PHONOLOGICAL ANALYSIS

The Abawiri tone system in typological perspective

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Abawiri (Indonesia: Lakes Plain) is a previously undescribed Papuan language. Two level tones (/L/ and /H/) combine into eight tone melodies on nouns (/L/, /H/, /LH/, /HL/, /ᴸH/, /ᴸHL/, /ØHL/, and Ø) and five on verbs (/L/, /H/, /LH/, /ᴸH/, and Ø). The default pitch of tonelessness is L. Several phonological processes involve tone. /H/ is lowered to M tone after a floating /ᴸ/. A polar (H) is linked to the final syllable of a non-/H/ word previous to an /L/-toned word. Utterance-final boundary tone L% is linked to all utterance-final syllables. /H/ spreads to the end of nouns but does not spread on verbs. A final section discusses typological characterization of the Abawiri tone system.*

Keywords: tone, Abawiri, Papuan languages, typology of tone, two-height tone systems, tonal polarity, category-specific effects

1. Introduction. This article reports on findings of recent work on the tone system of Abawiri, a previously undocumented language of Papua, Indonesia. This work highlights the interest Abawiri has for linguistic theory and, in particular, for tone system typology. The language has two phonological tones, /H/ and /L/, in addition to a derived M tone. The /H/ and /L/ tones each pattern in some ways like the more marked tone. There is strong evidence for floating /ᴸ/ tones that trigger lowering of a following /H/. This is in spite of the fact that these floating tones are never linked to syllables, and that linked /L/ tones do not trigger lowering. /L/ tones must be preceded by /H/; this leads to the phonological process anticipatory tonal polarity. This article discusses several alternative analyses of the phonetic facts.

The remainder of this section provides a brief introduction to the language and its speakers, what is known about its genealogical relationship to surrounding languages, and the language's segmental phonology.

Abawiri (ISO 639-3 flh), also known as Foau, is a Papuan language spoken by about 350 people in the Mamberamo River Basin of Papua, Indonesia (Lewis et al. 2017). It is spoken exclusively in the village of Fuau (or Foau). The location of the language community is shown in Figure 1.

Fuau village is in a remote location on the Dijai River, a tributary of the Mamberamo River. Although it is only about 150 kilometers southwest of the provincial capital Jayapura, it is inaccessible by road. Transportation is by river boat or single-prop aircraft. The nearest neighboring village, where the related language Taburta (ISO 639-3 tbp) is spoken, is at least a full day's motorboat ride downriver from Fuau. Abawiri language vitality remains very high, although many adults now have some ability in Indonesian. The majority of people marry within the village. However, a few exogamous marriages have taken place, with the result that there are a few native speakers of other languages in the community. These men and women have all learned Abawiri.

* Many thanks to Yulianus Waw and Bastian Guani, who provided the bulk of the data on which this article is based. Their tireless work has been invaluable. The analysis presented here benefited greatly from insights by Eric Campbell, whose careful reading of previous drafts shaped the analysis in important ways. Credit is also due to Matthew Gordon, Bernard Comrie, and the participants at the 8th Austronesian and Papuan Languages and Linguistics Conference at SOAS for their feedback and suggestions. I also thank two anonymous referees and the journal editors for their many helpful comments. All remaining errors are my own.

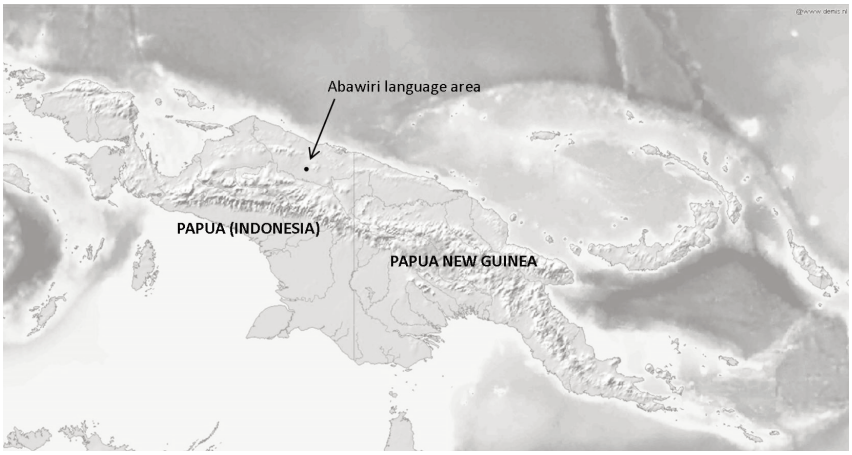


FIGURE 1. Map of the Abawiri language area in New Guinea.[1]

Abawiri is currently almost completely undocumented, the only previous documentation consisting of a list of thirty-nine words (Voorhoeve 1975). Clouse (1997) tentatively includes Abawiri and Taburta in the Lakes Plain family, pending further work, but since very little data was available, it was not factored into his reconstruction. Impressionistic evidence from my own work strongly suggests that the two languages do indeed belong to the Lakes Plain family, although it is unclear how they are related to the other languages. More documentation and detailed historical work are needed to determine the genealogical relationships of these languages.

The Abawiri segmental inventory consists of the seventeen consonants and seven vowels shown in Table 1. This is based on my own fieldwork, which is summarized in §2 below.

CONSONANTS				VOWELS		
	t		k	ɨ		
	t^w		k^w	i	y	u
b	d	dʒ	g	ɛ		ɒ
b^w	d^w	$dʒ^w$	g^w		a	
f	s					
f^w	s^w					
	r					

TABLE 1. Abawiri consonants and vowels.

Of typological note is the complete lack of nasals (even in phonetic form), as well as the paucity of sonorant consonants. /r/, the only sonorant consonant, is somewhat marginal as its distribution partially overlaps that of /d/. Abawiri is the only Lakes Plain language that has a full set of labialized consonants. Additionally, the high front rounded vowel /y/, robustly attested in Abawiri, is not known to occur in any other Lakes Plain language and is very rare in New Guinea in general. None of the approximately forty Papuan languages surveyed by Maddieson (2013a) has the front rounded vowel, and there are no front rounded vowels in the overview of Papuan phonological

[1] 'Map of New Guinea Demis'. Licensed under public domain via Wikimedia Commons; https://commons.wikimedia.org/wiki/File:Map_of_New_Guinea_Demis.png#/media/File:Map_of_New_Guinea_Demis.png. Text markup by the author.

inventories by Foley (1986). The only other Papuan language I am aware of with this vowel is Kombai (de Vries 1993). In Abawiri, this vowel likely arose historically from tautosyllabic *uC sequences, the reflex of which in many other Lakes Plain languages is an 'extra high' back vowel that contrasts with the high back vowel /u/ (Clouse 1993, 1997). The Abawiri extra high front vowel /ɨ/ is, like in many other Lakes Plain languages, from tautosyllabic *iC sequences. The extra-high vowels in Iau (Bateman 1990) and Doutai (Donohue et al. 2006) are described as 'fricativized' in that there is audible frication between the articulators, but in Abawiri there is no audible frication. Impressionistically, the vowel is perhaps shorter in duration and higher in the oral cavity than [i]; further work is needed to establish its phonetic details. Minimal pairs exist (e.g. [dɨ̀] 'person' vs. [dì] 'food'; [àrɨ̀] 'aunt' vs. [àrȳ] 'eye'), and native speakers feel strongly that separate symbols are needed for /i/, /ɨ/, and /y/ in the community orthography (Yoder 2017a).

This article is organized as follows. I first present the methodology and the data that form the basis for this study (§2). Tonal contrasts on words in isolation are presented in §3, while further tonal contrasts evidenced only in phrasal context are discussed in §4. In §5 I place the Abawiri tone system in tone-system typology in terms of four characteristics that have been proposed in the literature. I then discuss the implications of Abawiri tone for markedness theory, as well as the typology of two-height tone systems and the distinction between word tone and syllable tone, which I argue is better viewed as gradient rather than categorial. Section 6 concludes.

2. METHODOLOGY. This article is based on the results of three months of fieldwork between 2014 and 2016 as part of an ongoing project to document the Abawiri language. I was first introduced to community members in 2014; I returned for short fieldwork trips in the summers of 2015 and 2016. The current tone analysis is based primarily on elicitation data from two men, Yulianus Waw and Bastian Guani. During analysis I frequently cross-checked my findings with my growing documentary corpus of connected speech, where speech from sixteen women and men is represented.

The elicitation data for this article consists of two parts: recordings of an extended list of 652 nouns and verbs, and recordings of a shorter list of 156 nouns and verbs. The extended list was collected primarily through semantic domain elicitation (Shore & van den Berg 2006) using Indonesian and supplemented with words that appeared in the documentary corpus. The shorter list is a subset of the extended list that I selected based on phonological properties, primarily the number and type of syllables. In the extended list, nouns were recorded in isolation and in two frames; verbs were recorded in both the imperative and past perfective forms in isolation.[2]

The shorter list includes ninety-three nouns and sixty-three verbs recorded in multiple frames. The nouns were recorded in the six frames shown in Table 2: three noun-adjective frames and three possessor-noun frames, yielding six tokens of each word. Both of these syntactic relations are expressed by juxtaposition: adjectives follow the nouns they modify, and possessors precede possessed nouns. Nouns in the extended word list were recorded only in frames 1 and 6. Each frame in the shorter and extended lists was recorded once. Since the shorter list is a subset of the extended list, these

[2] Audio recordings were made with two recorder configurations. A portion of the shorter list was recorded with a Marantz PMD620 handheld audio recorder at 24-bit depth, 48 kHz sampling rate, using the built-in microphone. Recordings of the remainder of the shorter list and the entire longer list were made with a Zoom H4n handheld recorder at 16-bit depth, 48 kHz sampling rate, paired with a Shure SM10A headset microphone.

words were recorded twice: once with all six frames during recording of the shorter list, and once only in frames 1 and 6 during recording of the extended list.

#	FRAME	GLOSS	FRAME TONE
1.	____ kɛ́sài	'little ____'	/H/
2.	____ dɔ̀bù	'big ____'	/L/
3.	____ fùrkù	'whole ____'	Ø
4.	dúkɛ́ ____	'bird's ____'	/H/
5.	dɛ̀bì ____	'child's ____'	/L/
6.	àitɛ̀ ____	'father's ____'	Ø

TABLE 2. Tone frames for nouns.[3]

The frame words were selected because of their varied tonal melodies. Examination of frames 4–6 did not find alienability to be relevant to the tone patterns observed. For example, the four nouns in the frames [àitɛ́ sỳrɛ̀] 'father's lungs', [àitɛ́ ɛ̀bài] 'father's uncle', [àitɛ́ ɛ̀brɛ̀] 'father's nest', and [àitɛ́ fʷàrɛ̀] 'father's bow' pattern identically as /L/-toned words in spite of potentially different conceptualizations of alienability.

The verbs in the shorter list were recorded in the five frames shown in Table 3. The verbs in the first two frames are in imperative form, with the toneless imperfective suffix *-i* and a preceding adverb. The verbs in the last three frames are in the past perfective form, with the past perfective suffix *-u* and declarative *-ɛ* (both toneless) and a preceding noun.[4] The three nouns were selected for their varying tonal properties; unfortunately, post-fieldwork analysis showed that both adverbs have the same tone melody. Abawiri is strongly verb-final, so it was not possible to record frames with material after the verb.

#	FRAME	GLOSS	FRAME TONE
1.	dɛ̀rì.à ____	'____ (IMP) well'	/L/
2.	kʷɔ̀ ____	'____ (IMP) badly'	/L/
3.	dúkɛ́ ____	'bird ____ (PFV)'	/H/
4.	dɛ̀bì ____	'child ____ (PFV)'	/L/
5.	àitɛ̀ ____	'father ____ (PFV)'	Ø

TABLE 3. Tone frames for verbs.[5]

Cross-checking with the documentary corpus suggests that tone is not part of the grammatical constructions in Table 2 or Table 3. The tonal patterns of these frame words remain consistent in other grammatical constructions as well. To date no evidence for grammatical tone has been found in the language.

3. TONAL CONTRASTS ON WORDS IN ISOLATION. Nouns and verbs exhibit four pitch patterns in isolation: L, HL, ML, and LHL. These are shown in Table 4. On the left side, a representative monosyllabic, disyllabic, and trisyllabic noun is shown for each pitch pattern, and representative verbs are shown on the right.[6]

[3] Throughout the article, adjacent vowels that form separate syllable peaks are separated by a period, while tautosyllabic vowel sequences are not marked for syllabicity, as in *kɛ́sài* 'little'.

[4] In this context, the preceding noun is generally a semantic agent, experiencer, or theme, depending on the semantics of the individual verb. Grammatical relations (as distinct from semantic roles and pragmatic relations) have not been found to be operational in the language (Yoder 2017b). My grammatical analysis is based primarily on corpus data, supplemented by elicitation data.

[5] Abbreviations used in this article: AUX: auxiliary verb, IMP: imperative, IPFV: imperfective, PFV: perfective. In glosses, '(sp.)' means 'species of'.

[6] Bare noun roots are shown here. Uninflected verbs are generally not possible in the language; the verbs here occur in a minimally inflected form with the imperfective suffix *-i*. This form with no additional suffixation functions as an imperative.

PITCH	σ	NOUN	GLOSS	VERB	GLOSS
L	1	bù	'firewood'	sì	'take!'
	2	kɒ̀rè	'turtle'	dàbì	'talk!'
	3	sèjàkà	'kingfisher'	bìdʒèrì	'bite!'
HL	1	trâ	'betelnut'	dôy	'cook!'
	2	dúkè	'bird'	dʒérì	'split!'
	3	fítúrè	'duck'	bɛ́dàrì	'lean!'
ML	1	tɒ̰ũ̄	'cuscus (sp.)'	fʷrɛ̰ī	'put out!'
	2	fɛ̄bì	'fish (sp.)'	ādrì	'search!'
	3	kʷī.ɒ̄rì	'fish (sp.)'	drɛ̄bàrì	'sharpen!'
LHL	1	ã̄i	'mother'		
	2	ɔ̀trû	'aunt'	àtrî	'smile!'
	3	bàtú.à	'squash'	àidɒ́rì	'be confused!'

TABLE 4. Tonal contrasts on words in isolation.

The fact that all four pitch patterns end with an L pitch can be attributed to a boundary L% tone that is always present in utterance-final position; for example, [trâ] 'betelnut' is realized with an HL pitch in isolation but with H pitch when nonfinal, as in [trá késài] 'little betelnut'. Also note the difference between the trisyllabic nouns and verbs with HL and ML pitch patterns. Nouns have H-H-L and M-M-L, while verbs have H-L-L and M-L-L. This is discussed further in §4.2.

In tone analysis, relative pitch in context is the crucial element rather than absolute pitch (Hyman 2014). Therefore, we must examine the distinction between the HL and ML pitch patterns carefully since both include a relatively higher pitch followed by a lower pitch. Acoustic analysis of fundamental frequency from several representative words confirms that the distinction as represented in Table 4 is indeed present. Twelve CVCV nouns with HL pitch and twelve with ML pitch were examined, all produced in isolation by a single male speaker during a single recording session. F0 was measured on the first and second vowels, averaged over the middle third of each vowel. The averages are shown in Table 5.

PITCH	F0: 1ST VOWEL	F0: 2ND VOWEL	F0 CHANGE	*SD*
HL	174 Hz	145 Hz	29 Hz	10.34
ML	158 Hz	141 Hz	17 Hz	4.54

TABLE 5. Average change in F0 in HL and ML pitch words.

HL-pitch words average a higher pitch on the first vowel and have a greater F0 drop to the second vowel, which has roughly the same F0 as that of ML-pitch words. The large standard deviation of the HL F0 drops is due to a few outliers; more data will be needed to confirm these initial acoustic findings. However, these findings line up with auditory impressions that the first pitch in HL words is higher than that in ML words, and they correlate neatly with the tonal behavior of these words in phrasal context (§4.4), where these two pitch patterns have quite different phonological patterns.

From the data in Table 4 it can be seen that pitch patterns are realized in predictable ways over words of one, two, or three syllables. Tone melodies (Snider 1999) are associated with words rather than with syllables. Abawiri thus generally conforms to Donohue's (1997) notion of 'word tone' rather than 'syllable tone'; however, see §5.2 below for a discussion of the gradience of this distinction.

4. TONAL CONTRASTS IN PHRASAL CONTEXT. All four of the pitch patterns in Table 4 show diverging patterns in other contexts. Each pitch pattern includes words with two distinct patterns depending on context, yielding an eight-way contrast in tone patterns.

An analysis of the two groups of L-pitch words as phonologically /L/-toned and toneless is presented in §4.1. I then demonstrate a phonological contrast between /HL/ and

/H/ tone for words with the HL pitch pattern in §4.2 and show in §4.3 that monosyllabic and disyllabic nouns with the LHL pitch pattern, as well as all verbs with this pattern, have phonologically /LH/ tone. Trisyllabic nouns with this pattern have either /LH/ tone or /ØHL/ tone. Section 4.4 presents several alternative analyses of the mid-level pitch, concluding that these words are best analyzed as containing a floating /^{L}/ tone followed by an /H/ tone, in two additional contrasting melodies: /^{L}H/ and /^{L}HL/. A summary of the tone system is presented in §4.5.

4.1. Contrast between /L/ tone and toneless. Words with L pitch in isolation can be divided into two groups based on their behavior in certain phrasal contexts. When following an L-pitch possessor, some of these nouns trigger a high pitch on the final syllable of the possessor, while others do not. The top half of Table 6 shows nouns that do not affect the tone of the previous syllable, while the bottom half shows nouns that trigger a high pitch on the previous syllable. Note the alternation in the pitch of the final syllable of the frame word [dɛ̀bì] ~ [dɛ̀bí] 'child'.

PITCH	σ	NOUN	GLOSS	FRAME	NOUN	GLOSS
L#L	1	bù	'firewood'	dɛ̀bì	bù	'child's firewood'
	2	kɔ̀rɛ̀	'turtle'	dɛ̀bì	kɔ̀rɛ̀	'child's turtle'
	3	sɛ̀jàkà	'kingfisher'	dɛ̀bì	sɛ̀jàkà	'child's kingfisher'
LH#L	1	dì	'person'	dɛ̀bí	dì	'child's person'
	2	sɔ̀rì	'earth'	dɛ̀bí	sɔ̀rì	'child's earth'
	3	sɛ̀wɔ̀rdʒɛ̀	'sandpiper'	dɛ̀bí	sɛ̀wɔ̀rdʒɛ̀	'child's sandpiper'

Table 6. Two pitch patterns on L-pitch nouns in phrasal context.

In both groups the pitch on the noun remains a constant L. However, the second set of words triggers an H pitch on the final syllable of the previous word 'child'. Thus the phonological contrast between these two groups is manifested phonetically only after a word with L pitch.

This contrast is shown in the following two pitch traces. Figure 2 shows the constant low pitch, with some minor declination, in a pitch trace of the phrase [dɛ̀bì kɔ̀rɛ̀] 'child's turtle', contrasted with a high pitch in [dɛ̀bí sɔ̀rì] 'child's earth' in Figure 3.

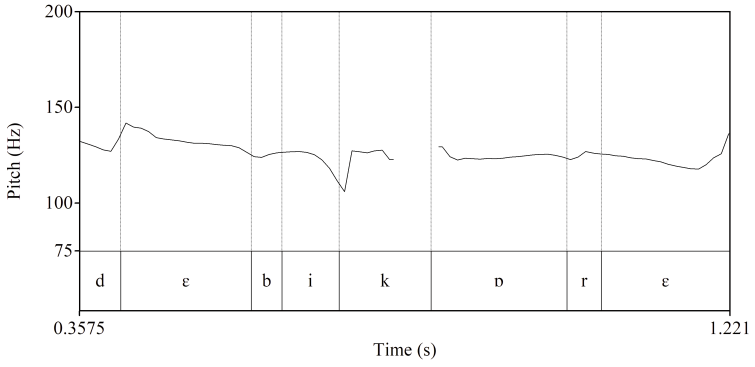


Figure 2. Pitch trace of [dɛ̀bì kɔ̀rɛ̀] 'child's turtle': L pitch throughout.

The contrast between these two pitch patterns is in verbs as well as nouns. Verbs that do not trigger previous high pitch are shown in the top half of Table 7; verbs that trigger it are shown in the bottom half. Note that the tone patterns are not affected by the grammatical role of the word that precedes the verb.

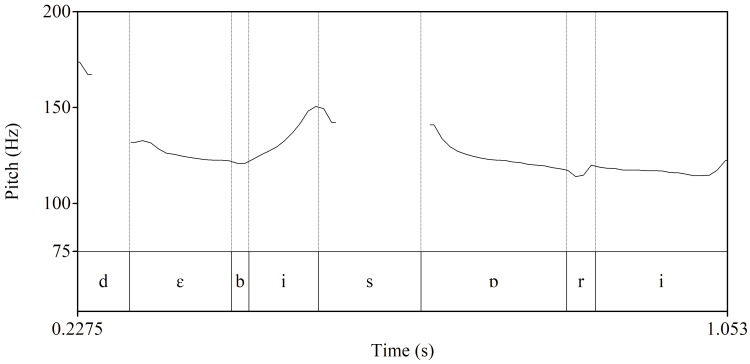


FIGURE 3. Pitch trace of [dɛ̀bí sɒ̀rì] 'child's earth': H pitch on second syllable.

PITCH	σ	VERB	GLOSS	FRAME	VERB	GLOSS
L#L	1	sì	'take!'	dɛ̀bì	sù.ɛ̀	'child took'
	2	dàbì	'talk!'	dɛ̀bì	dàbù.ɛ̀	'child talked'
	3	bìdʒɛ̀rì	'bite!'	dɛ̀bì	bìdʒɛ̀rù.ɛ̀	'child bit'
LH#L	1	bì	'close!'	dɛ̀bí	bù.ɛ̀	'child closed'
	2	tɛ̀bì	'sleep!'	dɛ̀bí	tɛ̀bù.ɛ̀	'child slept'
	3	sɒ̀bìtɛ̀i	'hunt!'	dɛ̀bí	sɒ̀bìtɛ̀wɛ̀	'child hunted'

TABLE 7. Two pitch patterns on L-pitch verbs in phrasal context.

The two groups of L-pitch nouns pattern differently when followed by an H pitch. When words of the first group are followed by an H pitch, the pitch on the final syllable is slightly higher in anticipation of the following H. This is seen in Figure 4: [drỳrɛ̄] 'hornbill', which belongs to the first group and does not trigger a high pitch on a previous word, shows a higher M pitch on the second syllable in anticipation of the H on the first syllable of [kɛ́sài] 'little'.

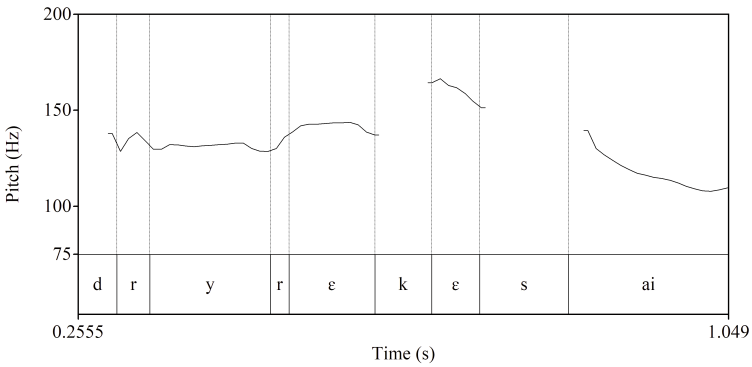


FIGURE 4. Pitch trace of [drỳrɛ̄ kɛ́sài] 'little hornbill': updrift before H pitch.

This higher pitch on the second syllable of [drỳrɛ̄] differs from words of the second group, where the pitch remains low throughout, even on the syllable immediately preceding an H pitch. This is seen in Figure 5: [fʷàrɛ̀] 'bow', which belongs to the second group and triggers a high pitch on a previous word, here shows constant low pitch throughout. The pitch even goes down slightly on the second syllable, immediately before the high pitch, in contrast with [drỳrɛ̄] 'hornbill' in Fig. 4, where the pitch drifts upward before the high pitch.

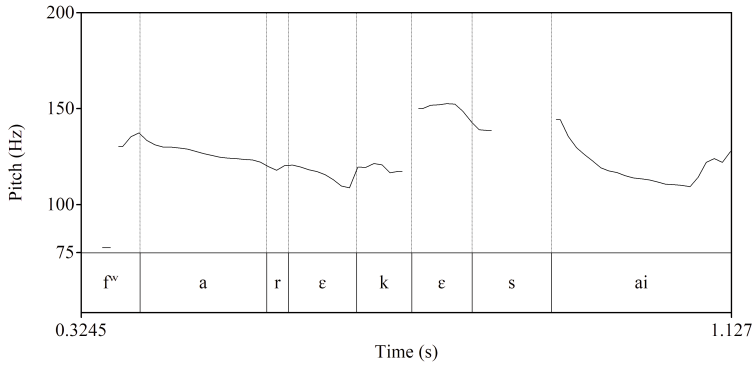


FIGURE 5. Pitch trace of [fʷàrè késài] 'little bow': constant low pitch before high pitch.

Words of the first group thus have two characteristics: they do not trigger high pitch on a previous syllable, and they show updrift in pitch before a following high pitch. By contrast, words of the second group trigger high pitch on a previous syllable and do not show updrift of pitch before a following high pitch. A few phonological analyses of this pattern are possible. I discuss two here, accepting the first as the most plausible analysis given currently available data.

Under one analysis, words of the first group are phonologically toneless, and words of the second group are phonologically /L/-toned. An anticipatory polar (H) tone (Muetze 2014) is inserted on the syllable previous to a phonological /L/ tone. The manifestation of this polar (H) tone is seen in the H pitch on the final syllable of *dɛ̀bí* in Fig. 3 above. Example 1 shows a preliminary autosegmental representation (Goldsmith 1979) of phonological tones mapping to syllables for the examples in Fig. 2 and Fig. 3 above.[7] In both examples the first word has /L/ tone. If the second word has an /L/ tone, as in 1b, tonal polarity occurs. If it is toneless, as in 1a, tonal polarity does not occur. In this analysis the default pitch of tonelessness is L, toneless syllables receiving their phonetic L pitch through interpolation (cf. Myers 1998, McPherson 2011).

(1) a. L (L%)
dɛ̀bì kɒ̀rɛ̀
'child's turtle'

b. L (H) L (L%)
dɛ̀bí sɒ̀rì
'child's earth'

In example 2, the frame word /aitɛ/ 'father' belongs to the first group, phonologically toneless under the current analysis. As in example 1, tonal polarity occurs only in 2b, where the second word has an /L/ tone.

(2) a. (L%)
àitɛ̀ kɒ̀rɛ̀
'father's turtle'

b. (H) L (L%)
àitɛ́ sɒ̀rì
'father's earth'

The two-word contexts in which polar (H) insertion occurs and does not occur are summarized in Table 8.

Anticipatory tonal polarity is also found in Mursi, a Nilo-Saharan language of Ethiopia (Muetze 2014), in which tonal polarity occurs on the final syllable of the preceding

[7] Solid lines represent association of phonological tones with a syllable in a word. Dashed lines represent other tone associations, both tone spreading and all association of nonlexical tones. Nonlexical tones are shown on the tonal tier in parentheses.

1ST WORD	POLAR (H)	2ND WORD
/L/	yes	/L/
Ø	yes	/L/
/L/	no	Ø
Ø	no	Ø

TABLE 8. Contexts for polar (H) tone insertion.

word. Tonal polarity in Mursi occurs only on phonologically toneless words and occurs preceding both tones: polar (H) before /L/ tone, and polar (L) before /H/ tone. Abawiri tonal polarity is restricted to the first: polar (H) before /L/ tone.

In Peñoles Mixtec, tonal polarity occurs only with adjacent /L/ tones as a result of an OBLIGATORY CONTOUR PRINCIPLE (OCP) constraint (Leben 1973). Daly and Hyman (2007:173) propose a formal analysis of the system using an optimality-theoretic constraint 'OCP(L): * L L', which prohibits adjacent /L/ tones on the tonal tier. In this language, the process occurs even across multiple toneless words. In Abawiri, anticipatory tonal polarity is not the result of an OCP constraint since it occurs before any /L/-toned word, regardless of the tone of the previous word.

An alternative analysis could assume a contrast between /L/ and /^{H}L/. In this analysis, the H pitch on the final syllable of a previous word is from the docking of the lexical floating /^{H}/ tone. This analysis is more straightforward in that no phonological processes need to be posited to explain the tonal patterns. A potential problem is that we would have to say that floating /^{H}/ tones dock, while floating /^{L}/ tones do not (see §4.4 below), going against the crosslinguistic tendency for /H/ tone to be involved in more phonological processes than /L/ tone. Another problem with this analysis is that it does not explain updrift of pitch in /L/-toned words before /H/ tone (Fig. 4) but steady L pitch in /^{H}L/-toned words (Fig. 5): it would have to account for why the L pitch drifts up in /L#H/ contexts, but not in /^{H}L#H/ contexts. In order to address this question, I investigated word combinations with pitch patterns LL#H, HL#H, and HLL#H. Crucially, in all contexts the pitch of the /L/ tones remains L. This goes against the analysis with an /L/ vs. /^{H}L/ contrast, which would predict updrift in LL#H sequences but steady L pitch in HL#H and HLL#H sequences. I therefore adopt the previous analysis as more plausible, with a contrast between toneless and /L/ tone.

4.2. CONTRAST BETWEEN **/H/** AND **/HL/** TONE. Nouns that have HL pitch in isolation have two distinct patterns when not at the end of the phrase. In some nonfinal words an H pitch is realized on all syllables, while in others the HL pitch pattern remains. In Table 9, nouns with nonfinal H pitch throughout are shown in the top half, and nouns with nonfinal HL pitch in the bottom half.

PITCH	σ	NOUN	GLOSS	NOUN	FRAME	GLOSS
H#H	1	trâ	'betelnut'	trá	kɛ́sài	'little betelnut'
	2	dúkɛ̀	'bird'	dúkɛ́	kɛ́sài	'little bird'
	3	fítúrɛ̀	'duck'	fítúrɛ́	kɛ́sài	'little duck'
HL#H	1	gʷî	'gecko'	gʷî	késài	'little gecko'
	2	kʷírù	'pole'	kʷírù	késài	'little pole'
	3	sérɔ̀rì	'yam'	sérɔ̀rì	késài	'little yam'

TABLE 9. Two pitch patterns on HL-pitch nouns in phrasal context.

Both the H and HL pitch patterns are relatively uncommon, each accounting for about 6% of the 603 nouns in the recordings of the extended word list. Monosyllabic nouns with these patterns are particularly infrequent, with eight H monosyllables and one HL monosyllable.

Pitch traces of both the H and HL pitch patterns are shown below. Figure 6 shows the H pitch on both syllables of nonfinal [fáití] ‘banana’; Figure 7 shows the lower pitch on the second syllable of [kʷírù] ‘pole’ in the same context.

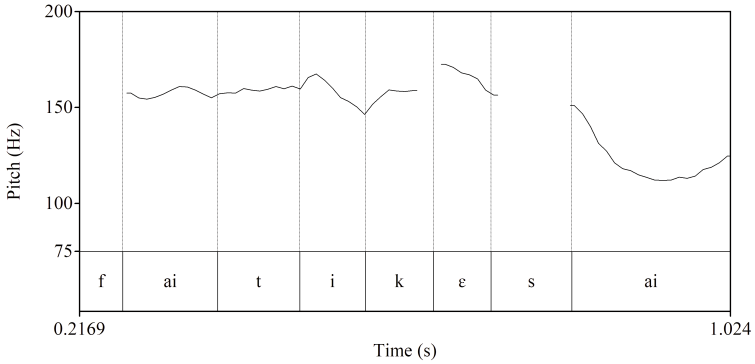


FIGURE 6. Pitch trace of [fáití kɛ́sài] ‘little banana’: H pitch on second syllable of target word.

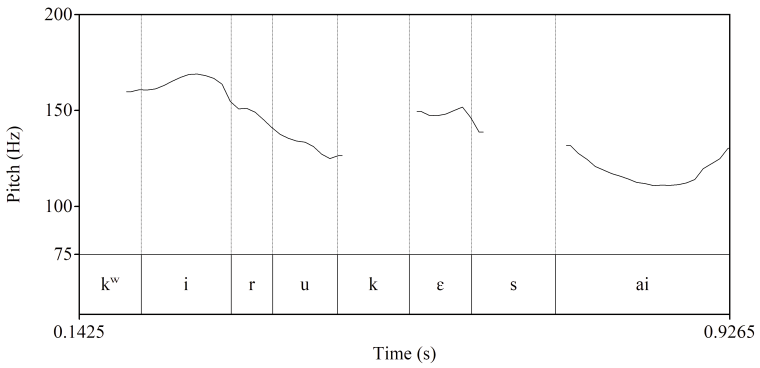


FIGURE 7. Pitch trace of [kʷírù kɛ́sài] ‘little pole’: L pitch on second syllable of target word.

Figure 7 additionally shows downdrift (Hombert 1974), where successive /H/ tones with intervening /L/ tones are realized with lower pitch. Here, the highest pitch is on the /H/-toned first syllable of /kʷírù/. After its /L/-toned second syllable, the /H/-toned first syllable of /kɛ́sai/ is lower in pitch. As also seen in this pitch trace, final boundary L% tone is often realized with the lowest pitch in the utterance, lower than preceding /L/-toned syllables.

The two pitch patterns demonstrated above hold regardless of the pitch of the following word. Words like [dúkɛ́] ‘bird’ always have a high pitch throughout in nonfinal position, whether the following pitch is high or low. In contrast, words like [kʷírù] ‘pole’ always have a high pitch on the first syllable and a lower pitch on the second in nonfinal position, regardless of the pitch of the following word. I analyze the first set of words as /H/, and the second set as /HL/. The fact that /H/-toned words have an HL pitch pattern in isolation is due to utterance-final L% tone insertion.

As seen in §4.1 above, anticipatory tonal polarity occurs on a syllable prior to an /L/ tone. When a disyllabic /HL/-toned word precedes an /L/ tone, the result is an HM#L pitch pattern, with the lexical /L/ tone and the polar (H) tone both linked to the final syllable to yield an M pitch. This contrasts with disyllabic /H/-toned words in this context, where the /H/ tone spreads to the end of the word. This is schematized in example 3.

(3) a. H L (H) L (L%) b. H L (L%)

kʷírū dɔ̀bù fáití dɔ̀bù

‘big pole’ ‘big banana’

As a slight modification to Table 4 above, the difference between /H/ and /HL/ tone is actually manifested on trisyllabic nouns in isolation, as can be seen in the difference between [fítúrɛ̀] ‘duck’ and [sɛ́rɔ̀rì] ‘yam’ in Table 9 above. Here, words with /H/ tone have a relatively high pitch on the second syllable, while words with /HL/ tone have a lower pitch on the second syllable. Thus, phonological tones associate with a single syllable from left to right; following this, spreading occurs to unassociated syllables. This is schematized in example 4.

(4) a. H (L%) b. HL (L%)

fítúrɛ̀ sɛ́rɔ̀rì

‘duck’ ‘yam’

The pitch distinction between the two types of trisyllabic nouns is rather subtle. This is for two reasons. First, an /H/-toned syllable immediately preceding the final boundary tone often tends to be lower in pitch than previous /H/ tones. Second, final boundary tone is often lower in pitch than a preceding /L/-toned syllable. These two facts mean that both /H/-toned and /HL/-toned trisyllabic nouns are realized with a high pitch on the first syllable, a somewhat lower pitch on the second syllable, and a low pitch on the final syllable. Figure 8 shows a pitch trace of a trisyllabic /H/-toned word, while Figure 9 shows a pitch trace of a trisyllabic /HL/-toned word.

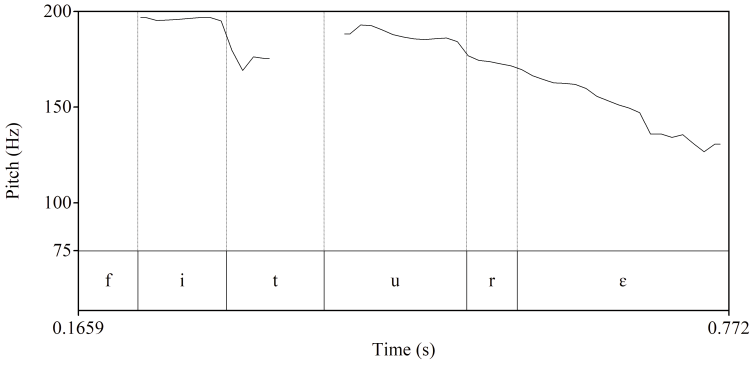


FIGURE 8. Pitch trace of [fítúrɛ̀] ‘duck’: HHL pitch on a trisyllabic /H/-toned word in isolation.

Unlike nouns, there is no distinction between /H/ and /HL/ tone among verbs. Verbs have a single pattern, with high pitch only on the first syllable and all subsequent syllables with low pitch. With a few exceptions (see the paragraph below), it is generally not possible for verbs to be in nonfinal position in the language since it is strongly verb-final. However, the single pitch pattern described above persists across verbs with any number of syllables created by the addition of various tense and aspect suffixes. Examples are shown in Table 10, where the verbs in the rightmost set have an additional syllable from suffixation.

The /H/-toned auxiliary /bɒ́rɛ/ can occur after the main verb, being one of the few cases of a lexical item following the main verb. In constructions with /bɒ́rɛ/, the main verb retains the H pitch on the first syllable of the root and L pitch on all subsequent syl-

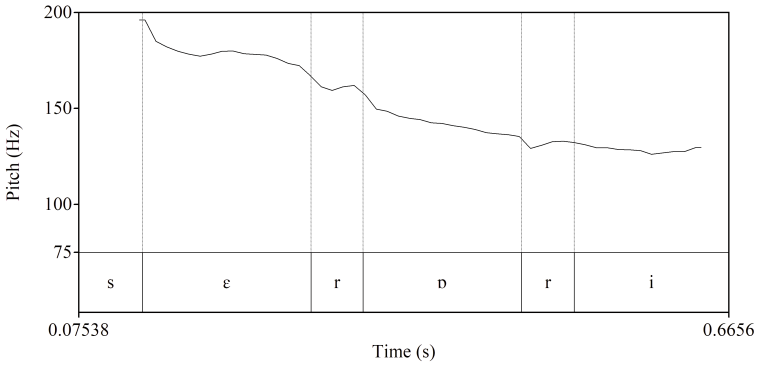


FIGURE 9. Pitch trace of [sérɔ̀rì] 'yam': HLL pitch on a trisyllabic /HL/-toned word in isolation.

PITCH	σ	VERB (IMP)	GLOSS	VERB (PFV)	GLOSS
HL	1	dɔ̂y	'cook!'	dɔ́ydʒɛ̀	'cooked'
	2	dʒérì	'split!'	dʒérù.ɛ̀	'split'
	3	bɛ́dàrì	'lean!'	bɛ́dàrìdʒɛ̀	'leaned'

TABLE 10. One pitch pattern on HL-pitch verbs.

lables. This is shown in example 5, an extract from a procedural text. Also note in this example that the prefix *bu-* 'down' does not interact with the tone of the verb root.

(5)

	H		H	(L%)
drɛ̀	bù-áfwè-i		bɒ́rɛ̀	
here	down-enter-IPFV		AUX	

'They enter downwards here.'

Verbs with this pitch pattern could be analyzed as phonologically either /HL/ or /H/. An advantage of the /HL/ analysis is that the tonal behavior of these verbs fits exactly with the /HL/ tone melody on nouns. However, this would also mean that there are verbs with /HL/ tone but none with /H/ tone, a rather surprising configuration since only the more complex melody would be attested. If these verbs are analyzed as phonologically /H/, a category-specific constraint (Smith 2011) would be needed, which would disallow /H/-tone spreading on verbs. This constraint nicely captures the fact that non-L pitch only occurs on the first syllable of verbs (see the discussion of LHL pitch on verbs in §4.3 and ML pitch on verbs in §4.4). A further consideration is the inventory of tone melodies. If the first analysis is adopted, no tone melodies on verbs would end in /H/ tone, giving an inventory of /L/, /HL/, /LHL/, /^{L}HL/, and Ø for verbs. Given the second analysis, the inventory is simpler: /L/, /H/, /LH/, /^{L}H/, and Ø. A final fact is that the /LHL/ tone melody is not found on nouns (although this is a dispreferred analysis for certain trisyllabic nouns, as discussed in §4.3). Given the above facts, I analyze verbs with the HL pitch pattern as phonologically /H/, with a category-specific constraint in which /H/ tone does not spread on verbs.

There are eight tone melodies on nouns but only five on verbs. The fact that Abawiri verbs have fewer tone melodies than nouns fits with the crosslinguistic observation that verbs often have fewer prosodic options than do nouns in the same language.[8] This is true of accentual systems such as Spanish, where location of stress is predictable for verbs but not for nouns (Smith 2011), and Hebrew, where stress is contrastive on nouns

[8] Thanks to Bernard Comrie for pointing out this fact.

but not on verbs (Becker 2003). In Tokyo Japanese, there is a binary distinction between accented and unaccented verbs, while nouns have more lexical accent contrasts (Kubozono 2011). This generalization also holds true of tone systems, where nouns often have more lexically specified tonal contrasts than verbs. Many Bantu languages have this configuration (Smith 2011). In at least one other Lakes Plain language, Iau, the same set of tonal contrasts is found on nouns as on verbs (Bateman 1986, 1990). However, tone is lexical only on nouns, while verbs are lexically toneless. Tone serves a strictly grammatical function on verbs.

All of the above languages have relatively rich verb morphology, and in at least some of the languages (Japanese, Iau) verb morphology interacts with prosody and/or tone. Thus a common scenario crosslinguistically is one where nouns are more lexically specified for prosodic information, while for verbs prosody is used more heavily in the morphology. Abawiri fits with the first part of this scenario in that nouns have more lexically specified tone melodies than do verbs. However, while the verb morphology is much more extensive than the noun morphology, tone has not been found to interact with the verb morphology. It is unclear why Abawiri verbs should have fewer tonal specifications than nouns. This remains an area for further investigation.

4.3. /LH/ AND PRELINKED /ØHL/ TONE. Nouns with an LHL pitch pattern in isolation have two distinct tonal patterns, with one being restricted to trisyllabic words. The pitch pattern on monosyllabic and disyllabic nouns is analyzed as phonologically /LH/ and is discussed first. Following this is a discussion of trisyllabic nouns, which have a more complex pattern and fall into two groups: phonologically /LH/ and /ØHL/.

Monosyllabic and disyllabic nouns with an LHL pitch pattern in isolation have an LH pitch pattern in nonfinal position. This is shown in Table 11, where words in isolation are shown on the left, words preceding the /L/-toned adjective /dɔ̀bu/ ‘big’ are shown in the middle, and words preceding the /H/-toned adjective /kɛ́sai/ ‘little’ are shown on the right. A trisyllabic noun is included for comparison.

σ	NOUN	GLOSS	NOUN	FRAME	GLOSS	NOUN	FRAME	GLOSS
1	ãi	‘mother’	ǎi	dɔ̀bù	‘big mother’	ǎi	kɛ́sài	‘little mother’
2	ɔ̀trû	‘aunt’	ɔ̀trú	dɔ̀bù	‘big aunt’	ɔ̀trú	kɛ́sài	‘little aunt’
3	bàtúà	‘squash’	bàtúá	dɔ̀bù	‘big squash’	bàtúà	kɛ́sài	‘little squash’

TABLE 11. Pitch pattern on LHL-pitch monosyllabic and disyllabic nouns in phrasal context.

The word [ãi] ‘mother’ shown in Table 11 is the only monosyllabic /LH/ noun in the data. In this word, both tones link to the single syllable, resulting in a rising pitch. (In isolation, the final boundary L% tone links as well, resulting in a rising-falling pitch contour, as seen in 7a below.) In disyllabic nouns with /LH/ tone, the /L/ tone links to the first syllable and the /H/ tone to the second syllable. Autosegmental representations of both are shown in nonfinal position in example 6.

(6) a. L H H (L%) b. L H H (L%)

ǎi kɛ́sài ɔ̀trú kɛ́sài

‘little mother’ ‘little aunt’

The /L/ tone in /LH/-toned words triggers polar (H) tone insertion on a previous syllable, as expected for /L/ tones. Examples of this are seen in 7; in [àitɛ́ ɔ̀trû] ‘father’s aunt’ in 7b, for instance, the L tone of /ɔ̀trú/ triggers polar (H) tone insertion on a previous non-/H/-toned syllable. On utterance-final disyllabic words, the /H/ and final boundary L% tone both link to the final syllable, creating a falling contour, as is also seen in 7b.

(7) a. (H) L H (L%) b. (H) L H (L%)

àitɛ̀ ã̀i ‘father’s mother’

àitɛ̀ ɔ̀trû ‘father’s aunt’

The utterance-final pitch pattern of [ã̀i] ‘mother’ in 7a shows all of the predicted elements, fully realized even on a single monosyllable: triggering of polar (H) tone, rising pitch from the /LH/ melody, and falling pitch from final boundary L% tone. A trace of the pitch contour of [àitɛ́ ã̀i] ‘father’s mother’ is shown in Figure 10.

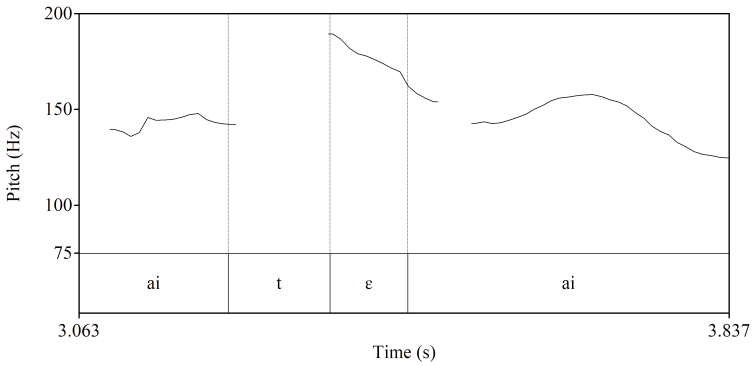


FIGURE 10. Pitch trace of [àitɛ́ ã̀i] ‘father’s mother’: final LHL pitch contour.

The rarity of the /LH/ tone melody on monosyllables mirrors the rarity of the /HL/ pattern on monosyllables, with only one example each. This suggests that multiple tones linked to a single syllable are dispreferred although not prohibited. In general, all tones obligatorily link to a syllable in the segmental tier. (The exception is floating /^{L}/ tone, which never links; see §4.4.)

Trisyllabic nouns with LHL pitch have exceptional behavior requiring explanation. Before /H/-toned adjectives the final pitch is L, suggesting /LHL/ tone. However, before /L/-toned adjectives the pitch is LHH, suggesting /LH/ tone with spreading /H/ tone. Under an analysis of these words as phonologically /LHL/, the LHH pitch before /L/ tone requires explanation. Polar (H) tone insertion is expected before an /L/ tone; the final /L/ tone would then be delinked from the final syllable and the polar (H) tone linked. This analysis is schematized in example 8. However, note that Abawiri does not have a general prohibition on multiple tones linking to a syllable, as seen in example 3 above where a lexical /L/ tone and polar (H) tone both link to a single syllable.

(8) a. L HL (H) L (L%) b. LHL H (L%)

bàtúá dɔ̀bù ‘big squash’

bàtúà kɛ́sài ‘little squash’

Alternatively, this pitch pattern could be analyzed as phonologically /LH/. In this analysis, it needs to be explained why the pitch of the final syllable is L before an /H/-toned adjective, where the /H/ tone is expected to spread. This analysis, schematized in example 9, requires postulating an exception to the generalization that /H/ tone spreads to the end of the word.

(9) a. LH L (L%) b. LH H (L%)

bàtúá dɔ̀bù ‘big squash’

bàtúà kɛ́sài ‘little squash’

Under this analysis, the failure of /H/ tone to spread before a following /H/ tone but not before a following /L/ tone could be attributed to an OCP constraint dispreferring adjacent /H/ tones. In general, however, /H/ tones occur freely together, as in the two /H/-toned words /dúkɛ kɛ́sai/ 'little bird' (Table 9 above). This is the only place in the data where /H/ tone fails to spread to the end of nouns, although /H/ tone never spreads on verbs. Both of the above analyses involve the addition of a phonological exception not found elsewhere: /L/ delinking under the /LHL/ analysis, and failure of /H/ tone to spread under the /LH/ analysis. The /LHL/ analysis, however, requires postulating a tone melody not found elsewhere in the language. Further, the /LHL/ analysis requires delinking, a phonological process that goes against the multiple linking seen elsewhere in the language, while the /LH/ analysis postulates that /H/ tone fails to spread, a fact robustly attested elsewhere in the language. For these reasons, the /LH/ analysis is adopted here.

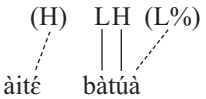
Not all trisyllabic nouns with LHL pitch in isolation pattern in the same way. When following an /L/-toned or toneless possessor, two distinct patterns emerge, as shown in Table 12.

σ	NOUN	GLOSS	FRAME	NOUN	GLOSS	FRAME	NOUN	GLOSS
3	bàtú.à	'squash'	àitɛ́	bàtú.à	'father's squash'	dɛ̀bí	bàtú.à	'child's squash'
3	kɔ̀bárɛ̀	'stork'	àitɛ̄	kɔ̄bárɛ̀	'father's stork'	dɛ̀bì	kɔ̄bárɛ̀	'child's stork'

TABLE 12. Two pitch patterns on LHL-pitch nouns in phrasal context.

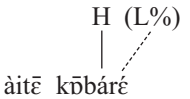
As seen in the center column, the word [bàtúà] 'squash' triggers polar (H) tone insertion on the previous syllable, while [kɔ̀bárɛ̀] 'stork' does not. Further, as seen in the rightmost column, the pitch on [kɔ̄bárɛ̀] gradually drifts up to the H pitch on the second syllable of the word. This contrasts with [bàtúà], where the first syllable is consistently L. While [bàtúà] has /LH/ tone, as discussed above, the first syllable of [kɔ̀bárɛ̀] appears to be toneless. It patterns like toneless syllables in that (i) it does not trigger polar (H) tone insertion and (ii) it shows updrift from a preceding /L/ tone to a following /H/ tone. An autosegmental representation of each pattern in the center column of Table 12 is shown in example 10.

(10) a.



'father's squash'

b.



'father's stork'

I analyze words like [kɔ̀bárɛ̀] 'stork' as containing an /HL/ tone melody, with the /H/ tone 'prelinked' to the second syllable. Donohue (1997) discusses the notion of lexically prelinked tones, based on earlier work in autosegmental phonology by Leben (1982). Prelinking of tones holds explanatory power for words where the tones are shifted to the left or right of their normal position in the word—where their placement would be difficult to derive by a regular phonological process and needs to be lexically specified. In the case of Abawiri, tone melodies are usually realized with the first tonal element linked to the leftmost syllable of the word. For the trisyllabic nouns here, however, the first tone is lexically specified as linked to the second syllable of the word, leaving the first syllable with no linked tone. This prelinked /ØHL/ tone melody thus contrasts both with the /LH/ tone melody and with the (non-prelinked) /HL/ tone melody on trisyllabic nouns.

Unlike nouns, verbs show only an LHL pitch pattern, regardless of the number of syllables in the word. On disyllables the first syllable has L pitch and the second has falling pitch. On verbs of three or more syllables the first syllable has L pitch, the second has H pitch, and all subsequent syllables have L pitch. This is shown in Table 13, where the

verbs in the rightmost set have an additional syllable from suffixation. There are no monosyllabic verbs with this pitch pattern.

PITCH	σ	VERB (IMP)	GLOSS	VERB (PFV)	GLOSS
LHL	2	àtrî	'smile!'	àtrí.è	'smiled'
	3	àidɔ́rì	'be confused!'	àidɔ́rù.è	'was confused'

TABLE 13. One pitch pattern on LHL-pitch verbs in phrasal context.

I analyze verbs with this pitch pattern as containing an /LH/ tone melody, with the category-specific constraint that /H/ tone does not spread on verbs. There are no verbs with /ØHL/ tone.

4.4. ANALYSIS OF M PITCH AS /^{L}H/. Words with the ML pitch pattern in isolation have two distinct pitch patterns in phrase-medial position, like words with HL pitch (§4.2). These two pitch patterns mirror exactly the patterns found on HL-pitch words. This is shown in Table 14. The set at the top has higher pitch throughout the word in medial position, while the set at the bottom has final L pitch in both medial and final position.

PITCH	σ	NOUN	GLOSS	NOUN	FRAME	GLOSS
M#H	1	tɒ̄ù	'cuscus (sp.)'	tɒ̄u	késài	'little cuscus (sp.)'
	2	fɛ̄bì	'fish (sp.)'	fɛ̄bī	késài	'little fish (sp.)'
	3	kʷī.ɒ̄rì	'fish (sp.)'	kʷī.ɒ̄rī	késài	'little fish (sp.)'
ML#H	1	sū	'leaf rib'	sū	késài	'little leaf rib'
	2	dūdʒɔ̀u	'sibling-in-law'	dūdʒɔ̀u	késài	'little sibling-in-law'
	3	kɒ̄ràrì	'tree (sp.)'	kɒ̄ràrì	késài	'little tree (sp.)'

TABLE 14. Two pitch patterns on ML-pitch nouns in phrasal context.

Also mirroring HL-pitch nouns is the contrast between the second syllables of trisyllabic nouns in isolation, with mid-level pitch on the second syllable of [kʷīɒ̄rì] 'fish (sp.)', but low pitch on the second syllable of [kɒ̄ràrì] 'tree (sp.)'. These facts suggest that these two patterns are the same as the /H/ and /HL/ tone melodies above, but with a different first tone (to be discussed below).

The phonetic difference between the H-pitch words exemplified in the upper half of Table 9 and the M-pitch words exemplified in the upper half of Table 14 becomes evident when the words are followed by an H pitch. Pitch on H-pitch words is the same as the following H pitch (Figure 11), while on M-pitch words it is relatively lower (Figure 12).

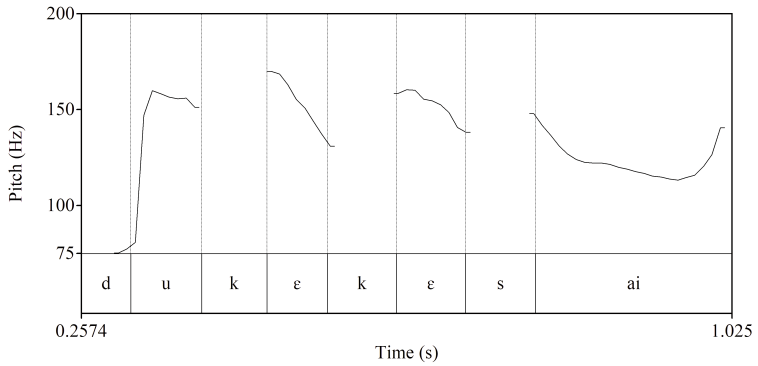


FIGURE 11. Pitch trace of [dúké késài] 'little bird': H pitch before following high pitch.

Verbs with the ML pitch pattern do not divide into two groups as nouns do when in context. This is shown in Table 15. Note that, as with /H/-toned verbs, the higher (M)

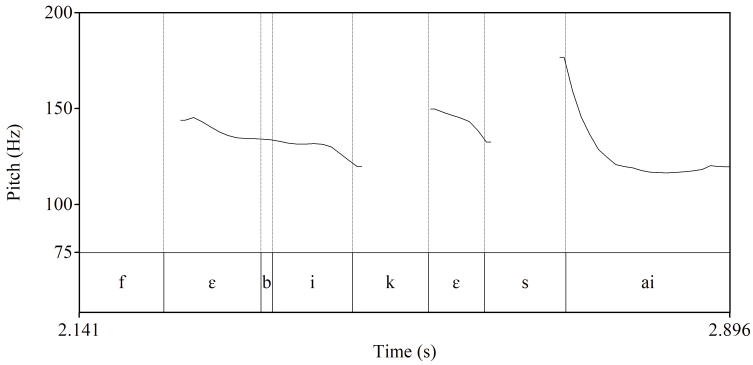


FIGURE 12. Pitch trace of [fɛ̄bī kɛ́sài] 'little fish (sp.)': M pitch before following high pitch.

pitch is only realized on the first syllable. Verbs with ML pitch thus pattern as expected based on nouns with the same pitch, and on verbs with HL pitch.

PITCH	σ	VERB (IMP)	GLOSS	FRAME	VERB (PFV)	GLOSS
LH#ML	1	fʷrɛ̌	'put out!'	dɛ̀rì.á[a]	fʷrɛ̌	'put out well!'
	2	ādrì	'search!'	dɛ̀bí	ādrìdʒɛ̀	'child searched'
	3	drēbàrì	'sharpen!'	dɛ̀bí	drɛ̄bàrù.ɛ̀	'child sharpened'

TABLE 15. One pitch pattern on ML-pitch verbs.

[a] I do not have a recording of a monosyllabic verb of this pitch pattern with /dɛ̀bi/ 'child'. Substituted here is the /L/-toned adverb /dɛ̀ria/ 'well', with a verb in imperative form. The tones and tonal processes are identical.

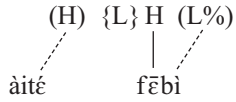
Another fact about words with the ML pitch pattern is that they trigger polar (H) tone insertion on a previous non-/H/-toned word, just as /L/-toned words do. This is shown in Table 16, where the preceding toneless possessor /aitɛ/ 'father' is realized with a high pitch on the final syllable ([àitɛ́]). Note that both sets of nouns trigger polar (H) insertion.

PITCH	σ	NOUN	GLOSS	FRAME	NOUN	GLOSS
LH#ML	1	tɒ̄	'cuscus (sp.)'	àitɛ́	tɒ̄	'father's cuscus (sp.)'
	2	fɛ̄bì	'fish (sp.)'	àitɛ́	fɛ̄bì	'father's fish (sp.)'
	3	kʷī.ɒ̄rì	'fish (sp.)'	àitɛ́	kʷī.ɒ̄rì	'father's fish (sp.)'
LH#ML	1	sū	'leaf rib'	àitɛ́	sū	'father's leaf rib'
	2	dūdʒɔ̀u	'sibling-in-law'	àitɛ́	dūdʒɔ̀u	'father's sibling-in-law'
	3	kɒ̄ràrì	'tree (sp.)'	àitɛ́	kɒ̄ràrì	'father's tree (sp.)'

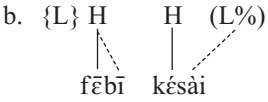
TABLE 16. Polar (H) insertion on syllable before words with ML pitch (both types).

Several analyses of the data are possible, all of which present at least one difficulty. The main issue concerns the phonological nature of the M pitch. Is it a phonologically distinct M tone, or is it derived? And why does it trigger anticipatory tonal polarity like /L/ tone? I discuss three possible analyses below.

One potential analysis (and the one adopted here) is that the M pitch comes from a lexical /ᴸH/ tone. The floating /ᴸ/ tone triggers lowering of the following /H/ tone to a derived M tone. Additionally, the floating /ᴸ/ tone triggers anticipatory tonal polarity like linked /L/ tones do. The floating /ᴸ/ tone does not dock (that is, it is never overtly realized). The ML pitch patterns are thus phonologically /ᴸH/ and /ᴸHL/. An autosegmental representation of the /ᴸH/ tone melody is shown in example 11, both after the possessor [àitɛ́] 'father' and before the adjective [kɛ́sài] 'little'. Floating tone is represented in the autosegmental tier in {curly braces}.

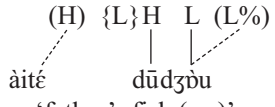
(11) a. 

'father's fish (sp.)'

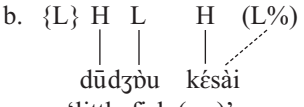
b. 

'little fish (sp.)'

An autosegmental representation of the /^{L}HL/ tone melody is shown in example 12.

(12) a. 

'father's fish (sp.)'

b. 

'little fish (sp.)'

At first glance, it might appear that the lowering of the /H/ tone could be a case of downstep. This would eliminate the need to posit an additional phonological M tone, which occurs only as a derived tone and is not part of the representation of any lexical item. But the derived M tone does not behave like a downstepped /H/. A downstepped /H/ would lower the pitch of the tonal tier so that any following /H/ tones are also realized at the lower pitch (cf. Hyman 2014). As seen in Fig. 12 and example 11, however, following /H/ tones are realized at a higher pitch than the M tone. There is no lowering of the register.[9]

The above analysis fits nicely with the analysis of lexically prelinked tones discussed in §4.3 above. Here, for the /^{L}H/ and /^{L}HL/ tone melodies, the second tone is lexically specified as linked to the first syllable of the word, leaving the first tone floating on the left edge of the word.

This analysis is rather abstract in relation to the phonetic pitch, particularly since the posited floating /^{L}/ tone is never linked to a syllable; it always remains hidden. An alternative analysis could posit a nonderived /M/ tone as part of the phonological inventory. The ML pitch patterns above would be analyzed straightforwardly as /M/ and /ML/. The inventory of lexically specified tone melodies would then include /L/, /H/, /M/, /LH/, /HL/, /ML/, and toneless. In this analysis not all possible combinations are attested with /M/ tone, specifically /*LM/, /*HM/, and /*MH/; /ML/ would be the only combination attested. This could be partially explained by appealing to phonetic perceptual distinctiveness. Any combination of an L or H pitch with an M pitch would create a less perceptually salient pitch change than a combination of L and H pitches, the pitch transition in the former being perhaps half that in the latter. Further, falling tones are crosslinguistically more common than rising tones; many languages have the former but not the latter, such as Hausa and Luganda (Gordon 2001:436, 442). This could help make sense of why the /*MH/ and /*LM/ melodies are unattested, but the absence of the /*HM/ melody would remain an unexplained gap. A more serious issue with this analysis is the fact that /M/ tone triggers anticipatory polar (H) tone insertion like /L/ tone. This analysis leaves unexplained the phonological affinity between the /M/ tone and the /L/ tone. With /M/ tone, the process could no longer be one of tonal polarity since the tone of the previous syllable changes from one unlike tone /L/ to another unlike tone /H/. To resolve this one might adopt a featural analysis such as [±raised] that creates affinity between /M/ and /L/ as opposed to /H/. Here I adopt the previous analysis as more phonologically plausible.

If one were to adopt the alternative analysis from §4.1 that attributes (H) tone insertion to lexical floating tone /^{H}L/, then the two tone patterns here could be analyzed as /^{H}H/ and /^{H}HL/, where the H pitch on the previous syllable is from docking of the float-

[9] Thanks to a referee for making this observation.

ing /^{H}/ tone. Here, the floating /^{H}/ tone would also trigger a dissimilatory process that lowers the linked /H/ tone to M. This analysis is not adopted here for reasons given in §4.1 above.

4.5. SUMMARY. To summarize, Abawiri has two contrastive lexical tone heights /H/ and /L/, along with tonelessness, a floating /^{L}/ tone, and a derived M tone. The lexical tones combine to form eight tone melodies on nouns and five on verbs. The following two tables show counts of the tone melodies found on nouns and verbs in the extended word list. Table 17 summarizes the eight tone melodies on the 554 nouns, separating stems of one, two, and three syllables.

TONE MELODY	PITCH IN ISOLATION	1σ	2σ	3σ	TOTAL	%
Ø	L	40	133	70	243	44%
/L/	L	32	59	23	114	21%
/^{L}H/	ML	17	63	14	94	17%
/H/	HL	8	21	6	35	6%
/HL/	HL	1	17	15	33	6%
/LH/	LHL	1	5	14	20	4%
/ØHL/	LHL			8	8	1%
/^{L}HL/	ML	2	3	2	7	1%
TOTAL		101	301	152	554	100%

TABLE 17. Type frequency of tone melodies on nouns, by stem length.

Nearly half of the nouns in the data are toneless. The next most frequent tone melody is /L/. Both /L/ and toneless words are realized with L pitch, meaning that nearly two-thirds of all nouns in the language have L pitch in isolation. The /^{L}H/ tone melody is nearly as frequent as /L/ on nouns, accounting for about 17% of the total. The /H/, /HL/, and /LH/ melodies account for 4–6% of the total, while /ØHL/ and /^{L}HL/ are both quite rare. The rarity of /ØHL/ is not surprising since it is restricted to trisyllabic nouns. The rarity of /^{L}HL/ could be correlated with the fact that it is the most complex, being the only tone melody with three tones.

Table 18 summarizes the five tone melodies on 104 verbs, separating stems of one, two, and three syllables.

TONE MELODY	PITCH IN ISOLATION	1σ	2σ	3σ	TOTAL	%
Ø	L	16	17	3	36	35%
/H/	HL	7	16	9	32	31%
/L/	L	16	6	1	23	22%
/LH/	LHL		4	5	9	9%
/^{L}H/	ML	1	3		4	4%
TOTAL		40	46	18	104	100%

TABLE 18. Type frequency of tone melodies on verbs, by stem length.

As with nouns, toneless verbs are the most common. Unlike nouns, a high percentage of verbs have an /H/ tone melody. The /L/ tone melody is about equally as frequent in nouns and verbs. An initial floating /^{L}/ tone is rare on verbs, occurring on just 4% of verbs as opposed to 17% of nouns. Failure of /H/ tone to spread on verbs means that all verbs end with L pitch. There is thus no contrast between /H/ and /HL/ or between /^{L}H/ and /^{L}HL/ tone melodies as on nouns. Additionally, the /ØHL/ tone melody attested on trisyllabic nouns is not found on verbs.

Following is a summary of the phonological processes in the Abawiri tone system. The syllable previous to an /L/ tone must be /H/. This requirement is resolved by anticipatory tonal polarity, with a polar (H) tone being inserted on the syllable just previous to the /L/

tone. Presence or absence of polar (H) tone is a factor distinguishing toneless and /L/-toned words; additionally, toneless words show updrift in pitch preceding an /H/ tone, while /L/-toned words do not. A boundary L% tone is always present utterance-finally, with the result that all utterances end with a low pitch. This pitch is generally lower than the pitches associated with any previous (nonfinal) /L/ tones and corresponds to the crosslinguistically common process of final lowering (Liberman & Pierrehumbert 1984). A floating /^{L}/ tone is lexically specified for certain words. This tone triggers polar (H) insertion, as does linked /L/ tone, and additionally triggers lowering of a following /H/ tone to M tone. The M tone is attested only in this derived context. /H/ tone can be lexically prelinked to either the first or second syllable of a word. Three of the eight tone melodies (/ØHL/, /^{L}H/, /^{L}HL/) include a prelinked /H/ tone. /H/ tone spreads to the end of nouns except to phrase-final syllables, which have boundary L% tone, and to the third syllable of trisyllabic /LH/ nouns before a following /H/ tone. /H/ tone does not spread on verbs and is confined to the first syllable.

5. The Abawiri tone system and the typology of tone.

5.1. Tone in New Guinea. Typological work on tone systems has traditionally focused mostly on Asia and Africa, with some attention to Mexico. However, descriptions of tone systems in New Guinea have now been in the literature for several decades, beginning with exploratory work (e.g. Wurm 1954). Tone is geographically widespread among Papuan languages of New Guinea, although non-tone languages are very common as well (Donohue 1997, Foley 2000).

Among the approximately twenty Lakes Plain languages (Clouse 1993, 1997), tone is a prominent feature of all languages for which data is available. No data is available for Taburta, the language most closely related to Abawiri. The geographically closest languages for which tone descriptions are available are the East Tariku languages Sikaritai, Obokuitai, Doutai, and Iau.

The small Lakes Plain family shows a diversity of tone systems, some relatively simple, such as Sikaritai, and others quite complex, such as Iau. Sikaritai (Martin 1991, Liem 2007) has a simple syllable-tone system in which tones are associated with syllables rather than with words. It has two tones, and no tone-sandhi processes are described. Obokuitai (Jenison & Jenison 1991) also has syllable tone, with a few static restrictions on tone and syllable cooccurrence. Iau has what is probably the most complex tone system yet described in New Guinea, with two level tones and six contour tones (Bateman 1986, 1990, Edmondson et al. 1992). Syllables can have combinations of two tones. Tone is lexical on nouns but has a grammatical function on verbs. Iau has a highly reduced system of segmental phonology with only six consonants and eight vowels and a preponderance of monosyllabic CV words. Finally, Doutai (McAllister & McAllister 1991, Donohue et al. 2006) has a two-height system that can be analyzed as word tone, although there are more tone-melody possibilities on words with more syllables.

This study suggests that Abawiri tone is typologically similar to the tone system of Doutai in that tone is associated with words rather than syllables, and various tone-sandhi processes are in place. Diachronic work is needed to show what the proto-Lakes Plain tone system was and how it developed in each of these languages.

5.2. Typologizing tone systems. Rather than attempting to classify the Abawiri language as containing a tone system of a certain type, I instead discuss how the various properties of the system fit with properties of tone systems in other languages, an approach Hyman calls ‘property-driven typology’: ‘Rather than seeking to classify or label languages, the central goal of phonological typology is to determine how different languages systematize the phonetic substance available to all languages’ (Hyman 2009:213).

There are several properties by which it is useful to classify tone systems. I discuss four here. Perhaps the most long-standing is Pike's (1948) famous distinction between register-tone systems and contour-tone systems. Abawiri is clearly of the former type, with contours decomposable into sequences of level tones.

Another property, discussed above, is Donohue's (1997) distinction between word and syllable tone, where in a language with word tone there are the same number of tone-melody contrasts on words of any length, while in a language with syllable tone the number of contrasts is associated with syllables, meaning that words of more syllables have more tone-melody possibilities. Lakes Plain languages show some variability in this regard. While Sikaritai has fairly unambiguous word tone, with the same number of tone-melody possibilities on words of any number of syllables (Martin 1991, Liem 2007), Obokuitai has syllable tone (Jenison & Jenison 1991), as does Iau (Bateman 1990). Doutai appears to be an intermediate case (McAllister & McAllister 1991), although it is analyzed by Donohue and colleagues (2006) as a word-tone system.

Donohue (1997) presents the distinction between word and syllable tone as categorical, in that a language has either word tone or syllable tone. However, to more accurately capture distinctions among tone systems, it would be helpful to view this distinction as gradient based on the number of tone-melody possibilities on words of various syllable lengths and on the number of tone processes that refer to the domain of the word vs. the domain of the syllable. In a pure word-tone system, there would be exactly the same number of possibilities on monosyllables, disyllables, and trisyllables. For the most part, this the case in Abawiri. In a true syllable-tone system with n tone melodies on monosyllables, there would n^2 melodies on disyllables and n^3 melodies on trisyllables. Iau is close to this. In perhaps most syllable-tone languages, however, the number of melodies on disyllables is only somewhat higher than those on monosyllables. Phonotactic constraints disallow certain combinations. Some systems might be best analyzed as syllable- (or mora-)tone systems with phonotactic restrictions on cooccurrence of adjacent tones, like Campbell's analysis of Zenzentopec Chatino (Campbell 2016:145–47),[10] or as word-tone systems with restrictions on cooccurrence of tones on a single syllable, like Donohue and colleagues' (2006) analysis for Doutai.

A third property useful in typologizing tone systems is the presence or absence of tone-sandhi processes, what Kutsch Lojenga (2014) refers to as 'moveable' vs. 'stable' tone. In some languages, tone is realized in phonetic pitch in a rather transparent way, without many tone-sandhi processes. This seems to be the case in Sikaritai, Obokuitai, and Iau. A Bantu-type tone system is 'moveable', where tones spread over long distances and may be realized several syllables away from their phonologically specified source. Abawiri and Doutai are intermediate cases, with local tone-sandhi processes confined largely to immediately adjacent syllables. This property is a gradient one, and a tone system may fall anywhere on the continuum from 'moveable' to 'stable'.

Another property useful in typologizing tone systems is the number of tone heights distinguished. For example, Maddieson (2013b), in classifying languages according to tone, makes a three-way distinction between languages without tone, those with a 'simple' tone system with only two height distinctions, and those with a 'complex' tone system with more than two height distinctions. This is also seen in such work as Hyman's typology of two-height tone systems (Hyman 2010, 2012). Hyman's more detailed investigation of two-height systems is based largely on phonological activation in the

[10] The tone-bearing unit in Zenzentopec Chatino is actually the mora rather than the syllable. Donohue's distinction is a binary one, between word and syllable tone, although it may be informative to add a further distinction between syllable-tone and mora-tone languages.

sense of Clements 2001, where features (here, tones) are specified only as needed to state generalizations about the system. Languages with two tone heights have one of three contrasts: between /H/ and /L/, between /H/ and Ø, or between /H/, /L/, and Ø. A few two-height systems, however, have been analyzed as having a contrast between /L/ and Ø (Hyman 2010), in which case the /L/ tone is the marked member.

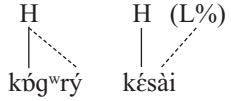
Determining the number of tone heights in Abawiri is not entirely straightforward. There is a three-way phonological distinction of lexically specified tone (/H/, /L/, and Ø); these are mapped onto three phonetic pitches (H, M, and L) in a skewed way. Phonological /L/ and Ø are realized with L pitch, while /H/ tone maps onto H pitch. Further, lexical /H/ tone is lowered to a derived M tone in certain contexts. While this largely fits Hyman's definition of a two-height system, the Abawiri system is certainly one of the more complex two-height systems in terms of both phonological contrasts and number of pitch heights.

An interesting related fact is that the phonetic pitch of toneless words is L. This is the inverse of the configuration in Yagua, a language of the Amazon, where both /H/ and /L/ tone are phonologically specified while the pitch of tonelessness is H (Payne 1985: 31). In other languages, the pitch of tonelessness is something other than the pitch of any phonologically specified tone. Peñoles Mixtec has a phonologically specified /H/ and /L/ tone and phonologically unspecified M-level pitch (Daly & Hyman 2007). In Zenzontepec Chatino, /H/ and /M/ are phonologically specified, while the L pitch is phonologically Ø (Campbell 2016). Zenzontepec Chatino and Peñoles Mixtec thus both have three pitch heights in isolation, reflecting two phonologically specified tones and one phonologically toneless. In both Abawiri and Yagua, by contrast, the distinction between toneless and one of the phonologically specified tone heights is only seen in the behavior of both types of words in context.

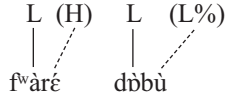
Both /H/ and /L/ tone in Abawiri are phonologically active, indicating that both are necessary for generalizations about phonological processes. First, /H/ and /L/ tone can link together on a single tone-bearing unit in certain contexts, creating a contour pitch contrasting with level H and L pitches. A second area where both /H/ and /L/ tones are phonologically active is in the change of /H/ tone to M tone after a floating /^{L}/ tone, indicating that both tones are necessary for stating a generalization about this process.

Anticipatory tonal polarity is sensitive only to following /L/ tones. Adjacent /H/ tones are frequent in the language, as demonstrated in 13a. For contrast, adjacent /L/ tones, which trigger insertion of polar (H) tone, are shown in 13b.

(13) a. H H (L%) b. L (H) L (L%)



'little snail'



'big bow'

The fact that this process applies only to /L/ tones and not to /H/ tones goes against the crosslinguistic tendency for /H/ tone to be more involved in phonological processes (Maddieson 1978). For example, OCP constraints prohibiting adjacent /H/ tones are more common than constraints prohibiting adjacent /L/ tones. While the OCP is not the same as anticipatory tonal polarity, as seen in §4.1, the two are related in that both serve to maximize tonal distinctness. In Acatlán Mixtec, the OCP prohibits adjacent /H/ and /M/ tones but allows adjacent /L/ tones (Aranovich 1994). While it is more common to have only the /*HH/ constraint or both /*HH/ and /*LL/ constraints, Hyman (2010) cites two Amazonian languages, Miraña and Gaviäo, that have a /*LL/ constraint but no /*HH/ constraint. These, along with Abawiri, are a minority in that the /L/ tone participates in the phonological process while /H/ tone does not.

Considering the relative markedness of /L/ and /H/ tones in Abawiri, features that have traditionally been evoked to indicate markedness give conflicting results (cf. Myers 1998, Pulleyblank 2004, Hyman 2012). Anticipatory tonal polarity applies only to /L/ tone, a fact that would indicate /L/ as the more marked tone. However, only /H/ tone is lexically prelinked. Also, greater markedness is generally thought to correlate with less frequency; in Abawiri, /L/ tone has a greater type frequency than /H/ tone. There are 561 occurrences of /H/ and /L/ tone in the extended word list of nouns and verbs. Of these, 319 (57%) are /L/ tone, while 242 (43%) are /H/ tone. The various markedness-related features of /L/ and /H/ are summarized in Table 19. The first two features do not indicate either tone as the more marked member, while the final three show conflicting results.

FEATURE	MARKEDNESS	COMMENTS
Contour tones	L = H	Lexical specification for both /L/ and /H/
H → M after floating L	L = H	Reference to both /L/ and /H/
Anticipatory tonal polarity	L > H	Only /L/ participates in the process
Prelinking	H > L	Only /H/ tone is lexically prelinked
Frequency	H > L	Type frequency of /H/ is lower than /L/

TABLE 19. Markedness of /H/ and /L/ tones.

If the analysis presented here is correct, neither /H/ nor /L/ tone is more 'marked' in Abawiri. /L/ tone is more frequent, but it is also involved in more phonological processes than /H/ tone. This is in line with Haspelmath's (2006) argument that the notion of linguistic markedness is not necessarily a coherent one, but instead reflects other, more basic, linguistic phenomena. However, the conclusion for the Abawiri data is highly analysis-dependent. If one were to adopt an alternative analysis of the M-level phonetic pitch (§4.1 above), anticipatory tonal polarity would not be relevant. The relative frequency of /H/ and /L/ tones (as well as the /M/ tone) would also be different. It is thus too simplistic to speak of one tone as more marked than the other, first because the phenomena related to markedness do not all indicate the same result (at least given the current analysis), and second because alternative analyses of the same data would indicate different results.

Typological characterization of the Abawiri tone system is best accomplished in terms of multiple phonological features rather than only one, as has been shown through the discussion of several representative features above: tone type (register vs. contour), domain (word vs. syllable), tone sandhi (moveable vs. stable), and, for two-height systems, phonological activation. I have not attempted to list all features potentially relevant in typologizing tone systems and have not necessarily selected the most important ones. However, these four are useful in characterizing the Abawiri tone system. Table 20 compares the tone systems of six languages along these four dimensions. The first five are Lakes Plain languages, while the final language, Skou (Donohue 2003), is a non-Lakes Plain language in New Guinea.

	TONE TYPE (Pike)	DOMAIN (Donohue)	TONE SANDHI (Kutsch Lojenga)	CONTRASTS (Hyman)
ABAWIRI	register	word	moveable	H, L, Ø
SIKARITAI	register	word	stable	H, L
OBOKUITAI	register	syllable	stable	H, L
DOUTAI	register	syllable/word	moveable	H, L
IAU	contour	syllable	stable	H, L, 6 contours
SKOU	register	word	moveable	H, L, Ø

TABLE 20. Tone systems of six Papuan languages by four typological criteria.

This table is necessarily simplistic in that it does not show gradience of features. It also groups languages together based on a general shared feature that is likely to differ in subtle and perhaps important ways between languages. An example is domain, where most (perhaps all) tone systems have at least a few phonotactic constraints and phonological processes that refer to the domain of the word, as well as at least a few that refer to the syllable (or mora). And since not all tone systems share the same phonotactic restrictions or phonological processes, at a basic level one-to-one comparison is not possible. This is, of course, a problem in linguistic typology more generally (Comrie 1989, Haspelmath 2010, Mithun 2016, inter alia). Another issue is that phonological characterization of a tone system is based at least in part on the analysis, of which there may be many for any given tone system.

From Table 20, it is interesting to observe that the language sharing the most typological features with Abawiri is Skou, the only non-Lakes Plain language examined. Both Abawiri and Skou are register-tone languages where the domain of tone melodies is the word. Both have various tone-sandhi processes. Both languages also have a three-way contrast between /H/, /L/, and Ø. Sikaritai, Obokuitai, and Doutai all have register tone and a contrast between /H/ and /L/. Minimal tone-sandhi processes are described for Sikaritai and Obokuitai, while several are in place in Doutai. It is possible that this fact reflects the level of analysis currently available rather than typological similarity of tone systems. McAllister and McAllister (1991) do not describe any tone-sandhi processes for Doutai, while the more detailed analysis of the same language in Donohue et al. 2006 describes several processes. Iau is by far the most typologically divergent system with eight phonological contrasts, many of them contours. This initial characterization of six tone systems in New Guinea is suggestive of the mismatch between typology and genealogy, hearkening to the wider problems of historical linguistics in relation to language contact (Ross 1996, Aikhenvald & Dixon 2001, Foley 2010, Bowern 2013).

6. Conclusion. In this article I have discussed the Abawiri tone system. Two tones, /L/ and /H/, combine into eight tone melodies on nouns and five on verbs. In avoidance of adjacent /L/ tones, a polar (H) tone is linked to the final syllable of a non-/H/-toned word previous to an /L/-toned word. /H/ tone is lowered to M after a floating /^{L}/, but not linked /L/. Utterance-final boundary tone L% is linked to all utterance-final syllables. The relative markedness of /H/ and /L/ tone was shown to be indeterminate, with /L/ tone being specified in more phonological processes but /H/ tone being less frequent.

I have argued that tone systems are best characterized along multiple dimensions and have suggested four dimensions useful for characterizing the Abawiri system in relation to other tone systems in New Guinea and beyond: register vs. contour tone (Pike 1948), word vs. syllable tone (Donohue 1997), moveable vs. stable tone (Kutsch Lojenga 2014), and number of contrastive tone heights (Hyman 2010). Refinement of these gradient dimensions and addition of other relevant typological dimensions will help clarify the place of Abawiri tone in a typology of tone systems.

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