

The role of rhythm in intonational melody: A case study from Fataluku

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Abstract. This paper takes a fresh look at the theoretical relationship between linguistic rhythm and linguistic melody, arguing for a closer connection between metrical structure and intonational organization than is typically assumed. The focus of this paper is the theoretical treatment of word-medial intonational targets in languages without stress, since at first glance, such word-medial targets challenge the core assumption of the autosegmental-metrical theory of intonation that all intonational targets are aligned either with a stressed syllable or with the edge of a prosodic domain. I propose that this theoretical dilemma may be resolved by taking into account foot edges as possible alignment sites for edge tones. The claim that intonational tones may be aligned with foot edges is supported with new data from the Papuan language Fataluku. The implications of such an analysis for other stressless languages are also discussed.

Keywords. prosody; feet; metrical phonology; Papuan languages; East Timor; Timor Leste

1. Introduction. Much current work treats intonational contours as composed of discrete phonological pitch targets, aligned with prominent syllables and prosodic boundaries. In the autosegmental-metrical theory of intonational phonology, this approach is formalized by classifying all intonational targets as either “pitch accents”—which align with a stressed syllable, or “edge tones”—which align with the edges of a prosodic unit (Pierrehumbert, 1980; Ladd, 2008). Such a distinction has proven useful for the description of a diverse array of languages (see for instance Jun, 2005b, 2014). This theoretical approach, however, encounters challenges when applied to stressless languages, some of which appear to have intonational pitch targets aligned neither with a stressed syllable nor with a prosodic boundary.

Languages without stress or lexical tone often exhibit a repeating intonational melody that occurs over each word, or sometimes, over a group of related words (Jun & Fletcher, 2015). Languages which have been claimed to have intonational systems of this type include Korean (Jun, 2005a), Fataluku (Heston, 2015a), Oirat (Indjieva, 2009), and Japanese, in phrases without pitch accents (Venditti, 2005). In some such languages, word-level melodies are anchored to word edges, behavior which can be straightforwardly analyzed by proposing word-edge boundary tones. In other languages, however, a clear intonational turning point exists within the boundary of the prosodic word. These intonational targets cannot be classified as “pitch accents,” since they are not anchored to a stressed syllable; however, they are not obviously attached to any prosodic edge either.

I propose that this theoretical dilemma can be resolved by taking into account foot edges as possible boundary tone alignment sites. I support this analysis with new data from the Papuan language Fataluku, showing that in this language, intonational melodies align with foot edges.

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This paper begins with a brief summary of the relevant aspects of Fataluku’s phonology in section 2, with a particular focus on its word prosody. Section 3 presents evidence for the existence of metrical feet in Fataluku, even in the absence of convincing evidence for stress. Section 4 examines alternative analyses and discusses the benefits of permitting alignment between metrical and intonational structures. Section 5 summarizes the primary arguments and suggests directions for future research.

2. Fataluku. Fataluku is an underdocumented language spoken by approximately 37,000 individuals in island Southeast Asia, on the far eastern tip of the nation of East Timor (Lewis et al., 2016). Fataluku is a member of the Timor-Alor-Pantar family of Papuan languages, which includes about twenty-five languages spoken on Timor and nearby islands (Klamer, 2014; Schapper et al., 2014). Fataluku’s phoneme inventory includes fifteen native consonants and three loan consonants (the voiced stops), as well as five native vowels (see tables 1 and 2). On the surface, Fataluku exhibits both long vowels and diphthongs, though neither exist underlyingly. Rather, both are represented underlyingly as sequences of vowels, identical in the case of long vowels and nonidentical in the case of diphthongs (Heston, 2014). Since consonants are non-moraic, there exists an exact one-to-one mapping between vowels and moras. A syllable with a single short vowel counts for one mora, while a syllable containing a surface long vowel or diphthong counts for two moras (Heston, 2015b).

	Bilabial	Labdent	Alveolar	Palatal	Velar	Glottal
Stop	p (b)		t (d)		k (g)	ʔ
Affricate			ts			
Fricative		f v	s z			h
Nasal	m		n			
Tap/trill			r			
Lateral			l			
Glide				j		

Table 1: Consonant phonemes

	Front	Central	Back
High	i		u
Mid	e		o
Low		a	

Table 2: Vowel phonemes

Though past impressionistic reports have claimed the existence of either stress (Campagnolo, 1973; Hull, 2005) or tone (Stoel, 2008), such analyses are not supported by phonetic data. Rather, phonetic analysis indicates that pitch movements are best analyzed at the phrasal level, rather than the word level, at least in the Lospalos variety of Fataluku (Heston, 2015a). I analyze Fataluku prosodic structure as consisting of a series of “accentual phrases” (or

APs), each of which typically contains between one and four prosodic words; prosodic boundaries tend to align with major syntactic boundaries. Each accentual phrase bears a rising-falling pitch pattern, which peaks on the second mora of the phrase. An example pitch track is given in figure 1.

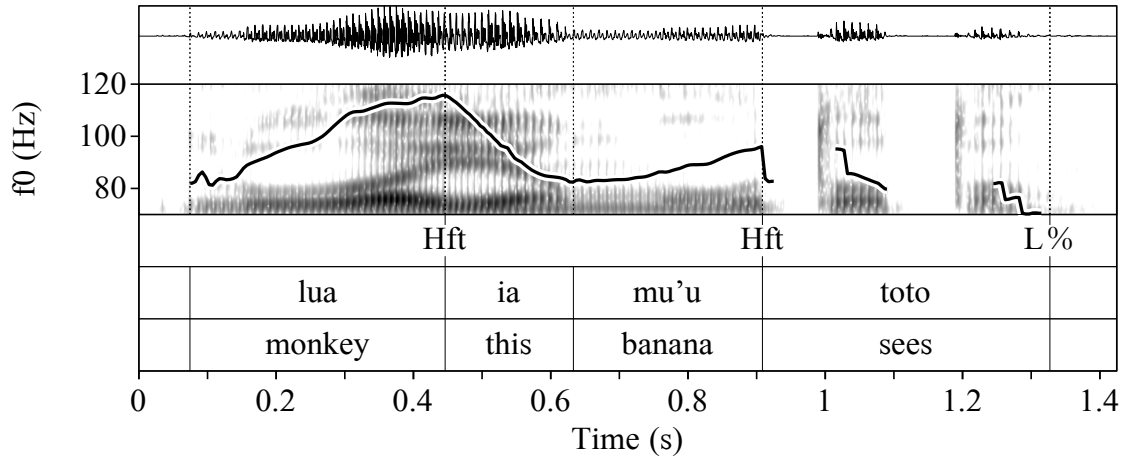


Figure 1: An example declarative sentence with two accentual phrases, *[Lua ia] [mu'u toto]* 'This monkey sees the banana.'

An intonation-only analysis of Fataluku prosody is superior to previous analyses involving stress or tone in a number of ways. In the first place, the location of pitch peaks in Fataluku does not correspond with the typical correlates of stress, such as intensity, resistance to reduction, and greater support for segmental contrasts (see e.g. Hayes, 1995). For instance, when an AP begins with a word of two light syllables, the pitch peak occurs over the second syllable. The second syllable of a disyllabic word, however, does not support the presence of long vowels and may be highly reduced, even to the point of devoicing. An analysis treating such a syllable as stressed is clearly incongruous.

The present analysis also provides a more parsimonious account than accounts positing phonemic word prosody (e.g. Campagnolo, 1973; Stoel, 2008), as the present analysis derives the location of pitch peaks on the basis of other, independently necessary factors (namely, syntactic structure and syllable weight). A phrase-level analysis also substantially simplifies the treatment of prosody in multi-word units. The analyses of Campagnolo and Stoel both invoke complicated procedures for determining the location of pitch peaks in two-word phrases, though the prosodic behavior of even lengthy and complex sentences follows naturally from the present analysis. (For further support of an intonation-only account, see Heston 2015a.)

Given accentual phrases with a rising-falling intonational contour, the question remains as to how these intonational contours should be analyzed. The second mora high target in particular poses a challenge to autosegmental-metrical analysis, since on cursory inspection, it does not appear to be either an intonational pitch accent or an edge tone. There is no convincing evidence for positing stress on the syllable to which the high target attaches, since many of these syllables actually exhibit evidence of being unstressed, but the intonational peak's location does not generally align with the edges of a prosodic word or phrase. I propose therefore taking into account the metrical foot as a possible site of alignment for intonational tones, analyzing

Fataluku’s AP-medial intonational peak as an edge tone that attaches to the right edge of the first foot in an accentual phrase.

3. Evidence for feet. While metrical feet are generally discussed in the context of stress, much evidence has been put forward for the existence of feet in languages without stress (see for instance Poser 1990 on Japanese, Akinlabi & Urua 2002 on Ibibio, Downing 2004 and the references within on Khoisan languages, and extensive discussion in Bennett 2012). Though no convincing evidence for stress in Fataluku has yet been established, I propose left-aligned, bimoraic feet in Fataluku on the basis of three pieces of evidence.

3.1. MINIMAL WORD REQUIREMENT. The first piece of evidence is a minimum word requirement requiring all content words to contain at least two moras (i.e., two underlying vowels). Surface alternation between long and short vowels is visible in some cases. For instance, underlyingly, the verb /na-e/ ‘to be at’ consists of the root /na/ ‘to be at’ and the verbal suffix /-e/ ‘VB’. Grammatically, the verbal suffix /-e/ occurs on most verbs in citation form, though the suffix does not occur on non-final members of serial verb constructions. When the verb /na-e/ ‘to be at’ occurs non-finally in a serial verb construction, the root is lengthened and realized as [na:], thus fulfilling the minimal word requirement. Several other examples of minimal words are given in (1). These transcriptions assume short vowels in the underlying representations, for expository purposes, though aside from /na/ ‘to be at’, an analysis assuming underlying long vowels is also possible.

- | | | | |
|-----|--------|---------|---------------|
| (1) | /na/ | [na:] | ‘to be at’ |
| | /tsal/ | [tsa:l] | ‘grandparent’ |
| | /hok/ | [ho:k] | ‘mud’ |
| | /nal/ | [na:l] | ‘mother’ |
| | /tsu/ | [tsu:] | ‘hut’ |

A minimal word requirement is a classic piece of evidence for foot structure (see e.g., McCarthy & Prince, 1993:45–48). McCarthy and Prince derive the minimal word requirement from two more primitive notions, namely, the binary structure of feet and the prosodic hierarchy. Since the prosodic word is above the foot on the prosodic hierarchy, it follows that each prosodic word must contain at least one foot. Since a foot must have two moras (or syllables, depending on the language), it follows that a prosodic word must also contain at least two moras (or syllables). The fact that the minimal word requirement can be derived directly from these two independently motivated notions, as well as the fact that the minimum word requirement is generally only weight sensitive when other foot-conditioned processes in the language are also weight sensitive, provides good support for analyzing this phenomena in terms of feet. Therefore, the fact that Fataluku has a minimum word requirement provides evidence that Fataluku does have feet, in spite of the absence of convincing evidence for stress.

3.2. REDUPLICATION. Another compelling piece of evidence for feet is the behavior of reduplication. Partial reduplication in Fataluku involves reduplicating the first two moras of a word, as illustrated in table 3.

Base form		Reduplicated form	
mimirek-e	‘red’	mimi-mimirek-e	‘reddish’
karas-e	‘yellow’	kara-karas-e	‘yellow’
ipil-e	‘steal’	ipi-ipil-e	‘steal repeatedly’
tifar-e	‘run’	tifa-tifar-e	‘jog’
teper-e	‘quiet’	tepe-teper-e	‘quiet’
ofot-e	‘cut’	ofo-ofot-e	‘cut repeatedly’
fuuleh-e	‘return’	fuu-fuuleh-e	‘come and go back’
laafai	‘big’	laa-laafai	‘big’
loohai	‘tall’	loo-loohai	‘tall’
uukani	‘one’	uu-uukani	‘one at a time’
faat-e	‘four’	faa-faat-e	‘four at a time’
kaur-e	‘scratch’	kau-kaur-e	‘scratch’

Table 3: Reduplication is based on bimoraic units (transcriptions are phonemic, with hyphens representing morpheme boundaries)

The fact that reduplication makes reference to the same two-mora units involved in the minimum word requirement is additional evidence for foot structure. McCarthy and Prince view reduplication patterns of this type as examples of foot-conditioned morphology, and discuss several languages in which the reduplicant is equivalent to the minimal word. The evidence of reduplication for foot structure in Fataluku was first observed by Stoel (2008), though his analysis of footing differs significantly from that put forth here. Stoel proposes that the presence of a lexical high tone conditions footing, which in turn conditions vowel length. I propose the reverse, namely, that syllable weight conditions footing, which in turn conditions pitch peak location. (See Heston 2014 for a more detailed summary and critique of Stoel’s analysis of vowel length).

3.3. CONSTRAINTS ON WORD SHAPE. A third piece of evidence for feet in Fataluku is a restriction on the metrical shape of two-syllable words. Out of four logically possible combinations of light and heavy syllables, only three are attested. Using H to represent a heavy syllable and L to represent a light syllable, words of the shape LL, HL and HH are widely attested, but words of the shape LH are completely unattested. Examples are shown in table 4.

Word shape	Example	Gloss
L L	vata	‘coconut’
H L	huula	‘spoon’
*L H	–	–
H H	ruumau	‘pomegranate’

Table 4: Possible syllable structures of two-syllable words (H = Heavy σ , L = Light σ)

Though this may seem a somewhat unusual constraint at first glance, it follows logically from two properties of Fataluku metrical feet mentioned above. The first property is that Fataluku

requires the first foot of a prosodic word to be aligned with its left edge. The second property is that Fataluku requires feet to contain two moras, and lengthens a vowel when it is the only vowel in the foot. Words of the banned shape *LH pose an issue for these restrictions on footing. A left-aligned foot could contain either a single mora (the first syllable), or three moras (the first and second syllables), but for a left-aligned foot to contain exactly two moras, it would be necessary for the foot to bisect the second syllable. This possibility is apparently avoided in Fataluku, and instead, the vowel in the first syllable is lengthened and the word is parsed unexceptionally into two feet, each containing a single heavy syllable. The existence of such a constraint on word shape—which appears somewhat unusual, but is straightforwardly derivable from general principles of foot structure—strongly confirms the existence of feet in Fataluku.

4. Discussion. Although there remains no convincing evidence for stress in Fataluku, the fact that constraints on the minimal word, reduplication, and word shape all make reference to the same bimoraic units provides strong evidence for positing feet. The location of foot edges under the analysis proposed here also aligns precisely with the position of otherwise unexplained AP-medial peaks. For this reason, I propose that the peak of Fataluku’s AP contour is represented by a high target aligned with the right edge of the first foot of the AP. Such an analysis is parsimonious, since the existence of metrical feet in Fataluku is independently necessary and the proposed analysis requires no modifications to autosegmental-metrical theory.

This analysis is preferable, in particular, to an analysis in which an unstarred intonational high tone is attached directly to the second mora of the AP. Although this type of analysis has been proposed for several languages, it is questionable how such an analysis relates to the claims of autosegmental-metrical theory. The foot boundary tone analysis allows Fataluku’s AP-medial intonational peak to be handled unexceptionally, like any other edge tone, while proposing an intonational high attached directly to the second mora would require at least additional theoretical machinery, if not a revision of a core tenet of the theory.

An additional benefit of the foot-based analysis is that it treats surface long vowels and diphthongs as units for the sake of prosody, rather than simply counting mora-bearing elements. The mora-counting option is much more arbitrary, and implies a powerful theory allowing intonational peaks at any point in a string. The foot-based analysis, however, offers a principled rationale for having a pitch peak on the second mora. Feet often condition word-level prosody, so their use in this way is consistent with typological generalizations. The foot-based analysis is also supported by the phonetic details of f_0 alignment. Most often, peaks occur very late in the syllable containing the second mora or very early in the syllable containing the third mora; assigning the tone to the boundary between the second and third mora captures this distribution well (Heston, 2015a).

It is possible that such an analysis may also be applied to other languages. For instance, Japanese is generally regarded a stressless language, though there exists strong evidence for bimoraic feet (see e.g. Poser, 1990). In phrases without a lexical pitch accent, Japanese’s intonational structure closely resembles that of Fataluku. Each accentual phrase bears a single rising-falling intonational pattern, peaking on its second mora (Venditti, 2005). Though the details have yet to be worked out, the similarities apparent between Fataluku and Japanese intonational structure suggest that a similar analysis, in which the intonational high is aligned with the first foot of the AP, may be applicable for Japanese as well. French is another language which has been analyzed as having accentual phrases with an intonational peak on the first or

second syllable, and there is evidence for feet consisting of one or two syllables (Jun & Fougeron, 2000; Goad & Buckley, 2006); Korean similarly has accentual phrases with an intonational peak on the second syllable (Jun, 2005a). Languages such as these suggest a previously unrecognized tendency for intonational peaks on the first or second syllable of an accentual phrase, as well as suggesting a possible theoretical account for these data, namely, an intonational target aligned with the initial foot.

5. Conclusion. To sum up, utterances in Fataluku are divided prosodically into accentual phrases, each of which contains generally between one and four prosodic words. Each accentual phrase bears a rising-falling intonational melody peaking on the second mora of the phrase. There is no convincing evidence for stress in syllables over which the intonational peak occurs, and I propose instead analyzing this peak as an edge tone, aligned with the right edge of the first foot in each accentual phrase. The existence of left-aligned bimoraic feet in Fataluku is independently supported by the existence of a two-mora minimum requirement for content words, a process of reduplication involving bimoraic units, and a repair process lengthening initial syllables which could not otherwise be parsed into bimoraic feet. Under this analysis, Fataluku's seemingly anomalous AP-medial high tone may be treated unexceptionally as an edge tone in the autosegmental-metrical theory of intonational phonology.

These findings have implications both for the study of Fataluku and for the analysis of a number of other languages. As indicated above, languages as diverse as Japanese, French, and Korean exhibit a superficially similar system of intonational peaks on the second mora or syllable of the accentual phrase, and further research is necessary to determine whether a foot-based analysis may also provide a more satisfactory analysis of intonational alignment in languages such as these.

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