Foot and Rhythmic Structure in Irabu Ryukyuan

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Abstract: The aim of this study is to show that foot structure plays a key role in the organisation of the prosodic system of Irabu, a north-west variety of Miyako Ryukyuan, spoken in Okinawa Prefecture, Japan. By introducing foot structure I give a natural explanation to two crucial features of Irabu prosody, i.e. bimoraic constituency and potential iterativity of prosodic features (High and Low tones). With this new approach, Irabu prosody will be shown to be characterised by a foot-based alternating rhythm of tone features, which is a typical manifestation of a cross-linguistically recurrent alternating rhythmic principle, or the Principle of Rhythmic Alternation (Selkirk 1984, Kubozono 1993).*

Key words: Irabu, Ryukyuan, foot, prosody, Principle of Rhythmic Alternation

1. Introduction

The aim of this study is to show that foot structure plays a key role in the organisation of the prosodic system of Irabu Ryukyuan (henceforth Irabu), a north-west variety of Miyako Ryukyuan, spoken in Okinawa Prefecture, Japan. By introducing foot structure I give a natural explanation to two crucial features of Irabu prosody, i.e. bimoraic constituency and potential iterativity of prosodic features (High and Low tones). With this new approach the hitherto little known system of Irabu prosody will be shown to be highly rhythmic in nature, in that High tone appears at regular intervals by grouping four feet into two 'foot groups' in which each foot group has one High-toned foot. Thus Irabu prosody is characterised by a foot-based alternating rhythm of tone features. I will argue that the alternating rhythm in Irabu is not a language-specific phenomenon but is a typical manifestation of a cross-linguistically recurrent alternating rhythmic principle, or the Principle of Rhythmic Alternation (Selkirk 1984, Kubozono 1993).

Typological implications are two-fold. On the one hand, the foot in Irabu empirically supports the view that the foot is independent of stress (Nespor and Vogel 1986, Poser 1990, Crowhurst and Hewitt 1995). On the other hand, Irabu rhythm demonstrates a hierarchical organisation of rhythmic structures, in which

the mora is a basic rhythmic unit and the foot is a higher-order rhythmic unit on which the alternating rhythm is based, thus calling into question the dichotomy between 'rhythm of succession' (e.g. moraic rhythm) and 'rhythm of alternation' (e.g. stress rhythm) which was suggested by Allen (1975) and is still implicitly assumed in prosodic typology.

   This study is organised as follows. In Section 2 I give an overview of the notion of foot and theoretical assumptions on this notion in general linguistics, clarifying the view of the foot taken in this paper and the potential contribution of this paper to foot theory and to prosodic typology. In Section 3 a preliminary sketch of Irabu segmental phonology and word structure is given. In Section 4 I briefly note the literature on Irabu prosody and summarise the basic characteristics of word prosody. In Section 5 I introduce the notion 'foot', and show that there is a foot-based alternating tonal pattern in Irabu prosody. In Section 6 I further note the functional aspect of this tonal pattern, arguing that Irabu alternating tonal pattern is rhythmic in nature, a direct manifestation of a cross-linguistically recurrent rhythmic principle, the Principle of Rhythmic Alternation.

2. The Notion 'Foot'

The notion 'foot' in linguistics has been developed and elaborated primarily in the study of stress languages. In phonetics, the foot was defined in relation to stress: foot was seen as a roughly isochronal unit between each stressed syllable (Abercrombie 1967, Catford 1977, Halliday 1985; see Pamies Bertrán 1999 for a review). In phonology, the foot has been characterised as a metrical constituent, in most cases disyllabic or bimoraic, above the syllable or mora within the phonological word domain, which plays a significant role in the prosodic and rhythmic organisation of stress languages (Liberman 1975, Liberman and Prince 1977, Selkirk 1980, Hayes 1981, 1995, Halle and Vergnaud 1987, Kager 1995 *inter alia*). One prominent feature of the stress foot is that the distinction can be made between the head, or the stressed syllable (strong), and the non-head (weak). Thus Hayes presents three basic foot types for stress languages, that is, a) the syllabic trochee, b) the moraic trochee, and c) the iamb, each of which is schematically represented below (the stressed syllable/mora, or the head, is indicated here with acute accent; light syllable and heavy syllable are indicated by ˘ and _ respectively):

(1)   foot types in stress languages (based on Hayes 1995: 71)
   a. syllabic trochee: (σ́ σ)
   b. moraic trochee: (μ́ μ) or (σ́)
   c. iamb: (σ σ́) or (σ́)

Given the strong bias in favour of the stress foot in the literature, where most arguments highlighting the foot are in direct relation to stress assignment, one might make the following two predictions: first, if stress can be described without a foot, e.g. by postulating an alternative metrical representation such as a metrical grid, then the foot becomes unnecessary in linguistic theory (Selkirk 1984); second, if a language lacks a stress system, then there is little if any need to assume a

foot structure.

However, Nespor and Vogel (1986) provide a theoretical framework which clearly argues against these predictions: they regard the foot as being independent of stress. In their theory the foot is situated within the universal Prosodic Hierarchy: syllable < foot < phonological word < clitic group < phonological phrase < intonational phrase < phonological utterance (in most recent works mora is hierarchically positioned below the syllable: Hall, Hildebrandt, and Bickel 2008). Here, it is a theoretical prediction that both stress languages and non-stress languages can have the foot, as a 'valid constituent of phonology' (Nespor and Vogel 1986: 84).

This view of the foot is actually in accordance with the fact that disyllabic or bimoraic metrical constituency is widely attested in languages that have been described with little or no reference to stress, such as pitch accent languages and tone languages. Thus Poser (1990) argues that in Japanese there are eight phenomena, each independent of stress, that refer to bimoraic constituents, which he calls 'bimoraic feet'. Also, Kashima (1992) and Kashima and Hashimoto (2000) note that Japanese has a metrical constituent, or what they call 'rhythm unit', which is either a bimoraic full constituent or a monomoraic stray (see also Kindaichi 1957, Toki 1995, Uemura 1998 for arguments for bimoraic rhythmic constituency in Japanese). Furthermore, Hyman, Inkelas, and Shibanda (1998) note that in the tone language Nbedele, reduplication and word minimality are measured against feet. This 'template' function of foot is also observed in stress feet (McCarthy and Prince 1995), and the Nbedele foot demonstrates, besides the possible existence of foot independent of stress phenomena, the functional similarity between the stress feet and non-stress feet.

This paper aims to provide further empirical support in favour of the existence of the foot in a non-stress language by describing Irabu, a hitherto little studied Japonic language. Irabu will be shown to demonstrate the existence of a binary (and a marked ternary) foot that consists of two (or three) moras. This constituent is relevant in prosodic and rhythmic organisation. Descriptively, the postulation of foot is of substantial importance to Irabu prosody, which has been considered to have no generalisable prosodic features ('collapsed' in Hirayama's (1967) terms). I will demonstrate that a clear prosodic pattern does become obvious once we introduce the foot. The pattern will be shown *not* to be one of word accent, but a manifestation of a global rhythmic principle.

3. Irabu

This section summarises Irabu segmental phonology and defines the notion word. Irabu is a north-west variety of the Miyako Ryukyuan language, which constitutes one of three major subgroups of Southern Ryukyuan: Miyako, Yaeyama, and Yonaguni, of which the last subgroup is alternatively argued to have developed from the second (Uemura 1997, Lawrence 2008). Northern Ryukyuan and Southern Ryukyuan constitute a single language group Ryukyuan, which is a sister language of Japanese, together forming the Japonic language group. Irabu has five

sub-varieties, i.e. Irabu, Nakachi, Kuninaka, Nagahama, and Sawada (Motonaga 1982).[1] Our focus is on Nagahama. Unless otherwise noted, Irabu refers henceforth to the Nagahama variety of Irabu.

Irabu shares major morphosyntactic characteristics with Japanese: verb-final, modifier-head order, nominative-accusative case system, dependent marking, and agglutinative suffixing morphology.

3.1. Inventory of phonemes

The inventory of Irabu phonemes is shown in (2), in a practical orthography. *c* and *z* are phonetically affricates [ts] and [dz], but phonemically classified as fricatives on the basis of their phonotactic and morphophonemic behaviours (see Shimoji 2007 for detail). There is a phonemic contrast between short and long segments, both in vowels (*kagi* 'beautiful' vs. *kaagi* 'smell') and resonant consonants (*mta* 'mud' and *mmta* 'k.o.tree'). As will be noted in Section 3.2, two resonants (*ž* and *r*) may function as a syllable nucleus.

(2)   Irabu phonemes in a practical orthography

Consonants:	Stops		*p, b, t, d, k, g,*
	Fricatives		*f, s, c* ([ts]), *z* ([dz]), *h*
	Resonants	R	*m, n, v*
		Rn (nucleic)	*ž* ([ʐ]), *r* ([ɾ]/[l])
Glides:	*w, j*		
Vowels:	*i, e, a, o, u, ï* ([ɨ])		

3.2. Syllable structure

The syllable canon for root words is given in (3) below.

(3)   Syllable canon for roots and mora-count rules (a mora is indicated by μ):

PRESYLLABLE	INITIAL SYLLABLE	NON-INITIAL SYLLABLE $1...n$
#(R_i) R_i	((C_i) C_i)(G)V_1(V_2) (C_{coda})	C (G) V_1 (V_2) (C_{coda})... (R_{coda})#
μ μ μ	_ _ μ μ μ	_ _ μ μ μ μ

A presyllable is an optional syllabic consonant filled by a R(esonant), only coming at the left-edge of a word, e.g. *m.cï* 'road' (R.CV) and *v.cca* 'quail' (R.CCV). There are a few words that consist only of a presyllable (e.g. *mm* 'potato' (RR), *vv* 'sell' (RR), *žž* 'rice ball' (RR), *rr* 'enter' (RR)). Other ordinary syllables (i.e. initial and non-initial syllables) have the nucleus V slots, which are normally filled by vowels, but may be filled by nucleic resonants (Rn). In such a case, the onset must be a labial (*pž.tu* [pʐtu] 'man' CRn.CV; *br.brr.gas.sa* [bl̩bl̩ ː gassa] 'alocasia odora' CRn.CRnRn.CVC.CV).[2] Initial CC must be a geminate, either of a fricative (e.g.

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[1] There is another variety on Irabu Island, i.e. Sarahama, which belongs to Ikema, a neighbouring variety of Irabu. Ikema is also one of Miyako Ryukyuan varieties (Hirayama 1967; Motonaga 1982).

[2] A number of scholars treat /ž/ as a central vowel with a potential friction (e.g. Hirayama 1967). I treat it as a consonant that may be nucleic in restricted environments. Diachronically,

ffa [ffa] 'child') or of a resonant (e.g. *žža* [z̩za] 'father'), or the stop *t*, with phonetic glottalisation (e.g. *ttar* [ʔtta˩] 'came' CCVC. cf. *tar* [ta˩] 'drip'). The word-final coda, if any, is a single resonant consonant.

(C)(G)V in initial and non-initial syllables constitutes a single mora, while all the other slots have one mora each. In addition to the typologically common pattern in which any light syllable counts one mora, Irabu has heavy syllables (counting two morae) and superheavy syllables (counting three morae). The quadrimoraic CC(G)VVC is not found in roots. A presyllable may form a light syllable (R) or a heavy syllable (RR).

(4)   Heavy and super heavy syllables
       2 morae: (C)(G)VC   *kan* 'crab', *jur* 'night', *pjar* 'leave'
                   (C)(G)VV   *kaa* 'skin', *kai* 'that way', *jaa* 'house', *sjuu* 'grandfather'
                   CC(G)V   *ffa* 'child', *mmja* (discourse marker)
       3 morae: CC(G)VC   *ccir* 'pipe', *ssam* 'louse'
                   CC(G)VV   *mmaa* 'No'
                   (C)(G)VVC   *aur* 'only', *juuž* 'celebration'
       2 morae: RR   *mm* 'potato', <u>*mm*</u>.*na* 'all', <u>*nn*</u>.*di* 'Yes'

As shown above, CCV (which I number C_1C_2V here) as in /ffa/ 'child' has two morae, with the onset C_1 having one mora. The analysis that /ffa/ has two morae is based on the following fact. As Shimoji (2007, 2008b) notes, there is a minimality constraint in Irabu, whereby a word must have at least two morae, and a monomoraic root must be augmented to appear as a word, as in /v/ 'sell' (root) > /vv/ 'sell' (non-affixed word form). The word /ffa/ can appear without any augmentation, thus is analysed as having two morae, with the initial C_1 having one mora.

Also, the analysis that /ff/ in /ffa/ is a single geminate onset is that /ff/ as a

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we may be looking at an intermediate stage developing from a vowel to a consonant, where /ž/ exhibits some vowel-like features and some consonant-like features in the synchronic system (thus some scholars postulate the category 'semi-consonant' for /ž/; see Karimata (2005: 74)). In Irabu, /ž/ has much more consonant-like features than vowel-like features, and so I take the consonant analysis synchronically, though readers should keep in mind the diachronic pathway noted above, and that there is no agreement on the synchronic analysis of /ž/ in Ryukyuan linguistics (see Sawaki 2000 and Karimata 2002 for a review). First, Irabu has a severe restriction on a VVV sequence, but VVž is well attested (e.g. *juuž* 'celebration'), and it is plausible to consider that this has the structure VVC where the final segment is a consonant, a very common phonotactic pattern in Irabu (e.g. *fiir* 'give'). Second, Irabu has a phonological rule whereby underlying C + V give rise to surface C_i-C_iV, called Geminate copy insertion (Shimoji 2007). ž + V also undergo this rule, giving rise to ž-žV, as in *juuž* + =*a* (topic) > *juužža*. The reason for calling the consonant /ž/ a resonant is as follows. /m/, /n/, /v/, /r/, and /ž/ share a number of phonotactic characteristics, so it is useful to give them a class, which I call resonant. For example, as described in Section 3.2, only resonants serve as a presyllable, and only resonants serve as a final coda. Also, the resonants /r/ and /ž/ further share the characteristic as a potentially nucleic consonant phoneme, and they only carry labial onsets.

whole is treated as an onset in morphophonemic processes. For example, as in Japanese, Irabu has sequential voicing, whereby the voiceless onset consonant of a non-initial stem of a compound is replaced by its voiced counterpart, as in /uku/ 'big' + /k̲an/ 'crab' > /uku+g̲an/ 'big crab'). In this process, /ff/ in /ffa/ is treated as an onset, as in: /biki/ 'male' + /f̲fa/ 'child' > /biki+v̲v̲a/ 'son'.

3.3. The word

To avoid terminological confusion, I define the notion 'word' and other related notions in what follows.

A word is defined here as a morphosyntactic unit that centres on a root, with a fixed ordering of its internal components ('grammatical word' in the sense of Dixon and Aikhenvald 2002). It may be a free bare root or may be morphologically complex with compounding and/or affixation. A word is minimally bimoraic in Irabu (Shimoji 2007, 2008b).

A clitic is an external member of a word, attaching to a host word from outside, while an affix is an internal member of a word, and thus may attach to a bound stem. Whereas an affix is stem-specific (e.g. a nominal affix only attaches to a nominal stem), a clitic is not stem-specific and its host varies considerably depending on syntactic structure (e.g. the modal clitic *=pazï* 'maybe' can attach either to a verb or to a nominal, as it simply attaches to a predicate, whether nominal or verbal). A word-plus is a morphosyntactic unit that consists of a word and a whole number of clitics that attach to the host word (the notion 'word-plus' here is different from the same term used in Kageyama 2001). A phrase consists of one or more word(-pluses). Below are illustrative examples of word and word-plus.

(5)   a. Word (root-only)   b. Word (with affixes) c. Word-plus
           jarabi   *jarabi-gama-mmi*   *jarabi-gama-mmi=kara=mai*
           child   child-DIM-PL   child-DIM-PL=from=even
           'child'   'little children'   'even from little children'

In the sections below, a word(-plus) of n morae will optionally be abbreviated as W_n. Thus in (5) above, (5a) is abbreviated as W_3, (5b) as W_7, and (5c) as W_{11}.

4. Irabu Prosody: Introduction

In this section I give an overview of how Irabu prosody has been described, and present a basic description on which the main discussion is based. Our focus in this section is on monomorphemic word prosody, which has been a major concern in the literature.

4.1. Previous works

All previous works on Irabu prosody agree that Irabu is a language with no lexically contrastive prosodic patterns (Hirayama 1964, 1967; Hirayama, Oshima, and Nakamoto 1966; Shimoji 2007). However, the exact interpretation of the non-lexically contrastive prosody differs among linguists.

On the one hand, Hirayama (1964) presents 'one-pattern accent' analysis (i.e.

fixed accent analysis) specifically for the Nagahama variety of Irabu (other varieties are analysed as 'accentless'). Unfortunately, no detailed observation or justification with a substantial set of examples has been made, and everything is left for reexamination.

On the other hand, another major contribution of Hirayama (1967), which is apparently a modified version of his earlier claim, is that Irabu (all varieties including the Nagahama variety) has a so-called 'collapsed' and 'accentless' system, i.e. with no generalisable accentual pattern obtaining within the word(-plus) domain. This is the most oft-cited and well known hypothesis about Irabu prosody. However, Hirayama's (1967) focus was on the Irabu-Nakachi variety and not on the Nagahama variety, and no examples were listed for the Nagahama variety, even though he did mention that his generalisation would hold true for all varieties of Irabu (Hirayama 1967: 31).

I will show in what follows that words of the same mora length have an invariable prosodic pattern, arguing against 'collapsed system' analysis. I will go on to show in Sections 5 and 6 that the invariable prosodic pattern is a manifestation of linguistic rhythm rather than a fixed accent, arguing against 'one pattern accent' analysis. Thus my analysis differs from both of the traditional analyses.

4.2. Prosodic patterns of root words

In this section I will clarify that Irabu words do not show lexically contrastive tonal patterns, confirming previous works' descriptions, and that, contrary to Hirayama's (1967) argument for 'collapsed' prosody, there is a certain constraint on the prosodic patterning in Irabu (Nagahama). I focus on nouns below. However, we will confirm later in Section 4.3 that there is no difference in tonal patterning among different word classes. The generalisation here applies to citation forms, i.e. monomorphemic (i.e. root) words that are uttered with no other element following.[3]

4.2.1. Prosodic patterns of W_2

The prosodic patterns of W_2 are listed in Table 1, which consists of four sets of examples (a–d).

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[3] The main data that I use in this study comes from three native speakers of Nagahama Irabu: Speaker A (born in 1939, male), Speaker B (born in 1944, female), and Speaker C (born in 1916, female). All were born and have been living in (the Nagahama area of) Irabu. My observation on long word-pluses (Sections 5 and 6) is also based on free text data recorded from a number of native speakers of Nagahama Irabu that I do not list here (16 speakers in total, all over 60 years old, 43 texts in various length).

Table 1.   Prosodic patterns of W$_2$

	Form	Gloss	Pitch pattern	Tonal pattern
a.	*pa.na*	'nose'	[HH] (or [HL])	/HH/
	ja.ma	'mountain'	[HH] (or [HL])	/HH/
	i.cu	'thread'	[HH] (or [HL])	/HH/
b.	*kam*	'god'	[HL]	/HH/
	kan	'crab'	[HL]	/HH/
	paž	'fly'	[HL]	/HH/
	pav	'snake'	[HL]	/HH/
	par	'needle'	[HL]	/HH/
c.	*mii*	'eye'	[HH] (or [HL])	/HH/
	naa	'name'	[HH] (or [HL])	/HH/
	sïï	'nest'	[HH] (or [HL])	/HH/
d.	*kai*	'that way'	[HH] (or [HL])	/HH/
	nau	'what'	[HH] (or [HL])	/HH/
	kui	'voice'	[HH] (or [HL])	/HH/

As is shown in Table 1, there are one or two surface pitch patterns in each W2 (which are indicated by '[ ]'), and there is one phonological tonal representation (indicated by '/ /') set up from the pitch pattern(s).[4] The tone-bearing unit is the mora, and there are two level tones, H(igh) and L(ow).[5]

The coda consonant in word final position is obligatorily lowered, due to Final lowering. Otherwise, the presence or absence of the lowering of the final mora seems to be a matter of free variation, though the lowering typically does *not* take place. Note here that the second member of a long vowel (c) or a diphthong (d) behaves like a light syllable (a) in the applicability of Final lowering.

(6)   Tonal pattern   Final syllable   Final lowering   Pitch pattern
      /HH/   VC#   +   [HL]
                       Otherwise   ±   [HH] (or [HL])

Final lowering occurs either at the end of a word or of an entire word-plus, and this is induced when the word(-plus)-final mora is a coda. When such a word as *mii* 'eye' (typically [HH] with no Final lowering in a citation form) is followed by the dative clitic =*n*, we get the word-plus *miin* [HHL], where the word-plus-final /n/ is lowered as a result of Final lowering, since the word-plus ends in a coda. When such a word as *par* 'needle' ([HL] with Final lowering in a citation form)

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[4] The term 'phonological' is used not to mean that the pattern is a lexical representation, but to mean that the pattern is a direct manifestation of a phonological rule, which will be uncovered in Sections 5 and 6.
[5] I use the term 'tone' to refer to a phonological feature, thus /H/ or /L/, and 'pitch' for a surface phonetic approximation of Fundamental Frequency (F0), thus [H] or [L].

is followed by the dative clitic, we get *parn* [HHL], where the word-plus-final /n/, not the word-final /r/, is subject to Final lowering. When *par* is followed by another clitic =*nu* (nominative) we get the word-plus *parnu*, where Final lowering is typically absent ([HHH]), since the word-plus does not end in a coda.

With regard to other examples than (b) it is not possible to predict exactly when Final lowering takes place, as it is free variation; however, the lowering is possible only if the word in question comes finally: *pana* is pronounced as [HH] (or [HL]) in citation, but *pana=nu* is typically pronounced as [HHH] where no Final lowering occurs on the host word *pana*, as it is in the middle of a word-plus.

Thus we can assume that a W_2 has an underlying tonal pattern /HH/, which may be realised as [HL] if Final lowering, which targets the final mora of a word(-plus), applies depending on the syllable structure of the right edge of a word(-plus).

4.2.2. Prosodic patterns of W_3

A situation is somewhat more complicated in dealing with W_3, though it is still uncontroversial to analyse that W_3 shows an invariable tonal pattern. Table 2 below lists the prosodic patterns of W_3.

A number of generalisations can be made about Table 2:

Table 2.   Prosodic patterns of W_3

	Form	Gloss	Pitch pattern	Tonal pattern
a.	*ka.ta.na*	'knife'	[HHH] (or [LHL])	/HHH/
	žža.ra	'tail cutter'	[HHH] (or [LHL])	/HHH/
b.	*bu.dur*	'dance'	[LHL] (or [HHL])	/HHH/
	mi.dum	'woman'	[LHL] (or [HHL])	/HHH/
c.	*pa.sïï*	'bridge'	[LHL] (or [HHL])	/HHH/
	n.gii	'root of sweet potato'	[LHL] (or [HHL])	/HHH/
	ka.tai	'in-law'	[LHL] (or [HHL])	/HHH/
d.	*juuž*	'celebration'	[HHL]	/HHH/
	pjaar	'summer'	[HHL]	/HHH/
	daav	'tool'	[HHL]	/HHH/
e.	*av.va*	'oil'	[HHH] (or [HHL])	/HHH/
	an.na	'mother'	[HHH] (or [HHL])	/HHH/
	jur.ru	'k.o.fish'	[HHH] (or [HHL])	/HHH/
f.	*kaa.gi*	'smell'	[HHH] (or [HHL])	/HHH/
	kai.na	'arm'	[HHH] (or [HHL])	/HHH/
g.	*mm.na*	'all'	[HHH] (or [HHL])	/HHH/
	nn.sa	'dumb'	[HHH] (or [HHL])	/HHH/

■ Unlike W_2, Final lowering is regularly seen if a word in a citation form ends in any kind of heavy syllable: the lowered mora may be a coda, the second

member of a long vowel or of a diphthong. See (b) to (d). Otherwise, as shown in (a) and (e–g), Final lowering is possible but not typical.

■   There is Initial lowering, whereby the initial mora of a word is L-pitched. This is possible if a word begins in a $(C_i)(C_j)(G)V$, i.e. if the initial mora is a light syllable or a geminate initial C (see *žža.ra* in (a)), or a light presyllable (see *n.gii* in (c)). Other initial heavy syllables never undergoes Initial lowering, as shown in (d–g). As noted below, Initial lowering is optional, and is heavily dependent on the presence or absence of Final lowering within the same word.

■   Initial lowering is present only if Final lowering is present within the same word (thus [LHH] is unattested in my database). In (b) and (c) in which the initial syllable is a light syllable or a light presyllable (thus may be subject to Initial lowering) and in which Final lowering is obligatory, the typical pitch pattern is [LHL], where both Final and Initial lowering are present. On the other hand, the parenthesised [HHL] in these examples, where there is only Final lowering, is atypical but possible. Thus it seems that a phonetically 'angular' contour is preferred.

(7)   TONAL PATTERN   INITIAL LOWERING   FINAL LOWERING   PITCH PATTERN

/HHH/			
	+	+	[LHL]
	−	+	[HHL]
	−	−	[HHH]
	+	−	*[LHH] (not attested)

■   In (d), there is a regular Final lowering as it ends in a coda, but there is no Initial lowering since the initial syllable is not $(C_i)(C_j)(G)V$ or a light R, and therefore Initial lowering is blocked.

■   In (e), (f), and (g), Final lowering is not typical, as the final mora is a light syllable; however, even if Final lowering occurs, Initial lowering is still blocked since the initial syllable here is not $(C_i)(C_j)(G)V$ or a light presyllable.

■   In (a) Final lowering is not typical, as the final mora is a light syllable. When Final lowering does occur in these examples, Initial lowering becomes possible. The pattern [HHL] (only with Final lowering) is also possible in (a), but it is almost absent in my database, and I do not consider this to be a productively attested pattern, and do not list it in the table above.

In the surface pitch pattern [LHL], the final L pitch is slightly lower than the initial L pitch. Thus a more elaborate auditory approximation of the pitch pattern of (b) *budur* 'dance' is [-‾_] (as opposed to (d) *juuž* 'celebration' [‾ ‾_]), in which straight lines represent relative pitch height per mora.

In sum, we can set up the tonal pattern /HHH/ assigned by a general rule, and additional Final and Initial lowering may apply after this general rule if the word has the relevant syllable structures. That is, Irabu has ordered phonological rules for tone/pitch assignment. The first rule (general rule) assigns tone, then the second rule (specific rule) may apply to the pitch realisation of a particular tone

depending on the syllable structure.

4.2.3. Prosodic patterns of W$_4$ and longer words

Table 3 below lists the prosodic patterns of W$_4$ and longer words. Irabu roots are mostly bi- or trimoraic and W$_4$ is not common in roots. It is even more difficult to find native roots of more than four morae, so that the list below includes a proper name of Japanese origin (W$_6$: *koozaburoo*), western loans (W$_7$), and a fossilised compound (W$_8$). Western loans such as frequently used country names (e.g. *oosïtoraria* 'Australia' [HHLLLLL]) and common concepts in daily use (e.g. *paama* 'perm' [HHH], *arubaito* 'part-time job (< German *Arbeit* via Japanese *arubaito*)' [LHLLL], *deisaabisï* [HHLLLL] 'day service', *famiriimaato* 'Family Mart (a convenience store)' [LHLLLLL]) seem to be well integrated into Irabu prosody, given that my consultants all produced these words with the same prosodic patterns.

Table 3. Prosodic patterns of W$_4$ and longer words

Form	Gloss	Pitch pattern	Tonal pattern
W$_4$			
u.tu.ga.ja	'jaw'	[LHLL] (or [HHLL])	/HHLL/
a.kjaa.da	'merchant'	[LHLL] (or [HHLL])	/HHLL/
a.mair	'bulb'	[LHLL] (or [HHLL])	/HHLL/
a.pav.cï	'chatterer'	[LHLL] (or [HHLL])	/HHLL/
mmiv.cï	'chest'	[LHLL] (or [HHLL])	/HHLL/
n.kjaan	'old times'	[LHLL] (or [HHLL])	/HHLL/
kam.nar	'thunder'	[HHLL]	/HHLL/
kuu.mu.ja	'cockroach'	[HHLL]	/HHLL/
W$_5$			
ban.cï.ki.ra	'guava'	[HHLLL]	/HHLLL/
sï.mu.juuž	'ankle'	[LHLLL] (or [HHLLL])	/HHLLL/
W$_6$			
koo.za.bu.roo	'Kozaburo'	[HHLLLL]	/HHLLLL/
kuu.sjan.guu	'fist'	[HHLLLL]	/HHLLLL/
W$_7$			
oo.sï.to.ra.ri.a	'Australia'	[HHLLLLL]	/HHLLLLL/
fa.mi.rii.maa.to	'Family Mart'	[LHLLLLL] (or [HHLLLLL])	/HHLLLLL/
W$_8$			
a.mi.fïï.bam.mai	'rain meal'[6]	[LHLLHHLL] (or [HHLLHHLL])	/HHLLHHLL/

---

[6] This is a special meal taken when one cannot go to field (and therefore cannot take vegetables from the field) due to a heavy rain. This word is a compound consisting of *ami* 'rain', *fïï* 'falling', *pammai* 'food'. However, many speakers do not normally know the etymology and they simply assume that *amifïïbammai* is a kind of 'plain food'.

Unlike W_2 and W_3, these longer words have a regular falling pitch between the second and the third moras without respect to syllable structure, i.e. without respect to whether the second mora and the third mora of a word are tautosyllabic or not. This is exemplified in W_4 above. Also, this medial falling pitch is observed without respect to whether the word in question comes finally or is followed by a clitic. I treat this medial falling pitch as being determined by a general phonological rule, as opposed to a specific phonological rule which is sensitive to the surface syllable structure of a word(-plus), i.e. Initial/Final lowering rules noted above. A traditional dialectological analysis would put 'accent' on the second mora. However, in Section 5 we will see that the accent analysis should be avoided in the Irabu case. This medial falling pitch after the second mora in W_4 and longer words seems to be fairly widespread in other Miyako Ryukyuan varieties as well (e.g. Hirara: see Hirayama 1967).

In addition to the medial falling there is an optional Initial lowering as observed in W_3. As in the case of W_3, it is only observed in the initial light syllable, the initial mora of a $C_iC_i(G)V$, or a light presyllable. There is no Final lowering as the words end in L by a general rule. The final L pitch is lower than the initial L pitch that results from Initial lowering. Also, in a sequence of L-pitched moras, a gradual lowering is observed toward word final position, before arriving at a level low after two or three moras. Thus we get [¯ ¯-_] for *kam.nar* 'thunder' ([HHLL]) and [-¯-_ _] for *sï.mu.juuž* 'ankle' (typically [LHLLL]).

A striking fact about W_8 is that it has an iterative pitch pattern where H and L alternate. This iterative prosodic pattern is explained by a general phonological rule, as will be shown in Section 5. Since it was impossible to list root W_8, I list a compound (*ami-fï̄-bammai* 'rain-falling-meal' > rain meal (i.e. a special meal for rainy days)). Such long words are very common in morphologically complex structures, and we will see in Section 5 that the iterative prosodic pattern as in *amifï̄bammai* /HHLLHHLL/ is fairly common and rigidly organised in morphologically complex word(-pluses). For the moment I just list a set of illustrative examples below, and it suffices here to note that there emerges an iterative prosodic pattern in W_8 and longer word(-pluses), and we even have /HHLLHHLLHHLL/ in W_{12} and longer word(-pluses). That is, the /HHLL/ pattern appears iteratively as a word(-plus) gets longer (see Appendix for praat pictures of some of these examples):

(8) W_2 *kan* 'crab'   /HH/

  W_3 *kan=nu*   /HHH/
        crab=NOM 'crab:NOM'

  W_4 *kan-gama*   /HHLL/
        crab-DIM 'little crab'

  W_5 *kan-gama=nu*   /HHLLL/
        crab-DIM=NOM 'little crab:NOM'

  W_6 *kan-gama-mmi*   /HHLLLL/
        crab-DIM-PL 'little crabs'

W$_7$ *kan-gama-mmi=nu*   /HHLLLLL/
        crab-DIM-PL=NOM 'little crabs:NOM'
W$_8$ *kan-gama-mmi-nagi*   /HHLLHHLL/
        crab-DIM-PL-and.so.on 'little crabs, and so on'
W$_9$ *kan-gama-mmi-nagi=nu*   /HHLLHHLLL/
        crab-DIM-PL-and.so.on=NOM 'little crabs, and so on:NOM'
W$_{10}$ *kan-gama-mmi-nagi=kara*   /HHLLHHLLLL/
        crab-DIM-PL-and.so.on=from 'from little crabs, and so on'
W$_{11}$ *kan-gama-mmi-nagi=kara=du*   /HHLLHHLLLLL/
        crab-DIM-PL-and.so.on=from=FOC 'from little crabs, and so on:FOC'
W$_{12}$ *kan-gama-mmi-nagi=kara=mai*   /HHLLHHLLHHLL/
        crab-DIM-PL-and.so.on=from=too 'from little crabs, and so on, too'

4.3. Summary

The above sections have revealed that Irabu words do not show lexically contrastive prosodic patterns, a fact already pointed out by all previous works of Irabu prosody. I further suggested that a given W$_n$ shows an invariable tonal pattern assigned by a general rule, and a specific rule may apply depending on the syllable structure of a word(-plus). Thus, all W$_4$ invariably show the /HHLL/ pattern, and if the initial syllable is light, the initial /H/ may be realised as [L]. This is true across word classes. For example, all quadrimoraic verbs and adjectives follow the prosodic pattern /HHLL/, as in *patarafï* 'work' (/HHLL/ [LHLL]) and *aparagi* 'beautiful' (/HHLL/ [LHLL]).

    In sum, it is possible to set up the following tonal patterns of the root words in citation, without respect to word class.

(9)   a. W$_2$:   /HH/
       b. W$_3$:   /HHH/
       c. W$_{4-7}$:   /HHLL(L...)/
       d. W$_8$:   /HHLLHHLL/

These tonal patterns of citation forms are subject to Initial and Final lowering, and various intonational modifications that are not discussed in this study.

    Contrary to Hirayama's (1967) view that all Irabu varieties have a 'collapsed' prosodic system (1967), there must be some phonological restriction on the tonal pattern of words with the same mora length in Nagahama Irabu. We are now left with the question of exactly what the constraint is, and this will be examined in Sections 5 and 6. It also turned out that W$_8$ (and longer word(-pluses)) has an iterative emergence of the /HHLL/ pattern, a fact that has not received any attention in the literature but is highly noteworthy and in fact crucial in uncovering the true nature of Irabu prosodic system.

5. A Foot-Based Analysis of Irabu Prosody

In what follows I examine morphologically complex words and word-pluses, and aim at a description that accommodates the prosodic patterns of both roots and

morphologically complex structures.

To give such a description, it is necessary to depart from the existing descriptive conventions of Japanese dialectology, in which there seem to be two tacit assumptions, which are actually present in Hirayama's (1967) description of Irabu and other Miyako Ryukyuan varieties, and which are problematic in dealing with Irabu. First, there is an assumption that words should have a 'flat' structure, i.e. words are directly composed of moras (or syllables, Sibata 1962) and no higher phonological constituency such as the foot exists within the word(-plus) domain. Second, there is an assumption that word(-plus)-level prosody can be explained with (the presence or absence of) accent, i.e. the specification of one prominent mora/syllable.

These two tacit assumptions are not justified in Irabu, since Irabu has the following two important characteristics that are clearly against these assumptions:

(10) Constituency: Irabu prosody has bi- or trimoraic constituency within the word(-plus) domain, which conditions tone assignment.
(11) Iterativity: in Irabu prosody there is a potential iterativity, giving rise to fall and rise and fall, etc., of pitch (e.g. *a.mi.fïï.bam.mai* 'rain meal' /HHLLH HLL/).

In order to handle these two characteristics, I first introduce the descriptive unit foot, and I will show that Irabu word(-pluses) are parsed into feet (Section 5.1), and tone is assigned to the pre-existing foot structure, in such a way that H tone is assigned to odd-numbered feet and L tone to even numbered feet, allowing for an iterative emergence of H and L (Sections 5.2 and 5.3).

5.1. Constituency
5.1.1. Foot structure
All word(-pluses) can be decomposed into (combinations of) bi- or trimoraic constituents (in what follows constituency is indicated by (μμ) and (μμμ)). In particular, the constituent structure is visible in the tonal patterns of W_{2-3}, W_{4-5}, and W_8. Thus W_{2-3} has the tonal patterns /HH/ and /HHH/ respectively, which are assumed to directly reflect the constituent structures (μμ) and (μμμ) to which H is assigned. W_{4-5} have the tonal patterns /HHLL/ and /HHLLL/ respectively, which are assumed to directly reflect the constituent structures (μμ)(μμ) and (μμ)(μμμ), and H and L are assigned to the first and the second constituent respectively. W_8 has the tonal pattern /HHLLHHLL/ which can be assumed to directly reflect the constituent structure (μμ)(μμ)(μμ)(μμ), and H is assigned to the first and the third constituents, L is on the second and the fourth.

Constituent structure can also be assumed for W_{6-7}, i.e. W_6 (μμ)(μμ)(μμ) and W_7 (μμ)(μμ)(μμμ), though the structure is not visible in the tonal patterns of these words in citation, since there is only a monotonic sequence of L-toned moras in the second and third constituents (W_6: /HH<u>LLLL</u>/ and W_7: /HH<u>LLLLL</u>/). However, the constituent structure here becomes obvious when these forms are followed by a polymoraic clitic such as =*dara* (emphatic). For example, a W_6

koozaburoo 'Kozaburo' is subject to the shift of tonal pattern from /HHLLLL/ to /HHLLHH/ when followed by the emphatic clitic =*dara* (*koozaburoo=dara* / HHLLHH=LL/), and a W$_7$ *oosïtoraria* 'Australia' is also subject to the shift of tonal pattern from /HHLLLLL/ to /HHLLHHH/ when followed by =*dara* (*oosïtoraria=dara* /HHLLHHH=LL/). That is, these host words consist of three constituents (koo)(zabu)(roo) and (oo)(sïto)(raria) respectively, and the attachment of =*dara* induces the final constituent of the host to be H-toned.

(12) below shows the tonal patterns of roots (W$_{2-8}$). The underlying constituent structures are shown to the right of each word, with tone assigned per constituent as specified in (13). This representation not only allows us to describe the attested patterns in a straightforward manner, but gives us an explanatory principle whereby we can predict that certain prosodic patterns will be *un*attested: for example, we can explain why W$_4$ is realised as /HHLL/ (or /LLHH/ as will be shown in Section 5.3.2 (38) *kjavdai* 'sibling') but not as /HLLL/ or /HHHL/, since such tonal configuration is impermissible as seen in (14). Henceforth, (13) will be represented as (μμ)$_T$ or (μμμ)$_T$ (e.g. W$_5$ has (μμ)$_H$ (μμμ)$_L$, which means that H tone is associated with the two moras of the first constituent, and L tone is associated with the three moras of the second constituent, rendering /(HH)(LLL)/).

(12)

			Tonal pattern	Constituent structure
a.	W$_2$:	*pana* 'nose'	/HH/	(μμ)$_H$
b.	W$_3$:	*katana* 'knife'	/HHH/	(μμμ)$_H$
c.	W$_4$:	*utugaja* 'jaw'	/HHLL/	(μμ)$_H$ (μμ)$_L$
d.	W$_5$:	*bancïkira* 'guava'	/HHLLL/	(μμ)$_H$ (μμμ)$_L$
e.	W$_6$:	*koozaburoo* 'Kozaburo'	/HHLLLL/	(μμ)$_H$ (μμ)$_L$ (μμ)$_L$
f.	W$_7$:	*oosïtoraria* 'Australia'	/HHLLLLL/	(μμ)$_H$ (μμ)$_L$ (μμμ)$_L$
g.	W$_8$:	*amifïïbammai* 'rain meal'	/HHLLHHLL/	(μμ)$_H$ (μμ)$_L$ (μμ)$_H$ (μμ)$_L$

(13)   Bimoraic constituent   Trimoraic constituent

$$(\; \mu \quad \mu \;) \qquad\qquad (\; \mu \quad \mu \quad \mu \;)$$

Tone   Tone

(14)   Impermissible tonal configuration: tone is associated across constituents

$$(\; \mu \quad \mu \;) \; (\; \mu \quad \mu \;) \qquad (\; \mu \quad \mu \;) \; (\; \mu \quad \mu \;)$$

H   L   H   L
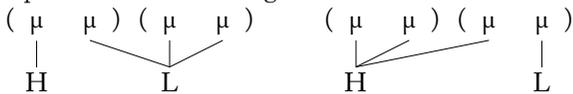
After tone assignment, the specific pitch assignment rules noted in Section 4 (i.e. Initial/Final lowering rules) may apply depending on the syllable structure of the edges of the word(-plus).

The notion of foot in Irabu is defined as the bimoraic or trimoraic constituent that serves as the domain of tone assignment as schematically shown in (13) above. Thus the Irabu foot is precisely the tonal foot suggested by Leben (1997) and in other works thereafter (Zec 1999, Leben 2002, 2003, Weidman and Rose 2006). The tonal foot analysis in the literature is based on the autosegmental analysis, where the assumption is made that the segmental tier and the tonal tier are mutu-

ally independent. This is illustrated in the configurations (13) and (14) above. A tonal foot is a metrical constituent on the segmental tier that is assigned a particular tone. In the literature on tonal feet, it is often suggested that there is no necessary correlation between tonal foot and stress (see, among others, Leben 1997, 2002, 2003, Zec 1999, deLacy 2002, Widman and Rose 2006).

The domain of footing is the word(-plus). Binary footing (μμ) goes from left to right iteratively, except for two special cases to be explained in the following section, where ternary footing (μμμ) may occur.

5.1.2. Ternary footing

The exhaustive binary footing from left to right naturally results in one stray mora finally if the word(-plus) has an odd number of moras. This gives rise to ternary footing to avoid leaving the unfooted mora. This is exactly what is shown in (12) above.

Ternary footing introduces an additional morphological factor: polymoraic roots, affixes, or clitics always commence their own footing, i.e. the left boundary of a polymoraic form always coincides with the left boundary of a foot (a few exceptions will be noted below). Thus if a root has an odd number of moras and precedes a bimoraic form, as in (15a–c) below (W_3 + bimoraic form = W_5) and in (16a–c) below (W_7 + bimoraic form = W_9), the root receives ternary footing rather than leaving one stray medially (i.e. (ii) in each example is impermissible):

(15) a. *katana-nagi*   b. *katana=mai*   c. *katana-kazi*
        knife-and.so.on   knife=too   knife=blacksmith
        'knife, and so on'   'knife, too'   'knife blacksmith'
        i. (katana)$_H$ (nagi)$_L$ i. (katana)$_H$ (mai)$_L$ i. (katana)$_H$ (kazi)$_L$
        ii. *(kata)na(nagi)   ii. *(kata)na(nagi)   ii. *(kata)na(kazi)

(16) a. *oosïtoraria-nagi*   b. *oosïtoraria=mai*   c. *oosïtoraria-pžtu*
        Australia-and.so.on   Australia=too   Australia-man
        'Australia, and so on'   'Australia, too'   'a man from Australia'
        i. (oo)$_H$ (sïto)$_L$(raria)$_H$ (nagi)$_L$ i. (oo)$_H$ (sïto)$_L$(raria)$_H$ (mai)$_L$ i. (oo)$_H$ (sïto)$_L$(raria)$_H$ (pžtu)$_L$
        ii. *(oo)(sïto)(rari)a (nagi)   ii. *(oo) (sïto)(rari)a (mai)   ii. *(oo)(sïto)(rari)a(pžtu)

Ternary footing is also observed when a trimoraic form follows the stems above:

(17) a. *katana=bjaam*   b. *oosïtoraria=bjaam*
        knife=I.wonder   Australia=I.wonder
        'I wonder if it's a knife'   'I wonder if it's Australia'
        (katana)$_H$ (bjaam)$_L$ (oo)$_H$ (sïto)$_L$ (raria)$_H$ (bjaam)$_L$

By contrast, monomoraic affixes, clitics, or roots do not necessarily come at the left boundary of a foot. That is, they are simply treated as part of the preceding host, to which the default footing applies (bimoraic footing from left to right with an optional final ternary footing), and do not commence a foot except if the default footing may allow them to commence a foot. For example, a W_2 *pana* 'nose' + =*u* (accusative) give rise to a W_3 (panau)$_H$ with no special footing. Likewise, a W_3

katana 'knife' + =*u* give rise to a W$_4$ (kata)$_H$ (nau)$_L$ with no special footing (cf. (15)). W$_7$ *oosïtoraria* 'Australia' + =*u* give rise to (oo)$_H$ (sïto)$_L$ (rari)$_H$ (au)$_L$, with no special footing (cf. (16)).

Furthermore, a sequence of two monomoraic clitics such as =*u*=*du* (accusative + focus) below is simply treated as part of the host, to which the default footing applies. Compare (18) and (19) with (15) and (16) above respectively.

(18) *katana=u=du* (19) *oosïtoraria=u=du*
    knife=ACC=FOC   Australia=ACC=FOC
    'knife:ACC:FOC'   'Australia:ACC:FOC'
    (kata)$_H$ (naudu)$_L$ (oo)$_H$ (sïto)$_L$ (rari)$_H$ (audu)$_L$

Some morphemes have monomoraic and bimoraic allomorphs, and this difference is reflected in footing. For example, quotative {=ti} has /=tii/ (which commences a foot) and /=ti/ (which may not).

(20) a. *katana=tii*   b. *katana=ti*
       knife=QT   knife=QT
       'knife:QT'   'knife:QT'
       (katana)$_H$ (tii)$_L$ (kata)$_H$ (nati)$_L$
(21) a. *oosïtoraria=tii*   b. *oosïtoraria=ti*
       Australia=QT   Australia=QT
       'Australia:QT'   'Australia:QT'
       (oo)$_H$ (sïto)$_L$(raria)$_H$ (tii)$_L$ (oo)$_H$ (sïto)$_L$(rari)$_H$ (ati)$_L$

A few polymoraic verbal affixes are exceptional in footing, as they do not always commence a foot, thus like monomoraic morphemes in this regard. Such verbal affixes include: *-rai* (passive) and *-tigaa* (conditional converb). As is shown below, unlike other polymoraic affixes that always start their own footing (note causative *-sïmi* in (22a) and past unmarked *-tar* in (23a) in terms of the ternary footing of their hosts), these exceptional affixes do not commence a foot except if the default footing may allow them to commence a foot, and so do not induce ternary footing on the part of the host. Thus what we get are (22b ii) and (23b ii) rather than (22b i) and (23b i).

(22) a. *nkai-sïmi-tar=pazï*   b. *nkai-rai-tar=pazï*
       pick.up-CAUS-PST.UM=maybe   pick.up-PASS-PST.UM=maybe
       'may have told (someone) to pick up'   'may have been picked up'
       (nkai)$_H$ (sïmi)$_L$ (tar)$_H$ (pazï)$_L$ i. *(nkai)$_H$ (rai)$_L$ (tar)$_H$ (pazï)$_L$
                                 ii. (nka)$_H$ (irai)$_L$ (tar)$_H$ (pazï)$_L$

(23) a. *nkai-tar*   b. *nkai-tigaa*
       pick.up-PST.UM   pick.up-CVB.CND
       'picked up (someone)'   'if (x) picks up (someone)'
       (nkai)$_H$ (tar)$_L$ i. *(nkai)$_H$ (tigaa)$_L$
                                   ii. (nka)$_H$ (iti)$_L$ (gaa)$_L$

5.1.3. Summary

To sum up the preceding sections, there is a restriction on the distribution of tones so that tone assignment is conditioned by bi- or trimoraic constituency, or foot structure. Footing is sensitive to morphological structure, so that polymoraic forms commence their own footing with just a few exceptions.

The aim which follows from this is to postulate a tone assignment rule that assigns tones to the pre-existing foot structure created by the strategies mentioned in Sections 5.1.1 and 5.1.2. Thus what we are doing is looking at Irabu prosody as consisting of two independent processes: (a) footing on the segmental structure and (b) tone assignment to this foot structure. The tone assignment rule will be described in Section 5.3 below, after noting the iterative nature of Irabu prosody in Section 5.2 below.

5.2. Iterativity

The potential iterativity of prosodic organisation, i.e. the potentially iterative emergence of tone features, is another striking feature of Irabu. As illustrated below, iterativity is pervasive once we examine morphologically complex word(-pluses), specifically with four feet or more. Below I list sets of examples of nominal word(-pluses) in which nominal roots are W_{2-8}, and other sets of examples of verbal word(-pluses) in which verb roots are W_{2-5} (longer roots are not available for verbs).

(24) a. W_2: *pav* 'snake' $(pav)_H$
      b. W_4: *pav* + *-gama* [diminutive] $(pav)_H (gama)_L$
      c. W_6: *pav* + *-gama* + *=kara* 'from' $(pav)_H (gama)_L (kara)_L$
      d. W_8: *pav* + *-gama* + *=kara* + *=mai* 'even' $(pav)_H (gama)_L (kara)_H (mai)_L$

(25) a. W_3: *jarabi* 'child' $(jarabi)_H$
      b. W_5: *jarabi* + *-gama* $(jarabi)_H (gama)_L$
      c. W_7: *jarabi* + *-gama* + *=kara* $(jarabi)_H (gama)_L (kara)_L$
      d. W_9: *jarabi* + *-gama* + *=kara* + *=mai* $(jarabi)_H (gama)_L (kara)_H (mai)_L$

(26) a. W_4: *akjaada* 'merchant' $(akja)_H (ada)_L$
      b. W_6: *akjaada* + *-gama* $(akja)_H (ada)_L (gama)_L$
      c. W_8: *akjaada* + *-gama* + *=kara* $(akja)_H (ada)_L (gama)_H (kara)_L$
      d. W_{10}: *akjaada* + *-gama* + *=kara* + *=mai* $(akja)_H (ada)_L (gama)_H (kara)_L (mai)_L$

(27) a. W_5: *bancïkira* 'guava' $(ban)_H (cïkira)_L$
      b. W_7: *bancïkira* + *-gama* $(ban)_H (cïkira)_L (gama)_L$
      c. W_9: *bancïkira* + *-gama* + *=kara* $(ban)_H (cïkira)_L (gama)_H (kara)_L$
      d. W_{11}: *bancïkira* + *-gama* + *=kara* + *=mai* $(ban)_H (cïkira)_L (gama)_H (kara)_L (mai)_L$

(28) a. W_6: *koozaburoo* 'Kozaburo' $(koo)_H (zabu)_L (roo)_L$
      b. W_8: *koozaburoo* + *-gama* $(koo)_H (zabu)_L (roo)_H (gama)_L$
      c. W_{10}: *koozaburoo* + *-gama* + *=kara* $(koo)_H (zabu)_L (roo)_H (gama)_L (kara)_L$
      d. W_{12}: *koozaburoo* + *-gama* + *=kara* + *=mai* $(koo)_H (zabu)_L (roo)_H (gama)_L (kara)_H (mai)_L$

(29) a. W_7: *famiriimaato* 'Family Mart' $(fami)_H (rii)_L (maato)_L$

b. W_9: *famiriimaato + -gama* $(fami)_H (rii)_L (maato)_H (gama)_L$

c. W_{11}: *famiriimaato + -gama + =kara* $(fami)_H (rii)_L (maato)_H (gama)_L (kara)_L$

d. W_{13}: *famiriimaato + -gama + =kara + =mai*

$(fami)_H (rii)_L (maato)_H (gama)_L (kara)_H (mai)_L$

(30) a. W_8: *amifïïbammai* 'rain meal' $(ami)_H (fïï)_L (bam)_H (mai)_L$

b. W_{10}: *amifïïbammai + -gama* $(ami)_H (fïï)_L (bam)_H (mai)_L (gama)_L$

c. W_{12}: *amifïïbammai + -gama + =kara* $(ami)_H (fïï)_L (bam)_H (mai)_L (gama)_H (kara)_L$

d. W_{14}: *amifïïbammai + -gama + =kara + =mai*

$(ami)_H (fïï)_L (bam)_H (mai)_L (gama)_H (kara)_L (mai)_L$

(31) a. W_2: *tur-* 'take' $(tur)_H$

b. W_3: *tur- + -as* [causative] $(turasï)_H$

c. W_4: *tur- + -as + -rai* [passive] $(tura)_H (sai)_L$

d. W_6: *tur- + -as + -rai + -tar* [past unmarked] $(tura)_H (sai)_L (tar)_L$

e. W_8: *tur- + -as + -rai + -tar + =pazï* 'maybe' $(tura)_H (sai)_L (tar)_H (pazï)_L$

f. W_{11}: *tur- + -as + -rai + -tar + =pazï + =dooi* [emphatic]

$(tura)_H (sai)_L (tar)_H (pazï)_L (dooi)_L$

(32) a. W_3: *barau-* 'laugh' $(barau)_H$

b. W_4: *barau- + -as* $(bara)_H (asï)_L$

c. W_5: *barau- + -as + -rai* $(bara)_H (asai)_L$

d. W_7: *barau- + -as + -rai + -tar* $(bara)_H (asai)_L (tar)_L$

e. W_9: *barau- + -as + -rai + -tar + =pazï* $(bara)_H (asai)_L (tar)_H (pazï)_L$

f. W_{12}: *barau- + -as + -rai + -tar + =pazï + =dooi* $(bara)_H (asai)_L (tar)_H (pazï)_L (dooi)_L$

(33) a. W_4: *patarak-* 'work'[7] $(pata)_H (rafi)_L$

b. W_5: *patarak- + -as* $(pata)_H (rakasï)_L$

c. W_6: *patarak- + -as + -rai* $(pata)_H (raka)_L (sai)_L$

d. W_8: *patarak- + -as + -rai + -tar* $(pata)_H (raka)_L (sai)_H (tar)_L$

e. W_{10}: *patarak- + -as + -rai + -tar + =pazï* $(pata)_H (raka)_L (sai)_H (tar)_L (pazï)_L$

f. W_{13}: *patarak- + -as + -rai + -tar + =pazï + =dooi*

$(pata)_H (raka)_L (sai)_H (tar)_L (pazï)_H (dooi)_L$

(34) a. W_5: *ugunaar-* 'gather' $(ugu)_H (naar)_L$

b. W_6: *ugunaar- + -as* $(ugu)_H (naa)_L (rasï)_L$

c. W_7: *ugunaar- + -as + -rai* $(ugu)_H (naa)_L (rasai)_L$

d. W_9: *ugunaar- + -as + -rai + -tar* $(ugu)_H (naa)_L (rasai)_H (tar)_L$

e. W_{11}: *ugunaar- + -as + -rai + -tar + =pazï* $(ugu)_H (naa)_L (rasai)_H (tar)_L (pazï)_L$

f. W_{14}: *ugunaar- + -as + -rai + -tar + =pazï + =dooi*

$(ugu)_H (naa)_L (rasai)_H (tar)_L (pazï)_H (dooi)_L$

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[7] *patarak-* is realised as a morphophonemically adjusted stem *pataraf* when functioning as certain stem forms such as finite verb stem as in (33a) *patarafï* 'work:NPST.UM', where the root-final /k/ is turned into /f/. See Shimoji (2008a) for details on Irabu morphology.

The passive suffix *-rai* is a bimoraic affix, whose onset /r/ is deleted by rule when attaching to hosts ending in a consonant, as shown in (31–34). As was noted in Section 5.1.2, it behaves like a monomoraic affix, in that it does not necessarily commence a foot, i.e. is treated simply as part of the host to which the default footing applies. Thus in (32c) *baraasai* is parsed into (bara)(asai) rather than (baraa)(sai), and in (34d) *ugunaarasaitar* is parsed into (ugu)(naa)(rasai)(tar) rather than (ugu)(naara)(sai)(tar). On the other hand, such a bimoraic form as *-tar* consistently induces ternary footing on the part of its host if the host has an odd number of moras.

5.3. Tone assignment
5.3.1. The rule
The potentially iterative emergence of tone features is now described in terms of tone assignment on the pre-existing foot structure. The rules are formulated as follows:

(35) a. Counting from the initial foot, odd-numbered feet bear H and even-numbered feet bear L.
      b. The final foot must be L-toned unless it is the only available foot.

The rule (35b) overrides the general rule (35a). Thus (35b) prohibits the appearance of H in the final foot of the word(-pluses) with an odd-number of feet (e.g. (34b, c, e)).

As is clear from the examples above, (35) applies to an entire word(-plus) rather than to a word. For example, see (26c) above: if the tone assignment rule only applied to the word (akja)(ada)(gama) and not the word-plus, then the word-final *-gama* would be L-toned from the rule (35b), which is not the case. Likewise, in (32e) above, if the tone assignment rule only applied to the word (bara)(asai)(tar) and not the word-plus, then the word-final *-tar* would be L-toned, which is not the case.

Moreover, as will be noted in the following section, there are limited cases where the rule set (35) applies to a larger structure, i.e. an entire phrase.

5.3.2. Phrasal mapping
Even though the tone assignment rule (35) *in principle* applies to the word(-plus) domain, a close inspection reveals that it may apply to an entire phrase if the first member of the phrase has one foot only. This is illustrated in (36) to (38) below, in each of which two nominal word(-pluses) form an NP. If the tone assignment rule exactly applied to each word(-plus) the expected pattern should be (a), where each member of a phrase (i.e. a word(-plus)) would constitute a single prosodic domain of tone assignment. However, what we actually get is (b), which demonstrates that an entire phrase is a single prosodic domain of the tone assignment. Note that in (36′) to (38′) where the first member of a phrase consists of more than one foot the phrasal mapping of tone assignment does not occur, and each word(-plus) remains the domain of tone assignment.

(36) *ba=ga*   *ffa-gama*   (36′) *koozaburoo=ga*   *ffa-gama*
   1SG=GEN   child-DIM   Kozaburo=GEN   child-DIM
   'my little child'   'Kozaburo's little child'
   a. *(baga)$_H$ (ffa)$_H$(gama)$_L$ (koo)$_H$ (zabu)$_L$ (rooga)$_L$ (ffa)$_H$ (gama)$_L$
   b. (baga)$_H$ (ffa)$_L$(gama)$_L$

(37) *ba=ga*   *ffa-gama-mmi* (37′) *koozaburoo=ga*   *ffa-gama-mmi*
   1SG=GEN   child-DIM-PL   Kozaburo=GEN   child-DIM-PL
   'my little children'   'Kozaburo's little children'
   a. *(baga)$_H$ (ffa)$_H$(gama)$_L$(mmi)$_L$ (koo)$_H$ (zabu)$_L$ (rooga)$_L$ (ffa)$_H$ (gama)$_L$(mmi)$_L$
   b. (baga)$_H$ (ffa)$_L$ (gama)$_H$ (mmi)$_L$

(38) *ba=ga*   *kjavdai=mai* (38′) *koozaburoo=ga*   *kjavdai=mai*
   1SG=GEN   sibling=too   Kozaburo=GEN   sibling=too
   'my sibling, too'   'Kozaburo's sibling, too'
   a. *(baga)$_H$ (kjav)$_H$ (dai)$_L$ (mai)$_L$ (koo)$_H$ (zabu)$_L$ (rooga)$_L$ (kjav)$_H$ (dai)$_L$ (mai)$_L$
   b. (baga)$_H$ (kjav)$_L$ (dai)$_H$ (mai)$_L$

To obtain phrasal mapping, the first member of an NP may be any mono-foot word, such as *vva=ga* (2SG=GEN) 'your', *kai=ga* (3SG=GEN) 'his/her', *pžtu=nu* (man=GEN) 'someone's', *unu* 'that', etc.[8] (39) to (41) below illustrate an NP with *naa=ga* 'one's own (reflexive pronoun)' as the first member.

(39) *naa=ga*   *ffa-gama*
   REF=GEN   child-DIM
   'one's own little child'
   a. *(naaga)$_H$ (ffa)$_H$(gama)$_L$
   b. (naaga)$_H$ (ffa)$_L$(gama)$_L$

(40) *naa=ga*   *ffa-gama-mmi*
   REF=GEN   child-DIM-PL
   'one's own little children'
   a. *(naaga)$_H$ (ffa)$_H$(gama)$_L$(mmi)$_L$
   b. (naaga)$_H$ (ffa)$_L$ (gama)$_H$ (mmi)$_L$

(41) *naa=ga*   *kjavdai=mai*
   REF=GEN   sibling=too
   'one's own sibling, too'
   a. *(naaga)$_H$ (kjav)$_H$ (dai)$_L$ (mai)$_L$
   b. (naaga)$_H$ (kjav)$_L$ (dai)$_H$ (mai)$_L$

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[8] Irabu has two nominative/genitive case forms =*ga* and =*nu*, as is typical in Ryukyuan languages in general. The use of one form over the other is determined by the semantic property and the pragmatic status of the NP to which it is attached. In general, human proper names, pronouns, kinship terms and social status terms (e.g. *sinsii* 'teacher') are marked by =*ga*, otherwise by =*nu*. There are overlapping cases, where the same noun is marked by =*ga* or =*nu* depending on its pragmatic status (definiteness). In sum, the use of =*ga* or =*nu* is sensitive to Animacy hierarchy or topic-worthiness hierarchy (see Payne 1997 for a summary of these notions). See Shimoji (2006) for detail.

Furthermore, the phrase may be a VP (for more phrasal contexts see Shimoji and Hayashi 2008). As is shown below, the VP (main verb + auxiliary verb + modal clitic) in each example forms a single prosodic domain to which the tone assignment rule applies, rendering the pattern (b).

(42) *mii*   *fii-tar=pazï.*
      look.CHN   BEN-PST.UM=maybe
      '(S/he) may have watched (something) (for someone).'
      a. *(mii)$_H$ (fii)$_H$ (tar)$_L$ (pazï)$_L$
      b. (mii)$_H$ (fii)$_L$ (tar)$_H$ (pazï)$_L$
(43) *jum-i-i*   *fii-tar=pazï.*
      read-THM-CHN   BEN-PST.UM=maybe
      '(S/he) may have read (a book) (for someone).'
      a. *(jumii)$_H$ (fii)$_H$ (tar)$_L$ (pazï)$_L$
      b. (jumii)$_H$ (fii)$_L$ (tar)$_H$ (pazï)$_L$
(44) *jum-i-i*   *njaat-tar=pazï.*
      read-THM-CHN   PRF-PST.UM=maybe
      '(S/he) may have finished reading.'
      a. *(jumii)$_H$ (njaat)$_H$ (tar)$_L$ (pazï)$_L$
      b. (jumii)$_H$ (njaat)$_L$ (tar)$_H$ (pazï)$_L$

Phrasal mapping occurs in tone assignment but not in foot building: footing commences and ends in each word(-plus), not across two word(-pluses). Thus in a phrase like W1+W2 below, we have the footing pattern (a) and not (b), the latter of which would be possible if the W1+W2 as a whole were treated as a single domain of footing. See (39) above for an illustration of (45) below.

(45)   W1   W2
          μ   μ   μ   μ   μ   μ   μ
      a. (μ   μ   μ)   (μ   μ) (μ   μ)
      b. *(μ   μ) (μ   μ) (μ   μ   μ)

This supports the view held in this paper that footing is independent of (i.e. preliminary to) tone assignment.

Two juxtaposed word(-pluses) that do not form a morphosyntactic phrase do not induce the phrasal mapping of tone assignment. Thus in (46) below, the subject NP *baga* and the object NP *ffa-gama=u* do not form a single prosodic domain, even when the first word-plus *baga* is a mono-foot word-plus (cf. (36)).

(46) *ba=ga*   *ffa-gama=u*   *ž-ža-di*
      1SG=NOM   child-DIM=ACC   scold-THM-NPST.INT
      Subject   Object   Verb
      'I will scold my little child.'
      (baga)$_H$ (ffa)$_H$ (gamau)$_L$ (žžadi)$_H$
      <Prosodic domain>   <Prosodic domain>   <Prosodic domain>

Similarly, in (47) below, where the mono-foot word *jumii* is followed by *fiitar* (cf.

(43)), the two verbs do not form a single VP but form distinct VPs (*jumii* is a chained clause head, and *fiitar* is a main clause head, thus (47) is a clause chaining structure). Thus each word(-plus) serves as distinct prosodic domain to which tone assignment applies.

(47) *jum-i-i,*   *fii-tar=pazï.*
        read-THM-CHN   give-PST.UM=maybe
        [chained clause]   [main clause]
        '(S/he) may have read (a book) and have given (it) (to someone).'
        (jumii)$_H$ (fii)$_H$ (tar)$_L$ (pazï)$_L$
        <Prosodic domain>   <Prosodic domain>

Thus phrasal mapping takes place only when two word(-pluses) form a single morphosyntactic phrase *and* the first member of the phrase is a mono-foot word(-plus).

5.3.3. Summary
By assuming that Irabu prosody consists of two independent processes, i.e. footing as formulated in Section 5.1 and tone assignment as formulated in Section 5.3, we can describe the prosodic pattern of root words and morphologically complex words and word-pluses (and even phrases in a limited case) with the same principle. Even though the tone assignment rule formulated in (35) seems rather language-specific and ad-hoc at this stage, Section 6 will reveal that this rule can be explained in terms of the rhythmic organisation of human language in general.

5.4. Typological status of Irabu foot
The Irabu foot is unlike a typologically common bimoraic foot such as Hayes's moraic trochee (1b) in two crucial ways. First, the Irabu foot has no head. Second, the Irabu foot cannot be said to govern the syllable as is the case with the moraic trochee in (1b).

5.4.1. Headedness
One possibly problematic fact about Irabu foot is that it is a 'headless foot', or 'flat foot' in Crowhurst and Hewitt's (1995) terms. That is, the Irabu foot cannot be analysed as containing a prominent mora corresponding to the stressed syllable of a stress foot.

 However, it must be noted that even in stress feet, footing does not necessarily entail headedness: both theoretical and empirical studies have shown that footing and head assignment are separate processes (Halle and Vergnaud 1987, Halle 1990, Hammond 1989, Crowhurst and Hewitt 1995). For example, in reexamining the prosodic system of the stress language Yidiny (Dixon 1977), Crowhurst and Hewitt (1995) presented the validity of 'prosodic overlay' (as outlined in (48) below), in which 'rules assigning metrical heads may be parasitic on pre-existing feet required independently of the stress system' (Crowhurst and Hewitt 1995: 41). That is, footing is a process of parsing segments into disyllabic/bimoraic constitu-

ents, or what they call 'constituentisation' (48a), whereas head assignment, as shown in (48b), assigns metrical prominence to an element that may be an element within a foot, or a phonetically prominent (e.g. heavy) syllable, or an element coming at the edge of a morphological structure such as the word. This separation between footing and head assignment is nicely compatible with Nespor and Vogel's (1986) claim that the foot exists independently of stress. Furthermore, their argument is that (48) applies in human language in general (i.e. it is part of universal grammar on their theoretical assumptions), with the implementation of these options being left to individual languages.

(48)   Crowhurst and Hewitt's (1995: 41) 'prosodic overlay' hypothesis
    a.   Constituentisation:
       Assign flat feet (σ σ), (μ μ), or (σ_μ $\sigma_{\mu\mu}$), within a specified domain.
    b.   Head assigning algorithms
       i.   foot-driven: Assign headship to a terminal of a foot.
       ii.   Prominence-driven: Assign headship to phonetically prominent elements.
       iii.   Edge-driven: Assign headship to an element at the edge of a morphological domain.

This formulation of foot and headship is insightful in typologising the foot in cross-linguistic perspective, since it predicts three major types of language, in one of which Irabu can be naturally situated: (1) languages having a foot and a head, (2) languages having only a head but lacking foot structure, and (3) languages having only a foot but lacking a head.[9] Crowhurst and Hewitt (1995: 41–42) note languages of types (1) and (2), of which (1) occurs only in stress languages. I claim here that Irabu is a language instantiating type (3), a type which can be expected especially if the language lacks a stress system.

In sum, with the assumption that footing and head assignment are mutually independent, I argue that headedness is not a necessary condition in the typology of linguistic foot. As is shown in (48a), binarity, or the bimoraic or disyllable constituency, seems to be more important than headedness in typologising the linguistic foot, and this is actually a recurrent characteristic of the foot structure in both stress languages and non-stress languages. In fact, the notion 'tonal foot' (Leben 1997, Zec 1999) has been characterised in terms of the disyllabic segmental constituency (without respect whether it has a head) which interacts with tone assignment (see also Section 5.1.1). Thus it is plausible to consider headedness to be non-criterial in determining the linguistic foot in cross-linguistic and typological perspective, and I continue to use the term foot in the Irabu case.

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[9] The fourth type is of course a language having neither foot nor head. Tone languages in which the tonal domain is not sensitive to constituency should be categorised into this fourth type (with no foot structure or metrical head). For example, Malcolm Ross (p.c.) states that Kewa (a tone language of Trans New Guinea Family) is a language where there is no evidence for foot structure or for a metrical head.

5.4.2. Hierarchical relationship between foot and mora/syllable

In Hayes's moraic trochee in (1b) a foot governs two light syllables or one heavy syllable, thus showing the hierarchical structure *mora < syllable < foot*, where syllable always mediates between foot and mora. However, such a syllable-foot hierarchy is not immediately justifiable in Irabu, as a foot boundary and a syllable boundary do not always coincide. This is clearly seen in the examples below where the second foot commences in the middle of a tauto-syllabic CVV, CVC or CVVC. Note that in the surface pitch pattern of each example, the initial [L] (if any) in the first foot results from Initial lowering (Sections 4.2.2 and 4.2.3).

(49) *akjaada* 'merchant'

Pitch pattern	[LH]	[LL]
Foot (2 feet):	(a kja)$_H$	(a da)$_L$
Syllable (3 syllables):	a. kja	a. da
Mora (4 morae):	a kja	a da

(50) *nkair* 'pick up (someone)'

Pitch pattern	[LH]	[LL]
Foot (2 feet):	(n ka)$_H$	(i r)$_L$
Syllable (2 syllables):	n. ka	i r
Mora (4 morae):	n ka	i r

(51) *kudansa* '*Kudansa* plant'

Pitch pattern	[LH]	[LL]
Foot (2 feet):	(kuda)$_H$	(n sa)$_L$
Syllable (3 syllables):	ku. da	n. sa
Mora (4 morae):	ku da	n sa

(52) *fiirna* 'don't give' (< *fii-* 'give' + *-r* (non-past) + *-na* (prohibitive))

Pitch pattern	[HH]	[LL]
Foot (2 feet):	(fii)$_H$	(r na)$_L$
Syllable (2 syllables):	fii	r. na
Mora (4 morae):	fi i	r na

The situation becomes somewhat more complicated when we observe other examples where an L-toned foot is followed by an H-toned foot word(-plus)-medially (i.e. …(μμ)$_L$ (μμ)$_H$…). As is shown in (53) below, where a medial foot is H-toned by rule and where the foot crosscuts the long vowel rhyme of a syllable, the surface pitch pattern of the H-toned foot is [LH] rather than [HH], i.e. with a phonetic delay of rising pitch by one mora. That is, a phonetic rising contour is avoided within a long vowel.

(53) *žžu–akjaada=mai* (fish-merchant=too) 'fish merchant, too'

Pitch pattern	[LH]	[LL]	[LH]	[LL]
Tonal pattern	/HH/	/LL/	/HH/	/LL/
Foot (4 feet)	(žžu)$_H$	(akja)$_L$	(ada)$_H$	(mai)$_L$
Syllable (5 syllables)	žžu.	a.kja	a.da.	mai
Mora (8 morae)	ž žu	a kja	a da	ma i

By contrast, diphthongs (/ai/, /au/, /ui/) are not subject to the phonetic delay.

(54) *mme-jukwaira=mai* (another-four.times=too) 'another four times, too'

Pitch pattern	[LH]	[LL]	[HH]	[LL]
Tonal pattern	/HH/	/LL/	/HH/	/LL/
Foot (4 feet)	(mme)$_H$	(jukwa)$_L$	(ira)$_H$	(mai)$_L$
Syllable (5 syllables)	mme.	ju.kwa	i.ra.	mai
Mora (8 morae)	m me	ju kwa	i ra	ma i

A vowel-coda rhyme as shown in (55) normally involves a phonetic delay, as in the Pitch pattern 1; however, the phonetic delay may be absent as in the Pitch pattern 2.

(55) *jana-apavcï=mai* (awful-chatter=too) 'awful chatter, too'

Pitch pattern 1	[HH]	[LL]	[LH]	[LL]
Pitch pattern 2	[HH]	[LL]	[HH]	[LL]
Tonal pattern	/HH/	/LL/	/HH/	/LL/
Foot (4 feet)	(jana)$_H$	(apa)$_L$	(vcï)$_H$	(mai)$_L$
Syllable (6 syllables)	ja.na.	a.pa	v.cï.	mai
Mora (8 morae)	ja na	a pa	v cï	ma i

When the medial foot crosscuts a superheavy syllable CV$_i$V$_i$C where the second foot commences with the second V of the long vowel, as shown in (56) below, the coda is always [H], i.e. the phonetic delay is found in the vowel but not found in the coda. With regard to CV$_i$V$_j$C, as shown in (57), there is no phonetic delay since the VV here is a diphthong.

(56) *mme-fïtaar=mai* (another-two.persons=too) 'another two persons, too'

Pitch pattern	[LH]	[LL]	[LH]	[LL]
Tonal pattern	/HH/	/LL/	/HH/	/LL/
Foot (4 feet)	(mme)$_H$	(fïta)$_L$	(ar)$_H$	(mai)$_L$
Syllable (6 syllables)	mme.	fï.ta	ar.	mai
Mora (8 morae)	m me	fï ta	a r	ma i

(57) *imi-amair=mai* (small-bulb=too) 'small bulb, too'

Pitch pattern	[LH]	[LL]	[HH]	[LL]
Tonal pattern	/HH/	/LL/	/HH/	/LL/
Foot (4 feet)	(imi)$_H$	(ama)$_L$	(ir)$_H$	(mai)$_L$
Syllable (6 syllables)	i.mi.	a.ma	ir.	mai
Mora (8 morae)	i mi	a ma	i r	ma i

Odden (2001: 187) points out that there is a cross-linguistic tendency for rising contours within a single syllable to be perceptually dis-preferred, thus the avoidance of the rising contour is phonetically motivated. Therefore I argue that there is a *phonetic* delay of rising pitch by one mora, rather than that the *phonological* footing is affected, e.g. (akjaa)$_L$ (da)$_H$ in (53). This latter analysis would certainly be problematic in that we have to postulate an ad hoc unary foot (da). On the other hand, (54) is not subject to this phonetic delay even though this causes a

rising contour within a diphthong. Thus a rising contour is the most disfavoured in long-vowel heavy syllables, then VC heavy syllables, then diphthongs. In a superheavy syllable CV_iV_iC, a rising contour is observed within a syllable, but it is constantly avoided within the VV nucleus. Given all these facts, there is a clear tendency for rising contours to be disfavoured within a syllable in Irabu, with the phonetic delay being one solution for this constraint, but this tendency seems to differ depending on the syllable type.

In sum, in terms of phonological footing, it is possible to state that syllable boundary and foot boundary do not necessarily coincide, and we do not have to refer to syllable structure in parsing segments into feet. However, a phonetic note is optionally necessary in terms of the phonetic delay. That is, in the Prosodic Hierarchy of Irabu, the mora is directly governed by the foot, and the syllable is not directly concerned in this hierarchy, though the syllable should still be taken into account to explain the phonetic delay that may occur in medial H-toned feet.

5.5. Summary and discussion

This section has noted two important characteristics of Irabu prosody, i.e. constituency and iterativity, and presented a new approach to give a unified account to these two characteristics, by suggesting that Irabu prosody can be described with two independent processes, i.e. footing (Section 5.1) and tone assignment (Section 5.3).[10]

Footing is binary by default, parsing word(-pluses) from left to right exhaustively. Polymoraic morphemes start their own footing. Any stray mora that results from these footing strategies is integrated into the preceding foot, forming a marked ternary foot. Then tone is assigned in such a way that the odd-numbered feet bear H, and the even-numbered feet bear L, showing a regular alternation of tones. The description in terms of these two processes naturally explains the constituency on the one hand, and the potentially iterative nature of prosodic organisation on the other. Also, it turns out that postulating the two independent

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[10] In addition to the area of prosody, there are two cross-linguistically recurrent phenomena in which foot plays a crucial role: template morphology (McCarthy and Prince 1990a, b) and the allophonic variation of certain phonemes, such as flapping and aspiration in English (see Nespor and Vogel 1986: 90–103). See Shimoji (2008b) for the former phenomenon. I could not identify the latter type of phenomenon in relation to Irabu foot. However, there is a similar phenomenon, in terms of the pitch realisation of /H/ tone: Initial lowering as was noted in Sections 4.2.2 and 4.2.3 does not seem to be restricted to word-initial position, but it seems to occur in foot-initial position, whether be word-initial or word-medial. For example, (34f) /ugunaarasaitar=pazï=dooi/ (see the Praat picture below, where the sound data was taken from Speaker A), which has the foot structure $(ugu)_H$ $(naa)_L$ $(rasai)_H$ $(tar)_L$ $(pazï)_H$ $(dooi)_L$, may involve 'Initial' lowering in word-medial H-toned feet, though this lowering does not seem to be obligatory. In the recorded sound Initial lowering is present in two H-toned feet, i.e. (ugu) and (rasai), whereas the third H-toned foot (pazï) does not involve Initial lowering. The auditory approximation of the figure below is something like [‾-‾_-‾ ‾-_‾ ‾-_ _] (each line has one mora). In a number of repeated utterances of (34f)

processes clarifies both the difference and the commonality between the prosody of roots and morphologically complex word(-pluses). For example, the difference between *bancïkira* 'guava' and *katana–nagi* 'knife, and so on', is in footing, i.e. (ban)(cïkira) and (katana)(nagi) respectively, whereas the commonality is in tone assignment, i.e. first foot H and second foot L.

Seen in this way, the prosodic organisation of Irabu turns out to be substantially different from those in typical Japonic varieties, in which the distribution of tones is determined, often lexically, by the position of one and only one accent within a word, and is not sanctioned by progressive structuring of constituency within a word (see Uwano 1984, 1999 for prosodic descriptions of major Japanese varieties). In Tokyo Japanese, for example, a W_n has n+1 tonal patterns, since accent can be positioned on any mora within the word, including a possibility of no accent: W_3 = H*LL, HH*L, HHH*, or HHH. If we adopted accent as a phonological representation and described Irabu word(-pluses) with it, this should mean that each boundary between H-toned feet and L-toned feet is re-interpreted as a place of accent (e.g. *utugaja* 'jaw' (utu)$_H$ (gaja)$_L$ > /HH*LL/). However, just as the number of feet increases in proportion to word length, so would the number of accents, and it is theoretically impossible to stipulate the maximal number of accents, just as it is impossible to stipulate the maximal length of the word. This is why an accent-based description should be abandoned in dealing with Irabu prosody.

6. Rhythmic Structure in Irabu

So far I have focused on the structural aspect of Irabu prosody, arguing for the existence of foot structure and giving a description of how foot structure and tone assignment interact. In this section, I focus on the functional aspect of Irabu

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by Speaker A, (rasai) did not always undergo Initial lowering, so it would be a level H (in terms of auditory impression) in other utterances. In any case, Initial lowering might be better explained by referring to the foot than simply referring to the word. More data are required to further clarify this phenomenon, however. This potential 'Initial lowering' is also seen in such a medial H-toned foot as (mmi)$_H$ in Figures (b) and (c) in Appendix.
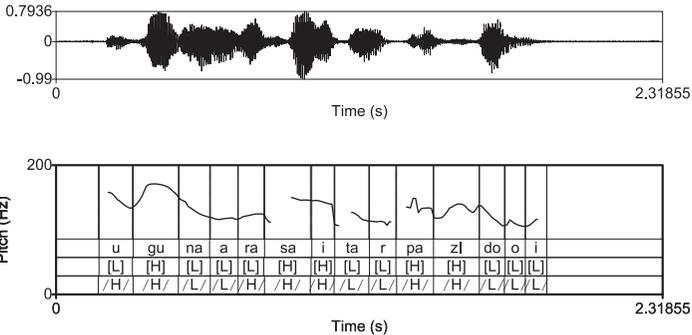
prosody, giving an analysis of the exact nature of the prosodic pattern identified in Section 5. In particular, I claim that the tone assignment rules in (35) are not an arbitrary rule set that only holds in Irabu, but can be reduced to a universal constraint on rhythmic organisation.

My argument in what follows is that the rule set is an instantiation of a cross-linguistically recurrent principle of alternating rhythm ('Principle of Rhythmic Alternation' (henceforth PRA), Selkirk 1984). The PRA states that 'between two successive strong beats there intervenes at least one and at most two weak beats' (p. 12). That is, there is a strong tendency for binary organisation of linguistic rhythm, which may allow a variation in which 'one may encounter ternary beats (a strong accompanied by a sequence of two weaks), but quaternary groups seem to be felt as two binary' (*ibid*). Let us schematically show the above statement in (58) below, where 'S' represents a strong beat, 'w' a weak beat, and < > a rhythmic group:

(58)   <S w (w)>
          <S w><S w> but not *<S w w w>

Note that the PRA refers to 'strong' and 'weak' since Selkirk's focus was on stress languages. However, as will be shown later, this can be restated with more general terms, i.e. 'marked' and 'unmarked' prosodic features, whereby we can refer to the PRA in both stress and non-stress languages.

6.1. Irabu prosody and the Principle of Rhythmic Alternation

Foot building and tone assignment in Irabu are most naturally explained by the PRA. The 'quaternary group' in Selkirk's (1984) terms is exactly four feet in Irabu, which are grouped into two 'foot groups' (indicated by < >), as they are tentatively named here. Thus the rules in (35) and the generated structures shown in (59) below can be interpreted as follows (in (59) (F) represents bimoraic or trimoraic foot, i.e. $(\mu\mu)$ or $(\mu\mu\mu)$, and (H) represents $(\mu\mu)_H$ or $(\mu\mu\mu)_H$, and (L) represents $(\mu\mu)_L$ or $(\mu\mu\mu)_L$). First, a word(-plus) must begin with an H-toned foot ('strong beat' in Selkirk's terms), and the remaining feet have no such specification, i.e. they remain the default L ('weak beats'): <(H)(L)...>. Second, the PRA requires that if a foot group is going to contain a sequence of four feet within it, e.g. when a foot is added to (59c) to create (59d) the sequence must be regrouped into two foot groups, and the second foot group begins with H as in the first (<(H)(L)(L)(L)> → <(H)(L)><(H)(L)>), to obtain the alternation of the HL pattern. The second process is iteratively applicable to the second foot group as well, as shown in (59e) and (59f), where the addition of a foot to the second foot group of (59e) induces the dividing of it into two foot groups in (59f), forming three foot groups in total.

(59) F(oot) structure   Rhythm (<foot group>)   Examples (from (8) above)

W$_{2\text{-}3}$ a. (F)   <(H)> $(kan)_H$
                                                                            $(kannu)_H$

       b. (F)(F)   <(H)(L)> $(kan)_H (gama)_L$
                                                           $(kan)_H (gamanu)_L$

c. (F)(F)(F)   <(H)(L)(L)> $(\text{kan})_H\ (\text{gama})_L\ (\text{mmi})_L$
                                       $(\text{kan})_H\ (\text{gama})_L\ (\text{mminu})_L$

d. (F)(F)(F)(F)   <(H)(L)><(H)(L)> $(\text{kan})_H\ (\text{gama})_L\ (\text{mmi})_L\ (\text{nagi})_L$
                                       $(\text{kan})_H\ (\text{gama})_L\ (\text{mmi})_H\ (\text{naginu})_L$

e. (F)(F)(F)(F)(F) <(H)(L)><(H)(L)(L)> $(\text{kan})_H\ (\text{gama})_L\ (\text{mmi})_H\ (\text{nagi})_L\ (\text{kara})_L$
                                         $(\text{kan})_H\ (\text{gama})_L\ (\text{mmi})_H\ (\text{nagi})_L\ (\text{karadu})_L$

f. (F)(F)(F)(F)(F)(F) <(H)(L)><(H)(L)><(H)(L)> $(\text{kan})_H\ (\text{gama})_L\ (\text{mmi})_H\ (\text{nagi})_L\ (\text{kara})_H\ (\text{mai})_L$

To sum up, it is clear that in Irabu the prosodic organisation is a matter of footing and creating foot groups each beginning with /H/, on the basis of the PRA. In the prosodic organisation of Irabu, therefore, not only the foot but also the foot group plays an important role.[11]

Even though I suggested the rules in (35) that specify in which case L is required, it is now evident that if we assume the PRA as a working principle in Irabu, we only need to refer to the specification of /H/. That is, we can now simply state that in each foot group (which is automatically parsed by the PRA) /H/ is assigned to the first foot, and no further statement for /L/ is required. This means that in the Irabu language the H tone is marked and the L tone is default, with a privative system of /H/ vs. /Ø/ (Hyman 2001), in which rules specify the marked /H/ only, and the other feature is seen as an absence of the H feature. The alternating tonal pattern is now analysed as the presence of the marked prosodic feature /H/ at as regular intervals as possible in accordance with the PRA, rather than the presence of a specific tonal melody such as HL. Thus the Irabu alternating tonal pattern is not as different as it first appears from the rhythmic alternation phenomena in stress languages in which stressed or 'strong' syllables (marked) and stressless or 'weak' syllables (unmarked) alternate. The differences are that in Irabu the marked prosodic feature is tone rather than stress and such a feature is borne by an entire foot rather than an individual syllable.

6.2. The 'H-clash' resolution

In Section 5.3.2 we noted that the alternating tonal pattern maps onto an entire phrase in limited cases. I will show in what follows that, by assuming that the alternating tonal pattern is rhythmic in nature, we can explain why phrasal mapping occurs in the first place, rather than treating it as a mere exception.

If the alternating pattern is rhythmic, the (a) situations of (36–44) will be an

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[11] The importance of metrical constituency larger than a foot in rhythmic organisation is also reported in Japanese modern verse (Tanaka 1999), where two-feet constituency plays an important role. An anonymous reviewer pointed out that the Irabu foot group instantiates the notion 'cola', a metrical constituent above the foot. The reviewer notes that the existence of cola has been suggested in the phonological literature but has received much less attention than foot since its direct manifestation in the prosodic system of a particular language is not common. The Irabu foot group is clearly a constituent above the foot, and is presumably an important empirical support for the notion 'cola'.

'H-clash' between the first and second members of a phrase, thus there is a motivation for avoiding this. Therefore rhythmic rearrangement, or 'H-clash' resolution, takes place, making a whole phrase a tentative domain for rhythmic alternation. Rhythmic rearrangement one way or another is fairly widespread cross-linguistically, and the alternating rhythm in particular (e.g. stress-unstressed alternation) is sensitive to a sequence of two marked prosodic features, and there are clash avoidance strategies, one of which is stress clash resolution in stress languages (Liberman and Prince 1977, Selkirk 1984, Hayes 1995): e.g. thirtéen + mén > thírteen mén. The phrasal mapping phenomenon in Irabu is thus seen as yet another type of clash avoidance strategy, motivated by the same constraint as in stress clash resolution: a sequence of marked prosodic features (whether stress or tone) are better avoided.[12]

6.3. Typological implications

The fact that there is an alternating rhythm based on the PRA in a non-stress language like Irabu sheds light on the typology of linguistic rhythm, where the major argument has been based on stress languages (see Liberman 1975, Liberman and Prince 1977, Selkirk 1984 among others). In particular, the most widely discussed alternating rhythm pattern is the rhythmic structure of stress languages. This is most clearly seen in Allen's (1975) dichotomic generalisation of 'rhythm of alternation' (for stress languages) vs. 'rhythm of succession', the latter including the rhythm of Japanese, which has mostly been regarded as a syllable- (or mora-) timed, with a simple succession of phonologically isochronal units, i.e. moras. A similar dichotomy is the well-known dichotomy of 'stress-timed' vs. 'syllable- (or mora-) timed' languages (Pike 1945, Block 1950, Abercrombie 1967).

However, as the Irabu data suggest, a language having a mora-based structure as its basic rhythmic structure ('rhythm of succession') can have a higher-order structure, i.e. foot structure which in turn serves as the basis of an alternating rhythmic structure ('rhythm of alternation'). That is, the two types of rhythm as formulated by Allen might not be mutually exclusive. This is exactly what Kubozono (1993: 60) points out by studying Japanese prosody, where he notes how the PRA is manifested in the accent pattern of long compounds. Irabu is an interesting language in which the two kinds of rhythm coexist and in which the alternating rhythm is translated into tone features.

Various descriptive studies have revealed that an alternating rhythm is mani-

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[12] Clash avoidance that I describe as 'H-clash' resolution can be restated in terms of Obligatory Contour Principle (OCP) which prohibits adjacent identical features or elements (Odden 1999: 199). Avoidance of adjacent identical features is a rhythmic phenomenon (see Odden 1999 in which Odden argues for the similarity between stress clash and OCP in terms of rhythmic structuring). There are various ways in which adjacent identical features are avoided. In Irabu, adjacent Hs are avoided by the tentative phrasal mapping of alternating rhythm that is otherwise found in the word(-plus) domain. In other languages such as Bantu languages, adjacent identical tone features are often avoided by deleting one of two adjacent identical tone features (Odden 1999: 199–200).

fested not only through stress (stressed vs. unstressed) but through length (long vs. short: iambic lengthening in Nakijin Ryukyuan, see Lawrence 1990, 2001) or tone (e.g. H vs. L). One good example of the alternating rhythm through tone comes from Kirundi (Goldsmith and Sabimana 1989, Hyman 2006), where /H/ tone iteratively appears (Below the acute accent marks /H/):

(60)   *ku-báz-a* (Infinitive-ask-Final inflection)   'ask (question)'
    ku-bí-baz-a   -bi- 'them'
    ku-bí-mu-báz-a   -mu- 'to him'
    ku-bí-mu-kú-bar-iz-a   -ku- '(for) you'
    ku-há-bi-mú-ku-bár-iz-a   -ha- 'there'
    'to ask him (for) them for you there'

Hyman (2006: 243) claims that, even though Goldsmith and Sabimana (1989) analyse the above kind of Kirundi rhythm in terms of Strong-Weak stress foot structure, the alternating rhythm pattern has nothing to do with stress in the light of his definition of stress, which is characterised by headship (i.e. one syllable marked for the highest degree of metrical prominence, or primary stress within a word; Hyman 2006: 231–232). Thus Hyman argues that Kirundi has the alternating rhythm of tones rather than stress.

Hattori (1967), cited by Lawrence (2001: 202, fn. 17), describes a similar kind of rhythmic alternation of tone features found in Rayciska Ainu, where there is an alternating pitch pattern as in *ku'arikirihi* (LHLMLM) 'my half' (p. 216), *'eci'arikirihi* (LHLMLML) 'your (pl.) half' (p. 217).

Given all these, an alternating rhythm through tone is typologically by no means exceptional or peculiar, and we can place the Irabu case in the cross-linguistic prosodic typology of 'tonal alternating rhythm'.

7. Conclusion

This study has argued for the existence of a bimoraic foot (and marked trimoraic foot) in Irabu, which serves as constituent based on which tone is assigned. By introducing the foot, two crucial features of Irabu word prosody, i.e. constituency and potential iterativity, were straightforwardly described. Furthermore, with our new approach the rhythmic nature of Irabu prosody has been identified. Irabu prosody is rhythmic in that the H tone appears at the most regular possible intervals in accordance with the Principle of Rhythmic Alternation (Selkirk 1984). In this rhythmic structure, a metrical constituent above the foot, or what I labelled the 'foot group', was identified as an important player together with the foot. The rhythmic nature of the alternating tonal pattern is also manifested in the fact that the pattern can span over an entire phrase to resolve a clash of two H-toned feet.

This study also presents an important future research topic for Miyako Ryukyuan prosody. The alternating rhythm that I identified in this study, or *H(igh)-L(ow) alternation* as is named here, seems to be widespread in Miyako Ryukyuan, and in varieties that have lexical accent such as Ikema, the H-L alternation and the lexical accent interact in an interesting way (whereas Irabu is accent-

less and the H-L alternation can manifest itself rather directly). Importantly, the accent system of Ikema is adequately described only when we recognise the H-L alternation as a global rhythmic pattern underlying Miyako Ryukyuan prosody in general (Shimoji and Hayashi 2008). Thus one important future research topic is to re-examine Miyako Ryukyuan varieties that are known to have a lexical accent system (e.g. Bora and Yonaha: Hirayama 1967), and to investigate interactions between lexical accent and the H-L alternation. It is equally important to re-examine those Miyako Ryukyuan varieties that were only referred to as 'accentless' and 'collapsed' in Hirayama's (1967) terms, since these varieties may well have a rigid tonal pattern once we focus on the H-L alternation. Such 'accentless' varieties will be actually accentless in the sense that they lack lexical or fixed accent, but this does not necessarily mean that their prosody is 'collapsed', as long as there is a rigid prosodic feature, as Irabu prosody clearly demonstrates.

Abbreviations

ACC: accusative	GEN: genitive	POT: potential
BEN: benefactive auxiliary	INT: intentional mood	PRF: perfect auxiliary
CAUS: causative	NEG: negative	PROG: progressive auxiliary
CHN: chaining verb	NLZ: nominalizer	PST: past
CVB.CND: conditional converb	NOM: nominative	REF: reflexive pronoun
DIM: diminutive	NPST: non-past	THM: thematic vowel
DSC: discourse marker	PASS: passive	TOP: topic
EMP: emphatic	PL: plural	UM: unmarked for mood

Appendix

To show the iterative emergence of /HHLL/ patterns, I list the praat figures of W_4, W_8, and W_{12} in (8). The sound data was taken from Speaker A.
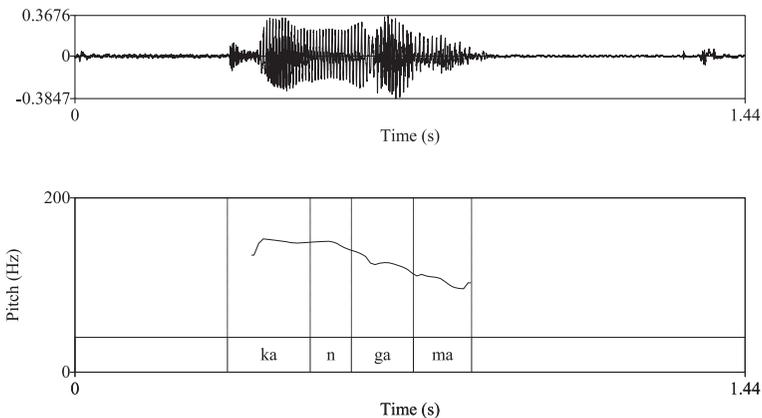
Figure (a) W_4: *kan-gama* 'little crab' (/HHLL/)
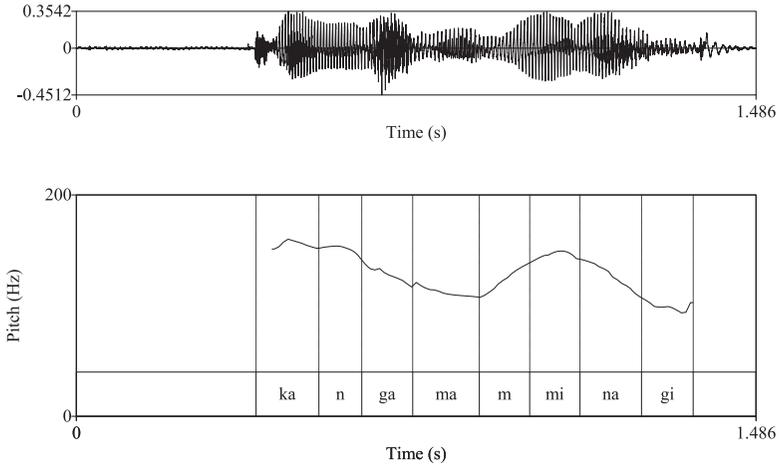
Figure (b) W$_8$: *kan-gama-mmi-nagi* 'little crabs, and so on' (/HHLLHHLL/)
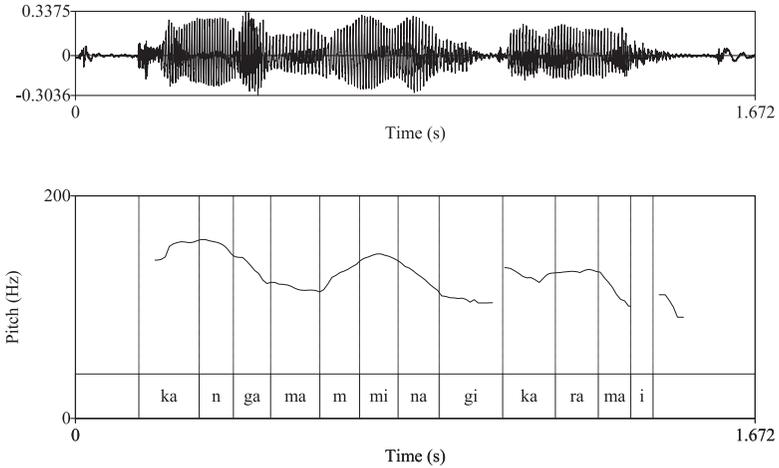
Figure (c) W$_{12}$: *kan-gama-mmi-nagi=kara=mai* 'from little crabs, and so on, too' (/HHLLHHLLHHLL/)

The medial /HH/ of /mmi/ in (b) and (c) is realised as [LH]. This is discussed in Footnote 10.

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【要　旨】

伊良部島方言のフットとリズム構造

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　本稿の目的は琉球語宮古伊良部島方言（以下，伊良部島方言）の韻律におけるフット構造の重要性を指摘し，フットを用いた分析によってこの言語のリズム構造を明らかにすることである。本稿の前半部では，この言語の 2 つの重要な韻律特徴，すなわち①語（＋付属語）の内部において 2（ないし 3）モーラの韻律的なまとまりが見られること，②高ピッチと低ピッチの繰り返しが見られることに注目し，これらを的確に記述するためにフット構造を導入する。そして，語（＋付属語）内部のフットに対して High と Low のトーンを交互に付与していくという規則を提案し，①と②を同時に説明する。本稿の後半部では，上記の韻律現象が（アクセントではなく）リズムの表出であることを示す。特に，Selkirk（1984）によって提唱され Kubozono（1993）ら後続の研究によってその普遍性が主張されている「リズム交替の原理」（Principle of Rhythmic Alternation）に注目し，伊良部島方言の韻律がこの原理に明確に支配されていることを示す。