrast****p : b***initial*

/pake/	HL	‘injera’	/bake/	ML	‘name of bird-species’
/pule/	HL	‘rolling something’	/buts’e/	HL	‘feast’

*intervocalic*

/k’ope/	HL	‘road’	/obe/	HL	‘brother’
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**p : p’***initial*

/pa:le/	MM	‘heavy / difficult thing’	/p’a:le/	LH	‘digging tool’
/po:ne/	HH	‘going out’	/p’owe/	HH	‘crossing’

*intervocalic*

/hupe/	MH	‘brooding (of a hen)’	/up’e/	HL	‘termite mound’
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**p’ : f***initial*

/p’owe/	HH	‘crossing’	/puwe/	HH	‘traditional beer’
---------	----	------------	--------	----	--------------------

*intervocalic*

/kup’e/	HL	‘hat’	/kupe/	ML	‘granary’
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**b : m***initial*

/be:ze/	HL	‘broom handle’	/me:ze/	HH	‘wise’
/buts’e/	HL	‘feast’	/muts’e/	LH	‘name of a Mao admin. area’

*intervocalic*

/i:be/	LH	‘visitor’	/i:me/	LH	‘cattle’
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**t : d***initial*

/tuge/	HH	‘foot; name’	/duge/	HL	‘house pole’
/tige/	LL	‘beer-brewing basket’	/dike/	LH	‘scratching’

*intervocalic*

/hawuta/	MLH	‘he cried out’	/hauda/ [ha <sup>3</sup> uda]	MHM	‘pile in a heap’
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**t : t'***initial*

/tjame/~[tame]	HH	'counting'	/t'ame/	LH	'tasting'
/te:ne/	MM	'chest'	/t'e:nt'e/	ML	'worm'

*intervocalic*

(there is no /t'/ intervocalically, only /d/, as noted above)

/kute/	MM	'skin'	/kut'e/	HL	'spine'
--------	----	--------	---------	----	---------

*in CC sequence*

/ma:lte/	ML	'fat'	/ma:lt'e/	ML	'bone'
----------	----	-------	-----------	----	--------

**g : k***initial*

/gite/	HL	'head-covering'	/ki-te/	ML	'came-REL'
/ga:ne/	LL	'riches'	/kane/	MH	'dog'
/gome/	HH	'cleared land'	/kowe/	HH	'sitting'

*intervocalic*

/hagaʃa/	MLH	'burp'	/hakaʃa/	MHM	'shut'
----------	-----	--------	----------	-----	--------

*in initial CC sequence*

/gja:je/	HL	'many'	/kjambe/	ML	'hunting'
/gwi:nt'e/	LH	'sweeping'	/kwi:nt'e/	HH	'hair'

**k : k'***initial*

/kane/	MH	'dog'	/k'ane/	LH	'arrangement'
/kuse/	HH	'hand'	/k'ets'e/	HH	'floor'

*intervocalic*

/ʃike/	MM	'knife'	/ʃik'e/	MH	'fart'
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**m : n***initial*

/mare/	MM	'grass'	/na:re/	HH	'brideprice'
/maʃe/	LL	'beer brewing'	/naʃe/	LH	'this'

*intervocalic*

/i:me/	LH	'cattle'	/ine/	HH	'doing'
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**n : ŋ**

(the velar nasal does not appear word-initially)

*intervocalic*

/ine/	HH	‘doing’	/e:ŋe/	MM	‘heart’
/ko:ne/	MH	‘jealousy’	/koŋe/	HL	‘collecting grain after harvest’

**s : ʃ***initial*

/se:pe/	LH	‘sword’	/ʃe:me/	ML	‘crab (fresh water)’
/soge/	MH	‘limping’	/ʃoŋe/	ML	‘krar’

*intervocalic*

/me:se/	HH	‘harvest’	/me:ʃe/	HH	‘shaman’
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**s : z***initial*

/soge/	MH	‘limping’	/zume/	HH	‘song of praise’
/se:me/	MH	‘finding’	/zep’e/	LL	‘together’

*intervocalic*

/hasoga/	MHM	‘limp’	/hazoga/	MLH	‘follow along a river/treeline’
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**s : tsʰ***initial*

/soge/	MH	‘limping’	/tsʰoge/	MH	‘collecting’
/se:re/	HH	‘law’	/tsʰere/	HL	‘cutting bamboo’

*intervocalic*

/hasoga/	MHM	‘he limped’	/hatsʰoga/	MHM	‘he gathered’
----------	-----	-------------	------------	-----	---------------

*in CC sequence*

/i:nse/	HL	‘wood’	/intsʰe/	MH	‘fear’
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**r : d**

(/r/ does not appear word-initially, except in borrowed words)

*intervocalic*

/ure/		HL	‘hump’	/ude/	ML	‘heap’
/are/		HH	‘nipple’	/ade/	ML	‘sister’
/mare/		LL	‘grabbing’	/ama:de/	LLL	‘in-laws’



**r : l**

(/r/ is not found word-initially; /l/ is found initially in only a single word)

*intervocalic*

/arime/		LHL	‘rotten thing’	/alime/	LHL	‘turban’
/ture/		MH	‘pushing’	/tu:le/	MH	‘pounding’

**w : b***initial*

/wit'e/	HL	‘calabash’	/bite/	LH	‘honey-mead’
/weze/	LL	‘crazy, mad’	/be:ze/	HL	‘broom handle’

*intervocalic*

/ke:we/	MM	‘wound’	/ʃebe/	HH	‘loitering’
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**w : m***initial*

/weze/	LL	‘crazy, mad’	/meze/	HH	‘wisdom, skillfulness’
/wame/	HH	‘river’	/ma:me/	LL	‘carrying a child’

*intervocalic*

/ke:we/	MM	‘wound’	/keme/	LH	‘growing’
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**w : j***initial*

/jo:se/	MH	‘song’	/wo:se/	MH	‘what?’ (response to question)
/je:se/	HH	‘stew’	/weze/	LL	‘crazy; mad’

*intervocalic*

/a:je/	LH	‘father’	/a:we/	LH	‘grasshopper’
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*in CC sequence*

/gja:re/	ML	‘peace’	/gwa:ne/	LH	‘pray, request (of God)’
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**j : ʃ***initial*

/jere/	LH	‘baby’	/ʃere/	MH	‘soup’ or ‘fresh, hot’
/je:ʃe/	HH	‘honey’	/ʃe:ʃe/	MM	‘urine’

*intervocalic*

/hawij:a/	MMH	‘say’	/hawif:a/	MHM	‘return’
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## # : h

*initial*

/a:ts'e/	LL	'tooth'	/harts'e/	ML	'water'
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/e:ge/	HL	'scorpion'	/hek'e/	MH	'death'
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*intervocalic*

/haup'a/ [ha <sup>2</sup> up'a]	MMH	'bury'	/hahup'a/	MHM	'steal'
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**Appendix B****Evidence for Vowel Contrast****i : e**

/int'e/	HH	'seeing'	/ent'e/	MM	'male'
/ts'ik'e/	LH	'white clay'	/ts'ek'e/	HH	'fermenting beer'
<i>long vowels</i>					
/i:me/	LH	'cattle'	/e:me/	LH	'touching (something)'

**i : u**

/tile/	MH	'stomach'	/tule/	HL	'being used to smoking'
/ki-te/	HL	'came-REL'	/kute/	MM	'skin'
<i>long vowels</i>					
/pire/	HH	'tasting of meat by elders'	/pure/	HH	'applying lotion'

**e : a**

/hets'e/	HL	'flattening grass'	/hats'e/	HL	'tomorrow'
/kese/	LL	'swelling'	/kase/	LL	'pouring into another's mouth'
<i>long vowels</i>					
/je:me/	ML	'crab (fresh water)'	/ja:me/	ML	'collard greens'

**e : o**

/kose/	MH	'breath'	/kese/	LL	'swelling'
/k'ope/	HL	'road'	/k'ele/	MM	'body'
/bet'e/	LH	'salt'	/bot'e/	ML	'groin'
<i>long vowels</i>					
/k'ots'e/	MH	'standing something up'	/k'ets'e/	MH	'flower; being lit, aflame'

**u : o**

/t'uʃe/	LL	'strapping'	/t'oʃe/	HH	'sprouting'
/puwe/	HH	'traditional beer'	/powe/	LL	'anus'
<i>long vowels</i>					
/ʃu:ʃe/	HH	'spitting'	/ʃo:ʃe/	HH	'snake'

**o : a**

/ʃowe/	HL	‘stone’	/ʃawe/	HL	‘sand’
/pole/	MM	‘outside’	/pale/	LL	‘Thompson’s Gazelle’

*long vowels*

/so:nts’e/	ML	‘child’	/sa:nts’e/	HL	‘bed’
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**e : u**

/bet’e/	LH	‘salt’	/but’e/	LH	‘shyness or fear (of person)’
/gese/	ML	‘friend’	/gute/	HL	‘crown (of rooster)’

*long vowels*

/t’e:nt’e/	ML	‘worm (general)’	/t’u:nt’e/	ML	‘bait; fishing worm’
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**o : i**

/ʃowe/	HL	‘stone’	/ʃiwe/	MM	‘wind’
/k’ope/	LH	‘cutting’	/k’ipe/	LH	‘covering a pot (for cooking)’

*long vowels*

/ʃo:ʃe/	HH	‘snake’	/ʃi:ʃe/	ML	‘name of tree’
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### Appendix C

#### Vowel Formant Data

#### i

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [i] Hz	F2 [i] Hz
/ʃike/	MM	‘knife’	69	146	103	148	418	2200
/ʃik’e/	MH	‘fart’	60	162	106	196	341	2204
/wit’e/	HL	‘calabash’	69	191	126	133	411	1419
/bite/	LH	‘honey-mead’	80	138	123	175	360	2153
/ints’e/	MH	‘fear’	89	140	75	159	422	1951
/ine/	HH	‘doing’	94	184	113	196	384	2175
/gite/	HL	‘head-covering’	85	171	97	133	358	2335
/tige/	LL	‘beer-brewing basket’	60	132	108	128	382	2222
/dike/	LH	‘scratching’	69	129	99	169	370	2327
/k’ipe/ ~ [k’ifɛ]	LH	‘covering pot (for cooking)’	83	138	96	189	434	2099
Totals			758		1046		3880	21085
Means			76		105		388	2109

#### e

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [ɛ] Hz	F2 [ɛ] Hz
/ts’ere/	HL	‘cutting bamboo’	113	158	86	121	639	1729
/hek’e/	MH	‘death’	96	142	73	159	573	1823
/k’ele/	MM	‘body’	92	152	117	157	558	1560
/keme/	LH	‘growing’	93	129	102	169	516	2043
/weze/	LL	‘crazy, mad’	72	128	90	133	517	1842
/ʃebe/	HH	‘loitering’	96	201	100	197	597	1983
/zep’je/	LL	‘together’	96	126	92	124	502	2005
/k’ets’e/	HH	‘floor’	112	177	79	177	546	1827
/keze/	ML	‘top’	105	128	83	103	458	2006
/kese/	LL	‘swelling’	95	127	86	127	480	1824
Totals			970		908		5386	18642
Means			97		91		539	1864

**u**

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [u] Hz	F2 [u] Hz
/puwe/ ~ [fuwe]	HH	‘traditional beer’	80	181	81	192	460	853
/kup’e/	HL	‘hat’	76	189	95	113	389	759
/kufe/	ML	‘granary’	61	159	70	128	478	821
/hupe/ ~ [hufe]	MH	‘brooding (of a hen)’	85	169	111	190	424	857
/buts’e/	HL	‘feast’	100	182	91	119	393	982
/pule/	HL	‘rolling something’	96	170	88	134	447	926
/dure/	ML	‘year’	104	135	140	117	376	1217
/tuge/	HH	‘foot; name’	67	193	101	204	402	999
/ude/	ML	‘heap’	104	149	74	127	435	907
/ure/	HL	‘hump’	106	182	86	114	387	933
Totals			879		937		4191	9254
Means			88		94		419	925

**o**

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [o] Hz	F2 [o] Hz
/ts’oge/	MH	‘collecting’	97	149	123	172	497	1325
/soge/	MH	‘limping’	63	147	121	160	486	1195
/ʃoŋe/	ML	‘krar’	104	155	105	125	621	1385
/koŋe/	HL	‘collecting grain after harvest’	95	174	91	116	591	1218
/gome/	HH	‘cleared land’	114	154	117	152	541	1113
/p’owe/	HH	‘crossing’	77	193	95	204	587	975
/obe/	HL	‘brother’	98	189	79	128	566	966
/k’ope/ ~ [k’ofe]	HL	‘road’	63	178	91	129	552	1094
/ʃowe/	HL	‘stone’	104	171	92	120	531	1133
/k’ope/ ~ [k’ofe]	LH	‘cutting’	97	134	116	171	537	959
Totals			912		1030		5509	11363
Means			91		103		551	1136

**a**

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [a] Hz	F2 [a] Hz
/pake/	HL	‘injera’	92	162	66	114	719	1619
/bake/	ML	‘name of bird-species’	81	136	71	112	671	1650
/wame/	HH	‘river’	73	166	93	165	733	1405
/ase/	MM	‘hail’	109	148	129	146	701	1639
/mare/	LL	‘grabbing’	71	118	102	119	787	1671
/are/	HH	‘nipple’	99	185	188	195	791	1684
/maʃe/	LL	‘beer brewing’	96	127	85	131	765	1676
/naʃe/	LH	‘this’	79	129	96	173	745	1686
/kane/	MH	‘dog’	87	176	78	202	744	1761
/kʻane/	LH	‘arrangement’	101	133	105	177	754	1650
Totals			888		1013		7410	16441
Means			89		101		741	1644

**i:**

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [i:] Hz	F2 [i:] Hz
/i:be/	LH	‘visitor’	145	131	104	162	387	2317
/i:me/	LH	‘cattle’	132	133	101	168	400	2276
/i:nse/	HL	‘wood’	139	146	76	100	399	2217
/gwintʻe/	LH	‘sweeping (cleaning mud off)’	119	127	88	169	387	2260
/mi:me/	HH	‘mosquito’	157	145	106	145	337	2189
/mi:ntsʻe/	LL	‘cutting; intestines / guts’	127	118	78	125	368	2197
/ʃintʻe/	HH	‘nose’	132	145	112	153	458	2158
/pire/ ~ [fire]	HH	‘tasting of meat by elders’	189	165	143	169	353	1290
/ʃi:ʃe/	ML	‘name of tree’	168	144	87	113	308	2303
/i:ntʻe/	HL	‘grunt’	216	172	107	126	335	2306
Totals			1524		1002		3732	21513
Means			152		100		373	2151

**e:**

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [e:] Hz	F2 [e:] Hz
/be:ze/	HL	‘broom handle’	179	159	120	118	506	2042
/te:ne/	MM	‘chest’	208	130	106	125	626	2033
/t’e:nt’e/	ML	‘worm’	166	135	84	111	673	1954
/se:re/	HH	‘law’	203	155	156	165	618	1918
/e:ge/	HL	‘scorpion’	166	153	110	109	607	1850
/se:pe/ ~ [se:fe]	LH	‘sword’	144	145	135	184	583	1997
/fe:re /	MH	‘soup’ or ‘fresh, hot’	205	155	146	176	487	2003
/je:fe/	HH	‘honey’	185	160	136	170	482	2062
/me:fe/	HH	‘shaman’	177	160	156	166	523	2025
/je:se/	HH	‘stew’	182	162	139	169	481	2010
Totals			1815		1288		5586	19894
Means			182		129		559	1989

**u:**

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [u:] Hz	F2 [u:] Hz
/tu:re/	MH	‘pushing’	191	168	164	191	375	1020
/pu:re/ ~ [fu:re]	HH	‘applying lotion’	204	196	173	200	408	979
/fu:fe/	HH	‘spitting’	169	209	150	210	430	1063
/t’u:nt’e/	ML	‘bait; fishing worm’	193	172	124	135	376	1031
/ku:me/	LL	‘bamboo fish trap’	179	130	137	121	408	796
/t’u:je/	HH	‘meeting’	180	202	148	201	420	1016
/du:le/	LH	‘hyena’	183	119	132	150	372	968
/pu:re/ ~ [fu:re]	LL	‘flour’	187	121	128	119	415	970
/su:nts’e/	MH	‘back’	197	146	119	164	450	1136
/ku:le/	MM	‘middle, central part’	176	158	127	162	393	830
Totals			1859		1402		4047	9809
Means			186		140		405	981



**O:**

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [o:] Hz	F2 [o:] Hz
/jo:se/	MH	'song'	136	169	128	185	520	1140
/ko:ne/	MH	'jealousy'	173	159	126	182	504	976
/go:me/	ML	'thinking'	190	129	116	108	418	900
/ko:le/	MM	'cliff'	176	173	116	170	518	999
/jo:ʃe/	ML	'rainy season'	143	155	87	128	471	959
/to:ke/	ML	'head'	174	125	120	110	468	1002
/ho:re/	LL	'tribe; ethnic group'	189	122	147	123	490	971
/ho:t'e/	HH	'sound; voice; yelling'	160	181	155	185	515	1019
/po:ne/	HH	'going out'	155	195	116	210	604	1164
/so:nts'e/	ML	'child'	156	146	83	117	606	1135
Totals			1652		1078		5114	10265
Means			165		108		511	1027

**a:**

Lexeme	Melody	Gloss	V1 ms	F0 Hz	V2 ms	F0 Hz	F1 [a:] Hz	F2 [a:] Hz
/ga:ne/	LL	'riches'	193	117	91	111	698	1616
/a:ts'e/	LL	'tooth'	176	121	94	117	811	1555
/ha:ts'e/	ML	'water'	169	134	78	105	788	1581
/ma:re/	MM	'grass'	184	137	133	141	579	1520
/ma:lt'e/	ML	'bone'	148	145	93	121	826	1495
/ma:lte/	ML	'fat'	140	128	79	112	758	1550
/pa:le/ ~ [pa:le]	MM	'heavy thing'	167	143	77	143	825	1549
/p'a:le/	LH	'digging tool'	180	108	100	147	856	1636
/a:ke/	HL	'phlegm'	185	167	108	115	832	1573
/a:ts'e/	LL	'language' (homophone with 'tooth')	157	124	101	117	849	1599
Totals			1699		954		7822	15674
Means			170		95		782	1567

### Appendix D Tonal Melodies of Three-Syllable Nouns

Syllable Pattern	HHH	LLL	HHL	HLL	HLH	LHH	LLH	LHL	MMM	MHH	MHL	MLL
CV.CV.CV	/gobole/ 'window'	/taŋets'e/ 'giraffe'	/iliŋe/ 'cooking pot'	/kuŋume/ 'chin'		/dabare/ 'turn'		/hakake/ 'cheek'	/uŋume/ 'navel'	/ŋap'ile/ 'armpit'	/jenŋe/ 'Berta'	/kit'iŋe / 'neck'
CVC.CV.CV	/gombole/ 'mortar (pounding pot)'	/gergeŋe/ 'wall'	/mamsese/ 'fair'	/tulkume/ 'knee'	/nakneja/ 'brother'		/ŋindit'e/ 'pimple'		/waŋgile/ 'jackal'		/nogdowe/ 'lion'	/k'embile/ 'loincloth'
CV.CVV.CV		/ama:de/ 'relative by marriage'			/kolo:le/ 'malaria'			/asane/ 'plate'				
CV.CVC.CV			/mamisje/ 'truth'				/awande/ 'neighbor'	/agunde/ 'tooth-brush stick'			/adurke/ 'white foreigner'	
CCV.CV.CV	/k'wak'ile/ 'skin (of fruit)'			/k'wek'iŋe/ 'turtle; tortoise'				/k'wagire/ 'thorn tree'			/ŋwalike/ 'partridge'	
CVV.CV.CV	/ja:reŋe/ '5 <sup>th</sup> month; January'							/ka:ŋaje/ 'baboon'				/ma:gawe/ 'friend'
CVC.CVV.CV						/ŋundore/ 'donkey'		/bisma:re/ 'nail'				
CCVN.CV.CV	/kwangile/ 'fishhook'											/twangile/ 'elephant'