Stress Distribution in Budai Rukai

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Abstract

In Budai Rukai, a Formosan language, primary stress exclusively falls on the rightmost, the penultimate or antepenultimate syllable of each prosodic word. More interestingly, prefixes and infixes can only bear secondary stress; they are excluded from the domain where primary stress is assigned. The goal of this paper then is to identify, compare, and account for the ways stress distribution is handled in Budai Rukai. More specifically, the present study aims to show how morpho-prosodic alignment constraints interact with other constraints to formalize the demarcative property of stress distribution in Budai Rudai.

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1 Introduction

In Budai Rukai, a Formosan language, primary stress exclusively falls on the rightmost, the penultimate or antepenultimate syllable of each prosodic word. More interestingly, prefixes and infixes can only bear secondary stress; they are excluded from the domain where primary stress is assigned. The goal of this paper then is to identify, compare, and account for the ways stress distribution is handled in Budai Rukai. More specifically, the present study aims to show how morpho-prosodic alignment constraints interact with other constraints to formalize the demarcative property of stress distribution in Budai Rudai.

2 Syllable Structure

Before commencing an analysis, we need to lay out some background information about syllable structure in Budai Rukai. According to Chen (2006), a minimal syllable in Budai Rukai contains just a vowel, whereas a maximal syllable is CV: or CVG. Nasal or lateral codas are also observed, but they are considered as perceptual effects due to fast speech of words ending with a weak schwa. Thus, excluding syllables involving nasal and lateral codas, Budai Rukai has the following types of syllable structure: (C)VG, (C)V:, and GV.[1] Of these types, (C)VG are heavy, whereas the others are light.

3 Stress Distribution

Generally speaking, primary stress in Budai Rukai falls on the rightmost, the penultimate or antepenultimate syllable of each prosodic word (Chen 2006:251).[2] Monosyllabic roots have stress on the only syllable, and disyllabic roots have stress on the penult. In trisyllabic or longer roots, the stress assignment is quantity-sensitive: if the penultimate syllable is light, main stress falls on the antepenult; if the penult is heavy, main stress falls on the penult. The stress assignment in roots is shown in (1).

(1) *Main stress in roots* (Chen 2006:251–252)

a. *Monosyllables are stress*:

Stress	Shape	Root	Gloss
H	**CV:**	**ku:**	‘owl’
H	**CV:**	**ɭə:**	‘neck’

b. *Penults are stressed in disyllabic words*:

Stress	Shape	Root	Gloss
LH	**CV**CVG	**pa**gaj	‘rice’
LL	**CV**CV	**ɭa**va	‘flying squirrel’
HL	**CV:**CV	**ro:**lo	‘urine’

c. *Heavy penults are stressed*:

Stress	Shape	Root	Gloss
L**H**L	V**CV:**CV	o**ko:**ɖo	‘crutch’
L**H**H	V**CV:**CVG	a**ba:**baj	‘woman’
L**H**L	CV**CV:**CV	ka**ra:**ða	‘pangolin’
LL**H**L	VCV**CV:**CV	əɭi**sə:**sə	‘nit’

[1] Chen has not observed any syllable consisting of glides in both onset and coda positions.

[2] In a disyllabic form, there would be no antepenultimate stress.

d. *Elsewhere antepenults are stressed*:

Stress	Shape	Root	Gloss
LLL	**V**CVCV	**ə**bə**ɭ**ə	‘smoke’
LLL	**CV**CVCV	**va**lisi	‘tooth’
LLH	**CV**CVCVG	**ɭi**kulaw	‘leopard’
L**L**LL	CV**CV**CVCV	**ɭ**ə**gə**ɭ**ə**gə	‘mountain’[3]

Note that the final syllable of a word never receives stress, unless it is the only syllable, as in (1a). This implies that the restriction on ultimas is overridden by weight-sensitivity in Budai Rukai. Accordingly, if VG is bimoraic, we should expect to see ultimate VG or CVG syllables bear stress, contrary to the fact: [**pa**gaj] ‘rice’ in (1b).

As for suffixed words, primary stress falls on the antepenult, as shown in (2).

(2) *Main stress in suffixed forms* (Chen 2006:252)[4,5]

Stress	Morpheme	Affixation	Gloss
L**L**LL	ka**nə**-anə$_{\text{suffix}}$	ka**nə**anə	‘food’
L**H**LL	wa-[**ɖə:**lə-ŋa$_{\text{suffix}}$	wa**ɖə:**ləŋa	‘saw’
L**L**LL	ma-[**pu**sa-lə$_{\text{suffix}}$	ma**pu**salə	‘twenty’
LL**L**LL	a-[**ələ**b-anə$_{\text{suffix}}$	a**ələ**banə	‘to be closed’
LL**L**LL	sanu-[**tu**ɭu-lu$_{\text{suffix}}$	sanu**tu**ɭulu	‘three times’
LLL**L**LL	kala-[bə**tsə**ŋ-anə$_{\text{suffix}}$	kalabə**tsə**ŋanə	‘millet festival’

What makes the stress pattern interesting is that prefixes and infixes are excluded from the domain where primary stress is assigned. As shown in (3), primary stress always falls on roots.

(3) *Stress in prefixed or infixed form*s (Chen 2006:253)

Stress	Morpheme	Affixation	Gloss
L**L**	wa$_{\text{prefix}}$-[pə:	wa**pə:**	‘to squeeze’
L**L**L	la$_{\text{prefix}}$-[ɖusa	la**ɖu**sa	‘couple’
LL**H**L	tu$_{\text{prefix}}$-a$_{\text{infix}}$[sa:pa	tua**sa**:pa	‘to weave a mat’
LL**L**L	si$_{\text{prefix}}$-a$_{\text{infix}}$-[titi	sia**ti**ti	‘to hit’
L**L**LL	wa$_{\text{prefix}}$-[tinono	wa**ti**nono	‘to weave’
LL**L**L	ma$_{\text{prefix}}$-θa$_{\text{prefix}}$-[limu	maθa**li**mu	‘muddy’
LL**L**LL	ma$_{\text{prefix}}$-sa$_{\text{prefix}}$-[sulapə	masa**su**lapə	‘smooth’
LLL**L**LL	paŋu$_{\text{prefix}}$-da$_{\text{prefix}}$-[davatsə	paŋuda**da**vatsə	‘by walking’

Moreover, in words consisting of five or more syllables, secondary stress is allowed on every other light syllable counting from the right to the left, as illustrated in (4).

(4) *Secondary stress* (Chen 2006:253–254)

Syllable	Word	Gloss
L**L**$_2$L**H**$_1$L	lu**pa**$_2$ka**va:**$_1$lə	‘the day after tomorrow’
L$_2$L**L**$_1$LL	**ta**$_2$ra**ɖa**$_1$marə	‘one month’

[3] All the examples in this paper are cited directly from Chen (2006:251–252). Nevertheless, we may be suspicious of this example being monomorphemic: reduplication might be involved here.

[4] The single bracket ‘[’indicates the left edge of the prosodic domain for primary stress.

[5] No words containing multiple suffixes are found in the data presented in Chen 2006. Moreover, suffixes in Budai Rukai are never heavy and at most bisyllabic, in the shapes of V, CV, and VCV (Chen 2006:201). Consequently, in all the available examples, primary stress never falls on syllables of suffixes.

LL$_2$L**L**$_1$LL	ka**la**$_2$kə**tsə**$_1$lanə	‘winter’
L$_2$L**L**$_2$L**L**$_1$LL	**ta**$_2$tsə**kə**$_2$tsə**kə**$_1$lanə	‘family’
LL$_2$L**L**$_2$L**L**$_1$LL	ka**la**$_2$ɖa**ɭa**$_2$ŋə**ɖa**$_1$ŋanə	‘summer’

In sum, the generalization of stress distribution is summarized below:

(5) *Generalization of stress distribution in Budai Rukai*
   a. Primary stress falls on the antepenult except when the penult is heavy, in which case the penult bears primary stress.
   b. Final syllable does not bear stress unless it is the only syllable.
   c. Secondary stress appears from right to left in words containing five or more syllables.
   d. Primary stress never falls on prefixes and infixes.

4 Analysis

In this section I attempt to give an optimality-theoretic analysis of stress distribution in Budai Rukai. The major constraints that appear in the proposed analysis are shown below:

(6) Constraints of the *Generalized Alignment* family (McCarthy and Prince 1993):
   a. ALIGN-FT-L: Align the left edge of every foot with the left edge of the prosodic word.
   b. ALIGN-FT-R: Align the right edge of the foot with the right edge of the prosodic word.
   c. ALIGN-HD-R: The right edge of the prosodic word aligns with the right edge of the head foot.
   d. ALIGN-HD-L: The left edge of the prosodic word aligns with the left edge of the head foot.

(7) Constraints of foot type (Prince and Smolensky 1993/2004):
   a. IAMB: Binary feet are iambic (right-headed).
   b. TROCHEE: Binary feet are trochaic (right-headed).

(8) Other constraints of unmarked prosodic structure adopted from Prince and Smolensky 1993/2004:
   a. FOOTBINARITY: Feet are binary at some level of analysis.
   b. PARSE-σ: Every syllable must be incorporated into a metrical foot.

(9) Weight-sensitivity constraint (Prince 1990):
   WEIGHT-TO-STRESS: Heavy syllables are prominent in foot structure.

(10) Morphology-phonology interface constraint:
   a. HAVESTRESS/ROOT (Smith 2002): Assign a violation mark if the root does not bear stress.
   b. WDCOND (cover constraint from Selkirk 1995): The left and right edges of every lexical word must coincide, respectively, with the left and right edges of some prosodic word.

Considering where primary stress is placed, Budai Rukai has a Latin-type stress pattern as analyzed in Prince and Smolensky (1993/2004): stress the penult if heavy, else stress the antepenult. This means that a moraic trochee is built as to the right edge of a word as possible, yet overridden by the restriction that the final syllable is unfootable. This is expressed by the following constraint ranking:

(11) *Penult and ultima both light: (primary) stress on antepenult*
   a. TROCHEE » IAMB

/LLL/	TROCHEE	IAMB
☞ (**L**L)L		*
(L**L**)L	*!W	L

   b. TROCHEE » NONFINALITY » ALIGN-HD-R, ALIGN-FT-R

/LLL/	NONFINALITY	ALIGN-HD-R	ALIGN-FT-R
☞ (LL)L		*	*
L(LL)	*!W	L	L

c. NONFINALITY » PARSE-σ

/LLLL/	NONFINALITY	PARSE-σ
☞ L(LL)L		**
(LL)(LL)	*!W	L

d. FOOTBINARITY » PARSE-σ

/LLLL/	FOOTBINARITY	PARSE-σ
☞ L(LL)L		**
(L)(LL)L	*!W	*L

(12) *Final syllable does not bear stress*
NONFINALITY » WEIGHT-TO-STRESS

/LLH/	NONFINALITY	WEIGHT-TO-STRESS
☞ (LL)H		*
(LL)(H)	*!W	L

(13) *(Primary) stress on heavy penult*
NONFINALITY » ALIGN-HD-R, ALIGN-FT-R

/LHL/	NONFINALITY	ALIGN-HD-R	ALIGN-FT-R
☞ L(**H**)L		*	*
L(**H**L)	*!W	L	L

Recall also that in Budai Rukai the prohibition against footing a final syllable is overridden in monosyllabic words. We may attribute the violation of NONFINALITY in these cases to the higher ranked WDCOND, which demands that every morphosyntactic word be parsed into a prosodic word, which in turn must have a head foot:

(14) *Monosyllabic words attract stress*:
WDCOND » NONFINALITY

/CV:/	WDCOND	NONFINALITY
☞ (**CV:**)		*
CV:	*!W	L

Furthermore, the fact that secondary stress appears from the right to the left in words containing five or more syllables suggests that PARSE-σ dominates ALIGN-FT-R, which in turn outranks ALIGN-FT-L:

(15) *Secondary stress appears from the right to the left*:
a. ALIGN-FT-R » ALIGN-FT-L

/LLLLLLLL/	ALIGN-FT-R	ALIGN-FT-L
☞ L(LL)(LL)(LL)L	********	*********
(LL)(LL)(LL)LL	**********!**W	******L

b. PARSE-σ » ALIGN-FT-R

/LLLLLLLL/	PARSE-σ	ALIGN-FT-R
☞ L(LL)(LL)(LL)L	**	*********
LLLLL(LL)L	***!***W	*L

Equally worth noting is that the head of a prosodic word must be the rightmost foot, from which we infer that ALIGN-HD-R dominates ALIGN-HD-L:

(16) *Rightmost foot is the head of a prosodic word*:
ALIGN-HD-R » ALIGN-HD-L

/LLLLLL/	ALIGN-HD-R	Align-Hd-L
☞ L(**L**$_2$L)(**L**$_1$L)L	*	***
L(**L**$_1$L)(**L**$_2$L)L	**!*W	*L

After laying out the analysis of the basic stress pattern, we can summarize as follows the con-

straint rankings responsible for the basic stress distribution in Budai Rukai:

(17) FOOTBINARITY NONFINALITY TROCHEE
PARSE-σ WEIGHT-TO-STRESS ALIGN-HD-R IAMB
ALIGN-FT-R ALIGN-HD-L
ALIGN-FT-L

However, the analysis presented so far cannot explain why primary stress never falls on prefixes and infixes, especially in the case of a prefix attached to a bisyllabic root:

(18) a. Chen 2006:253

Stress	Morpheme	Affixation	Gloss
L**L**L	la_{prefix}-[**ɖu**sa	la**ɖu**sa	'couple'

b. TROCHEE » IAMB

/L_{prefix}-LL/	TROCHEE	IAMB
☹ ☞ (**L**$_{prefix}$-L)L		*
(L_{prefix}-**L**)L	*!W	L

To address this problem, I invoke *Positional Augmentation* (Smith 2002), which states that when a phonological requirement specifically affects phonologically strong positions, that requirement must enhance perceptual salience. According to Smith (2002), strong positions include main-stress syllables, initial syllables, long vowels, roots, and onsets. And the property required for a root as a strong position is stress. Consequently, I propose that the relevant constraint coming into play in the case of prefixed and infixed forms in Budai Rukai is HAVESTRESS/ROOT, which bans a root without stress:[6]

(19) HAVESTRESS/ROOT » TROCHEE

/L_{prefix}-LL/	HAVESTRESS/ROOT	TROCHEE
(**L**$_{prefix}$-L)L	*!W	L
☞ (L_{prefix}-**L**)L		*

If this analysis is on the right track, then HAVESTRESS/ROOT must also dominate NONFINALITY, as illustrated by a bisyllabic sequence consisting of a monosyllabic prefix attached to a monosyllabic root:

(20) a. Chen 2006:253

Stress	Morpheme	Affixation	Gloss
L**H**	wa_{prefix}-[**pə:**	wa**pə:**	'to squeeze'

b. HAVESTRESS/ROOT » NONFINALITY

/L_{prefix}-H/	HAVESTRESS/ROOT	NONFINALITY
(**L**$_{prefix}$)-H	*!W	L
☞ L_{prefix}-(**H**)		*

Note that since ALIGN-HD-R dominates ALIGN-HD-L, as shown in (16), in prefixed and infixed

[6] An alternative would be to invoke a constraint that concerns alignment to morpheme boundary. For instance, we could modify ALIGN-HD-R$^{\{rt\}}$ (Buckley 1998), which requires the right edge of a root to coincide with the right edge of the head foot, into ALIGN-HD-L$^{\{rt\}}$, which poses the same condition in an opposite way. Such an alternative, however, would not break the ice: on the one hand, [ka(**nə**-a)nə] 'food' would suggest that ALIGN-FT-R, and ALIGN-HD-R dominates ALIGN-HD-L$^{\{rt\}}$ and therefore, by transitivity, NONFINALITY and FOOTBINARITY should be ranked over ALIGN-HD-L$^{\{rt\}}$; on the other hand, [si_{prefix}-a_{prefix}-(t**i**)ti] or [si_{prefix}-a_{prefix}-(**ti**ti)] 'to hit' would violate FOOTBINARITY and NONFINALITY, respectively, in favor of ALIGN-HD-L$^{\{rt\}}$.

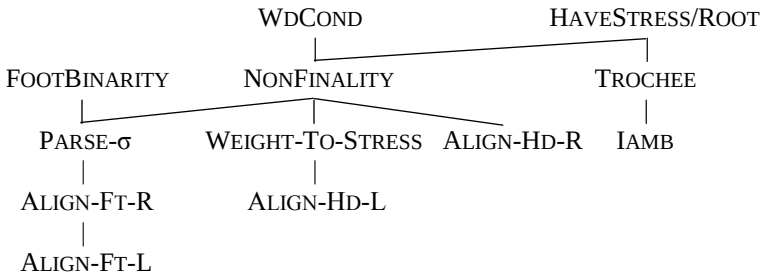
sequences that have five or more syllables, ALIGN-HD-R will ensure that the head foot is the last foot. As a result, primary stress falls exclusively on syllables of the root, whereas syllables of the prefixes and infixes can only bear secondary stress.

Another important point worth noting is that what HAVESTRESS/ROOT demands is that a root bear stress; the constraint does not require the stress to be primary. Thus, either primary or secondary stress on the root will satisfy the constraint. Along this line of thought, if there was a stack of suffixes, containing at least three syllables, in a sequence consisting of four or more syllables in total, TROCHEE and NONFINALITY would ensure that primary stress falls on the antepenult,[7] which would be a syllable in the concatenation of suffixes. In that case, the root would bear secondary stress. However, given that no data presented in Chen (2006) involve multiple suffixes in a single word, I leave this issue open for further investigation.

5 Conclusion

I have shown that stress distribution in Budai Rukai as a result from the interaction between morphology and prosody can be accounted for under *Generalized Alignment*. The constraint ranking that induces the stress pattern in Budai Rukai is illustrated below:

(21)



In short, in Budai Rukai, NONFINALITY, taken together with TROCHEE, is responsible not only for primary stress on the antepenult, except when the penult is heavy, but also for the lack of stress on final syllables. In this regard, the fact that monosyllabic words are always assigned stress is attributed to the higher ranking of WDCOND over NONFINALITY. In addition, ALIGN-HD-R and ALIGN-FT-R ensures that the head foot of a prosodic word is the last foot and that secondary stress appears from right to left. Most importantly, the crucial constraints responsible for the lack of primary stress on prefixes and infixes are HAVESTRESS/ROOT and ALIGN-HD-R.

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[7] Recall, as mentioned in footnote 5, that suffixes in Budai Rukai are never heavy and at most bisyllabic. Consequently, primary stress should never fall on the penult in a sequence of suffixes.

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