1. Orthography

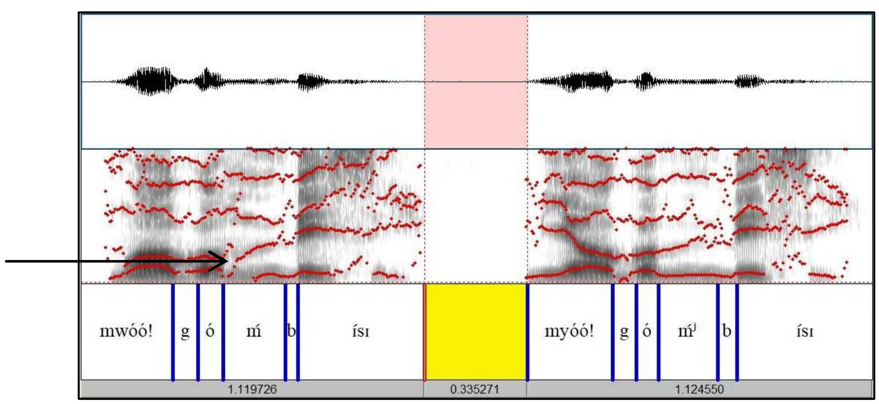
Data in this work are presented in a compromise between IPA phonemic transcriptions and (a kind of) augmented spelling. Because the focus of this work is to provide technical details of the language, more information about the language is given than is likely to be of use to a casual reader with an interest in Logoori rather than in linguistics. The system of writing used here is designed to be at least reasonably accessible to non-specialist readers with an interest in the language, but is primarily intended to convey information about the language to people without experience in Logoori. An explaination is available online at https://Languagedescriptions.github.io/Logoori/WritingtheLogoorilanguage regarding the need for special symbols such as ɪ, ʊ, ɲ along with contrastive tone marks (á, í vs a, i) . That document includes some sound files, designed to familiarize a speaker of the language having no training in linguistics with an indication of what these symbols represent. Other soundfiles can be found in the online dictionary at https://languagedescriptions.github.io/Logoori/OnlineDictionary/. The goal of the present work being to scientifically record as much information about the language as is practical, including details of pronunciation, a given word may be written in many different ways in this work – this is because there are many different actual pronunciations of words. Therefore, phonetic transcriptions must supplement plain spelling conventions with other symbols.

In terms of segment values, the following translations between the present work and IPA can be applied.

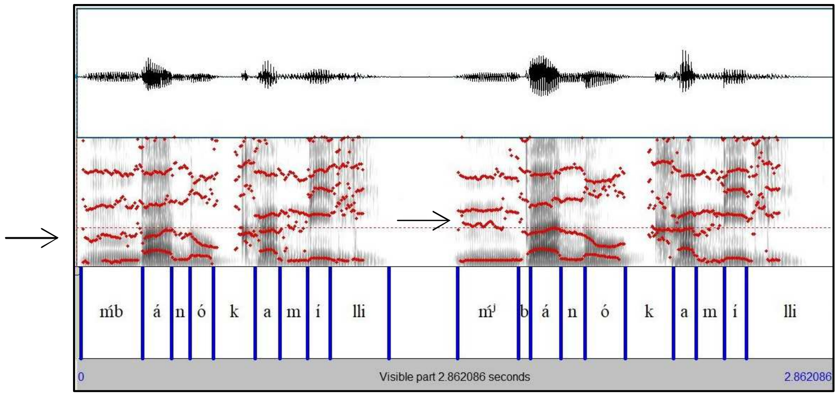
This work	*IPA*
ch	tʃ
j	dʒ
sh	ʃ
y	j
ny	nj ~ nʲ, ɲ
ɲ	variable nj, n̺, ɲj

Long vowels are notated by doubling the vowel letter (*koroota* ‘to dream’), likewise geminate consonants are indicated by doubling the first letter (*ɪddíiji* ‘window’). There are no underlying geminates in the language, but many speakers employ derived geminates arising from reduction of ri+C, rʊ+C, for example [ɪddíku] 'day' (EM,RK,BK), alternating with *(ɪ)rídíku* for these speakers; *ɪnneke* ~ *rineke* 'Syzygium cordatum' (BK); *ɪttígɪnyʊ* ~ *(ɪ)ritígɪnyʊ* 'heel' (EM,BK). All speakers appears to at least potentially have geminate *l* from /rVr/, e.g. *lláánde* 'Stephania abyssinica' (/ri-ráánde/, cf *maráánde* 'S.A. plants'), *ĺlími* 'tongue' (/rʊ-rími/). Geminate [vv] also arises (again for at least some speakers) by reduction of /vi+v/ (vvírí '2 (cl. 8)' /vi-vírí/) and /vʊ+v/, vvírí '2 (cl. 14)' /vʊ-vírí/).

Non-contrastive details are be included at various points in the work, providing information about the pronunciation of particular tokens. For example, a superscripted pre-consonantal glide e.g. [^{y}ḿbí] or [^{j}ḿbí] 'bad (cl. 4)', [^{w}ḿbí] 'bad (cl. 3)', is encountered in some examples from speaker BK – this will surprise linguists since such palatalization is not a typical feature of Bantu. This notation indicates a palatal offglide (versus labial offglide or, possibly, no offglide) from the preceding vowel. This feature was noticed and recorded before an analysis of the phenomenon was available. This palatalization is probably the trace of a deleted front prefix vowels /ɪ, i/. An example is [myóó$^{!}$gó ḿ^{y}bísɪ] 'raw cassavas', underlyingly /mi-ógo ɪ-mi-vísɪ/, therefore the surface form might reflect a merger of the vowel sequence /o#ɪ/. That analysis was not initially considered, since it seemed that BK lacked the augment, but subsequent analysis revealed that the augment is underlyingly present, and is deleted (almost everywhere, for this speaker). The same phenomenon has been observed with a few other ('remote interaction') speakers. The effect can be seen in the following spectrograms. The first example contrasts *mwóó$^{!}$gó ḿbísɪ* 'raw cassava' versus *myóó$^{!}$gó ḿ^{y}bísɪ* 'raw cassavas' from speaker FA. In the former utterance (with non-palatalized *m*), the second formant during *m* is initially quite low and rises significantly within the nasal, and in the second utterance F_2 starts higher and rises less.



In the following example from FA, *ḿbánó kamílli* 'proper knife' versus *ḿ^{y}bánó kamílli* 'proper knives' (or, *^{y}ḿbánó kamílli*), the utterance-initial difference [ḿ] versus [ḿ^{y}] again shows that palatalized [m^{y}] has a higher F_2, averaging 1590 Hz versus 1418 Hz in the case of [ḿ].



This effect has not been observed with EM or ML. In the case of ML, this probably reflects a difference in the underlying distribution of the augment. In the case of EM, augment deletion is dispreferred, and his strategy for phrasal hiatus reduction favors retention of the second vowel (the augment). For EM, we have *ʊmwóóꜜg-ʊ́ḿ'bísɪ* 'raw cassava' versus *ɪmyóóꜜg-íḿ'bísɪ* 'raw cassavas' where there is a very obvious difference in surface vowels of the adjective. At any rate, this was a minor trend in the data, attested rarely enough that a systematic study is not currently possible.

Non-identical vowel sequences poses a minor transcriptional problem. Such sequences arise in three contexts. One is as the realization of /Vyi/, where *y* may be phonetically elided before [i], giving rise to forms like [adui] 'he hit' from /aduyi/. The second is (rare) stem-internal sequences in some pronunciations of *ɲasááye*, *ɲasááe* 'God', *ring'óꜜááni* 'crested crane' (sometimes attested as *ring'óꜜwááni*) and *ɪkɪbíꜜráhóóni* or *ɪkɪbíꜜráʊ́ʊ́ni* 'small plate' – though such sequences may be consistently created from /VyV/ within the perfective stem, for instance *kwaabómóe* 'we destroyed'. The third source of vowel sequences, which is very common, arises at the phrasal level with the combination of a word-final vowel before a word-initial vowel. Some speakers (in the available data) simply maintain vowels in hiatus; others (especially EM) seem to at least phonetically systematically merge such vowel sequences into a single syllable, often deleting the first vowel. Tonal evidence supports the conclusion that the two vowels are merged into a single syllable (the phonological tonal facts will be discussed in later chapters). In the transcriptions presented here, a breve mark may be used to notate this property.

[bk]maháraambá ɪ̆siríini	'20 wasps'
[rl]ɪrʊ́ʊ́mʊ̆ ɪndara	'1 room'
[em]mkáꜜrájí ʊ̆mꜜtáámbɪ	'tall judge'
[em]vʊ́r-iɪ̆ng'ɪɪnga	'every moment'
[ml]mboozɔ̆̋ꜜávó	'their sister'
[ro]ɪkááꜜyóóng-ʊ̆́ngʊzúúzu	'young weed'

The breve mark is one way of notating the impression that the two vowel are "run together" into one syllable. The mark might appear on the first vowel or the second, with no implication that there is a systematic difference between first-V reduction and second-

V reduction. Similarly, such vowels in sequence might be run together with no space, or there could be a separating space (as observed in the preceding examples); or, there could be a hyphen separating the words (see also *gʊmééꜝr-íógónéne* 'big ship' with no breve). It was eventually decided that spellings like *gʊmééꜝr-íógónéne* would be conventionally used to notate apparent syllabic merger. Location or presence of a breve, or a hyphen, in a vowel cluster simply indicates that the vowels in a sequence phonetically merge into one syllable. The evidence that there is phonological merger pertains to the tone system. As you can see from the variant ways of writing such sequences in the examples above, transcriptions were not systematically and post-hoc regularized to conform to a single convention of spelling. The most-common practice in my data-recording is simply to mark phrasal vowel mergers with a hyphen before the first vowel.

Other variable phonetic details are generally retained in the transcriptions. For example there is velarization in some tokens, thus phonemic *ɪmbwá* may be attested as [ɪmbɣʉ̯á] 'dog', *mwaakweeya* as [mɣaakweeya] '2p swept'. Again, the transcriptions have not been filtered to eliminate such variations and low-level detail when they were recorded. The forms [mwaakweeya] and [mɣaakweeya] are phonologically identical; the transcription [mɣaakweeya] indicates that velarization in that token was noticeable, and the transcription [mwaakweeya] either means that there was no noticeable velarization, or that it wasn't considered important enough at the time to write it (or, it was ignored as well-understood and predictable). Typically, such allophonic details (which are commented on in appropriate parts of this chapter) were not systematically noted in transcriptions, except when they are initially observed, or where they are otherwise "striking" (e.g. uncommon for a particular speaker). Resolving details about these kind of phonetic variants will require a focused and controlled sociophonetic study.

2. Segmental inventory

2.1. Consonants

The clearly-contrastive consonants of Logoori are as follows.[1]

	t	[tʃ] ch	k	
b	d	[dʒ] j	g	
f	s	[ʃ] sh		
v	z			
m	n	[n̪, n̪ʲ] ɲ	[ŋ] ng'	
w	r, l	[j] y		h

The consonant [f] is infrequent, and generally only appears in loan words or before *u, w* – however [fwV] is widely replaced with [fV]. Some speakers maintain [fw] in *ífwééza* 'silver' vs. [f] in *mféneesi* 'jackfruit', but others employ *f* in both words – *íféëza* 'silver', *ʊmfenesi*. Both words derive from Swahili *f* (*fedha, mfenesi*), and the contrast in Logoori is quite marginal, originating from the fact that *f* originally comes from a voiceless con-

[1] The orthographic conventions used here are given in this table, along with the corresponding IPA symbol in square brackets, when they differ.

sonant before degree-1 round vocoids, i.e. *u, w*. *rífwá* ~ *ɪrífá* 'thorn' ← Proto-Bantu **pua*, *rʊfʊ́rʊ* 'foam' ← **pudʊ*. Transformation of loanword *f* to *fw* as in *ífwééza* is uncommon and probably indicates that the word is an older loan. I have not observed inserted *w* for any speaker with recent words like *ofisá* 'officer', never **ofwisá*.

The consonant *b* is somewhat infrequent unless it is preceded by a nasal ([mb] is very common, being the surface result of combining a nasal plus various consonants). Words with bare [b] are often loans.

ebééi	'price'
ɪbáága	'bag'
ɪbáákuuri	'bowl'
ɪtáábu	'trouble'
kebóóko	'hippo'
kítábu	'book'
rijííbu	'answer'

Few words universally have [p]. Candidates would be loanwords with [p] in the source language. A common but not universal strategy for source-language [p] is to voice [p] to [b] when using such a word in Logoori. Some speakers use [p] in these words, some of the time.

ɪbíícha (ɪpíícha)	'picture'
ɪbɪrabɪrɪ (ɪpɪrɪpɪrɪ)	'pepper'
ebóósta (epóósta)	'post office'
ɪbʊ́ʊ́nda (ɪpʊ́ʊ́nda)	'donkey'

There are a few words with [p] which have not been observed to undergo voicing with any speaker, so far.[2]

ríꜝpéera	'guava'
m'páángo	'plan'
m̀'pííra	'ball'

There are also words with [b] which do not appear to vary with [p].[3]

kíkábo (Sw. *kikapu*)	'basket'
msííbi (Sw. *mshipi*)	'belt'
abáchi (Luo *abaki*)	'abachi '
kɪbáanji	'water pot'

[2] I have not pursued investigation of adoption of Swahili words into Logoori, so these examples arose in the course of ordinary elicitation.

[3] On occasion, the word [ɪbárási] 'horse' has been gathered in the form [ɪfárási] which is essentially the Swahili word and the immediate source of [ɪbárási], but since this is corrected to [ɪbárási], I conclude that [ɪfárási] is not actually part of Logoori. However, it is plausible that such a replacement has or will take place for some speakers.

kɪburuburu	'butterfly '
ríꜜbwóoni (Luo *rabuon*?)	'potato'

There is also some variation between [k,g] and [t,d] associated with loan words, such as [ɪgánísa ~ ɪkánísa] 'church' from Swahili *kanisa*, or [ɪdágíga ~ ɪdákíka] 'minute' from Swahili *dakika*; [rikáꜜrádáasi] 'paper' from Swahili *karatasi*, [ryááꜜngázéedi] 'newspaper' from *gazeti*.

The phonetic consonants *l* and *r* are highly variable. As noted in chapter 1, orthographic practice of written Logoori is not uniform, in that both *r* and *l* may be used, with *r* being less frequent. The orthographic rule which is promulgated in Godia (use <r> after front vowels) does not correspond to a phonetic pattern of Logoori[4] that I have observed, but I have frequently encountered both a lateral approximant [l] and a flap that can be written as [r] (more accurately IPA [ɾ]). The distinction is largely rule-governed ([i,y] may condition immediately preceding [l]), but this varies substantially across speakers. No speaker whom I have encountered systematically uses a singleton [l] that is comparable to Swahili *l* for all instances of the liquid. Even FI, who generally instantiates the singleton liquid as a lateral realizes it as [ɭ] and not [l]. Both *r* and *l* are employed in my transcriptions, the choice being based on my judgment of whether the token was more *r*-like or more *l*-like. Such judgments largely fell out of the transcriptional record over time, since it became clear that more sophisticated methods are necessary to capture the extant range of pronunciations. All instances of <r> could be spelled with <l>, or vice versa, without losing general contrasts of the language.

For most speakers, /rVr/ reduces to [ll] (hence *llógoori* 'Logoori language' ← /rʊ-rogoori/, vs. *mrógoori* 'Logoori person' ← /mʊrógoori/). The qualitative difference between [ll] and [r] is very significant, and I always write [ll] although "rr" could, by rule, be interpreted as always being pronounced [ll]. The duration of derived [ll] is, at least in certain contexts, typical of that found in various languages which have phonemic geminate [*l*][5] and for all speakers, it is quite evident when *ll* is word-initial (it can bear contrastive tone: [ĺꜜléési] 'cloud'). For some speakers, the duration of intervocalic *ll* is not consistently different from that of singleton *l* (as observed in their productions of Swahili words). In some instances, such as the verb *kʊhʊ́lla* 'to hear' from /kʊ-hʊ́r-ɪr-a/, *ll* tends to sound somewhat long, but sometimes does not appear to be very long.

Especially among younger speakers, /l/ may be emerging as a phoneme which is distinct from, though phonologically related to, /r/. There are some lexical items, all adaptations of Swahili *l* or English, which for some speakers have non-geminate [l]. For example the adjective *kamíili* 'proper' always has a short consonant (though it may also be pronounced by some with *r*), and the word 'bell' from Swahili *kengele* may be pronounced *ekééngele*.[6] The word for 'Luo (person)' is always *mjálwo ~ mʊjáluo*, never *[mʊjárwo]. The most wide-spread strategy for loanword adaptation and the strategy exemplified in long-established loans is to change Swahili *l* into *r*. However, the innovative strategy exemplified by words like *kamíili* is to adopt *l* as short [l]. As far as can be de-

[4] This rule is probably inspired by the valid rule for distributing *l* and *r* in Luganda.

[5] E.g. Saami, Norwegian, Italian, Arabic, Somali.

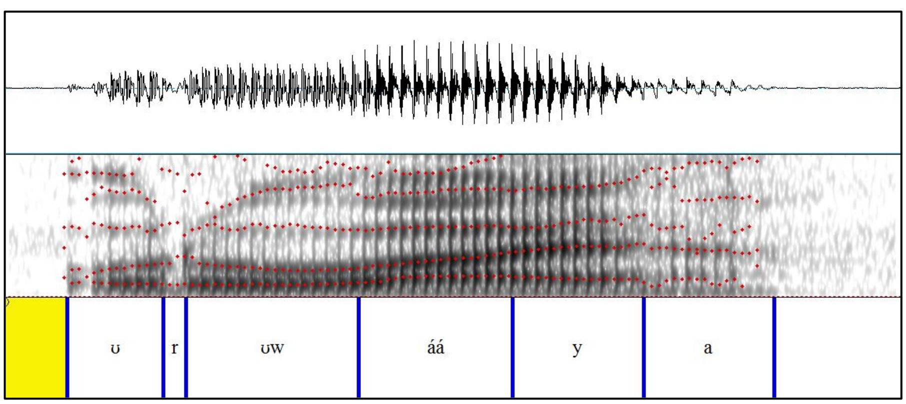
[6] The most-nativized form is *egééngere*, which can also be pronounced *ekééngere*. I have so far not encountered **egééngele* with nativization of just the initial consonant.

termined, there is no strategy to adopt foreign *l* as [ll], that is, delateralization (not gemination) is the only alternative to direct incorporation of [l] from another language.

The short version of *r* is a lingual flap (written here as *r*) and varies between [ɾ] and a lateral flap [ɺ] or as [ɭ], with both contextual and individual factors being relevant. Instances of [ɺ] in the speech of EM are relatively infrequent compared to BK and RL. Word-initial position and a following *i*, *y* are factors that especially favor the lateral flap. Given the wide range of phonetic realizations of the Logoori liquid, only a two-way distinction is made here between <l> and <r> (the former possibly being geminated), reflecting a judgment as being more like canonical [l] versus more like [ɾ] (never trilled [r])

The voiced labial fricative, written as *v* (consistent with standard spelling practice), though it is somewhere between IPA [β] and [v], except that for FI it is closest to IPA [ʋ] and sometimes [w].

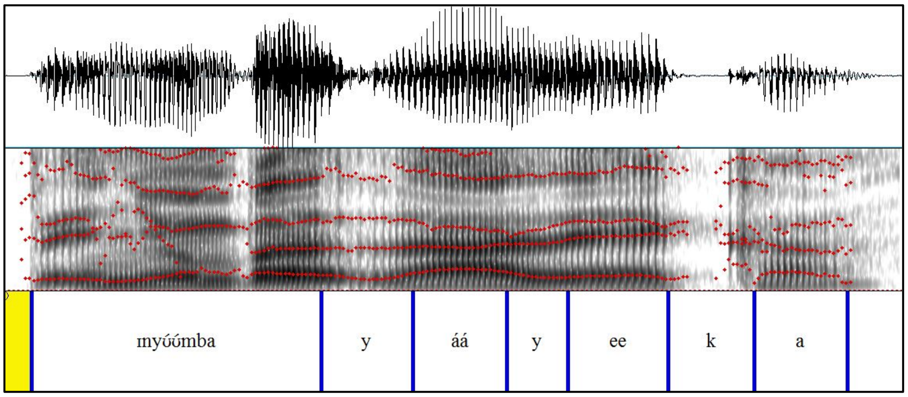
The glide *y* in Logoori, in most idiolects, is phonetically unusual, compared to the segment transcribed [j] in IPA which found in many other languages (such as English, German, Swahili), indeed there is a parallel only in the Central Kenyan Bantu language Kamba. The front glide need not have a raised tongue position, so it is not always a palatal, it may be a dental approximant. Leung also notes this feature and transcribes *y* as <y̪>, referring to it as a 'dental glide'.[7] The glide is palatal (which, for clarity, I indicate in this section as [y^{j}]) when it stands before the tense vowels [i,u], also when preceded by a consonant, and is realized as a dental glide when syllable-initial before [ɪ e a o ʊ]. For some speakers, the glide is palatal on some (most) tokens of the word *rʊwááya* 'wire' – [rʊwááy^{j}a] – a loanword, which allows a comparison of the palatal vs. dental versions of *y* in reasonably comparable contexts. As can be seen in [ʊrʊwáá**y**^{j}a], we find the expected shift in formants for [y^{j}], but no appreciable change in waveform amplitude at that point.



In [ɪnyʊ́ʊ́mba **y**ááyeeká] 'sagging house' below, dental *y* has a significant decrease in waveform amplitude during its articulation, reflecting the effect of the narrower approximation.[8]

[7] Mould 1976 likewise marks *y* with the dental diacritic, but does not comment on that property.

[8] In this token, the second *y* has some but not as much constriction.



For those speakers with the dental allophone, alternations within a morpheme can be observed depending on phonetic context, for example *kʊváaya* 'to visit', *avááyʲi* 'he visited'. Since this feature is entirely transparent, it is not otherwise noted in transcriptions. It should also be noted that *y* is often not very distinct before [i]. There are very few contests illustrating [yʲu], but the palatal variant can be seen [vʊyʲúúsi] 'corn silk' or [kɪgáꜜyʲu] 'despised (cl. 7)'.

A related phenomenon is the pronunciation of *ɲ*. Especially among the majority of speakers with the dental glide pronunciation of *y*, the palatal nasal is phonetically dental [n̪]. There is an alternations where /ɲ/ becomes [ny] before *i* and *u*, for example *kokóoɲa* [kokóon̪a] 'to help', *vaakóonyi* [vaakóonʲi][9] 'they have helped'. The phonological relationship of *ny* and *ɲ* is dealt in in more detail in X. Another source of surface distinction between [n̪] and [ny] is the reduction of /n,ɲ/ plus causative /iz/, which creates alternations such as [kohóna] 'to get well', [kohónya] 'to heal (trans.)', or [kokóoɲa] 'to held', [kokóonya] 'to make help'. The high lax vowels [ɪ, ʊ] constitute a middle ground for lexicalization, since there are tautomorphemic sequences [ɲɪ, ɲʊ] where one might expect [ɲ], for example *kʊnyɪɪra* 'to stretch', *ɪnyʊ́ʊ́mba* 'house', cf. *kʊʊɲíímbɪra* 'to sing for me'; *ɲʊmbákáa* 'I am building' with the dental realization. The difference is that *nyɪ* in 'to stretch' is entirely within the verb root 'stretch', and *nyʊ* in 'house' is entirely within the root, at least synchronically, but ɲ+{ɪ,ʊ} in *kʊʊɲíímbɪra* 'to sing for me'; *ɲʊmbákáa* 'I am building' comes from the combination of /N/ plus root-initial /y/ (which in these instances is inserted by rule).

The distribution of [ny] versus [n̪] can almost be predicted either by identifying bisegmental sources (/kʊ-hón-in̪-a/) or else the following vowel (/ɲ/ → [ny] / __i,u), there are unpredictable cases of surface [ny] that have to be lexically recorded – *amáꜜnyáánga* 'shakers', *ʊvʊ́ꜜnyéégéri* 'itch', *ɪrichíꜜnyéeri* 'hyrax', which may be occasionally pronounced with [ɲ]. There are also two problematic verb roots, /nia/ 'defecate' and /niaara/ 'wither, become thin', where the nasal is followed by a very short high front vocoid that might be mistaken for [y], but this sequence remains phonetically distinct from [ny] as attested elsewhere in the language. These roots will be written here as [nia, niaara]. In

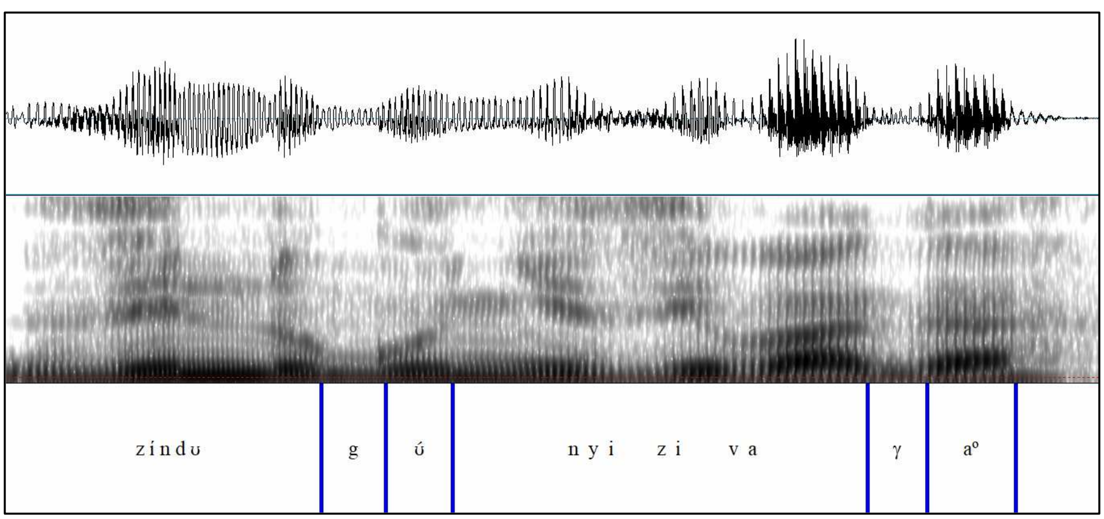
[9] Alternative transcriptions would be [vaakóonji, vaakóoɲi, vaakóoɲji, vaakóon̪ji]. What is auditorily distinctive about the "ny" pronunciation is its palatal offglide, and the status of the on-glide from the vowel is not at all distinct,

short, even though there is a relationship between *ny* and *n̪* (they are indeed spelled identically in popular writing, as <ny>), the surface distinct sounds will be recorded as pronounced, where <ɲ̪> is the generally-dental allophone and <ny> is the generally-palatal allophone – and where some speakers simply pronounce <ɲ̪> the same as <ny>.

The fricative *sh* ([ʃ]) is highly variable. The original situation is that there was no [ʃ], and there was a contrast between [hy] and [sy]. Palatalization of *hy* to *sh* is quite widespread, compared to palatalization of *sy* to *sh*. A few speakers have been identified who synchronically maintain a three-way distinction between *sh, hy* and *sy*, though for those speakers, robust [ʃ] is only found in loan words such as *ɪmíísheni* 'mission', *ríꜝsháhídi* 'witness' (from Swahili), and *hy* seems to vary freely with *sh*. Most speakers uniformly neutralize *sh* and *hy* to *sh*, thus *kʊhyʊ́ʊha* ~ *kʊshʊ́ʊha* 'to be warm'). Speaker LI tends to preserve a distinction between original *sy* and *hy*, the latter generally being pronounced as [ç] e.g. *kʊ́ꜝçá* 'to be warm'. Finally, some speakers systematically have *sy* where other speakers use *sh*, e.g. *kʊsyeena* ~ *kʊsheena* 'to step'. EM, for example, uses *sh* in these words, whereas BK uses *sh* in the former example and *sy* in the latter, and PM uses *hy* and *sy* as well as *sh* (at least potentially). An additional context for deriving *sh* is that /h/ becomes [sh] optionally or obligatorily (depending on speaker) before suffixal *i*, for example *kwááha* 'to pluck', *nzahi* ~ *nzashi* (EM) 'I plucked'. Paradigmatic fronting of *h* before *i* is much more variable than tautomorphemic pronunciation of *hy*.

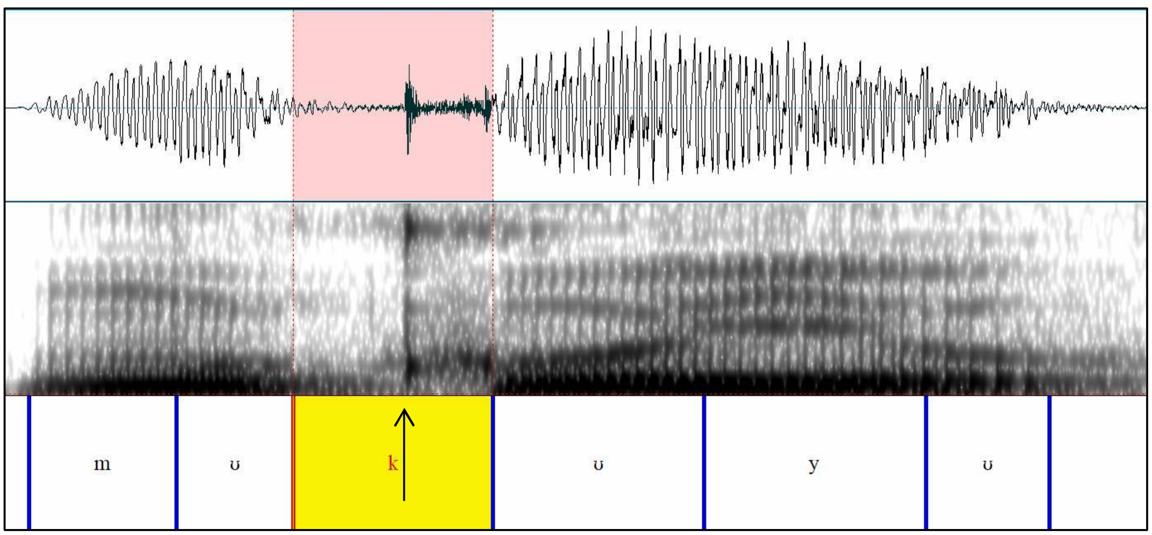
The fricative *z* is widely pronounced as [z], but some speakers (esp. BK, PM and FI, the latter being more systematic in that pronunciation) optionally pronounce this as an affricate [dz], with a relatively short closure period.

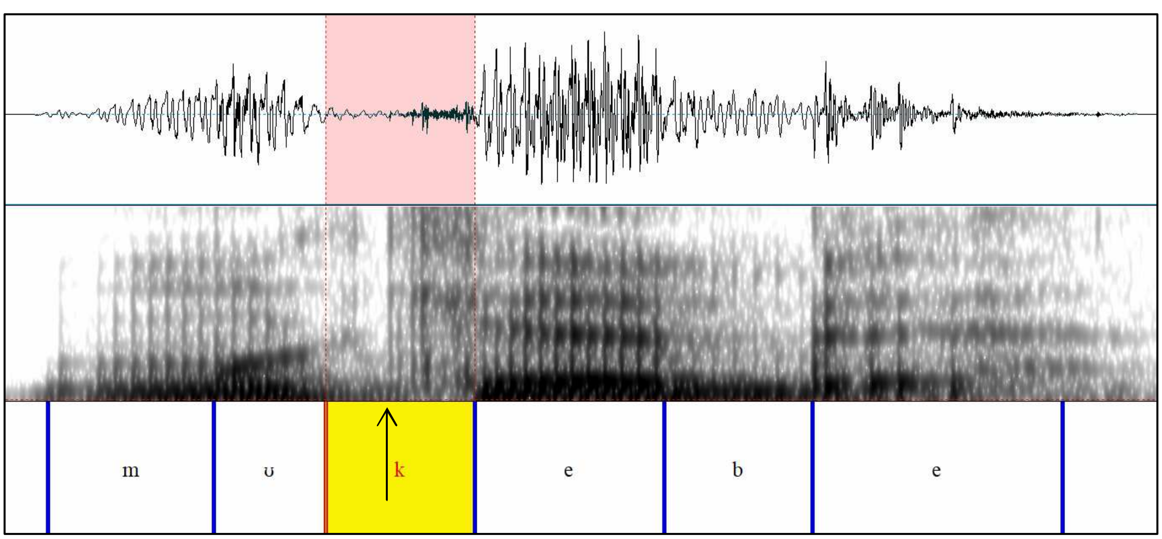
The velar consonant *g* may be pronounced in postvocalic position as a continuant [ɣ], without noticeable friction. In the following token of [zíꜝndʊ́gʊ́nyi zivaɣaº] '3 ants' from LI, /g/ is realized as a stop in the noun [zíꜝndʊ́gʊ́nyi] but as a fricative in the numeral [zivaɣa]. The segmental margins of /g/ are clearer in the first instance and there is a visible release burst, and in the second instance voicing during the consonant is attenuated, and the waveform is more irregular in shape.



FI produces a lenited version of /g/ most of the time.

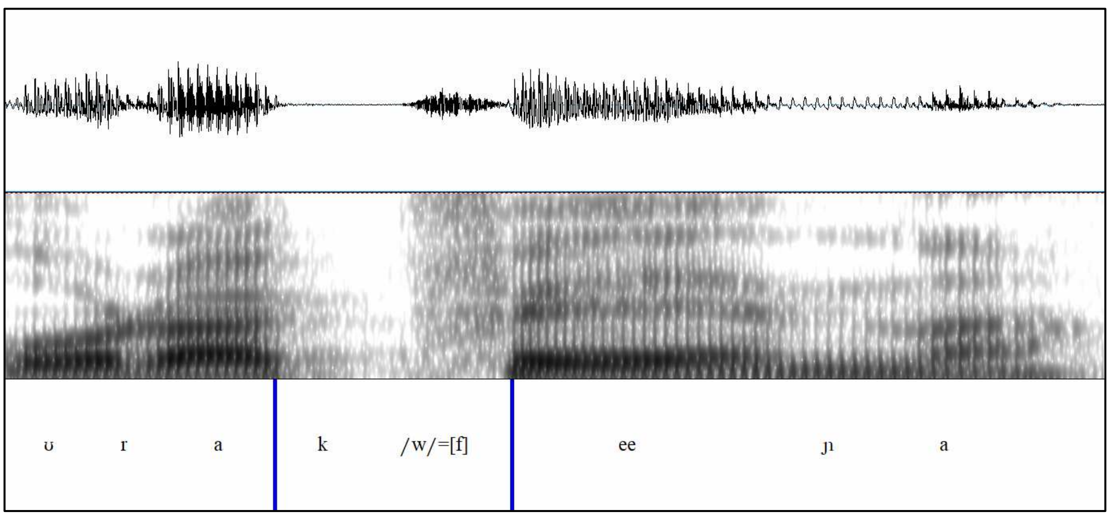
It was noted previously that [x] is said to exist in some dialects, including that of speaker FI. The percept [x] is most prominent utterance-initially, to the point that all instances of /k/ in that position from other speakers sound like [x]. Intervocalically, there is a degree of variation so that (speaking in approximate terms) about half of the time the voiceless velar sounds like [x], otherwise [k] or [kx]. Consider the following two tokens, [mʊkʊyʊ] 'fig' and [mʊkebe] 'tin'. In the former, there is a clear release burst within *k*, which is not present in the later token. The transition from closure to fricative opening is indicated by an arrow in the transcription: it should be noticed that the presumed closure is not acoustically silent (we also see from the margins that this is not environmental noise). It is conjectured that the closure is brief and often partial, so that there is some acoustic 'leakage' from the preceding vowel into the closure of /k/. In other words, /k/ lenites to a "weakened k", not being a full fricative not a full stop.





Another variable phonetic details is that the clusters *mw, bw, vw* may be pronounced with fricativization and unrounding of the glide, for example [bk]*ɪmbwá* [ɪmbγṳ̯á] ‘dog’ [fa]*mwaakweeya* [mγaakweeya] ‘2p have swept’, [rl]*mwaaráa* [mγaaráa] ‘2p are spreading’, [em]*ʊvwóóngo* [ʊvγṳ̯óóngo] ‘brain’.[10] This phonetic process is most noticeable in the case of /mw/, where /w/ may delete without a trace in some tokens, e.g. [rl][ʊmíívi ʊmdáámaanʊ́] ‘bad thief’ alongside [ʊmwíívi ʊmdáámaanʊ́]; [em][yaarí míígizi] ‘he was a teacher’.[11]

A similar process affects /kw, gw/ which are realized as [kp, kpf, gb, gbv, gv], for instance [rl][ʊmsáára gbaakpfáádɪka] ‘a split tree’, [ʊmpííra gbaakpáádɪka] ‘a burst ball’ (*gwáákwáádɪka*), [kpfááḿkʊba] ‘we beat him’ (*kwááḿkʊba*) [yááꜜngvííra] ‘he fell on me’ (*yaangwííra*); [fa]mʊryáángo gbííguchi ‘open door’ (*gwííguchi*), [aaŋgbíírɪɪ] ‘he fell on me’ (*aangwíírɪɪ*); [pm][kpʊ́ʊ́mbaka] ‘to build’ (*kwʊ́ʊ́mbaka*), [kʊgba] ‘to fall’ (*kʊgwa*). An example of [ʊ́rákféeɲ̯a] = /ʊrakʊ́eɲa/ ‘you will want us’ from LI is seen below, where a clear fricative release is seen after the stop [k].



One final pair of consonants should be mentioned, namely [θ, ð] which would conventionally be spelled as <th, dh>, and will be so spelled here. These fricatives arise for some speakers in words taken from Swahili, for example *thamaníini* ‘80’, also pronounced *dhamaníini*, or *ɪféédha* ‘money, silver’, *ɪdháhaab* ‘gold’. These words are usually nativized so that *θ→s* and *ð→z* (*dhamaníini* is also recurring in the data for FA). I have not pursued the question of how English [θ,ð] are adapted. It is important to note that these words are still subject to rules of Logoori phonology such as the regular tone rule dis-

[10] This feature is also noted in Mould’s transcriptions [mŋ] for *mw.*

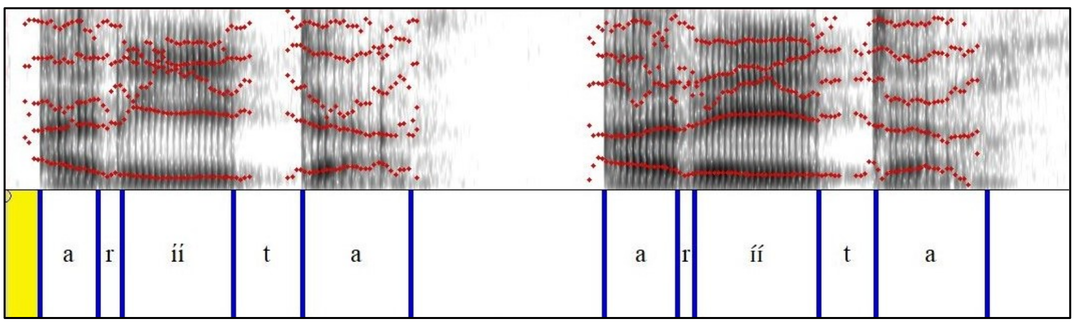
[11] There is no practical way to determine if *w* is actually deleted as opposed to being rendered most difficult to detect: by comparison, some evident correspondent of *w* is audible in all tokens of *vw, bw*, except in the case of deletion of *w* before *ʊ*, which is an optional rule.

cussed in Q generating the contrast between *zisɔ́zɪ dhamaníini* '80 fish' and *zíndóóngóózí dhámaníini* '80 peaks', therefore this is not code switching into Swahili.

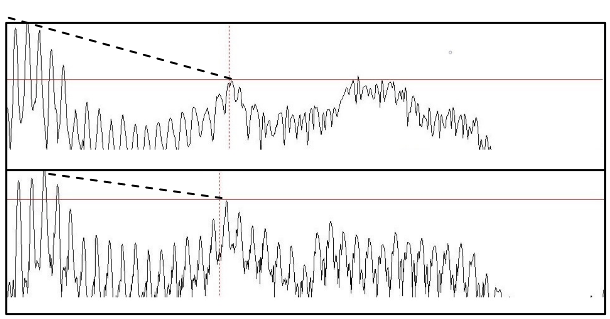
2.2. Vowels

There are 7 underlying vowel qualities in Logoori: [a e o ɪ ʊ i u]. All vowels may be long or short, long vowels being indicated by doubling the vowel letter, for example *kʊhana* 'to close', *kʊháana* 'to give'; *kohéra* 'to come to an end', *koheera* 'to breathe'; *kʊhɔ́lla* 'to hear', *kʊhʊ́ʊlla* 'to thresh for'.

The vowels [e,o] are comparable to Swahili *e,o* and IPA [ɛ, ɔ]. The distinction between [i, ɪ] and [u, ʊ] is quite subtle. I have only found one (morphologically-complex) minimal pair in word-medial position, [aríita] 'he will kill' and [aríɪta] 'he will bury himself'.



The following spectral slice in the range 0-5500 Hz compares the energy distribution of [ɪ] and [i], where we can see that the tense vowel on the top display has a more pronounced downward spectral tilt compared to the lax vowel on the bottom. Compare the greater decrease in amplitude between F1 and F2 for [i], and the lesser decrease in amplitude between these formants for [ɪ]. This is consistent with the impression that the tense high vowels are somewhat breathy-voiced – the spectrum of breathy vowels has a larger negative slope compared to modal-voiced vowels.

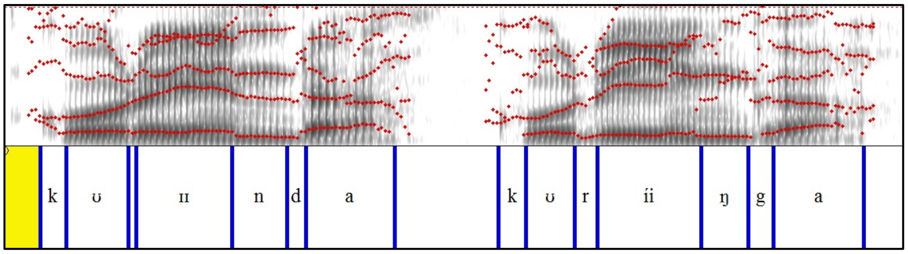


tense [i]

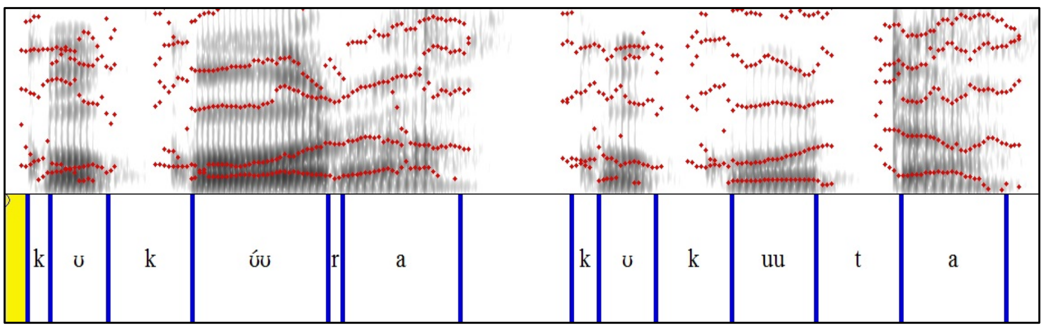
lax [ɪ]

The spectra and spectrograms indicate that the first two formants of [i] are further apart than those of [ɪ], by about 200 Hz.

A general grammatical source of minimal pairs is the difference between singular imperative with object prefix (*kʊrɪɪndí* ‘guard us!’, *gɪgʊrí* ‘buy it!’) and plural imperative with object prefix (*kʊrɪɪndí* ‘guard-pl. us!’, *gɪgʊrí* buy-pl. it!’), with high root vowels. An example of a near-minimal pair *kʊrɪɪnda* ‘to guard’ vs. *kʊríinga* ‘to fold’ is seen below.



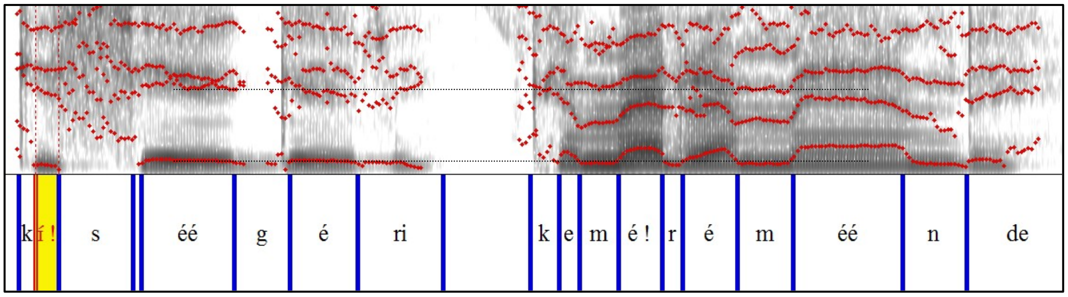
The near-minimal pair *kʊkʊ́ʊra* ‘to extract’ vs. *kʊkuuta* ‘to scrape’ are seen here.



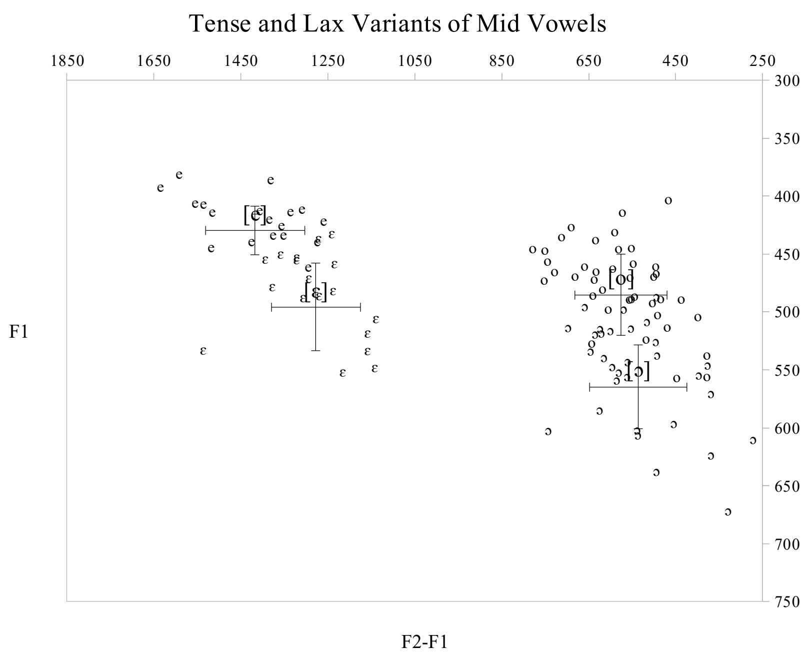
The vowels [i,u] tend to partially devoice in favorable environments, which can aid in identifying the vowel distinction.

Although the distinction between [i u] and [ɪ ʊ] is linguistically significant, it is also ‘tenuous’ in that expected [i,u] in a root may be pronounced with [ɪ,ʊ]. This plays a role in lexical variation, where ‘leaf trash’ may be pronounced [amavururi] or [amavʊrʊri], and ‘mole’ may be [í'mbʊ́kʊ́] or [í'mbúkú] (even from the same speaker). Certain common roots are consistent, for instance the root *-ndʊ* ‘person’ in *ʊmʊʊndʊ* is (probably) never pronounced **-ndu*; the root *-itu* ‘market’ is always pronounced with [i], not [ɪ] as in *ɪchiitʊ*. Root-variation between [i,u] and [ɪ,ʊ] is especially common when the following vowel is [i,u], suggesting an earlier or emerging rule of regressive tenseness harmony. As a general rule, [i,u] are less common compared to [ɪ,ʊ], and a speaker is most likely to produce a borrowed or unfamiliar word having a high vowel with [ɪ, ʊ] rather than [i, u]. The high degree of variation over [i, ɪ] and [u, ʊ] suggests that the distinction may be lost in a few generations.

There is also phonetic raising of the mid vowels *e, o* ([ɛ, ɔ]) which become tense [ẹ, ọ] before *i,u*. For some speakers this process applies iteratively through a string of mid vowels. In the examples below from SY *kí'syẹ́ẹ́gẹ́ri* ‘sty’ versus *kemé'réméende* ‘candy’, the lowest two formants are much closer together in the latter (more closely resemble *a*) compared to the former (more closely resembling *i*). Formant comparison lines are aligned to F1 and F2 of *ee* in *kí'syẹ́ẹ́gẹ́ri*.



Older speakers tend to have a more “phonologized” version of mid-vowel raising and younger speakers seem to raise vowels only when the mid vowel is right before the high trigger. Some speakers to devoice prepausal *i, u* but not other vowels. Nevertheless, data from speaker EM exemplifying /e,o/ before [a,e] versus [i] suggests a rule of iterative harmony. These data include sequences of multiple syllables with mid vowels before [i], and the goal was to determine (a) whether there is a measurable acoustic difference in [e,o] before [i] versus before [a,e] and (b) whether any raising effect is limited to the syllable immediately before [i]. Below is a plot of formant measurements.



The expectation, based on hearing many tokens, was that there would be raising throughout *kọọtẹẹvi* ‘we have asked’, *kọọchẹ́ẹ́rẹvi* ‘we were late’, *kọọvẹẹzẹgẹri* ‘we have belched’, and there would be no raising in *óósoomeree* ‘you have read for me’, *kooroondani* ‘we have followed e.o’, *kooteevani* ‘we have asked e.o’, *koveezegera* ‘to belch’. Accordingly, in the above plot, /e,o/ followed by [i] and not separated from [i] by [a] are marked as [e,o], and /e,o/ without following [i] or with [a] intervening between /e,o/ and [i] are marked as [ɛ,ɔ].

Over a corpus of 107 vowels, there was no significant difference in F_2 value as associated with the following vowel context (i.e. /e/ before [i] versus /e/ before [a]), but there was a significant difference in F_1 value. Thus it is credible to claim that there is a raising harmony process in the language affecting mid vowels. Moreover, there was no significant difference in F_1 depending on whether the mid vowel is immediately before [i] versus being separated from [i] by one or more syllables with /e,o/ (which are assumed to harmonize and thus to be the immediate cause of vowel raising in e.g. [*ko̧o̧vȩȩzȩgȩri*]) – but /e,o/ followed by [aC_0i] is different from [eC_0i]. This latter fact suggests an iterative categorial rule. It is tenatively concluded that there is a low-level phonological rule tensing /e,o/ to [ȩ o̧] before [i] (and presumably [u], but constructing contexts is difficult) as well as before derived [ȩ o̧]. There are a number of cases where [ȩ] appears apart from following [o̧ ȩ i u], the most striking being [ribȩ́ȩ́ba] (LI), [ɪribȩ́ȩ́ba] (BA) 'small tank' and [esȩȩtwȩ] 'mouse bird' (LI, BA), also [kokȩrȩnya] 'to gorge' (BA) with iterative raising, presumable triggered by /ny/. The status of completely unexpected tensing in *ɪribȩ́ȩ́ba*, presumably derived from the Swahili verb *-beba* 'carry' is a mystery – such tensing is not a characteristic of Swahili loan words (*ebéde* 'ring', *ebéénzeni* 'wash basin', *ʊmʊchéére* 'rice').

There is also a tendency for the lax high vowels /ɪ ʊ/ to become tense before [i, u] and [u]. For example, the cl. 7 prefix /kɪ/ may be pronounced as [ki] in [kivúnɪ] 'reason'. It is not clear whether this tensing results in a categorial neutralization of /i/ and /ɪ/: it is possible that the resulting vowel is just "somewhat tenser". Such tensing is optional. There is at least one lexicalized example of high vowel tensing, that the root /-ɪg-/ 'learn' has a tense vowel in /-igiz-/ 'teach'.

3. Prosody: Vowel Length, Tone, Syllables

3.1. Vowel length

Vowel length is significant in the language, and is indicated in some traditional orthographic practices. Nevertheless, perfectly-controlled lexical minimal pairs such as *kokeera* 'to age (of female)', *kokera* 'to milk' are extremely rare. Near-minimal pairs are seen below.

kʊgʊʊmara	'to grow large'	kʊgʊmɪra	'to catch'
koheera	'to breathe'	kohéra	'to come to an end'
kʊhʊ́ʊlla	'to beat for'	kʊhʊ́lla	'to hear'
kʊkʊʊva	'to flatter'	kʊkʊ́va	'to be partially cooked'
koɲoora	'to get'	koɲóra	'to strip leaves'
kʊsáámʊra	'to slap'	kʊsamʊra	'to go to work'
kosona	'to point at'	kosooma	'to read'
kʊtʊ́ma	'to send'	kʊtuuma	'to jump'

ɪmbíízi	'warthog'	ɪmbítí	'hyena'
ɪmbʊ́ra	'rain'	ɪmbʊ́ʊ́za	'strong wind'
ḿféneesi	'jackfruit'	mféréji	'water tap'

mʊkáádo	'avocado'	kíkábo	'basket'
mʊkʊ́rʊ	'initiate'	rikʊ́ʊ́rʊ	'pigeon'
emééri	'ship'	emére	'mashed cooked bananas'

Surface distinctions derived by the application of general or construction-specific rules also leads to an opposition between long and short vowels.

vaafúúti	'they erased me'	vafúúti	'they erased'
yaakʊ́ʊ́sinikiza	'he has annoyed me'	yaakʊsinikiza	'he has annoyed'
aríita	'he will kill'	aritá	'he may bury'
varáata	'they will do surgery'	varata	'they will bury';
kodeechi	'we cooked'	koodéechi	'we have cooked'

Vowel length is not lexically contrastive before NC clusters, but unlike the situation in some Bantu languages, both long and short vowels are surface possible before NC.

nzámbááyaa	'I am swinging'
ɲɪmbáa	'I am singing'
ɲʊ́mbákáa	'I am building'
ɲééngaa	'I am brewing'
ɲííngʊkaa	'I am melting'
ɲóómbooraa	'I am over-pouring'
ímbwá	'dog'
zíímbwá	'dogs'
ɪnji	'fly'
ziinji	'flies'

Phonological alternations in vowel length are rather complex, as discussed in later chapters.

3.2. Tone

Logoori is a tone language, and distinguishes two surface tones, H and L (the former marked with acute accent). Lexical strict minimal pairs are rare.

kwiizʊriza	'to remember'	kwíízʊriza	'to fill'
kʊviimba	'to roof'	kʊvíimba	'to swell'

However, tonal minimal pairs reflecting grammatical differences are frequent in the language.

váámíga	'they strangled'	váámiga	'they strangled me'
yáákagʊra	'he has bought'	yaakagʊra	'he bought'
umúúndú yááváriza	'the person counted'		
umúúndu yááváriza	'the person who counted'		

3.2.1. SYLLABLE DYNAMICS OF TONE

Viewing tone from the syllabic perspective, there are three surface tone distinctions, namely High (H), Low (L) and Fall (F) – additionally, there is a general pitch-register lowering process of downstep (notated with $^!$) which occurs between H tones. A further surface tone marker is the marker º which indicates "non-falling", a rule-governed surface property of some pre-pausal syllables, for instance [na kodeekeº] 'we will cook' from /na kodeeké/ – an alternative transcription would be [nā kōdēēkē] with mid tones on all vowels.

F only occurs on a long syllable, and is notated as just H (accent) on the first vowel, e.g. *kodéeka* 'to cook'. F is highly restricted in the language. There are grammatical and lexical contrasts between F and H in the penultimate syllable, for example:

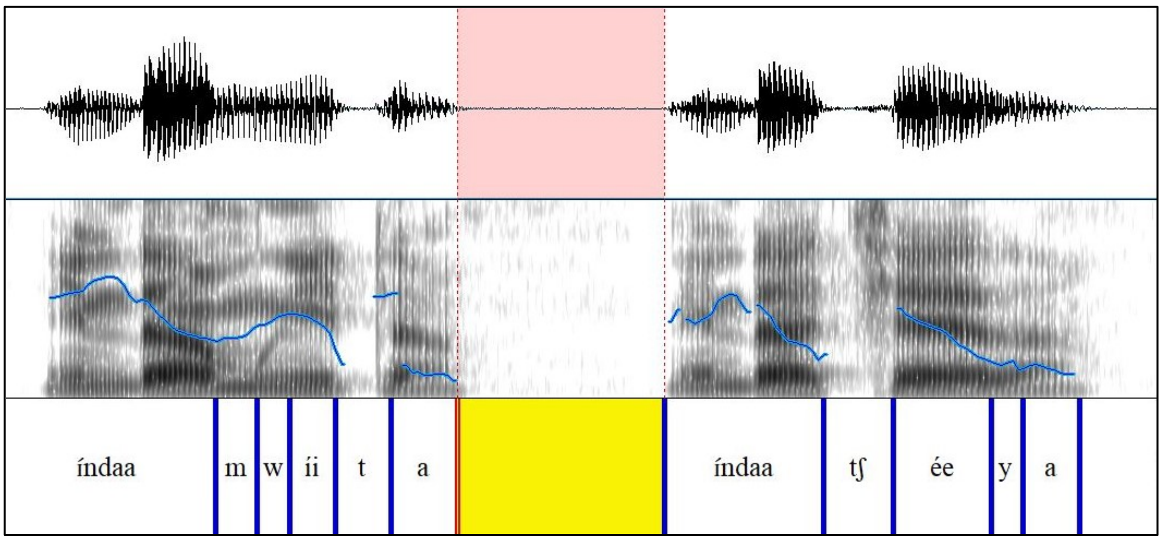
ɪjʊ́ʊmbɪ	'salt'
éng'éende	'jigger'
ɪkíráato	'shoe'
ʊmʊsáaza	'husband'
kodéeka	'to cook'
nɪ vakaráange	'they will fry'
yáakadéeka	'he has just cooked'
ɪráánji	'color'
ʊrʊbááng'a	'panga'
ekékóómbe	'cup'
ɪɲááɲa	'tomato'
akedééchi	'he cooked it'
yáádééka	'he cooked (remote)'
akeróónda	'he is dreaming'

It should be noted that penult F is rare in CVVCV nouns, compared to level H (in verbs, the contrast is governed by grammatical tone pattern). There are actually two types of fall, one being H-to-L fall, the other being H-to-$^!$H fall, seen in [egó$^!$ófyá] 'hat'. This (infrequent) H-to-H fall generally derives from CV́VCV́, and alternates with CV́V́$^!$CV́.

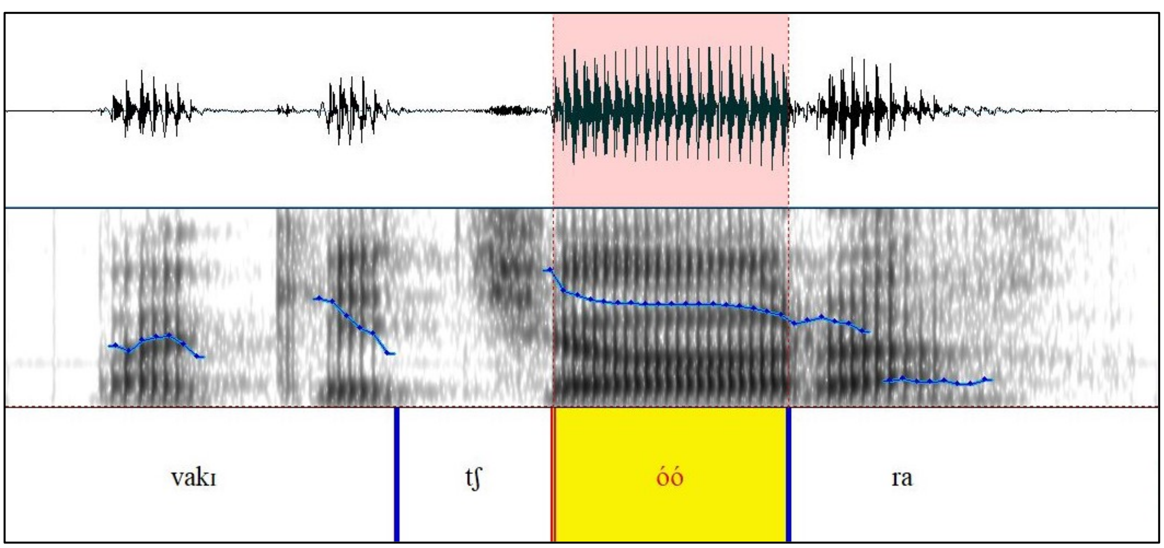
Expected falling tones may be realized as an apparent level tone, thus 'to cook' may be realized as *kodééka* – 7 of 28 tokens of this infinitive have level H. It is not entirely clear whether there is an optional phonological neutralization of H and F in this context, instead there may be variation in the realization of fall where some tokens more closely resemble level H rather than falling tone. The strongest indication that there is a categorial phonological process is that one speaker (EM) has on occasion offered pronunciation-pairs side-by-side, such as *árákíishɪ, árákíɪshɪ* 'he will grind himself', noting that both pronunciations are possible (thus, the speaker is aware of the difference – which might be taken to indicate phonological status if speakers are unaware of subphonemic phonetic differences).[12]

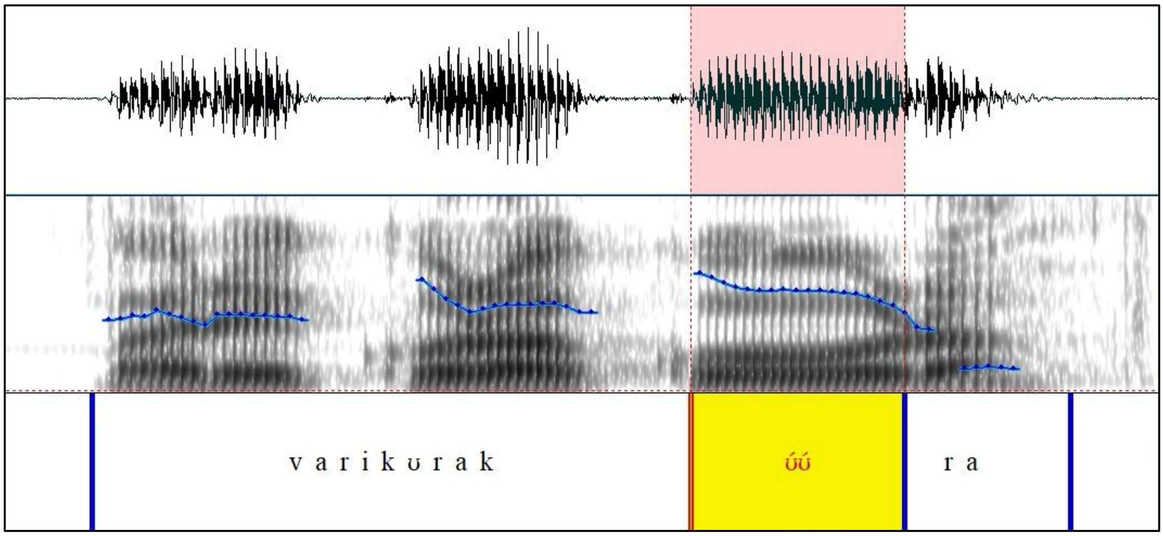
[12] This is not an endorsement of that theory, just a report that such a belief is held in linguistics.

In the following tokens, *índaamwíita* 'before I killed him' and *índaachéeya* 'before I swept it', pitch falls starting with the penultimate vowels, moreover, the extent of fall is comparable – from 112 Hz. to 90 in *índaamwíita*, from 114 Hz to 88 Hz in *índaachéeya*. The subjective impression of these tokens is different, in that *índaamwíita* sounds like it has a level tone and *índaachéeya* sounds like it has a falling tone. The most significant difference between these two tokens is the duration of that fall: in *índaamwíita* the fall takes 83 msc and in *índaachéeya* it takes 178 msc, if we only count the portion of the fall during the vowel, or 240 msc if we include the entire fall. In other words, the phonological fall in *índaamwíita* is physically realized so rapidly that it is hard to identify the first token as an example of falling tone, thus it may be perceived as level. This is a token-specific limit on detecting falling tone, and other instances of penult fall on [íi] have sufficient duration that the falling nature of the tone is evident.



Compare this to a couple of examples of phonologically unambiguous (and invariant) level H, *vakɪchóóra* 'they are still drawing' and *varikʊrakʊ́ʊ́ra* 'they will release us'.



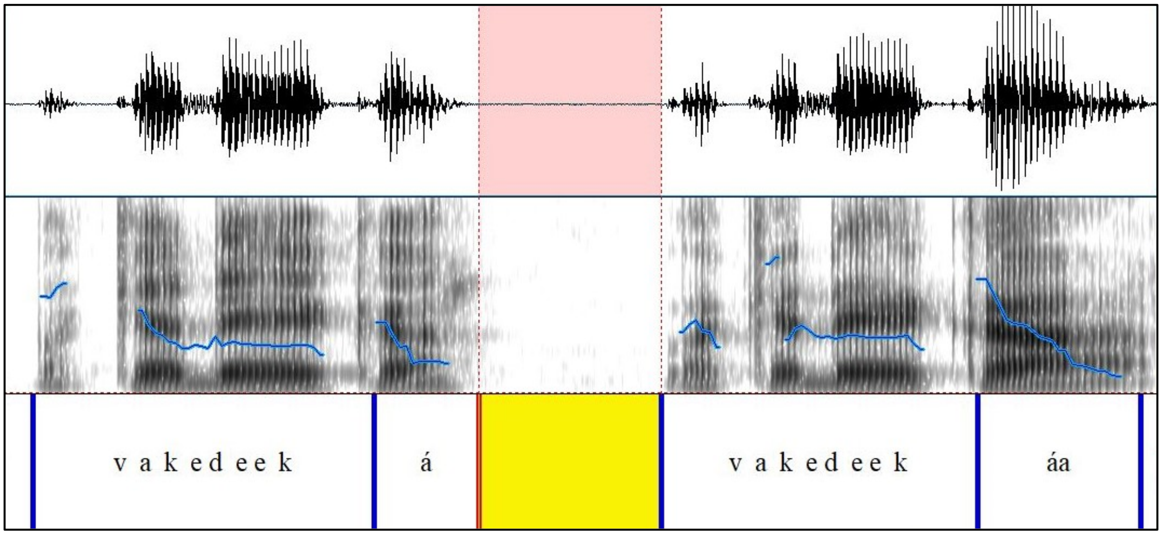


In these examples, there is (if we exclude the substantial raising of F_0 in the initial 15 msc. contributed by the consonant release – a feature lacking in the earlier example *índaachéeya*) much less fall within the syllable (avg. 15 Hz).

A systematic instrumental investigation of the realization of penult fall is necessary to verify this claim, but it appears from informal inspection of a number of tokens that there is substantial variation in the timing of a penultimate fall, with a continuum of phonetic realizations and not just two outputs. The practical phonological diagnostic for phonological fall vs. level H is simple: a form which seems to have level H when it ought to have fall will eventually be pronounced with perceptible fall, given multiple tokens, but a real, phonologically-level H will not. The fact that penult fall versus level H are potentially confusable at the phonetic level leads to a prediction of future sound change, and also past sound change. Briefly, the noun tone systems of Tiriki and Logoori are very similar, but lexical correspondence between level H versus fall on the penult is one area where the systems do not match as well.

In utterance-final syllables, which can be contrastively long in Logoori, there is no contrast between F and H. Level H tokens can occur as well as F tokens e.g. $_{\text{[em]}}$*yɪɪká*ꜝ*ráá* ‘he is cutting himself’, $_{\text{[em]}}$*vaaɲíí*ꜝ*mbíráa* ‘they are singing for me’.[13] However, there are phonetic reasons to treat final H on long versus short vowels differently: pitch on final [áa] is much higher than it is on final [á]. When a single final H is on a long vs. short vowel, pitch falls in both contexts, but the starting point of the fall in the case of a long vowel is higher than in the case of a short vowel. Compare *vakedeeká* and *vakedeekáa* below, two grammatical variants of ‘they are still cooking’.

[13] Phonetic fall is much more common compared to level H in final position.

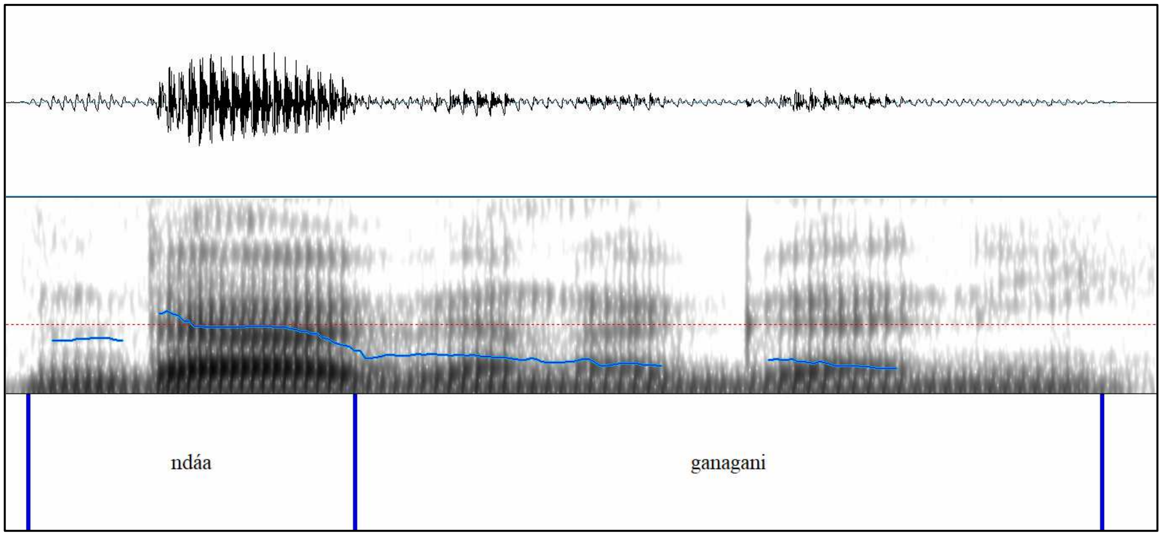


In position before the penultimate syllable, Fall is almost entirely non-existent. The most common context where it appears in the transcriptions is when a long vowel with H tone immediately precedes an independent H, for example *wéendéve* 'chairman', which is also realized *wé*ꜝ*éndéve* and *wéé*ꜝ*ndéve*. The realization of phonologically concatenated H tones is discussed below, but it is a general rule that when adjacent syllables have their own H tones, the second tone is realized in a lower register, notated with the downstep marker (*wéé*ꜝ*ndéve*). The timing of the register drop is somewhat fluid, and cv́v́ꜝcv́ may be realized as cv́ꜝv́cv́ or cv́vcv́. Such differences were noted in transcriptions since it was not certain that there was no contrast, but phonologically speaking, cv́ꜝv́cv́ or cv́vcv́ appear to be translatable into phonologically uniform (surface) cv́v́ꜝcv́. Underlyingly, though, this surface form may derive from cv́+vcv́ or from cv́v́+cv́.

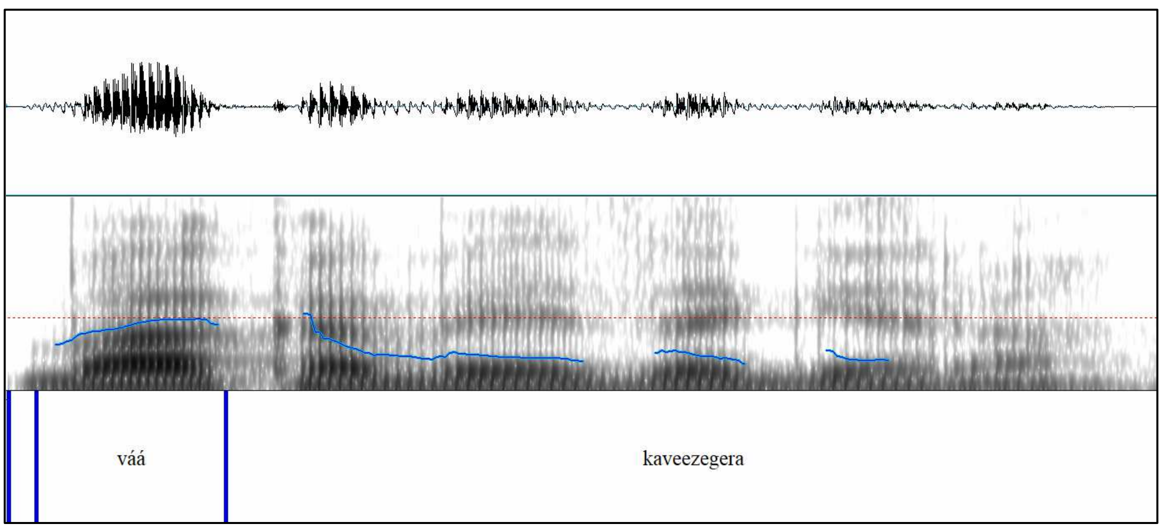
Another context where phonological F is widely encountered is in certain verb inflections where a grammaticalized property of 'prominence' is given to the subject prefix (related to focusing on the completion of the action). This prominence is realized as vowel lengthening in some contexts but as a H tone – phonetically as F – when the subject prefix stands before a vowel, as in the following examples.

ndáaganagani	'I have now thought'
yáakakuza	'he has now died'
váakaveezegera	'they have now belched'

We can see from the pitch track of *nd**áa**ganagani* that there is a drop within the first syllable (from 132Hz to 104Hz), but in the center of the syllable, pitch is flat. The auditory effect is that there is a slight fall.



Compare the above token with [v**áá**kaveezegera], where pitch does not fall, instead it rises by 10Hz.



The difference in tokens is either purely phonetic implementation, or the result of a late optional phonological rule where H alternates with Fall. The pattern will be treated as phonological, since there is a noticeable similarity between this pre-penult falling pitch and the clearly-contrastive fall found on phrasal penults. Such a Fall also arises at the phrasal level from the merger of a final H toned vowel plus an initial L toned vowel.

ɪmbw-íɪndara	'1 dog'
mb-éeɲeengero	'give me a brew pot'
naahíím-íɪngʊrʊvɪ	'he will hunt the pig'
rw-áakaraangizi	'when he fried up'
rw-áacheerizi	'when he greeted'
n-íɪngʊrʊvɪ	'with a pig'

The combination CV́+V may also be realized with level H, cf. *n-ííɲama* 'with meat', *n-éérefʊ* 'with 1000'.

The main tone-inventory issue, then, is what the status of falling tone is. It is almost, but not quite, a positional variant of (level) H on a long syllable. The difference does enter into grammatical and lexical contrasts, therefore it must be included in transcriptions. The difference is often neutralized, and it is often phonetically uncertain whether, in a given token whether Fall has optionally (phonologically) become level H. There is generally no doubt as to what the deeper phonology of the language has (there are level Hs and falling Hs), but the phonological output for specific tokens can be unclear.

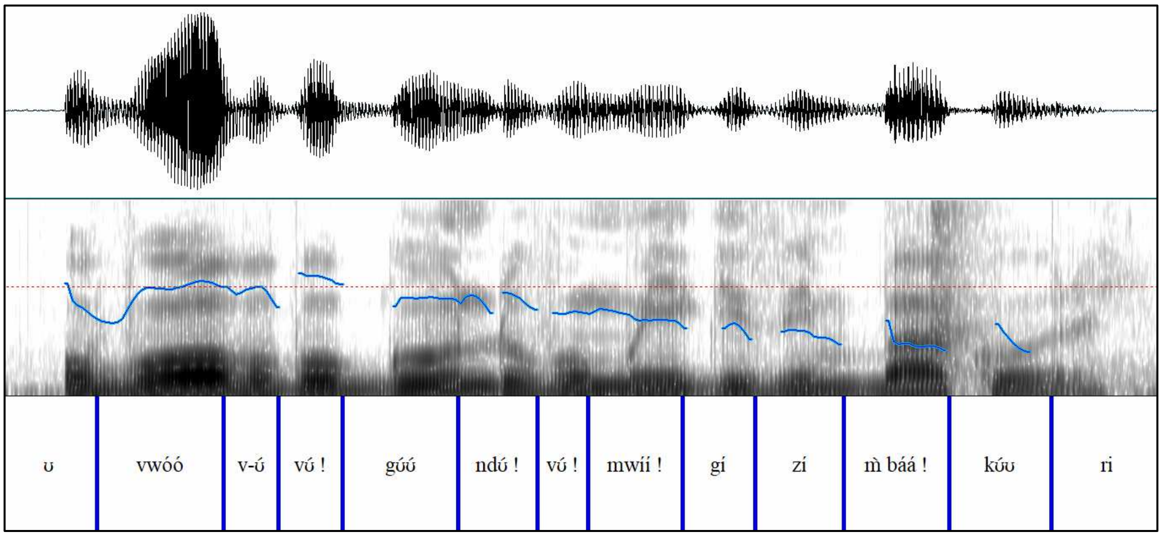
3.2.2. Intersyllabic phonetic effects

The phonetic realization of tone as a function of neighboring syllables is complex, to the point that it can be difficult to say which properties are phonological rather than phonetic (which implies decisions about transcription), and it is challenging to say how abstract phonological representations relate to phonetic realizations. In terms of understanding how tone translates into physical pitch, the primary challenge is sorting the intersecting factors into a system of phonetic principles. Ideally, a H tone would be realized as a relatively high pitch and L as a relatively low pitch, therefore if you know the approximate pitch range of H vs L in a language for a given speaker, you might be able to efficiently switch between tonal categories and physical traces. A level tone ideally has a consistent pitch during its realization but a falling tone has a consistently decreasing pitch. The situation in Logoori is much more complicated, because there are many contextual micro-adjustments of pitch – rules of phonetic implementation. The challenge of tonal phonetics in Logoori is identifying those adjustments, and determining exactly which ones are phonological versus phonetic.

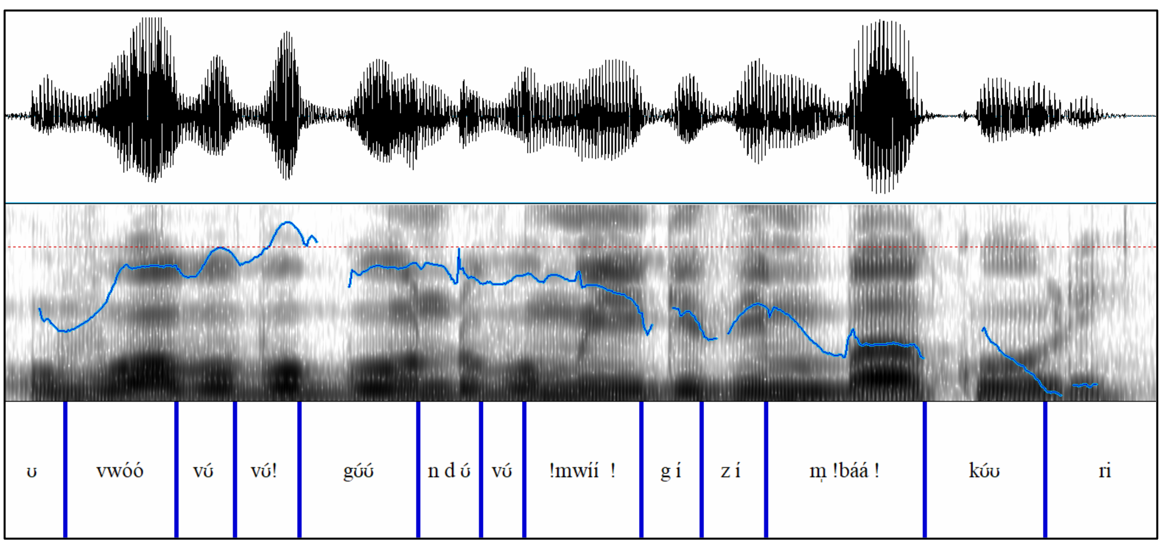
An example of the interpretive problem is the utterance [ʊvwoov-ʊvʊgʊʊndʊ v-ʊmwiigizi m'baakʊʊri] 'the teacher's rotten mushroom in the bowl' (tone omitted), composed of the toneless nouns *ʊvwoova*, the adjective *ʊvʊ́gʊʊndʊ́*,[14] the associative connector /vʊ-a/, the noun *ʊ+mwíígizi* where the prefix *ʊ-* bears an underlying H tone that deletes in certain phrasal contexts, and the locative-marked form /mʊ+báá[!]kʊ́ʊri/. Ultimately, we want to know the systematic phonological representation of this combination of morphemes. The challenge is understanding how to arrive at the correct surface phonological form, based on actual pronunciation. Simply combining the individual words,

[14] This is the underlying tone. On the surface, the final H spreads to the left giving [ʊvʊ́ꜝgʊ́ʊ́ndʊ́] – except that the question of leftward spreading and appearance of downstep is a hypothesis that needs to first be established, and is the point under discussion here.

with suitable segmental modifications (reduction of vowel sequences, reduction of /mʊ/, deletion of *w* before *ʊ*) would give us [ʊvwoov-ʊvʊ́gʊʊndʊ́ vʊ́mwíígizi m’bááꜝkʊ́ʊri]. Compare that transcription to the following two spectrograms, the first transcribed as [ʊvwóóv-ʊ́vʊ́ꜝgʊ́ʊ́ndʊ́ ꜝv-ʊ́ꜝmwííꜝgízí m̀bááꜝkʊ́ʊri].



The second token (gathered on an earlier day) was transcribed as [ʊvwóóv-ʊ́vʊ́ꜝgʊ́ʊ́ndʊ́ v-ʊ́ꜝmwííꜝgízí m̀bááꜝkʊ́ʊri].



There are differences between the two utterances, as well as an overall similarity. The initial syllable [ʊ] in both instances has relatively low pitch, followed by two syllables [vwóóvʊ́$_1$] with an intermediate pitch, then the highest pitch is found on [vʊ́$_2$] (the adjective agreement prefix of /ʊvʊ́ꜝgʊ́ʊ́ndʊ́/). In the second token, vʊ́$_2$ is much higher than vʊ$_1$.

Such differences are familiar in tone languages, and we would not say that this reflects a phonological difference in tones, such as H versus Extra-High (a difference that exists in Kamba). It may be a result of an optional rule boosting the pitch of certain Hs, or it may be an example of different ponits in the continuum of pitch realization.

Pitch drops after [vʊ́$_2$] and it remains relatively flat for [gʊ́ʊ́ndʊ́]. The tokens differ in that [ndʊ́] is noticeably higher than [vʊ́$_3$] ("of") in the first token, and the tokens are transcribed differently. A phonological treatment is that downstep is present after [ndʊ́] in the first token, and not in the second: but it is possible (indeed likely) that the lack of apparent downstep is an example of the lower end of pitch-drop that characterizes downstep in this language. Pitch then falls over the syllable [mwíí] – to a greater extent in the second token. In light of other pitch facts discussed in this section, it is worth noting that the pitch of preceding [vʊ́] does not rise significantly in the second token.

In general, the pitch excursions in the second token are larger than in the first. Otherwise, the overall pitch pattern in the tokens is essentially the same, except the lack of downstep in ndʊ́_vʊ́ in the second token, a divergence that we will for the moment dismiss as a mystery. What is primarily of interest is figuring out how to relate the underlying form /ʊvwoov-ʊvʊ́gʊʊndʊ́ vʊ́mwíígizi m'báá'kʊ́ʊri/ to the surface transcription [ʊvwóóv-ʊ́vʊ́'gʊ́ʊ́ndʊ́ (')v-ʊ́'mwíí'gízí m̀báá'kʊ́ʊri]. Coming to terms with Logoori tonal phonetics requires not just knowing what the underlying contrasts are, it also requires understanding the adjustments that are potentially but not necessarily part of the phonological form.

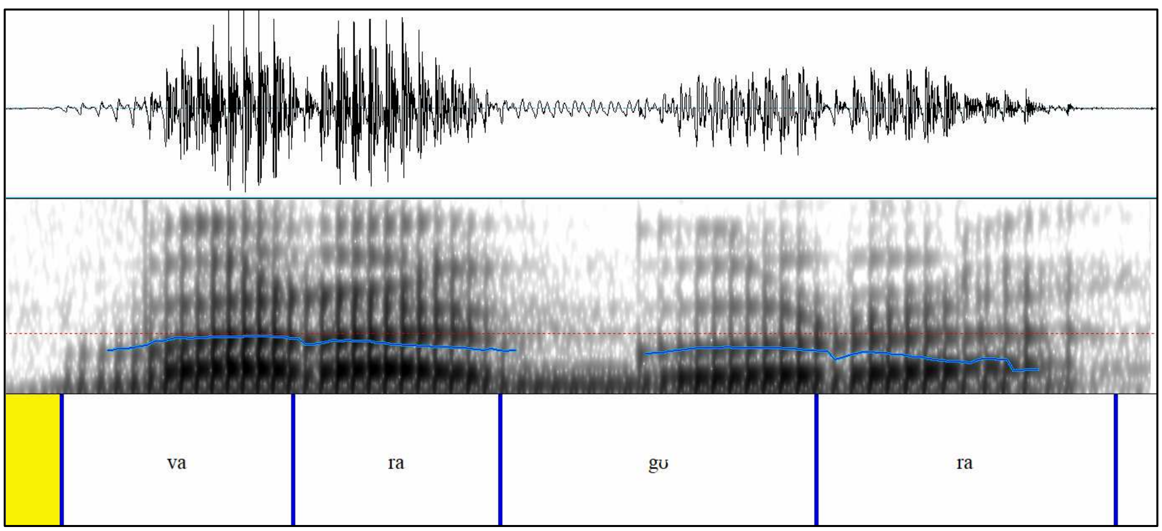
There are three general trends at work in relating the abstract tonal form to actual pronunciations, as embodied in the surface transcriptions, which are perhaps phonological or perhaps phonetic. A first general property of the language is that H tone spreads to the left, explaining why the underlyingly toneless vowels at the left edge of the utterance have higher pitch – this is arguably but not self-evidently the result of a phonological spreading rule, Leftward Spreading. Second, whenever two H tones come together, pitch register is always lowered – they are separated by a downstep (though in a few tokens, the lowering is slight). These two facts are related, in that the automatic lowering that constitutes downstep does not apply *within* the span of a single H which undergoes (presumed) Leftward Spreading, but otherwise is always present between any two adjacent H toned syllables. Segmentally-oriented transcription methods have the defect that the distinction between a single H with a multi-syllabic domain cannot be easily written distinctly from a sequence of Hs over a similar domain. The downstep marker is a surrogate for marking the phonological difference between single H on two syllables vs. separate Hs on adjacent syllables.

A third phonetic process is seen in both tokens, that the last H tone in a sequence of Hs has raised pitch, but again the status of this process depends on how these patterns are analyzed. The pattern might reflect a local process of "pre-L boost", or it could reflect a tendency that the physical peak of a H (associated to multiple syllables) is at the right of the H's domain. The discussion in this subsection starts with the possibility that these are all phonetic processes and therefore the phonological form of the utterance is [ʊvwoov-ʊvʊ́gʊʊndʊ́ vʊ́mwíígizi m'báákʊ́ʊri]. We will ultimately (but not overwhelmingly) conclude that Leftward Spreading is phonological, which then simplifies, indeed trivializes, the account of downstep as well as the raising of pitch before a downstep (or L).

Leftward Spread

An underlyingly H will typically spread leftwards to preceding vowels, which is phonologically treated and notated in all previous tone-marked works. For example, *kwaakʊgʊra* 'we bought' has no H tone and *ekekóómbe* 'cup' has penultimate H. In the phrase *kwáákʊ́gʊ́r-ékékóómbe* 'we bought a cup', the vowels preceding the noun (may) have a higher pitch. In the citation form of the noun, there is generally raising at least of the syllable *ke*, thus *ekékóómbe*. The essential phonological question is whether there is a categorial phonological rule spreading H to the left – a phonological form [kwáákʊ́gʊ́r-ékékóómbe] implying a tone spreading rule – or is the phonological form [kwaakʊgʊr-ekekóómbe], and is the appearance of higher pitch due to phonetic implementation?

In order to answer the question, we must first look at the difference between an all-L utterance and an utterance with a penultimate H plus a number of preceding toneless syllables. The first kind of utterance is relevant in setting an expectation for what L looks like, and how H might look different from L. Consider an example of the utterance [varagʊra] 'they will buy'.[15]



In an utterance with no H tones, pitch gradually declines throughout the utterance. In [varagʊra], pitch declines from 113Hz to 102Hz in the span that excludes the final syllable (final syllables are expected to have special pitch properties, and pitch is often not computable in a prepausal syllable).

In [varagʊr-eng'oombe] 'they will buy a cow', we find a similar decline of pitch from 114Hz to 93Hz over the non-final syllables.

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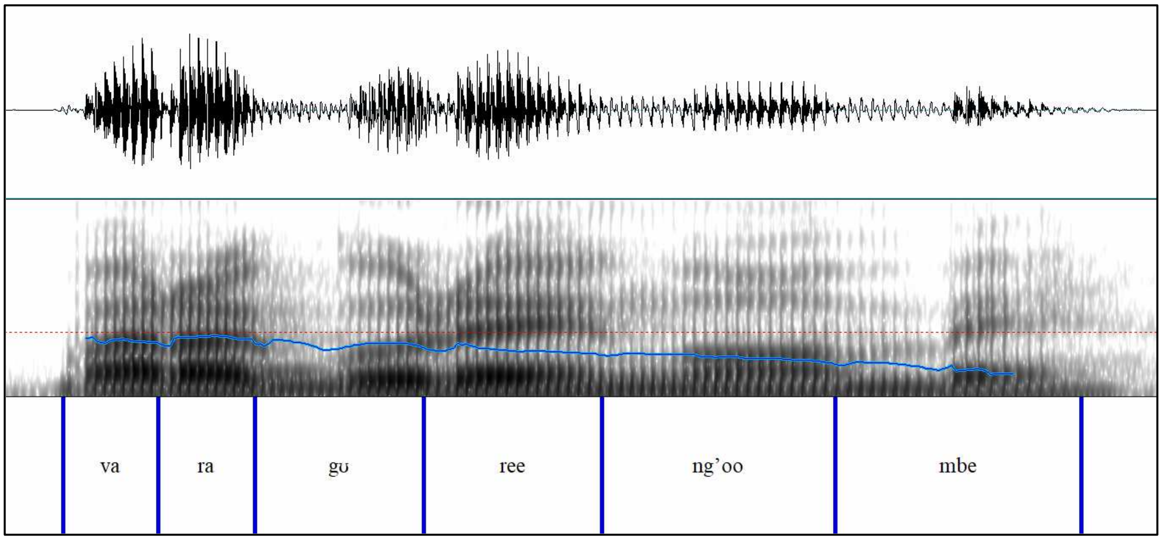
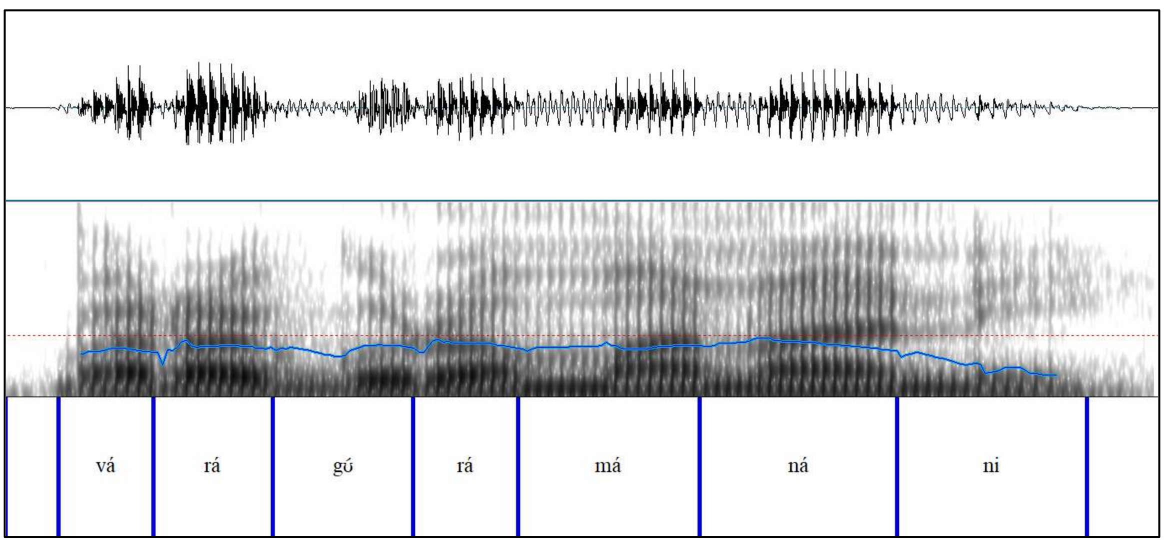
15 This set of examples is drawn from a single session where the speaker (EM) maintained the same general pitch range and was focused on producing "canonical pitch patterns".

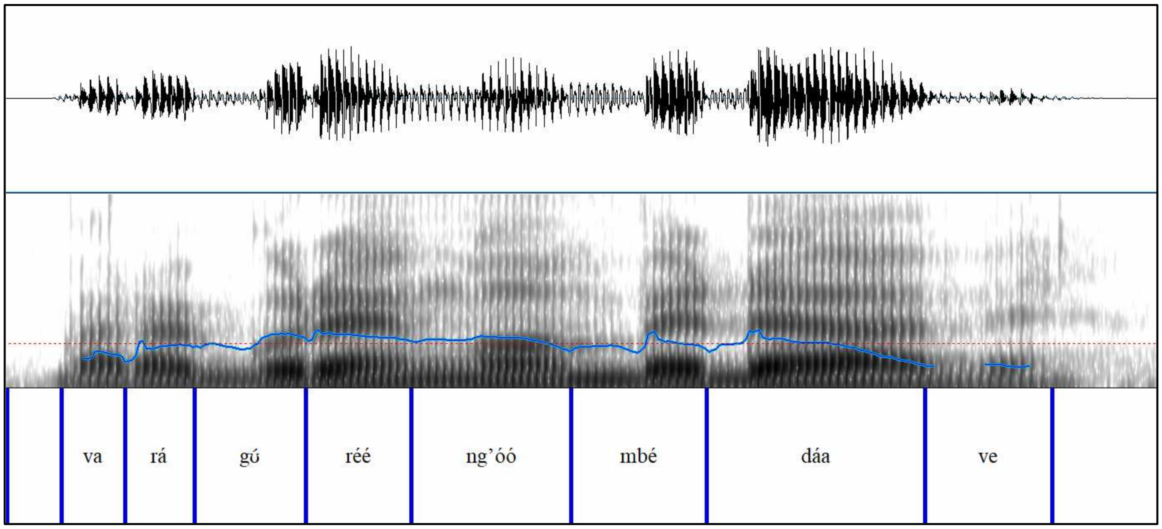


Now compare the preceding two examples to [várágʊ́rá mánáni] ‘they will buy monsters’, with the noun /amanáni/ which has penultimate H. Rather than declining, initial pitch is relatively flat, and actually rises a bit at the penult from 105Hz to 108Hz.



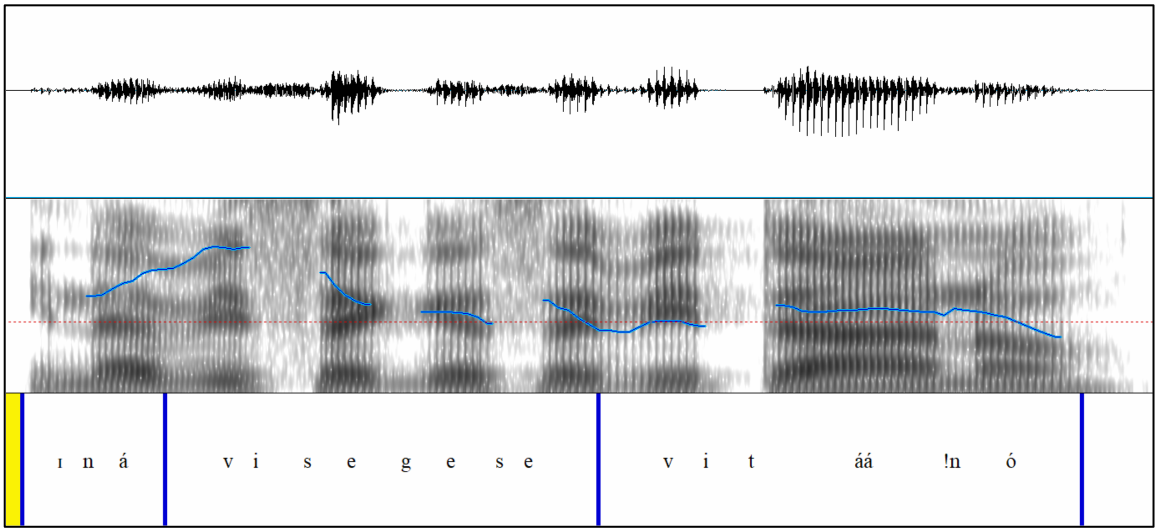
While we can easily characterize the difference between L* versus H*L from L*HL as a degree of anticipatory raising in L* (a raising which enables continuous pitch declination) versus a relatively flat pitch pattern in H*L (presuming a rule spreading H tone), the perceptual challenge is that the initial “H” tone of [várágʊ́rá mánáni] is physically lower than the initial “L” tone of [varagʊr-eng’oombe]. The all-L utterance confusingly starts at a higher pitch that the H*-initial utterance.

A related puzzle is the difference between [várágʊ́rá mánáni] and [varágʊ́r-ééng'óómbé dáave] 'they will not buy a cow', from /varagʊra eng'oombe dáave/. In the former example, the pitch of the first syllable of the utterance is close to that of the second syllable (102Hz vs. 105Hz), whereas in [varágʊ́r-ééng'óómbé dáave], there is a greater separation of pitch in the first two syllables (90Hz vs. 96Hz).



This 3Hz difference in the first syllable is audible and might be categorial (maybe interpolation does not start with the initial syllable in [varágʊ́r-ééng'óómbé dáave] but does include the initial syllable in [várágʊ́rá mánáni]). Or, the difference may reflect a difference in specific realization value that arises at random from token to token. A phonologized difference [varágʊ́r-ééng'óómbé dáave] vs. [várágʊ́rá mánáni] does reflect a recurring distinction in realizations, in my experience, but that may simply reflect a categorization strategy of this hearer. This is a matter that requires extensive experimental testing.

The main reason for treating Leftward Spreading as phonological is that it is impossible to say when H is anticipated, based solely on phonetic criteria. For example, there is systematically no such spreading in the syllables before the penult in *ɪmávisegese vitáá*ꜜ*nó* 'towards (the) 5 roof peaks', which exemplifies the *ɪma-* construction. The citation noun is *ɪviségese*, which becomes *ɪmávisegese* by prefixation of the directional prefix. A characteristic of this construction is that the noun following *ɪma-* is L toned, meaning it loses lexical H tones, and is not assigned H by any phonological process. Observe that while final H spreads to the penult in *vitáá*ꜜ*nó* (splitting of the final H into HꜜH being a common variant of prepausal H), it does not spread further left. We see that pitch is higher over the last two syllables and lower in the intervening span (allowing for general rightward shift of the pitch peak by up to a syllable, and the one-syllable transition to the non-H target pitch).



A phonological account of this difference in pitch realization which avoids phonological tone-spreading is to posit a surface contrast between marked L and unmarked Ø, thus *ɪnávisegese vitááꜝnó*. Grave accent effectively indicates where would-be Leftward Spreading is blocked. There is no phonetic difference between marked L and a tonally unmarked vowel – the distinction would be based strictly on this particular phonological behavior.[16] While this specified-L treatment may avoid a rule of Leftward Spreading, it necessitates a rule of L insertion. At this level of analysis – questions of transcription – this is not a valid basis for adopting a more opaque transcription, even if it turns out to be a correct phonological analysis of the data more narrowly transcribed.

Below we see an example of contrasting tone patterns, where H spreads from the enclitic *kʊ́* into the preceding verb. There is a difference between *ndááꜝmóóɲá kʊ́ ꜝdáave* ‘I’ve never gossiped’ and *ndáákooɲá kʊ́ ꜝdáave* ‘I’ve never helped’, brought about because /mooɲa/ is a toneless (L) verb stem but /kóóɲa/ has lexical H, which, while phonologically deleted still has a blocking effect on leftward spread of H. In *ndáákooɲá*, pitch rises after the initial fall into the L syllable, whereas in *ndááꜝmóóɲá* there is a continuous fall from the higher-register H to the lower-register H.

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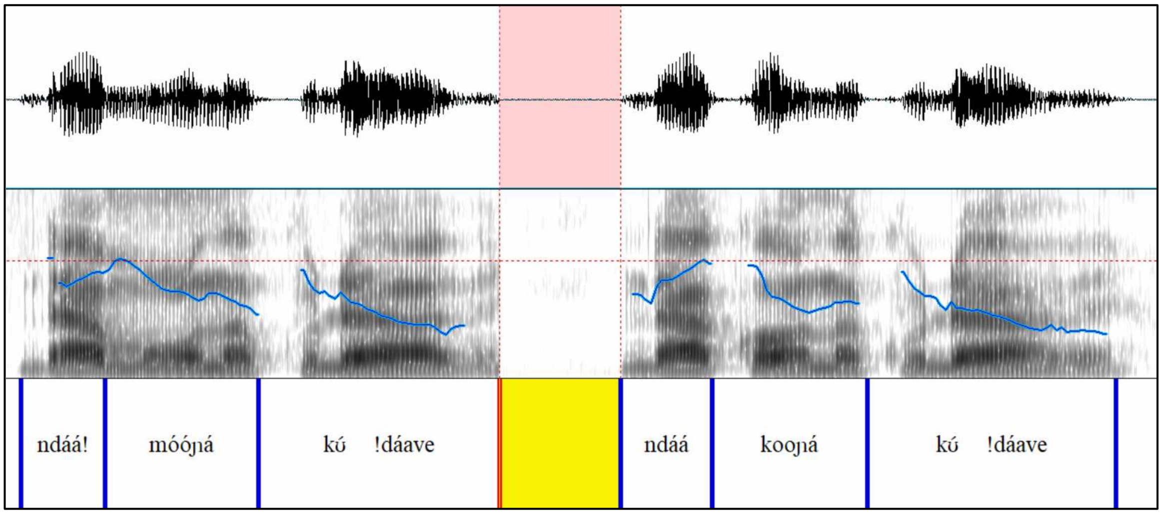
[16] Note though that grave (and acute) accent *are* used, somewhat unsystmatically, in this work to mark syllabicity of nasals, rather than introducing the syllabicity diacritic in [m̩, n̩]. The orthographic practices promulgated by Lung’afa Igunza further eliminate the need for that use of tone marks, since syllabic [m̩,n̩] always derive from deletion of a vowel after the nasal, and consonants brought together by vowel deletion can be notated with an apostrophe, thus [ʊm’mósi] rather than [ʊm̀mósi]. I have since adopted this writing convention, but the majority of my data were previously notated with this distinctive use of grave accent as a substitute for IPA [m̩].



Again, these examples could also be transcribed as *ndáámooɲa kʊ́ dáave* versus *ndáákòòɲa kʊ́ dáave*. In eliminating Leftward Spreading from transcriptions and substituting grave accent to indicate the leftward limit of a phonetic analog of Leftward Spreading, we could also eliminate downstep markers in surface transcriptions, instead understanding that any two H tone marks are always separated phonetically by downstep (otherwise, two adjacent H tone marks always reflect application of Leftward Spreading).

A final pair of sentences can be given to demonstrate the phonological nature of Leftward Spreading. In the hodiernal past, we find that lexically H verb roots have no H in the citation form, and L verbs have H on the first two stem vowels. When followed by a modifier with a H – *gáráha* in the following examples – H spreads into the verb in the case of lexically L verbs, but not at all in a H verb; and note that the limit of spreading is tense-specific.

kʊvʊrʊganya	'to stir'
kʊgírʊng'ana	'to turn around'
kʊ́vʊ́rʊ́gányá gáráha	'to stir slowly'
kʊgíꜝrʊ́ng'áná gáráha	'to turn around slowly'
mbʊ́rʊ́ganyi	'I stirred'
ngɪrʊng'ani	'I turned around'
mbʊrʊ́gꜝányí gáráha	'I stirred slowly'
ngɪrʊng'ani gáráha	'I turned around slowly'

We can account for failure of LS by positing a distinction /kʊvʊrʊganya, kʊgírʊng'ana, mbʊ́rʊ́ganyi, ngɪrʊng'anì/, allowing us to deny that Leftward Spreading is a phonological rule.

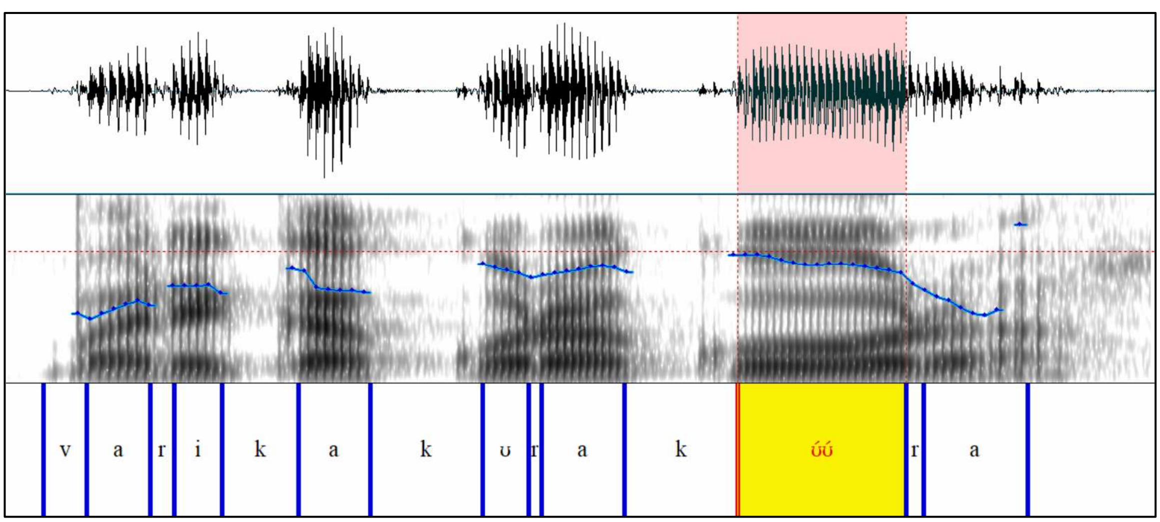
This approach to tone marking requires further adjustment, because there is a difference between long vowels with level H, Fall, and H-to-downstep Fall, e.g. *musáára* 'tree', *mʊsáaza* 'man' and *egóꜝófyá* 'hat'. The level H vs Fall distinction could be indicated in exactly this way, with the understanding that V́V́ means "long level H", but if downstep markers are eliminated, how do we indicate *egóꜝófyá*? Since CV́ꜝV́CV́ does not contrast underlyingly with CV́VCV́, indeed surface CV́ꜝV́CV́ often demonstrably derives from CV́VCV́, CV́VCV́ would be a possible alternative transcription. On the other hand, CV́ꜝV́CV́ and CV́V́ꜝCV́ are not freely interchangeable transcriptions. Some forms such as *rwá varikʊyááꜝnzá* 'when they will love us' always have the downstep between the final two syllables, but *egóꜝófyá* usually has the downstep within the penultimate syllable. This difference is rule-governed, as discussed in the chapter on verbal tone melodies, but that distinction is embedded fairly deeply in the grammar and is not easily predictable at the surface level. Or, one could write 'tree' as [mʊsaára], with the understanding that there are no rising tones and apparent rising tones are really level H.

The transcriptional complexity that results from an attempt to remove the effects of Leftward Spreading and downstep from transcription indicates that such a move is informationally dysfunctional, therefore tone transcriptions will not be modified to erase these two properties of pronunciation, in the hope of reducing Leftward Spreading to a non-phonological process. The effects which they represent are not necessarily phonological – a phonetic account of Leftward Spread and downstep is still on the table if we assume marked L tone – but as far as theory-neutral data-representation is concerned, a more-phonetic transcription will be used here.

Pitch interpolation

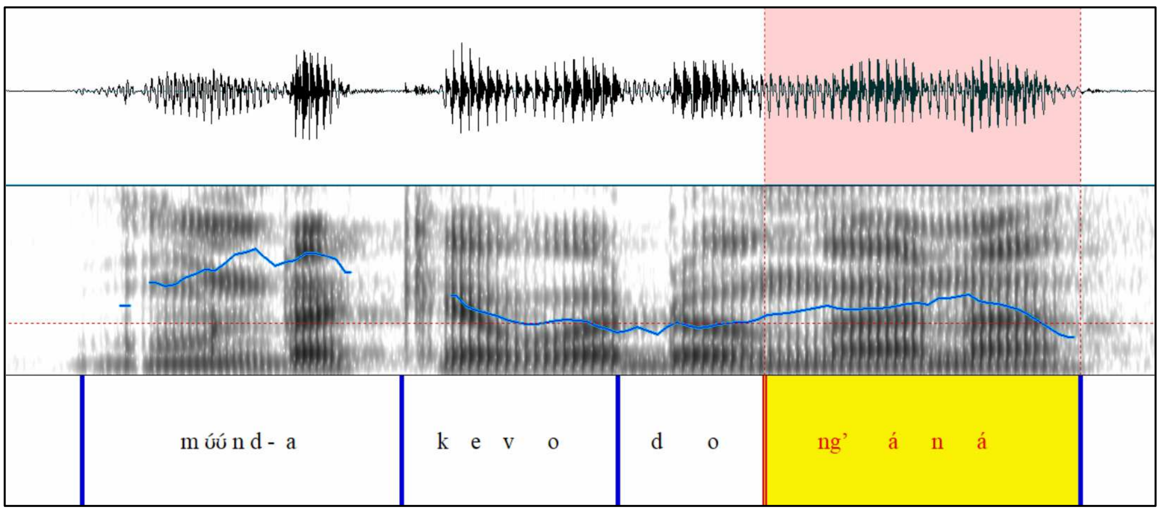
A basic challenge in tonal parsing for Logoori is deciding what phonological tone pattern to attribute to a sequence of toneless syllables. How does one distinguish ØØ…ØØ# from ØØ…HØ# or ØØ…ØH#? You might expect that the procedure is simply to detect whether and where pitch goes up, but there are long-distance pitch interpolation processes which make tone-identification difficult.

One complicating factor is that H does not always spread to the left (even setting aside absolute blocking as in *ɪmavítabù víra*). One can find a gradual interpolative rise in pitch in the pre-penultimate syllables of [varikakʊrakʊ́ʊ́ra] 'they would release you'.



Each syllable up to the penult has a slightly higher pitch than its predecessor, a pattern often taken as evidence that such syllables have no phonological tone, and instead receive their F0 value by an phonetic interpolation. Various phonological interpretations of this particular token are possible – [varikakʊrakʊ́ʊ́ra], [varikakʊrákʊ́ʊ́ra], [varikakʊ́rákʊ́ʊ́ra] or [varikákʊ́rákʊ́ʊ́ra]. Reasonable principles of phonology and phonetic interpretation may be posited where H optionally spreads phonologically to the left up to some point, but the upward pitch trend still takes time within the two or three syllables that constitute the domain of the phonological H. One can hope that a focused phonetic investigation will eventually identify the exact range of variation in pitch realization, but for the time being we will simply say that sometimes there is an apparent categorial raising of pitch as in the previous example [várágʊ́rá mánáni], versus the gradual rise in [varikakʊrakʊ́ʊ́ra].

In the following example [mʊ́ʊ́nd-akevodóng'áná] 'the person who is still going around', there is a final phonological H, which seems to spread to the preceding two syllables (judging from the pitch pattern), stopping at [vo].[17]

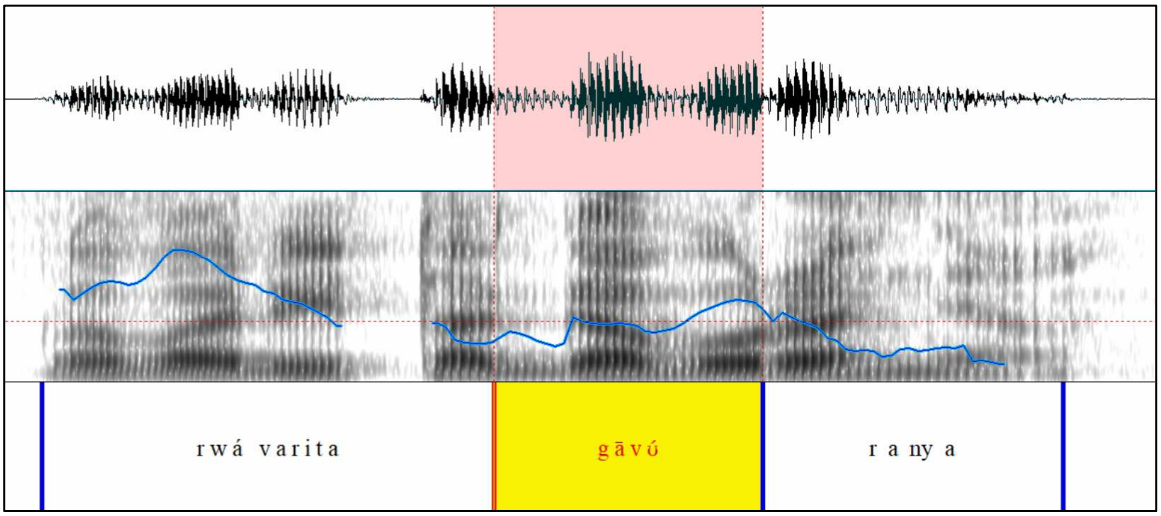


We find more pitch raising in penultimate [ng'a], and some pitch raising in antepenultimate [do] – but no raising in [vo]. We could then notate this limit on leftward pitch interpolation with a grave accent, thus [mʊ́ʊ́nd-akevòdong'aná]. The underlying verb root is /vódong'an-/, and this verb form is inflected with the M2 tone pattern where a H appears at the end of lexically H verbs, with the preceding lexical tone being deleted. Judging from the evidence of the limit on Leftward Spread, we might instead say that H converts to L, which constrains the possibility of pitch raising on /vó/.

Apart from understanding the disposition of the final 3 syllables, other phonetic processes are at work in the first four syllables. The second syllable *nda* has a relatively high pitch owing to the preceding H syllable. H pitch on [mʊ́ʊ́] carries over to the following toneless syllable. Subsequently, there is an even lower pitch on [ke] followed by the lowest pitch on [vo]. This example introduces post-H pitch roll-off.

[17] It is a general pattern that a short leftmost syllable in the domain where LS applies has the lowest pitch, a well-known start-up effect in tone languages.

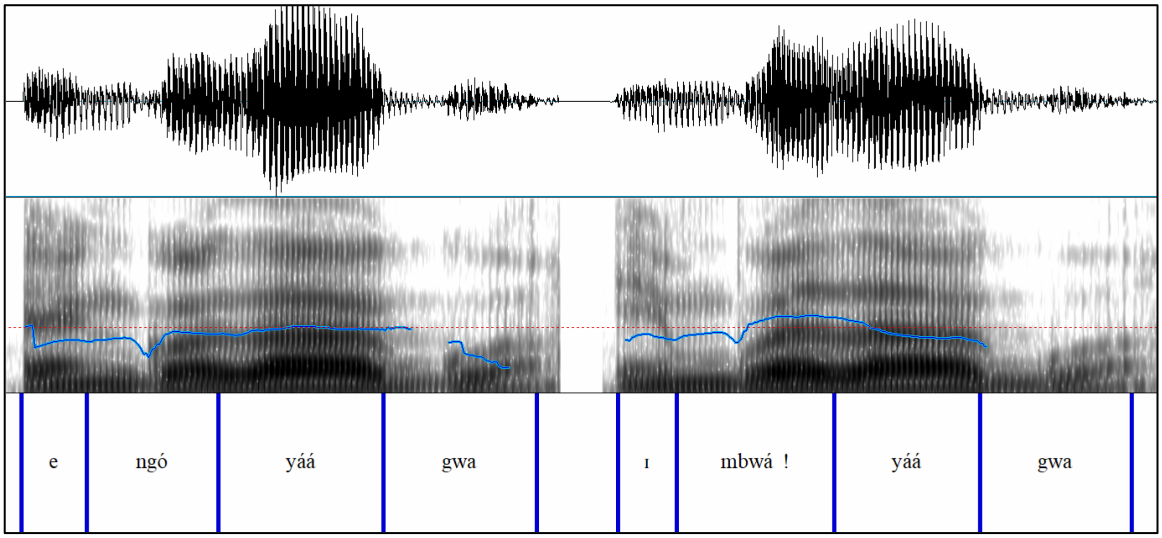
In [rwá varitagávʊ́ranya] 'when they won't divide up', the second H syllable [vʊ́] is more noticeably higher in pitch compared to the preceding syllable [gá]. This could be because there is one H over two syllables and pitch only reaches its peak at end of the domain of association. Or, it could be because of a process of pre-L boost – H becomes higher before L. Whatever the cause of this raised pitch, it is rather noticeable, and is phonetically transcribed as a mid tone followed by H tone in the spectrogram.



The notation [gā] does not mean that the language has phonological M, it just records a perceptible low-level phonetic property of this particular token, that the pitch of that syllable is intermediate between preceding L-toned [ta] and following H-toned [vʊ́].

Downstep

Logoori also has the contrastive register-lowering operation of downstep, where downstep always and only occurs between two phonologically autonomous H tones. For example, the noun *ɪmbwá* 'dog' has a final H, and the verb *yáágwa* 'it fell' has initial H. When these two words are combined, a downstep appears – *ɪmbwá ꜜyáágwa* 'the dog fell'. We can contrast downstepped H with the HH sequence of *engó yáágwa* 'the leopard fell' which comes from /engo yáágwa/ via Leftward Spreading.

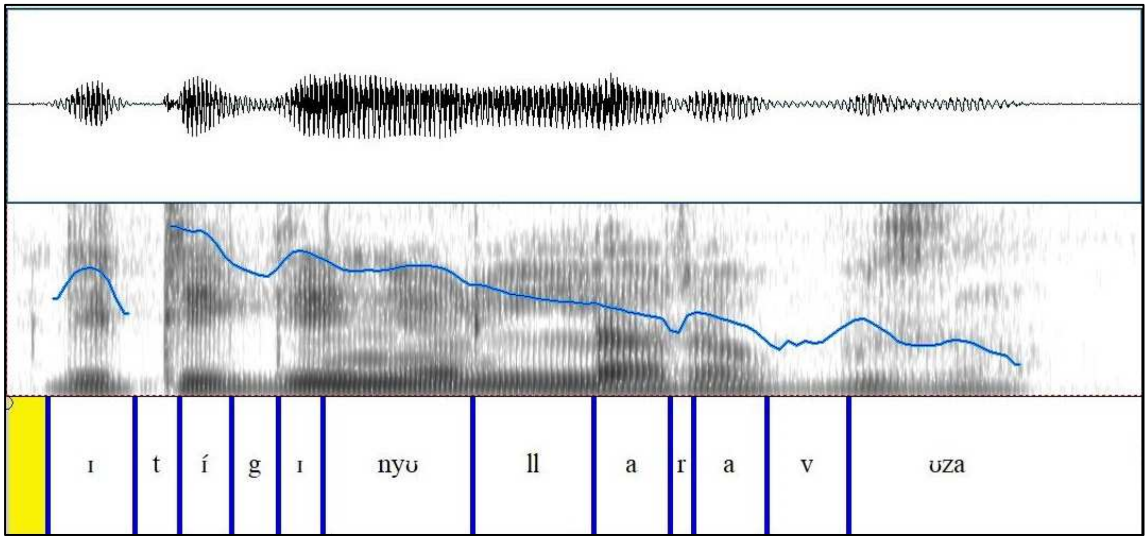


In [ɪmbwá ꜝyáágwa], the syllable [mbwá] has a peak pitch of 130Hz and [yáá] has a terminal pitch of 110Hz – a drop of 20 Hz. This drop is accomplished partially by lowering the pitch of the following syllable, but also partially by raising the pitch of the first H in the sequence of Hs. Compare also the highest pitch in [engó yáagwa] which is 119Hz, 11 Hz lower than that of the highest pitch in [ɪmbwá ꜝyáágwa].

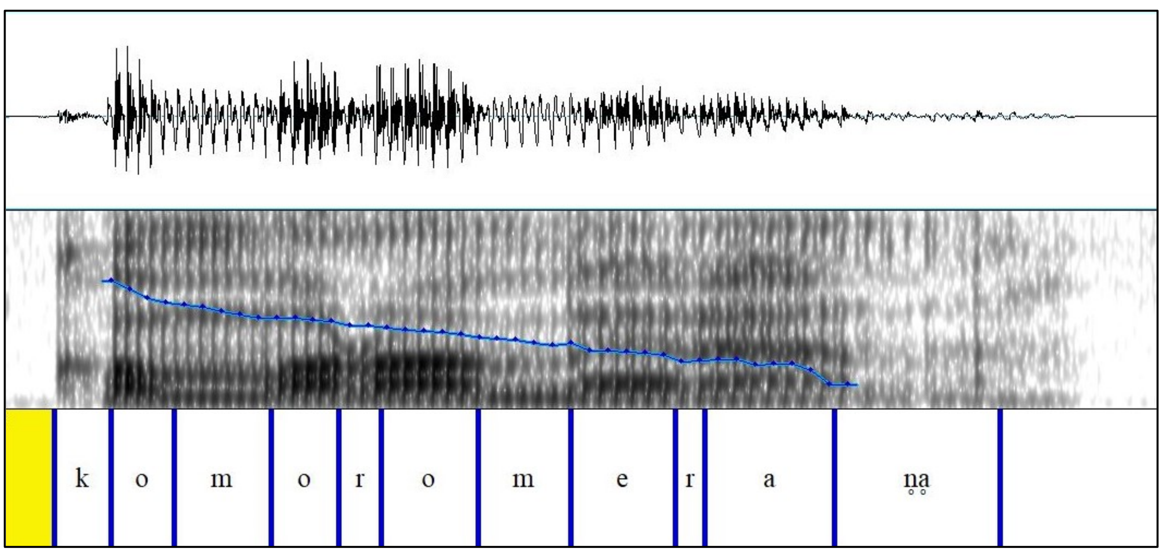
Given a phrasal combination of a word with H followed by a word with H, and underlyingly L toned syllables between, when H tone spreads leftwards, the two H tones abut at the point of the first syllable, and there is downstep, thus *vááꜝná váráhɪ* 'good children' from /váána varáhɪ/. Downsteps can arise within the word when there are two H tones, for example *míꜝdógá* 'cars', from /mí-dogá/. Word-internal downstep typically involves non-adjacent vowels, and when Hs might be directly concatenated within the word, one of the Hs is generally deleted. Those processes are taken up in the chapters on tonal phonology. As suggested in the previous section, downstep is fully predictable.

Toneless Downtrend

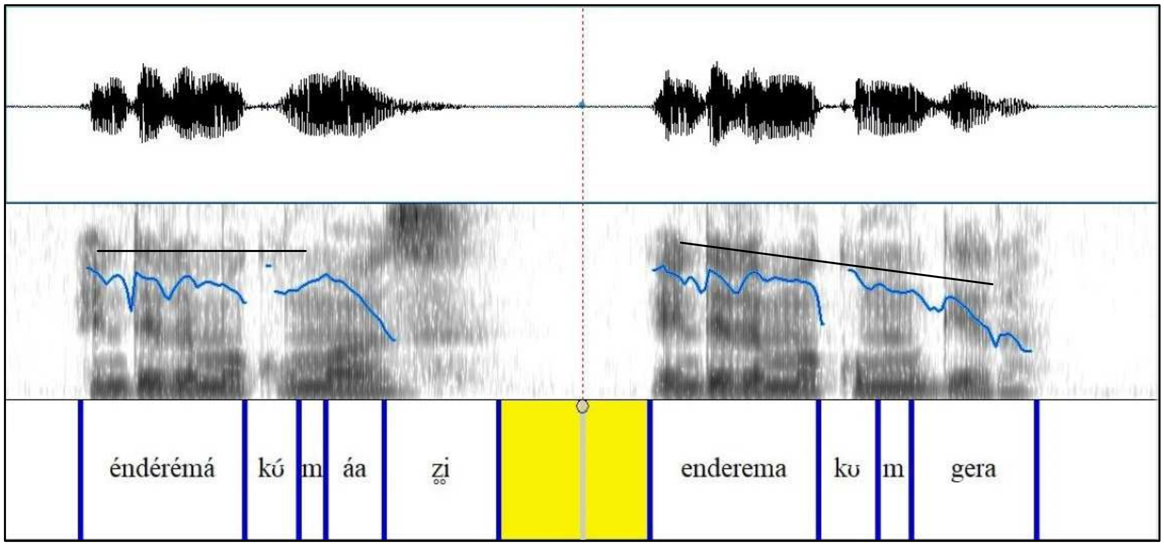
Another noticeable phonetic tendency mentioned above is that pitch gradually descends after H, in a sequence HL*. Phonologically, only the syllable [tí] in [ɪttígɪnyʊ llara vʊza] 'just 1 heel' has H tone, but the pitch trace shows that pitch slopes continuously down from the peak on [tí].



This downward sloping trend does not require a preceding H, as can be seen in the example [komoromerana] ‘to speak for e.o.’.



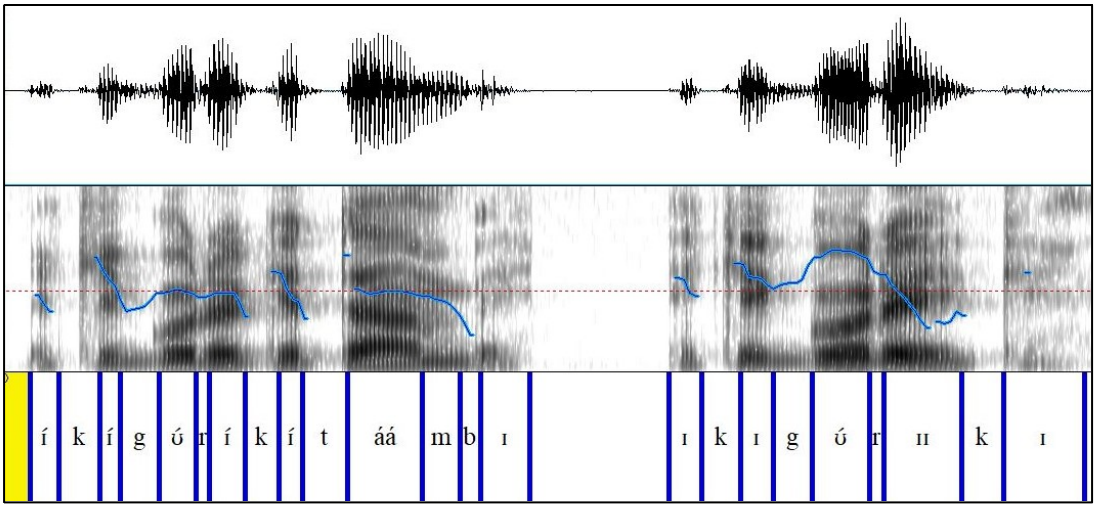
The general phonetic pattern is that in any sequence of final Ls, pitch falls continuously, meaning that the initial pitch of the first L may be raised compared to later Ls, in order to accommodate this descending pitch profile. This can lead to extreme raising and near-neutralization between L* and HL*. In [enderema kʊm̩gera] ‘enderema at the river’, the initial pitch of *enderema* is comparable to that found in [éndérémá kʊ́máazi] ‘enderema at the water’ (these utterances were collected together, in order to control pitch range). The difference lies not in the absolute pitch level of *enderema* in these two contexts, but rather in the fact that in [éndérémá kʊ́máazi], the pitch level is flatter and falls abruptly with the falling toned syllable [máa], whereas in [enderema kʊmgera] there is a subtle decrease in pitch across all syllables.



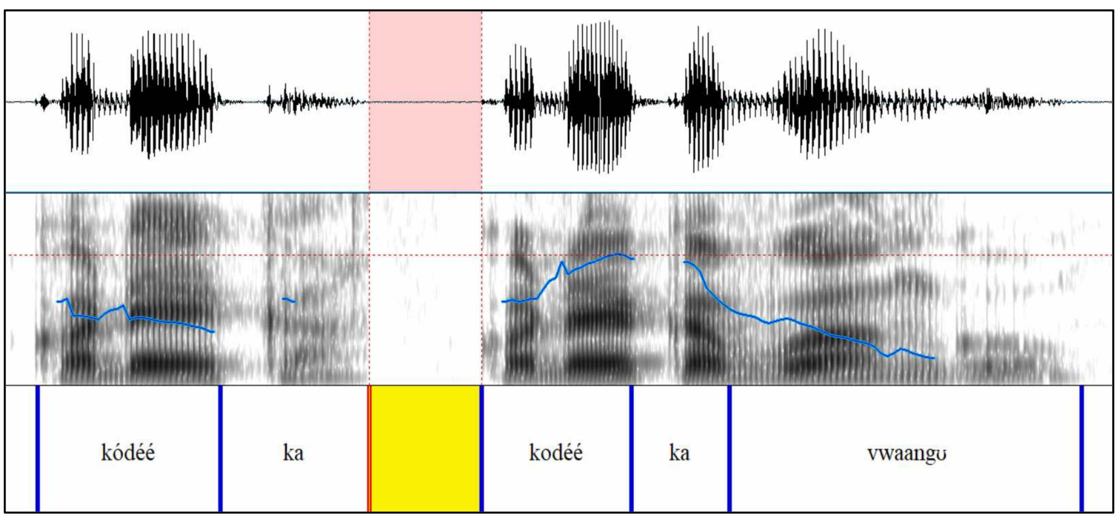
Comparing [éndérémá kʊ́máazi] above, versus earlier [varikakʊrakʊ́ʊ́ra] in the discussion of Leftward Spread, and as implied by the different transcriptions, we find gradually increasing pitch in [varikakʊrakʊ́ʊ́ra] and abruptly increased pitch in the former. Either one or both of these phonetic processes is optional, or Leftward Spreading is phonological and is not applied in the case of [varikakʊrakʊ́ʊ́ra]. Since there is no clear phonetic rationale behind blockage of Leftward Spread in this case, this is an analytic puzzle, and is one of the facts that underlies the decision to not transcriptionally suppress the effect of Leftward Spreading.

H Boost and Pre-Penult position

A related and often-encountered feature of Logoori tone is raising of the pitch of a pre-penultimate H. This can be seen in comparing *íkígʊ́r-íkítáámbɪ* 'tall hill' versus *ɪkɪgʊ́r-ɪɪkɪ* 'this hill'. The noun *ɪkɪgʊrʊ* is L toned, and in the first example, H spreads leftward from the adjective *kɪtáámbɪ*. In the second phrase, H is phonologically assigned to the penult of *ɪkɪgʊrʊ* because of the following demonstrative. The examples differ in where the (last) H appears – on the penult versus the antepenult. In the former case with the last H on the penult, F_0 remains at around the same level up to the penult (average 106 Hz), which level is indicated by the dashed line. In the latter context, the first two syllables are at roughly the same pitch compared to *íkígʊ́r-íkítáámbɪ* then on the syllable *gʊ́*, pitch rises substantially (average 130 Hz).

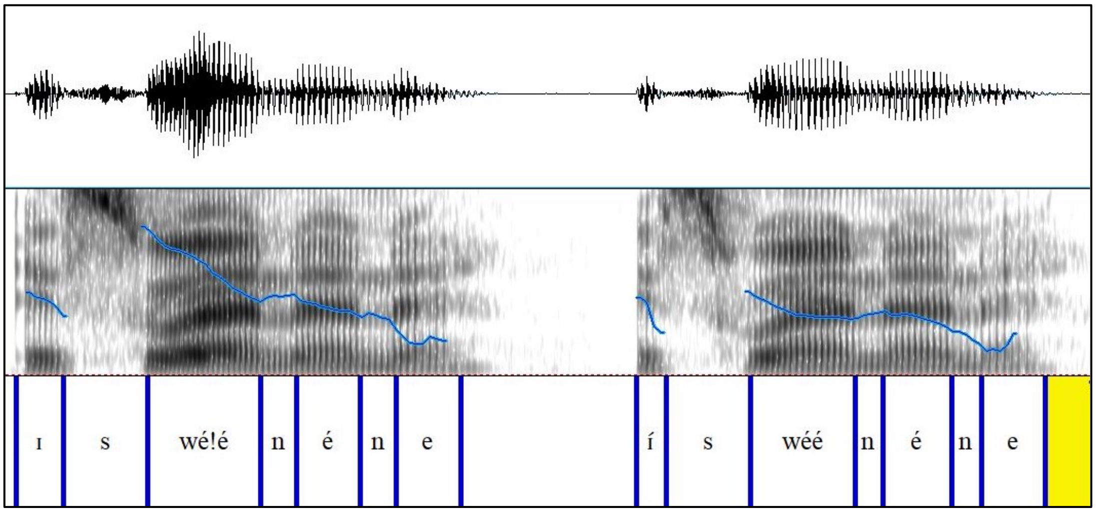


Another example of potential pre-L boost is the difference between [kódééka] 'to cook' versus [kodééka vwaangʊ] 'to cook quickly', where placing *vwaangʊ* after the verb subjects the H to phonetic pitch-raising (these utterances were elicited next to each other so that a similar pitch range would be maintained).



A further point to notice in connection with pre-H boost is that it only affects the syllable which is immediately before L, a fact which motivated the interpretation of Leftward Spread as a phonetic process rather than phonological category-changing (in which case all syllables should have raised pitch).

Pitch-boosting is seen even when there no overt L tone, in a H!H sequence. Consider *ɪswé!énéne* 'termite sp.' from /ɪswá enéne/ and *ɪswéénéne* 'big female chicken' from /ɪsu enéne/. In the former, the initial H is much higher, and in the latter the H is simply a "copy" of the penult H, which would be lower because it is in the penult.

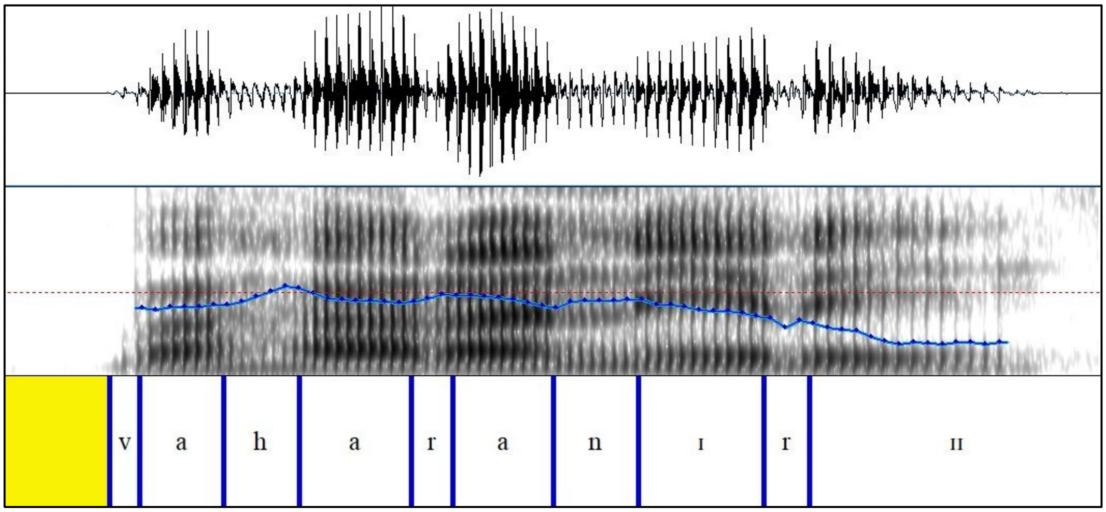


If downstep is a floating L, we can explain the higher pitch on the second syllable by reference to pre-L boost. We can also explain it because there are two autonomous H tones in the former example and only one in the latter, so to make room for two H-defined pitch registers, the first H would naturally have to be raised above the second. Furthermore, the first H in *ɪswé*[!]*énéne* precedes the penult, but the H in *ɪswéénéne* is in the penult. Penult and final H are phonetically lower than pre-penult H.

Penult-Lowering

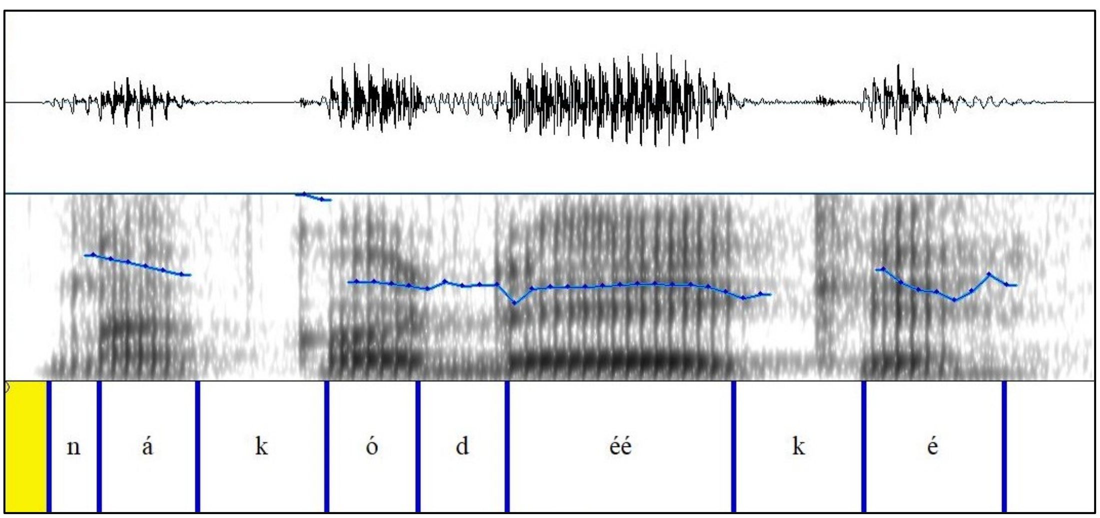
As observed above in [kódééka] versus [kodééka vwaangʊ] a penult H has lower pitch than pre-penult H. Raising in [kodééka vwaangʊ] may be due to pre-L boost, but final L does not trigger raising. Another interpretation is that there is no boost of H, instead there is lowering of a H in the penult – but L is also subject to pitch lowering.

Frequently, F0 slopes downwards more rapidly in the last two syllables, as illustrated in *vaharanɪrɪ* ‘they smoothed for e.o’. This may give the impression that the tone pattern is HHHLL, though no syllable is phonologically H.



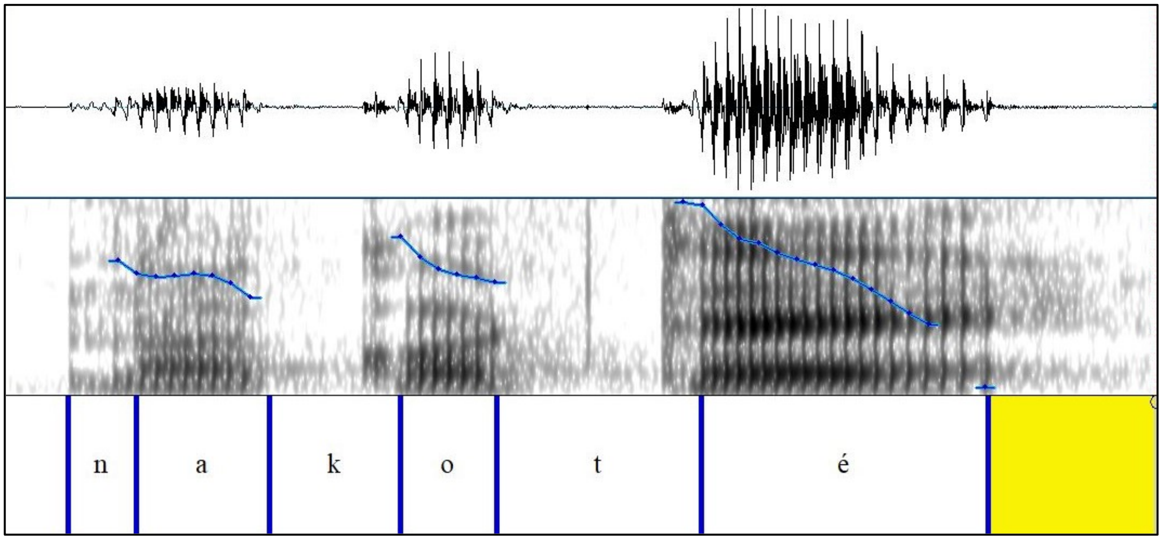
Final Flattening

When an utterance ends L*H, it is often realized as a relatively flat, slightly raised pitch. An example of this is seen in the following token of /na kodeeké/ 'we will cook'.



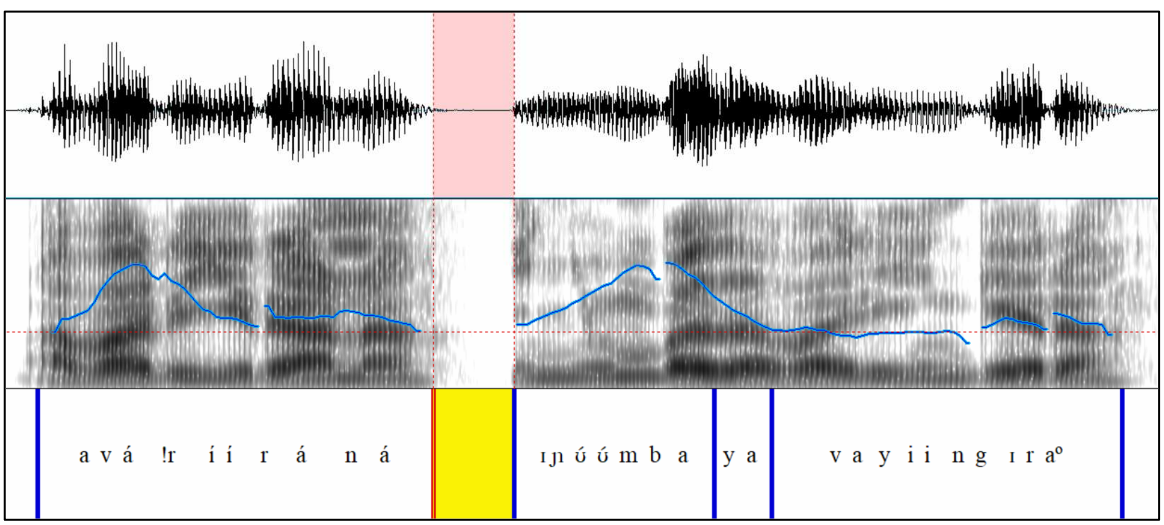
This might be transcribed as [ná kódééké] (as in the spectrogram annotation). However, the pitch level in such tokens is lower and flatter than usual H spans, to the point that one might also transcribe the sequence as ending in a string of mid tones. In the data presented in this work, this is often reported using the "non-falling" diacritic, viz, [na kodeekeº]. This is not a distinct underlying tone, it is a way of capturing a fact about the phonetics of a given token. The phonetic characteristic of L*º is that all syllables from the last H are more or less at the same pitch, which is noticeably lower than a sequence of H tones.

The above token can be compared to the following, [na koté] 'we will bury', where the final syllable is distinctly higher than the preceding syllables, and where pitch falls substantially from the beginning of the syllable.



In the data of this work, some tokens may be presented as e.g. [na kodeekeº], which is phonologically equivalent to [ná kódéékḗ], but indicates that the degree of final lowering is significantly less that in tokens like [na koté].

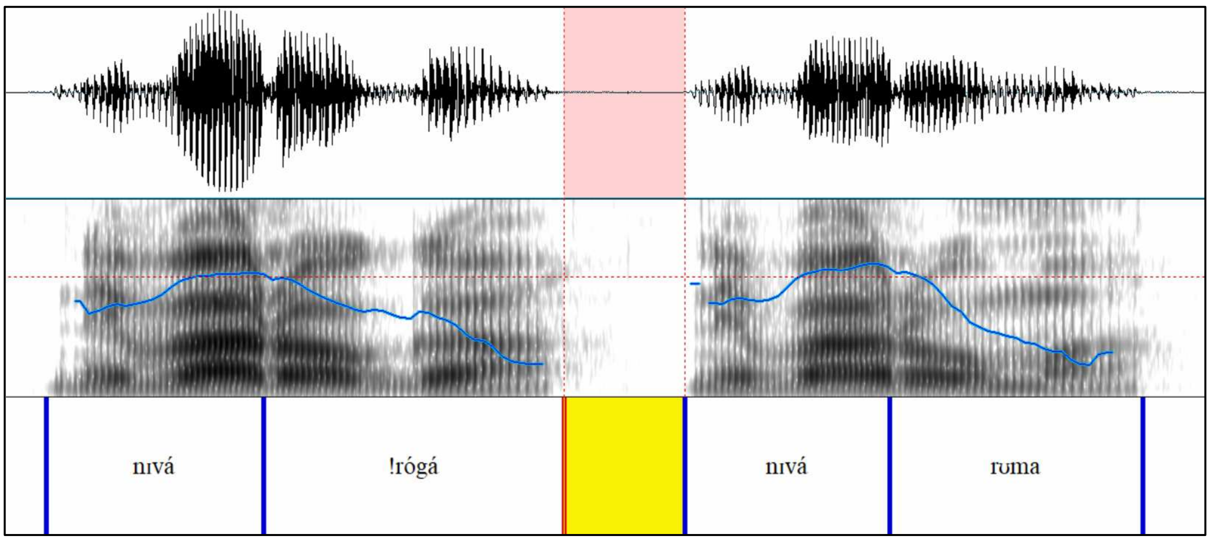
An example of the non-contrastive phonetic distinction between H$^{!}$H* and HL*º is seen in the following pair of words [avá$^{!}$ríírána] 'the ones who will come back' versus [ɪɲʊ́ʊ́mba ya vayiingɪraº] 'the house which they will enter' (note that these are separate utterances combined into a single display for convenience of reference).



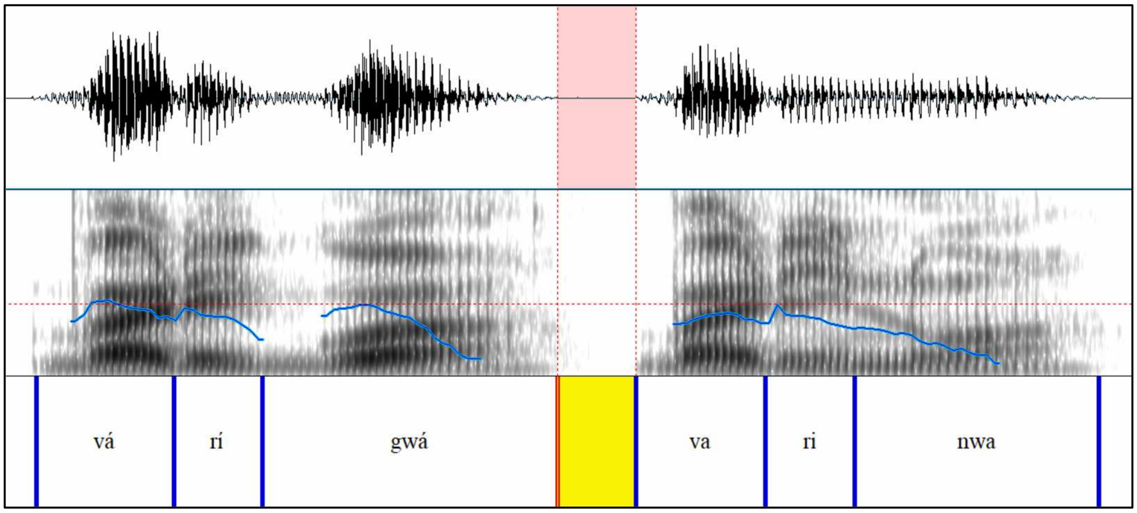
The overall pitch profile of the two utterances is comparable and they are phonologically identical in the relevant respect – H on the final and second syllables of the utterance, and a span on toneless syllables. They differ primarily in the pitch level of the final sequence of syllables, ꜝH* of the first utterance being higher than L*º of the second utterance.

Up to this point, we could simply say that sometimes a final H is realized at a significantly lower level which perhaps spreads to preceding toneless syllables. However, there is also a "non-falling H", restricted to [dáº], a variant of the negative marker [dáave], and in light of the more systematic and contrastive status of this tone variant (discussed in the next section), one might also consider "non-falling" to be an autonomous phonological property – signalled with the diacritic º.

The analogous distinction between final LL and ꜝHH is also subtle. As seen in the following pair [nɪ váꜝrógá] 'if they bewitch' vs. [nɪ várʊma] 'if they bite', there is a sharper fall in pitch after H in HLL, but even in HꜝHH there is a trend where pitch falls finally.

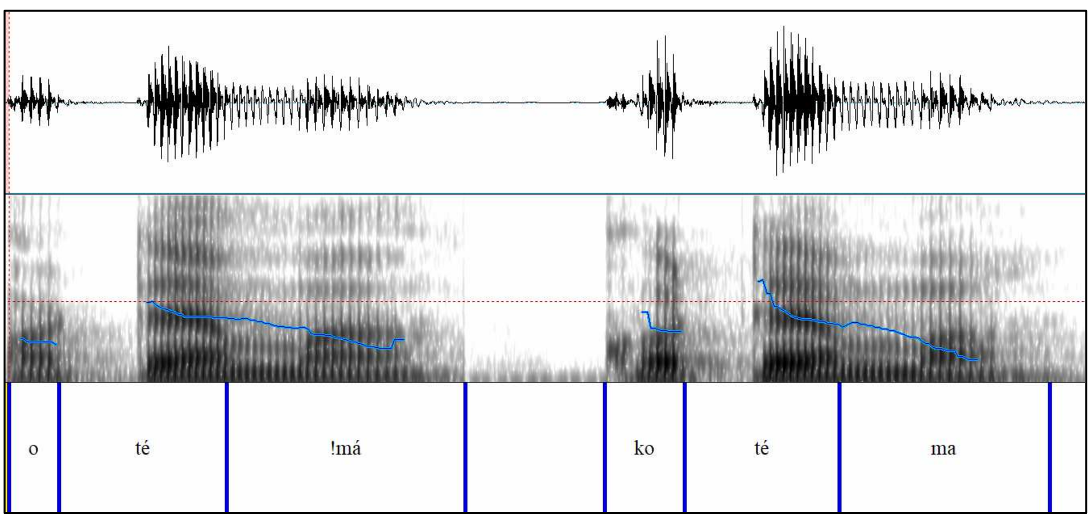


The difference between final H* and L* is even more subtle, as the following contrast between [várígwá] 'they will fall' and [varinwa] 'they will drink' shows.



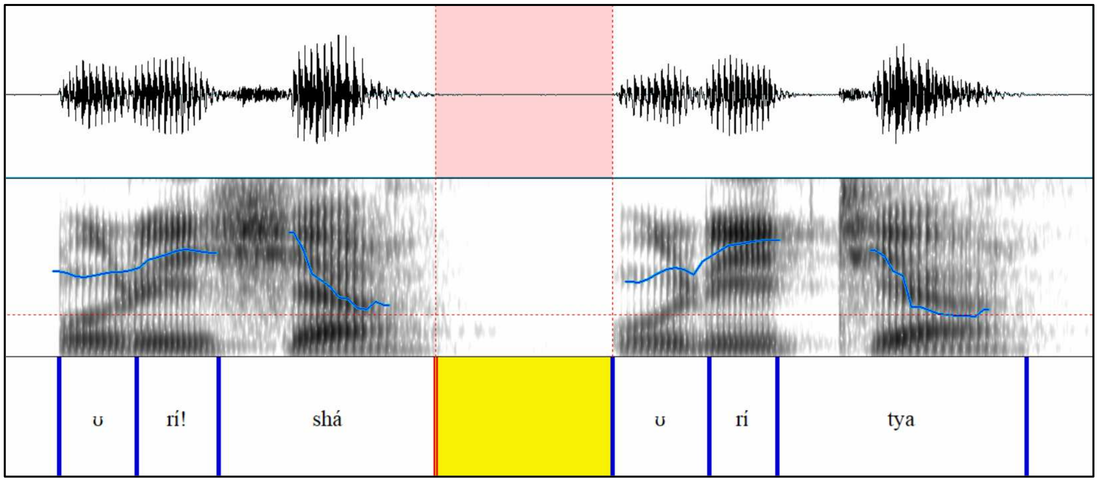
In [várígwá], the three syllables have the mean pitch 105-100-97, where [varinwa] has the pitch profile 100-100-88. The main difference lies in the extra-low pitch of prepausal L in [varinwa].

Finally, in the following case of [oté'má] 'he who will chop' versus [kotéma] 'to chop', the phonetic difference between 'H after H versus L after H is primarily in the greater fall in the final syllable – 120-94 in the case of [oté'má], 115-81 for [kotéma].[18]



Another example of prepausal HL versus H'H is *ʊrí'shá* 'one who will grind' vs. *ʊrítya* 'one who will fear'. In this pair, pitch ends lower in *tya* (86Hz over the last 50 msc) and reachs that low point halfway into the vowel, compared to *shá* where pitch falls throughout the vowel to 90Hz at the final 50 msc, without a sustained level-pitch span. The perceptual effect is that *tya* sounds lower than *'shá* (95Hz over the syllable versus 102Hz).

[18] The appearance of a greater fall in the syllable [té] in [kotéma] comes from a pitch-tracking artifact right at the consonantal release. The pitch of the utterances is the same (134Hz) at 20 msc after the consonant release.



3.2.3. Phonological summary of tonal phonetics

The phonological analysis of tone presented in this work depends on categorizations of pitch events in terms of a small number of tone classes. It is important to be clear on uncertainties in this classification.

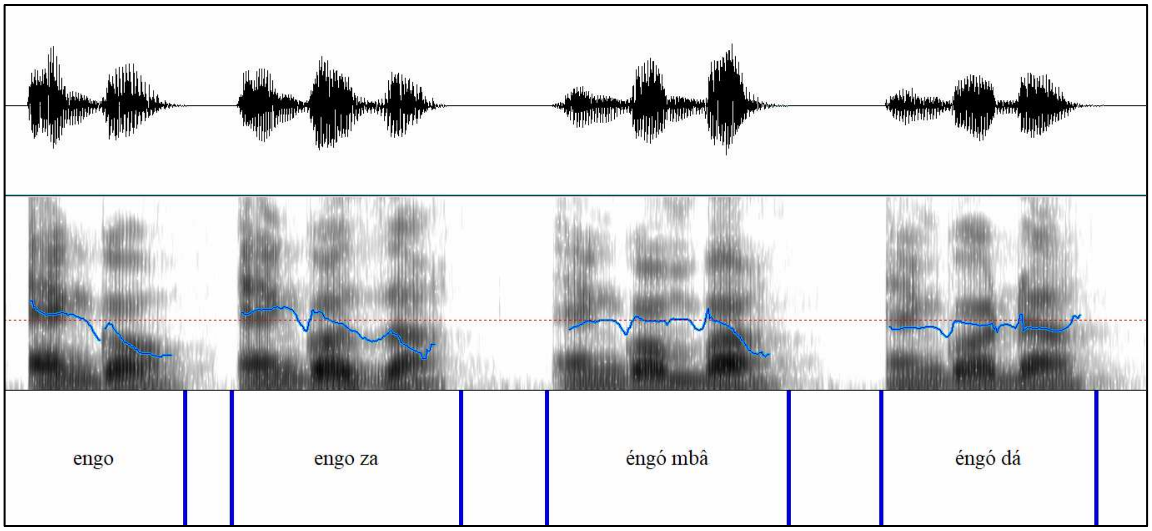
As commented on above, the answer to the question of whether there is phonological leftward spreading of H tone, as opposed to phonetic pitch interpolations, is not immediately obvious, but as we will see in subsequent chapters, the case for a phonological treatment of the facts is good enough to say in advance that there is such a rule. The main argument for a phonological treatment is that Leftward Spreading shows the indicia of surface contrastiveness – not an underlying contrast, but a derived contrast by way of different limits on the extent of spread depending on grammatical context, one that does not submit to elimination by appeal to purely surface phonetic environment. At the same time, those facts do not preclude the possibility that there is both phonological spreading and gradient phonetic interpolation. Phonetic interpolation (or similar effect) is credible, indeed necessary, for two kinds of facts. First, we have seen examples where there is a more gradual rise in pitch up to a certain syllable, often (but not always) the last syllable with H, a pattern which is attested infrequently, and which cannot be easily covered as a 'minor detail' variant within categorial pitch raising which is most common. Second, there is a rather frequent 'start-up' effect where the first potentially-H syllable of an utterance has noticeably lower pitch. It is possible that the utterance-initial syllable is optional excluded from leftward spreading; it is also possible that there is no such exclusion, but that initial HH is realized with a somewhat lower pitch on the first syllable. This constitutes a basic limit on the phonological precision of the tonal data: there may or may not be a phonologically-encoded limit on leftward spreading.

A related area of murkiness in the phonological vs. phonetic divide for tone is pre-penultimate boosting of the rightmost H in, e.g., [rwá varitagá**vʊ́**ranya] 'when they won't divide up' where [vʊ́] has a higher pitch than [gá]. In terms of the phonological derivation, this derives from /rwá varitagavʊ́ranya/ via (stem-domain limited) phonological leftward spreading. But since [vʊ́] has much higher pitch (supposedly because of "pitch boosting"), how do we know that [ga] isn't simply toneless, and the higher pitch on that syllable comes from a low-level anticipatory process with a window of one syllable? Sometimes, the degree of pitch raising on [ga] is small enough that this is a plausible account, so in fact there is a significant and fundamental uncertainty in the proper treatment of apparent …LLHHLLL…, which might also be …LLLHLLL…

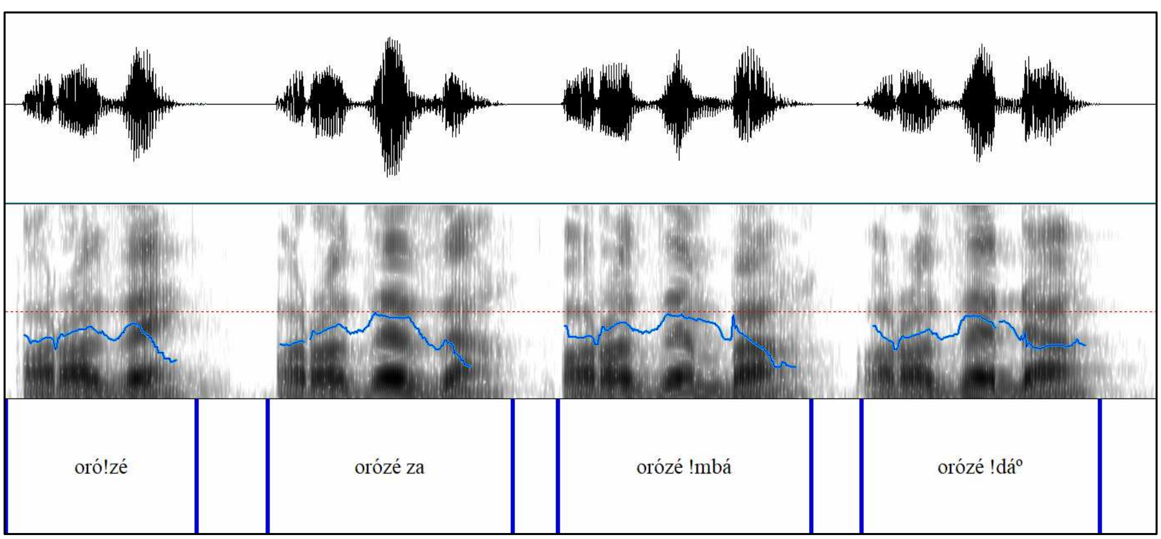
Prepausal position also carries with it certain uncertainties. Prepausal syllables usually fall to some extent (the notable exception being …CVCV^{o}, a variant of prepausal …CVCV́ where the final syllables are all at more or less the same low pitch without final fall), which gives the final syllable an overall lower perceived pitch level. Downstep between two separate Hs has that same effect, therefore one may wonder whether a prepausal H$^{!}$H-like pattern is truly H$^{!}$H, or is it HH with phonetic lowering of the second H being a biproduct of prepausal pitch fall. To decide whether final H$^{!}$H is properly analyzed (in some or all cases) as HF, we have to undertake some phonological analysis. A first step towards deciding the question is to compare phonological /LH##/ versus /HH##/. In order to do this, one has to have a basis for treating a particular word as having /LH##/ as opposed to /HH##/.

The difficulty with pursuing this reasoning is that forms with demonstrable final H are hard to generate. Monosyllabic roots can have underlying H tone, and when they do (in prepausal position), final H usually but optionally splits into H$^{!}$H, thus we have a general pattern exemplified by [ɪkí$^{!}$vwí ~ ɪkívwí] 'fox'. Any monosyllabic noun with prepausal H potentially splits that H into a H!H sequence: there are no lexical exceptions in the form of non-splitting final H. The same is true of lexically-H CV verb roots in the M1 tone pattern, e.g. [aránwá ~ arán$^{!}$wá] 'he will drink'. Not every final H does so, see melodic M2 H in *varikarágá* 'they will judge' or M3 *vávégé* 'that they shave'. Tokens like [ɪkí$^{!}$vwí] vs. [ɪkívwí, vávégé] provide a baseline for distinguishing final HH from H$^{!}$H, and the fact that melodic H tones behave differently from lexical H tones of monosyllabic roots suggests that this process creating H$^{!}$H is phonological.

It is generally true that a prepausal H falls to some extent, which suggests a possible account of final H-spliting as one end on a continuum of final fall *qua* phonetic process. In that view, /orozé/ undergoes Leftward Spread giving *orózé*, then prepausal H becomes falling tone, thus [orózê]. This may be perceived as non-split HH – [orózé] – if the degree of fall is small but as split H!H – [oró$^{!}$zé] – when the fall is greater. It is true that almost all final Hs have some degree of prepausal fall, which might suggest that a phonetic process is at work. But there is one exception (and only one, as far as I have determined), namely that the truncated form of /dáave/ 'not' is [dá] *without* falling tone. Notice the difference between *mbá* and *dá* (both meaning 'not') as well as L tones *za* 'just' before /engo/ 'leopard'.



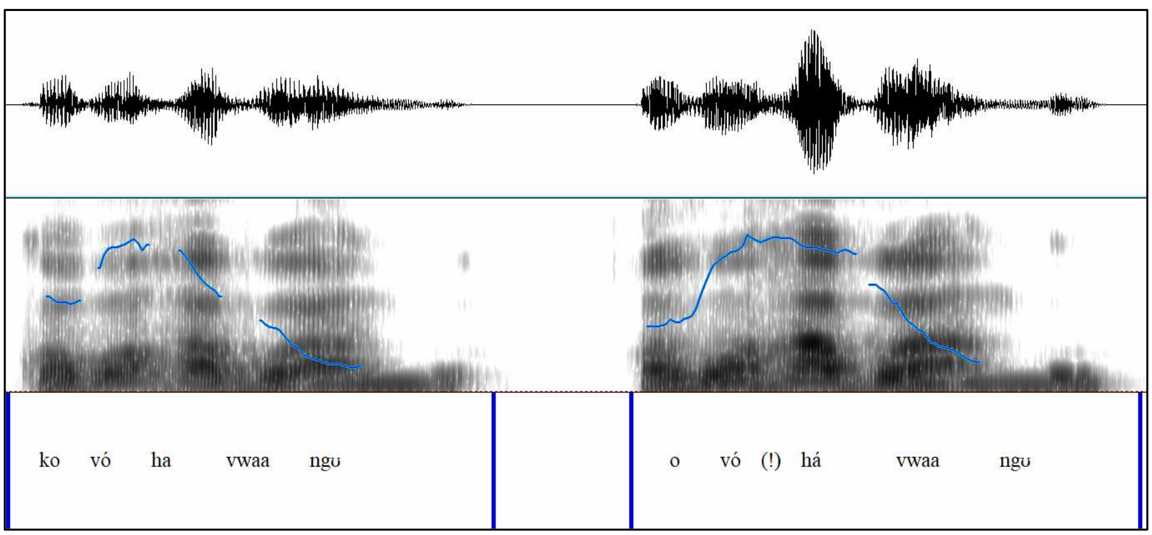
As expected, there is considerable fall in the LL and LL#L sequence of the first two examples. Pitch is relatively flat in the two HH#H sequences, but there is a clear difference between the falling H of [mbâ] and the level H of [dá]. This suffices to either establish the phonological nature of final fall in prepausal H tones, or else it establishes that [dá] has some property yet to be determined, which somehow foils expected final fall. This work will adopt the latter stance (*dá* is an exception in some sense) and transcribe the truncated form of *dáave* as [dáº]. This transcription means that the pitch property of this syllable is linguistically significant and must be recorded in the data, without burying the analysis of the contrast in the transcription. The examples below further examplify the difference between the split-H citation form [oró!zé] and the same noun before /za/, /mbá/ and /dáº/. The difference between [orózé !mbá] and [orózé !dáº] provides a perceptual basis for phonetically distinguishing downstep from prepausal fall.



The upshot of the contrast between [mbá] and [dáº], and the fact that systematic H-splitting has a grammatically contrastive distribution (*vávégé* vs. *oró*ꜝ*zé*), is that HꜝH cannot be dismissed as a phonetic variant of HH. The downstep in *oró*ꜝ*zé* is not phonologically very robust – it only occurs pre-pausally, and is optional (though most frequent). There are other instances of final H!H which are more robust.

Final HꜝH is also created in verb inflections where under certain circumstances, the stem can have an initial and a final H, for example [ʊríꜝkáméꜝɲé] 'the one who would live' cf. [ʊríkakáꜝráángé] 'the one who would fry'. In this verb form, the stem has a initial H and a final H, the two being separated by downstep as expected. In the case of a CVCV stem, this means that a HꜝH structure will be created – the tone pattern of [ʊríꜝkáméꜝɲé] is phonologically analogous to that of [ʊríkakáꜝráángé], save for the number of syllables. Similarly, in the bare future headless relative verb form, the initial H in /ó-vohá/ shifts to the right in [ovóꜝhá] 'the one who will tie', cf. /áva-vohá/ → [aváꜝvóhá] 'the ones who will tie'. This contrasts with /ari-goná/ → [arigóná] 'he will sleep (indefinite future)' without downstep between the two surface H-toned syllables. In examples like [arigóná], the final syllable has the perceptually highest pitch, and may sound like [arigōná] or [arigóná], but not *[arigónā] ≈ [arigóꜝná].

The H!H tone structure of [ovóꜝhá] is contextually robust, in that the pattern is still found phrase medially. Compare [ovóꜝhá vwaangʊ] 'the one who will tie quickly' and [kovóha vwaangʊ] 'to tie quickly'.



We see that in [ovóꜝhá vwaangʊ], the pitch level of the stem syllables [vóꜝhá] are similar, indeed there is not a clear drop of pitch as encountered in most …H!H… sequences.[19]

[19] Most examples of …HꜝH… as observed in the preceding sections also have the effect of Leftward Spreading so that we encounter …HHHꜝH… Because the pitch peak in a multisyllabic H span is always at the right edge of the span, we can tell that [ovóꜝhá vwaangʊ] is not actually [ovóhá vwaangʊ]. If the H of [vó] were actually the result of Leftward Spreading, the pitch of [há] would be significantly higher than that of [vó]. Phrase-medial …LHꜝHL… has a very limited distribution, which is why we have not previously encountered this pattern.

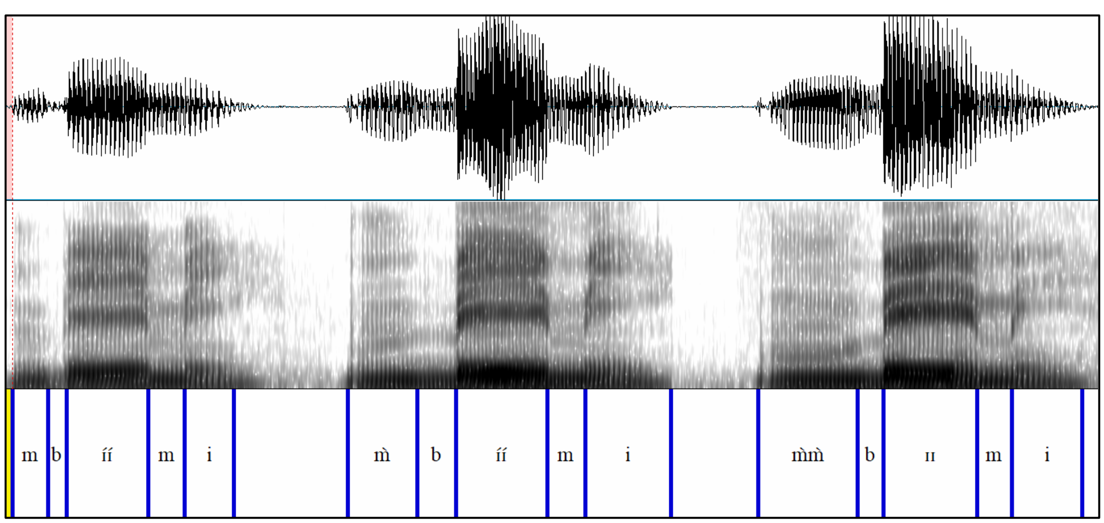
Thus we have good reason to say that [ovó$^{!}$há vwaangʊ] has independent H tones separated by downstep, and apparent final H$^{!}$H in this context is not the product of phonetic final lowering.

While we can identify invariant H$^{!}$H as having separate Hs and distinguish them from prepausal-only H!H as in /orozé/ → [oró$^{!}$zé], we cannot argue directly that lowering of *zé* proves that prepausal H splits into two Hs. But we know from examples like /engo mbá/ → [éngó mbá], where the pitch-lowering percept downstep is lacking when prepausal H does fall, that final H$^{!}$H is not a misanalysis of the falling tone of final HH.

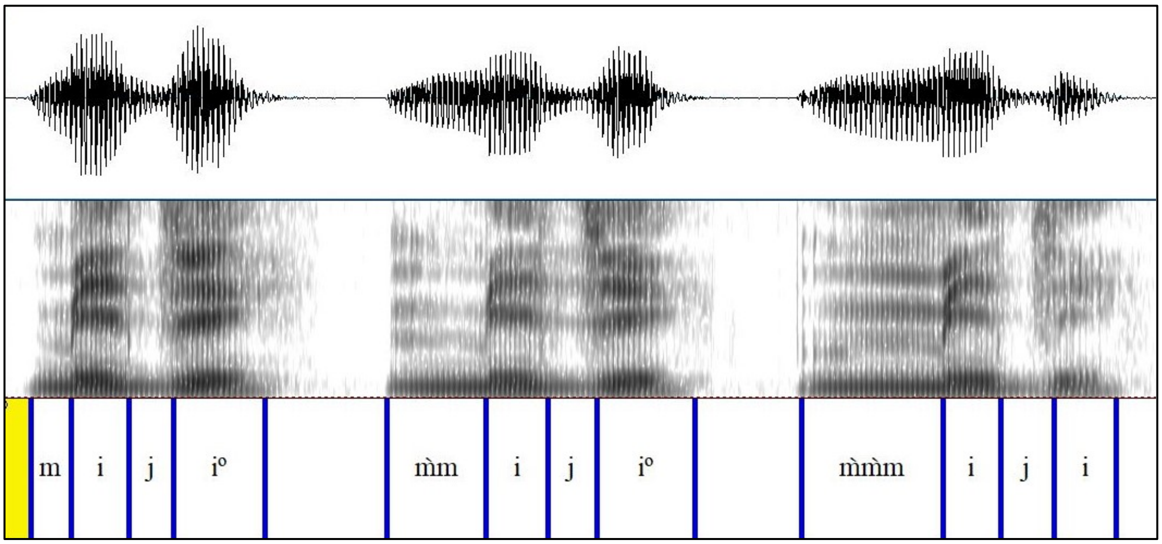
3.3. Syllabicity

While there is no underlying distinction between syllabic and non-syllabic segments, there are derived syllabic nasals as found in *mgera* ‘river’, which is phonetically [ṃgera]. Syllabic *m* derives from /mʊ/ by rules discussed in X, and [ṃgera] can also be realized as [mʊgera]. In this case, the fact of being syllabic can be easily recovered on the surface from the fact that the nasal and following consonant are not homoranic, whereas all non-syllabic nasals are homorganic with the following consonant. Reduction of prefixal /mʊ/ is particularly frequent, indeed almost universal and possible obligatory for many speakers before labials *p b v f m*. A tactic of reading syllabicity off of the homorganicity of the nasal and following consonant does not consistently work. In certain cases, a labial nasal plus labial always has a syllabic nasal, for example /mʊ-pííra/ ‘ball’ → [ṃpííra]. A nasal before another nasal, a fricative, or a voiceless stop is always syllabic. However, there is only one context where syllabicity of a labial nasal is surface distinctive, and that it before *b*, as exemplified by [mbárízi] ‘I counted’ versus [ṃbárízi] ‘2pl counted’, the latter from /mʊ-várízi/. Before consonants other than [b], *m* is always syllabic, because non-syllabic *m* causes other underlying labials to change to [b] (in the case of *p v f*) or causes *m* to delete (in the case of *m*). Syllabicity on a (nasal) consonant is here notated with grave or acute accent, depending on whether it bears L versus H tone, thus [m̀bárízi] ‘2p. counted’, or else with an apostrophe (m’bárízi).

A syllabic nasal may be distinctively long, which gives rise to near-minimal triples such as *mbíími* ‘I measured’, *m̀bíími* ‘2p measured’ and *m̀m̀bıımi* ‘2p have measured’. The distinction in these nasals is realized phonetically via the greater duration of the syllabic nasal and the even greater duration of a long syllabic nasal.



Preconsonantal non-syllabic [m] has a duration of approximately 75 msc, whereas short syllabic [m̀] has twice that duration, and long [m̀m̀] is about 1.40 times the duration of [m̀]. A difference also exists between prevocalic non-syllabic, short syllabic and long syllabic *m*, where a root beginning with /m/ may have the 1s prefix /N/ which deletes before a nasal, vs. /mʊ/ ‘2p’, and the lengthened variant, resulting in the phonological distinction [mijiº] ‘I strangled’, [m̀mijiº] ‘2p strangled’ and [m̀m̀miji] ‘2p have strangled’.



In this case, the overall duration of the nasal is longer in the case of syllabic and long-syllabic nasals where [m̀m] is about 2.5 times the duration of [m] and [m̀m̀m] is about 1.5 times the duration of [m̀m].

Syllabic *m* is reasonably common in word-final position, where it may freely vary with [mʊ], for example, *ríꜜmwáám ~ ríꜜmwáámʊ́* ‘dark$_{5}$’. This, again, is the result of reduction of /mʊ/, in this case without a following consonant. There do not seem to be any cases of mandatory final [m̩] (H or L toned), though some words like *máárам̀* ‘crushed rock for roads (murram)’ are almost always produced without final [ʊ]. The word ‘needle’ is produced by BK as *ɪsííndaani* or *sííndaaǹ*, and otherwise syllabic *n* does not occur finally.

Reduction of /#ɪnC/ to [ń ~ ǹ] is uncommon except for speaker BK, but is sometimes attested with other speakers.

reduced	*unreduced*	
[bk]ńꜜgʊ́rʊ́ve	ínꜜgʊ́rʊ́ve	‘pig’
[bk]ńꜜdʊ́gʊ́nyi	ínꜜdʊ́gʊ́nyi	‘ant sp.’
[sy]ńzʊ́kɪ	ínzʊ́kɪ	‘bee’
[em]ńz-ʊ́táꜜdééchí	ínz-ʊ́táꜜdééchí	‘I who didn’t cook’
[em]ńgʊ́v-íínávꜜú	íngʊ́v-íínávꜜú	‘sewn clothes’

[bk]ǹnéke	ɪnnéke, rinéke	‘Syzygium cordatum’
[sy]ǹzógu	ɪnzógu	‘elephant’
[em]ǹgʊ́rʊ́vé ɪsírʊ	ɪngʊ́rʊ́vé ɪsírʊ	‘stupid pig’
[em]ǹzí ꜜndátááđééka	ɪnzí ꜜndátááđééka	‘I who didn’t cook’

Although nearly all cases of geminate syllabic *n* derive from optional reduction of an initial syllable, the word *ǹnya* ‘mother’ is a candidate for having an underlying syllabic nasal. One token from speaker FA presents this word as *nyina*. In a very few other tokens, the word is given with initial [i], viz. [bk]*ínnyá mʊ́ráhɪ* ‘good mother’, [em]*ínyéꜜévé* ‘his mother’, [em]*inyóꜜóvó* ‘your mother’, but otherwise this word is simply [ǹnya].

4. Syllable structure

Syllables in Logoori usually have an onset consonant, though syllables may begin with a vowel at the beginning of a word. The stricture in *y* before *i* is sufficient reduced so that it is often imperceptible, e.g. *ʊmʊ́ꜜyáá*(*y*)*i* ‘boy, *rivógo*(*y*)*i* ‘amaranthus sp.’, *ligúúꜜyágúú*(*y*)*i* ‘dragonfly’, *dáꜜníbóói*. Other apparent vowel sequences include those in *lyáꜜʊ́a* ‘flower’, *ring’óꜜááni* ‘crested crane’, *ɪbía* ‘beer’ and *ʊmʊjáꜜlúó* ‘Luo’, which may also be interpreted as *lyáꜜ*(*w*)*ú*(*w*)*a* ‘flower’, *ring’óꜜ*(*w*)*ááni* ‘crested crane’, *ɪbí*(*y*)*a* ‘beer’ and *ʊmʊjáꜜlú*(*w*)*ó*. Such an interpretation is possible since underlying prevocalic *w* is nearly non-existent in the language, existing only in *kaháwa* ‘coffee’, *rʊwááya* ‘wire’.[20] A final example of possible vowel sequences is *ɪkɪbíꜜráʊ́ʊ́ni* ‘saucer’, which however has *h* after *a* for some speakers (*kɪbíꜜráhʊ́ʊ́ni*).

Syllables maximally begin with NCG where N is a nasal homorganic with the following consonant, and G is one of the glides *w* and *y*. The nucleus of the syllable is a single vowel, which may be long or short. Other consonant clusters exist in loanwords, for example *ɪbóósta* ‘post office’, *kondákta* ‘conductor’, *ʊ́ꜜmstáári* ‘line’: it is unknown whether such clusters are modified in the speech of Logooris with no knowledge of English.[21] Some speakers also have word-final consonants in loan words such as *ɪkʊ́reet* ‘crate’, *ɪmííshen* ‘mission’, *ɪtáp* ‘tap’, *skʊ́l, ɪskʊl* ‘school’, *chíɪf* ‘chief’, *ɪdháhaab* ‘gold’ (Swahili)[22] though can have a final vowel as well (*ɪsʊkʊ́ʊ́rʊ, ɪmíísheni, chíɪfʊ*). Final consonants are also occasionally attested in native words, where a vowel has been deleted, e.g. *ʊvwééref*(*ʊ*) ‘heaven’, *ʊvʊ́ꜜcháaf*(*ʊ*) ‘filth’, *ɪring’ówaan*(*i*) ‘crested crane’, *ɪcháany*(*i*) ‘house site’, *íꜜndʊ́gʊny(i)* ‘ant sp.’ *ɪgáꜜrádáas*(*i*) ‘paper’.

There are no generally-applicable phonological tests that establish how many surface syllables exist in *ʊ́ꜜmstáári* (3 or 4?), *ĺlími* (2 or 3?), *kíꜜmwááḿ* (3 or 4?). Insofar as syllabic consonants derive from the reduction of CV syllables, it will be assumed that those processes are syllable-internal reorganizations which do not reduce the number of syllables.

The status of geminate consonants as reduced syllables is a matter of theoretical phonological analysis. The first half of a geminate can be tone-bearing, for example /kʊ-

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[20] That is, most instances of [w] derive from morpheme-final /ʊ/.

[21] It is equally unknown if there exist (adult) speakers of Logoori with no knowledge of English.

[22] *dh* is a voiced dental fricative, used by some speakers in loanwords from Swahili and English.

rí-rɪma/ is often realized as [kʊĺlɪma], where pitch rises over [l]. Syllables only have one or two moras, but a syllable can contain a long vowel plus a syllabic or geminate consonant – if indeed we are to assume that [vaam̀] in [vaam̀miʝí] 'they strangled him' from /va-a-mʊ-migí/ is a single syllable. Parsed as [vaa.m̀.mi.ʝí] there is nothing worth commenting on, in terms of moraic count in any syllable.