

The Prosodic Structure of Burmese: A Constraint-Based Approach

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In this paper I shall explain the structure of the syllable, foot, and prosodic word in Burmese, using a constraint-based framework following Optimality Theory. In particular, I shall propose a family of constraints called UNARITY, which states that a prosodic category (PrWd, Ft, σ) is permitted to contain no more than one of the next lower prosodic category (Ft, σ , μ , respectively). This constraint is responsible for several types of idiosyncratic prosodic behavior seen in Burmese: the difference between and distribution of major (heavy) and minor (light) syllables; the fact that a foot (obligatorily bimoraic in Burmese as elsewhere) can be only a single heavy syllable; the resulting lack of [L L] feet, and the difference between so-called “reducing” compounds (in which a member is reduced from a major syllable to a minor syllable) and “nonreducing” compounds (in which no such reduction takes place).

1. Introduction

The Burmese language has been discussed descriptively by a variety of authors, including Bernot (1963, 1980), Okell (1969), and Wheatley (1987), but little work on the theoretical aspects of Burmese phonology has been done.¹ In this paper I propose to explain the structure of the syllable, foot, and prosodic word in Burmese, using a constraint-based framework. In particular, I shall discuss several issues in the prosodic structure of Burmese, including the distinction between, and distribution of major and minor syllables and the nature of the foot in Burmese. To this end I shall propose that in Burmese, a prosodic category is permitted to contain no more than one of the next lower prosodic categories; this constraint is responsible for the idiosyncratic prosodic behavior seen in Burmese.

In the rest of section 1 I give the inventory of Burmese surface phones—vowels, tones, and consonants. In section 2 I discuss major and minor syllables. In section 3 I argue that the foot in Burmese is a single heavy syllable, not the iamb proposed by Bennett (1994) for Thai and by Griffith (1991) for Cambodian. In section 4 I discuss the prosodic word (PrWd) with especial attention to compounds and superlong words. In section 5 I discuss the maximum size of prosodic categories and propose a family of constraints called UNARITY to limit the size of any prosodic category to exactly one of the next lower prosodic category. Finally, in section 6 I present other constraints necessary to account for the prosodic behavior of Burmese.

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¹Detailed phonetic studies include Mehnert and Richter (1972–77) and Thein Tun (1982).

1.1 Vowels and tones

The surface vowels and tones of Burmese are as shown in (1).²

(1) The surface vowels and tones of Burmese

Monophthongs		Diphthongs		Tones
i(ɪ)	u(ʊ)	ei	ou	high: à etc.
eɪ	oɪ	ai	au	low: ȧ etc.
ə	ɔɪ			creaky: á etc.
ɛ(ɪ)	a(ɪ)			checked: aʔ etc.

The syllable structure of Burmese is basically C(G)V((V)C), which is to say the onset may consist of a consonant optionally followed by a glide,³ and the rhyme may consist of a vowel alone, a vowel with a consonant, or a diphthong with a consonant. Vowel length in Burmese is not phonemic, but predictable: vowels (except ə) are long in open syllables, and short in closed syllables. Some representative words are shown in (2).⁴

(2)

a.	CV	mɛɪ	'girl'
b.	CVC	mɛʔ	'crave'
c.	CCV	myɛɪ	'earth'
d.	CCVC	myɛʔ	'eye'
e.	CVVC	ʃauʔ	'address (a superior)'
f.	CCVVC	pyèiN	'be stupid'

²There is very little agreement from one author to another on the designation of the tones. Some authors use terms such as *low*, *high*, *creaky*, *checked*, *falling*, *heavy*, *glottalized*, etc.; others number the tones 1–4. Among the authors who use numbers, there is even variation as to which tone is given which number. There is also wide variation as to the transliteration of Burmese. Throughout this paper, I shall be using the same names of tones as used by Wheatley (1987), and the same marks to indicate them, except that while Wheatley leaves the low tone unmarked I mark it by *ȧ*, etc., to disambiguate low tone from absence of tone. Other differences in this paper compared with Wheatley's usage are the transliteration of the placeless nasal as *N* rather than *n* and spelling aspirated sounds as *p^h s^h h_m* etc., rather than *hp hs hm* etc. As Bennett and Lehman (1994, 19) point out, the aspirated nasals are phonetically preaspirated, whence the transcription *h_m*.

³But some C + glide clusters are prohibited, e.g. **ky*, **ty*, etc.

⁴All examples in this paper are from Bernot (1963), Okell (1969), or Wheatley (1987), unless otherwise noted.

Burmese, like many languages of Southeast Asia, has a distinction between major and minor syllables.⁵ The exact definitions of major and minor syllables vary from language to language, but in general a major syllable is a surface-heavy ($\mu\mu$) syllable, and a minor syllable a surface-light (μ) syllable. In Burmese, the characteristics of a major syllable are: (i) it is always heavy (thus open syllables are long); (ii) it may contain any vowel or diphthong except ə ; and (iii) it bears tone. All the words in (2) above are examples of major syllables. The characteristics of a minor syllable in Burmese are: (i) it must contain the vowel ə and no other vowel; (ii) it must be a light (therefore open) syllable; (iii) it must not bear tone; and (iv) it must not be the final syllable of the word. A result of this last restriction is that a word may not contain only minor syllables. Examples of words containing minor syllables are shown in (3).

(3)

- | | | |
|----|----------------------------------|--------------------|
| a. | $k^h\text{ə}lou^?$ | 'knob' |
| b. | $p\text{ə}lw\text{ɛ}:$ | 'flute' |
| c. | $\theta\text{ə}y\text{ɔ}:$ | 'mock' |
| d. | $k\text{ə}l\text{ɛ}^?$ | 'be wanton' |
| e. | $t^h\text{ə}m\text{ə}y\text{ɛ}:$ | 'rice-water' |
| f. | $m\text{ə}iNm\text{ə}wu^?$ | 'women's clothing' |

Examples of illicit minor syllables are shown in (4). (4a) and (b) violate the restriction that minor syllables must be light; (4c) violates the restriction that minor syllables must not bear tone; (4d–f) violate the restriction that minor syllables must not be word-final; and (4e–f) also violate the restriction that a word must have at least one major syllable.

(4)

- | | |
|----|-------------------------------|
| a. | $*m\text{ə}Nm\text{ə}wu^?$ |
| b. | $*k^h\text{ə}lou^?$ |
| c. | $*\theta\text{ə}y\text{ɔ}:$ |
| d. | $*b\text{w}\text{ɛ}z\text{ə}$ |
| e. | $*z\text{ə}b\text{ə}$ |
| f. | $*z\text{ə}$ |

⁵The terms "major syllable" and "minor syllable" seem to have been used first by Henderson (1952) for Cambodian and Shorto (1960) for Palaung.

Syllables will be discussed more fully in part 2 below.

1.2 Consonants

The consonants of Burmese are shown in (5).

(5) The consonants of Burmese

Stops (the palatals are affricates)				
p	t	c	k	ʔ
p ^h	t ^h	c ^h	k ^h	
b	d	j	g	

Nasals (N is placeless)				
m	n	ɲ	ŋ	N
^h m	^h n	^h ɲ	^h ŋ	

Fricatives			
θ	s	ʃ	h
	s ^h		
ð	z		

Liquids and glides			
l	y	w	(r)
l ^h		(w ^h)	

r and *w^h* are rare.

Only placeless consonants are allowed in the coda position, namely ʔ (which can assimilate to the onset consonant of the following syllable) and a placeless nasal *N* (which also can assimilate to the place of articulation of the following consonant; otherwise it is realized as nasalization on the vowel with an approximate coronal articulation after monophthongs and an approximate velar articulation after diphthongs (Bennett and Lehman 1994).⁶ Before the aspirated sonorants, ʔ tends to drop rather than assimilate (Okell 1969, 6–7). Examples of the assimilation of ʔ and *N*, which tends to happen only in rapid speech, are seen in (6).⁷

⁶See Trigo (1988) for a full discussion of the behavior of placeless nasals (she calls them nasal glides) across languages.

⁷In this paper I transcribe words with internal ʔ or *N* in their unassimilated forms (*yaʔkwεʔ*, *pyàun̩kquN*, etc.), chiefly to disambiguate such forms as *ʔeimmεʔ* 'sleep-IRREALIS', which is from *ʔeiʔmεʔ*, and *ʔeimmεʔ* 'at home', which is from *ʔeiNmεʔ*.

(6)

- | | | |
|----|---|--------------------|
| a. | yakkwɛ? < ya?kwɛ? | 'area, quarter' |
| | seitt ^h iN < sei? ^h iN | 'opinion' |
| | lousza? < lou?za? | 'fictitious story' |
| | myɛ ^h na: < myɛ? ^h na: | 'face' |
| b. | pyàun̄kɔuN < pyàun̄kɔuN | 'alter completely' |
| | ?əpyint ^h wɛ? < ?əpyiNt ^h wɛ? | 'go outside' |
| | θaŋjei? < θaŋjei? | 'iron hook' |

2. Syllables

2.1 Major syllables

As alluded to above, a word in Burmese must contain at least one major syllable, which may be defined as a syllable whose nucleus is a full vowel—i.e. any monophthong or diphthong except ə. Major syllables are always bimoraic, as vowels are long in open syllables, and short in closed syllables (7).

(7)

- | | | |
|----|-------------------|------------|
| a. | k ^h a: | 'shake' |
| b. | k ^h aN | 'undergo' |
| c. | k ^h a? | 'draw off' |

Since there is no underlying vowel-length distinction in Burmese, [k^ha:] is undoubtedly the surface representation of /k^ha/; the vowel is lengthened in an open syllable in compliance with the principle of the minimum word (McCarthy and Prince 1986, 1990, 1993b, 1995), which says that a lexical word must correspond to a PrWd. The optimality-theoretic constraint for this is LX≈PR (8).

(8) **LX≈PR** (Prince and Smolensky 1993, 101)

A lexical word must correspond to a prosodic word.

A PrWd must contain at least one foot, and FOOTBINARITY (9) says that feet are binary at some level of analysis—either the syllable or the mora.

- (9) **FOOTBINARITY** (Prince and Smolensky 1993, 47)
 Feet are binary at some level of analysis (σ , μ).

Since Burmese is a quantity-sensitive language, it is appropriate to propose that feet in Burmese are binary at the moraic level of analysis. Therefore the word in Burmese must be at least bimoraic. Lengthening a short vowel violates the constraint FILL (10).

- (10) **FILL** (Prince and Smolensky 1993, 25)
 Syllable positions are filled with segmental material.

The ranking $LX \approx PR$, $FTBIN \gg FILL$ is shown in the tableau in (11). A $PrWd$ is demarcated by [] _{ω} , and a foot is demarcated by parentheses (). The first candidate in (11) is a candidate with no prosodic structure at all, which could not be realized phonetically.⁸

(11)	/k ^h a/	$LX \approx PR$	$FTBIN$	FILL
	k ^h a	* !		
	[(k ^h a)] _{ω}		* !	
	\Rightarrow [(k ^h a \bar{x})] _{ω}			*

Major syllables are also always associated with one of the four tones (12).

- (12)
- | | | | |
|----|----------|-------------------|-------------|
| a. | high: | k ^h a: | 'be bitter' |
| | | k ^h aN | 'dry up' |
| b. | low: | k ^h a: | 'shake' |
| | | k ^h aN | 'undergo' |
| c. | creaky: | k ^h a: | 'fee' |
| | | k ^h aN | 'appoint' |
| d. | checked: | k ^h a? | 'draw off' |

⁸In optimality tableau, an asterisk (*) indicates violation of a constraint, an exclamation point (!) indicates that a violation is fatal, and a pointing finger (\Rightarrow) indicates the optimal candidate. Angled brackets indicate the failure to parse an underlying segment (e.g. <x> means x is not parsed), and outlining indicates the addition of a segment that is not underlying (e.g. \bar{x} means x is added).

Burmese patently obeys this constraint, as ? and N are both placeless. The Coda Filter has traditionally applied only to consonants. But if the Coda Filter is extended to coda VOWELS as well, we can explain the complementary distribution of diphthongs and monophthongs seen above. Specifically, if coda vowels are barred from having place specifications, diphthongs can be excluded from open syllables, because to allow diphthongs in open syllables is to allow the place features of the second element of the diphthong to occur in coda position. An optimality-theoretic constraint called CODA-COND, excluding all place features from coda position, can be formulated as in (17).

(17) **CODA-COND**

A coda segment can have no place specification of its own at all.

Other relevant constraints here are PARSE (18) and *COMPLEX^{Nuc} (19).

(18) **PARSE** (Prince and Smolensky 1993, 85)

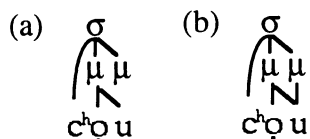
Underlying segments must be parsed into syllable structure.

(19) ***COMPLEX^{Nuc}** (Prince and Smolensky 1993, 87)

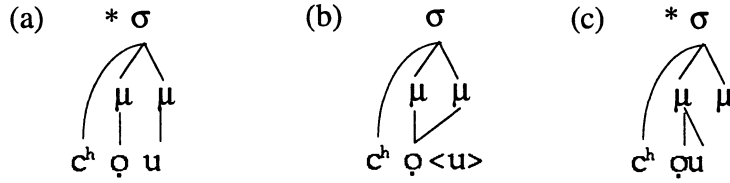
No more than one segment may associate to the nucleus.

Let us consider a form such as $c^h\text{ou}$ ‘be sweet’ (14b), and assume the diphthong ou to be underlying; in this case, the structure shown in (20a) violates CODA-COND by placing the place features of u in the syllable coda. In (20b) the coda is filled by the o of the nucleus (which licenses place features), and the u simply fails to be parsed. In (20c) both elements of the diphthong are governed by the first mora, and the second mora is left empty, in violation of FILL.⁹

⁹According to Prince and Smolensky (1993, 50), we can assume “that unfilled moras are interpreted in the output as continuations of a tautosyllabic vowel.” Although in their example the vowel is a monophthong, we can extend this interpretation to the second vowel in the diphthong of $/c^h\text{ou}/$; thus (b) below is an interpretation of (a). According to Prince and Smolensky’s analysis, both (a) and (b) are violations of FILL.



(20)

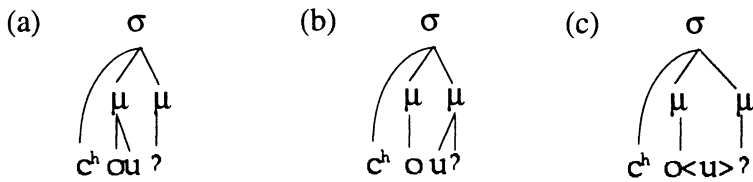


As shown in the tableau in (21), the constraint ranking CODA-COND, FILL » PARSE » *COMPLEX^{Nuc} derives the correct results.

(21)	/c ^h ou/	CODA-COND	FILL	PARSE	*COMPLEX ^{Nuc}
(20a) =	c ^h [o] _μ [u] _μ	* !			
(20b) =	☞ c ^h [o] _μ μ<u>			*	
(20c) =	c ^h [ou] _μ [] _μ		* !		*

On the other hand, when the diphthong is followed by a (placeless) coda consonant, as in *c^hou?* ‘sew’ (10c), the coda is filled with the consonant, and the diphthong is placed under a branching nucleus (22a). This violates *COMPLEX^{Nuc}, but other candidates (22b, c) violate the more highly ranked constraints CODA-COND and PARSE. The tableau illustrating this is seen in (23).

(22)



(23)	/c ^h ou?/	CODA-COND	PARSE	*COMPLEX ^{Nuc}
(22a) =	☞ c ^h [ou] _μ [?] _μ			*
(22b) =	c ^h [o] _μ [u?] _μ	* !		
(22c) =	c ^h [o] _μ <u>[?] _μ		* !	

This explanation will hold for the other monophthong/diphthong pairs, seen above in (13–14): $ʔe:$ ~ $ʔeiN$, $ʔei?$; $cɔ:$ ~ $cəuN$, $cau?$. Thus we may conclude that the monophthongs e o $ɔ$ are surface allophones of underlying /ei ou au/.

Since ε and ai both occur before $ʔ$ (e.g. $s^h\varepsilon?$ ‘offer respectfully’ ~ $s^hai?$ ‘arrive’; $t\varepsilon?$ ‘go up’ ~ $tai?$ ‘attack’), they are separate phonemes / ε / ~ / ai /, but the distinction between them is neutralized as $\varepsilon:$ in open syllables. It should be emphasized, however, that since no phonological or morphological process in Burmese will convert an open syllable into a closed syllable, it is impossible to determine whether words like $\theta w\varepsilon:$ ‘connect by thread’, $b\varepsilon:$ ‘duck’, $zəb w\varepsilon:$ ‘table’, $n\varepsilon:$ ‘district’, $w\varepsilon:$ ‘buy’, $p\varepsilon:$ ‘peas’, etc., have underlying / ε / or / ai /. From the point of view of learnability, therefore, it may be preferable to assume that / ai / simply does not occur in open syllables.¹⁰

We may regard the absence of / εN / as an accidental gap, since the other underlying monophthongs permit a nasal coda: / iN /, / uN /, / aN / surface straightforwardly as [iN], [uN], [aN].

The underlying full vowel system of Burmese is shown in (24). The diphthongs / ei /, / ai /, / ou /, / au / have diphthongal allophones only in closed syllables: in open syllables they surface as [e:], [ɛ:], [o:], [ɔ:] respectively.

(24) Underlying vowels of Burmese

Monophthongs		Diphthongs	
i	u	ei	ou
ε	a	ai	au

The complete inventory of rhymes of major syllables, including tones, is shown in (25). The high vowels i u are pronounced lax in closed syllables (iN , $i?$; uN , $u?$) (Wheatley 1987, 840), but as this is not relevant to syllable structure I shall transcribe such rhymes simply as iN , $i?$; uN , $u?$.

¹⁰Historically, Burmese $-\varepsilon:$ has three Proto-Tibeto-Burman sources, namely $*-e$, $*-ay$, and $*-ay$, as shown, for example, by $p\varepsilon:$ ‘peas’ < TB $*be$, $l\varepsilon:$ ‘change, exchange’ < TB $*lay$, and $n\varepsilon:$ ‘knead’ < TB $*nay$ (Benedict 1972, 59 ff.)

(25) The fifty rhymes of major syllables

	Nonnasal rhyme				Nasal rhyme		
	Low	High	Creaky	Checked	Low	High	Creaky
/i/	1. iː	2. iː	3. íː	4. iʔ	5. jN	6. ìN	7. ín
/u/	8. uː	9. ùː	10. úː	11. uʔ	12. ʊN	13. ùN	14. úN
/a/	15. aː	16. àː	17. áː	18. aʔ	19. ʌN	20. àN	21. án
/ɛ/	22. ɛː	23. èː	24. éː	25. ɛʔ			
/ai/	(˘)	(˘)	(˘)	26. aiʔ	27. ʌiN	28. àiN	29. áiN
/ei/	30. ɛː	31. èː	32. éː	33. eiʔ	34. ɛiN	35. èiN	36. éiN
/au/	37. ɔː	38. òː	39. óː	40. auʔ	41. ʌuN	42. àuN	43. áuN
/ou/	44. ɔː	45. òː	46. óː	47. ouʔ	48. ʊuN	49. òuN	50. óuN

2.2 Minor syllables

Minor syllables contain only the vowel ə in Burmese. They contain neither tone nor coda consonants, and may never appear in the final position of a word; a minor syllable must always be followed by a major syllable. Examples of licit and illicit minor syllables were seen above in (3)–(4); they are repeated here for reference in (26–27).

(26)

- a. kʰəlouʔ 'knob'
 b. pəlwɛː 'flute'
 c. θəyɔː 'mock'
 d. kələʔ 'be wanton'
 e. tʰəməyɛː 'rice-water'
 f. meìNməwuʔ 'women's clothing'

(27)

- a. *məNməwuʔ
 b. *kʰəlouʔ
 c. *θəyɔː
 d. *bwèːzə
 e. *zəbə

f. *zə

As we have seen, major syllables are bimoraic; it is reasonable to suppose that minor syllables are monomoraic. This supposition is borne out by the phonetic evidence of Mehnert and Richter (1972–77), in which the duration of minor syllables has a range of 25–50 ms, while the duration of major syllables has a range of 150–600 ms. Following standard definitions of feet (Hayes 1995, Prince 1990, Allen 1973, *inter alios*), we may assume that heavy ($\mu\mu$) syllables are in fact feet; they may in principle be either iambs or moraic trochees. The difference between major and minor syllables is thus to be explained in terms of foot structure.

3. Feet

3.1 The case for monosyllabic feet

Although most words in Burmese are either [L H] or [H], there is good reason to suppose that the foot in Burmese is not an iamb—either (L 'H) or ('H)—but rather a single heavy syllable ('H) only. In this case, light syllables in [L H], [L L H], and [H L H] words would remain unfooted, as shown in (28).

(28) Monosyllabic feet in Burmese

- | | | | |
|-----------|----------|------------------|--------------------|
| a. (bɛː) | 'duck' | d. zə(bwɛː) | 'table' |
| b. (pàN) | 'flower' | e. tʰəmə(yɛː) | 'rice-water' |
| c. (ʰniʔ) | 'year' | f. (mèiN)mə(wuʔ) | 'women's clothing' |

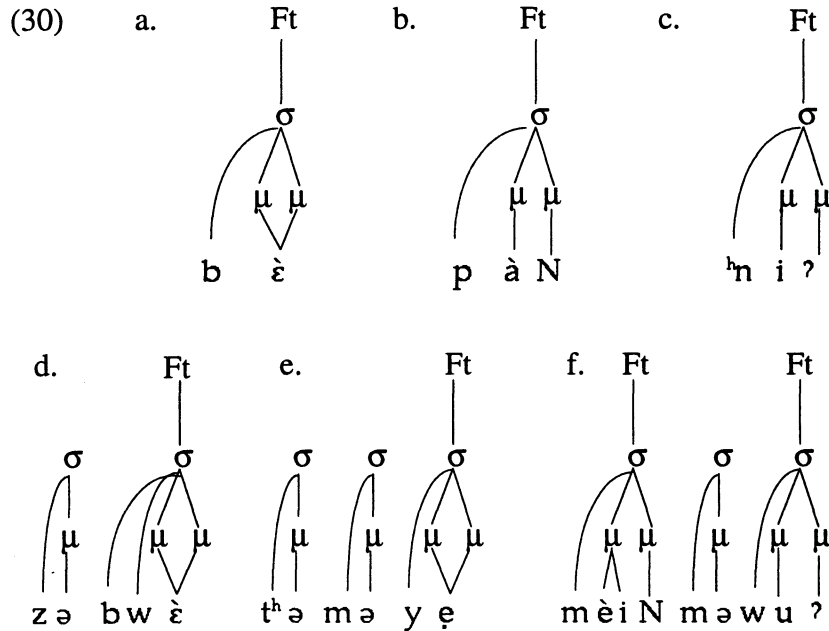
As mentioned above, the nonoccurrence in Burmese of [L] words can be explained by invoking the principle of the minimum word.

The descriptive fact that ə is unfooted in Burmese is reminiscent of Cohn and McCarthy's (1994) analysis of Indonesian, where ə resists footing, where possible, by virtue of a constraint NON-FOOT(ə), which states that a syllable headed by ə has no metrical projection, in effect prohibiting the inclusion of ə in a foot (29).

(29) NON-FOOT(ə) (Cohn and McCarthy 1994, 21)

Schwa-headed syllables have no metrical projection.

This constraint is also relevant in Burmese, since all light syllables contain ə in their nuclei, and all light syllables are unfooted. Thus, leaving aside the issue of tone,¹¹ the full prosodic structures of the words in (28) above are as shown in (30).



Now, according to Grouping Harmony (Prince 1990), for both iambs and moraic trochees, (L L) is as harmonious a foot as (H); the two should be equivalent. But although a Burmese word may consist of a single heavy syllable, as shown above, no Burmese word consists of two light syllables; *zəbə is not a possible word, and therefore presumably not a possible foot. One result of this phenomenon is that it is impossible to determine whether the (H) foot of Burmese is a trochee or an iamb. If (L L) feet WERE allowed, the issue would be resolved by the placement of stress (or tone): (¹L L) would mean a trochaic system, (L ¹L) an iambic system. But (¹H) alone is ambiguous. Before addressing the issue of why (L L) feet are prohibited in Burmese, I shall first argue against an iambic analysis, and then discuss compound words and the PrWd.

3.2 The case against iambs

At first glance, it may appear that Burmese has iambic feet. The Grouping Harmony Principle of Prince (1990) shows that iambs are preferably of the shape (L ¹H), otherwise

¹¹In a future version of this paper, I hope to show that tone in Burmese is licensed by the foot.

(L 'L) or ('H). These foot shapes correspond to his Weight-to-Stress Principle, which says, "if heavy, then stressed," and to its contraposition, "if unstressed, then light." (In Burmese and Thai—discussed below—tone-bearing syllables fill the role of stressed syllables.) As mentioned in the discussion of major and minor syllables above, Burmese allows words of the shape [L 'H] and ['H], but not [L 'L]. If Burmese is to be analyzed as iambic, the nonoccurrence of [L L] words (*zəbə) must be explained.

At least two other Southeast Asian languages have been described as iambic: Thai by Bennett (1994), and Cambodian by Griffith (1991) and Hayes (1995). Both languages, like Burmese, allow [L 'H] and ['H] words, and disallow [L 'L] words. Thai at least also allows [L L 'H] words, just as Burmese does; if Cambodian allows [L L 'H] words, Griffith does not mention them. It seems desirable that a theory to explain the behavior of feet in one of these languages should be able to explain all three languages as uniformly as possible.

Griffith's (1991) discussion of Cambodian shows how iambic feet can be built on words, as shown in (31) (= Griffith's (6)). In these Cambodian words, vowel length is indicated by doubling the vowel letter; primary stress is marked by ´; secondary stress by `; əə, etc., indicates a long (bimoraic) diphthong; ǝə indicates a short (monomoraic) diphthong. Note that while Burmese and Thai use tone to indicate the head syllables of words, Cambodian (which does not have tones per se) uses stress. (The stress marks in (31) are as given by Griffith. I do not know why some syllables with a single grid mark are marked as bearing primary stress, while others are marked as bearing secondary stress, and others are unmarked for stress. But the point is that every syllable with two grid marks bears primary stress.)

(31)	(×)	(×)	(×)	(×)
	(×)	(×)	(×) (×)	(×) (×)
	-	-	- -	- -
	bət	chi	baŋkáət	sìəwphîw
	'to close'	'to be ill'	'to originate'	'book'
	(×)	(×)	(×)	(×)
	(×) (×)	(×) (×)	(×) (×)	(×)
	- -	- -	- -	- -
	bùəŋ-súəŋ	thǝəmmədáa	púttəsáhsnáa	
	'to pray'	'ordinary'	'Buddhism'	

(×		(×
(×)	(×)	(×)	(. ×)	(. ×)	(. ×)	(. ×)
-	-	-	˘ -	˘ -	˘ -	˘ -
ríæcrò [̀] ættháaphibáal			wicáarəná [˘] kətháa			
'royal government'			'editorial'			

While Griffith's analysis accounts for the attested forms, she does not address why (L 'L) iambs are not encountered in Cambodian.

Bennett's (1994) optimality-theoretic analysis of Thai reveals that Thai has not only [H] and [L 'H] words, as shown in (32), but underlying [L] and [L 'L] words as well. These latter type are augmented by a coda ? to become surface [H] and [L 'H], as shown in (33). In the Thai examples, ´, ^, and ` mark high, falling, and low tones, respectively; mid tone is unmarked.

(32)

a.	/tôn/	[tôn]	'stem'
b.	/taa/	[taa]	'eye'
c.	/tòɔ/	[tòɔ]	'to reply'
d.	/tapuu/	[tapuu]	'nail'
e.	/sanùk/	[sanùk]	'fun'
f.	/lamút/	[lamút]	'sp. fruit'
g.	/prat ^h êet/	[prat ^h êet]	'country'

(33)

a.	/tó/	[tóʔ]	'table'
b.	/dù/	[dùʔ]	'fierce'
c.	/kò/	[kòʔ]	'island'
d.	/kat ^h í/	[kat ^h íʔ]	'coconut milk'
e.	/pracù/	[pracùʔ]	'to fill up'
f.	/rajá/	[rajáʔ]	'space, period'

Bennett proposes that this augmentation takes place in order to comply with the Stress-to-Weight principle, which says, "if stressed, then heavy." Bennett attributes this principle to Prince (1990), but actually, Prince is arguing for the converse: "if heavy, then

stressed” (the Weight-to-Stress Principle, or WSP). He says (358), “we specifically deny” that “if stressed, then heavy” is a principle. On the other hand, Hayes (1995) argues that (L 'L) iambs violate his “Iambic/Trochaic Law”—actually more of a functionally based tendency—which says, in essence, that the strong and weak syllables of iambs should contrast in duration, while the strong and weak syllables of trochees should contrast in intensity. In other words, (L 'H) is a better iamb than (L 'L), but ('L L) is a better trochee than ('H L). Prince’s (1990) Grouping Harmony principle makes the same prediction, but ranks (H) equal to (L L) for both iambs and trochees.

Hayes (1995, 83 and 205 ff.) lists some two dozen languages with iambic lengthening rules that change (L 'L) feet into (L 'H) feet. Of course, it is not obligatory in iambic languages that (L 'L) feet get lengthened to (L 'H); Hayes (1995, 64 ff. and 211 ff.) lists Seminole/Creek and Unami and Munsee Delaware as iambic languages with iambs of all three possible shapes: (L 'H), ('H), and (L 'L).

The case of [L L L] words in Thai is interesting: one might think that the natural footing (with iambic ?-augmentation) would be either [(L H)(H)] or [(H)(L H)]. But neither of these is the case; the actual result (following Bennett’s iambic analysis) is [L (L H)], with the first syllable left unfooted, as shown in (34).

- (34) /k^harahá/ ‘fortune’
 *[k^hara?há?]
 *[k^ha?rahá?]
 [k^harahá?]

Bennett proposes that [L (L H)] is preferable to either [(L H)(H)] or [(H)(L H)] because of FTBIN. Bennett proposes that the foot in Thai is binary at the syllabic level, so that the monosyllabic (H) feet in [(L H)(H)] and [(H)(L H)] violate FTBIN.¹² But this analysis is theoretically worrisome: Bennett is proposing that although Thai is a weight-sensitive language (as proved by his Stress-to-Weight Principle), Foot Binariness operates on the syllabic level. Prince and Smolensky allowed Foot Binariness at the syllabic level to account for syllabic trochees, which are of the shape ('σ σ) and tend to occur in quantity-insensitive languages (though Hayes 1995, 102 lists ten exceptions). Neither Hayes

¹²Monosyllabic words like *tó?* ‘table’ and *taa* ‘eye’ would thus also violate FTBIN, but satisfaction of FTBIN in these cases, for example by **?ató?* and **?ataa*, would violate a higher-ranked constraint against epenthetic syllables (FILL-σ).

(1995) nor Prince (1990) permits “syllabic iambs”, as such would seem to entail quantity-insensitive iambic systems, which Hayes argues do not exist.¹³ Thus Bennett would seem to be taking unfair advantage of optimality theory’s chief flaw—that it is too powerful. There is nothing intrinsic in the OT framework that prevents FTBIN from operating at the syllabic level in languages with iambic systems, yet Hayes’ results indicate that such a restriction is desirable.

The facts in Cambodian and Thai can be accounted for with a theory of monosyllabic (ʰH) feet, as I proposed for Burmese above, without the problems of Bennett’s iambic analysis. The ʔ-augmentation of underlying [L] and [L L] words in Thai can be seen as compliance with FTBIN at the moraic level—theoretically desirable in quantity-sensitive languages. Examples (35–36) show monosyllabic feet in Cambodian and Thai.

(35) Monosyllabic feet in Cambodian

- | | | |
|----|----------|--------------------|
| a. | (bət) | ‘to close’ |
| b. | kɑ(káay) | ‘to scratch about’ |
| c. | prɑ(kán) | ‘to object’ |

(36) Monosyllabic feet in Thai

- | | | |
|----|------------|----------------|
| a. | (tóʔ) | ‘table’ |
| b. | ka(tʰiʔ) | ‘coconut milk’ |
| c. | (taa) | ‘eye’ |
| d. | kʰara(háʔ) | ‘fortune’ |
| e. | ta(puu) | ‘nail’ |

Although iambic lengthening in Thai is unnecessary under this analysis, and although I am skeptical of Bennett’s “Stress-to-Weight Principle,” it should not be thought that I am arguing against iambic lengthening as a valid process. Hayes (1995, 205 ff.) gives many examples of languages with iambic lengthening, e.g. Hixkaryana, Choctaw/Chickasaw, Cayuga, and several of the Yupik languages. Hung (1994, 57 ff., 117–9) discusses Hixkaryana and Choctaw in optimality-theoretic terms. She proposes a constraint IAMBIC QUANTITY that says, “In a rhythmic unit (W S), S is heavy” (63), to achieve iambic leng-

¹³Hayes (1995, 266–8) shows that apparent cases of syllabic iambs, as in Southern Paiute, Araucanian, Onondaga, and Dakota, are actually cases of (L L) iambs in languages without heavy syllables; this absence of heavy syllables precludes the possibility of (L ʰH) or (ʰH) iambs.

thening. This is less general than Bennett's Stress-to-Weight Principle, but in the case of a (W S) iamb, the two have the same result. Following Hung's account of Hixkaryana, one could argue for iambicity in Thai thus: FTBIN applies at the moraic level, augmenting /tó/ 'table' to [(tóʔ)]; IAMBIC QUANTITY will then augment /kat^{hi}/ 'coconut milk' to [(kat^{hi}ʔ)]. Bennett's theoretically tenuous Stress-to-Weight Principle is thus unnecessary. Nevertheless, I still believe that the only well-formed foot in Thai may well be a single heavy syllable, as it is in Burmese.

4. Compounds, superlong words, and the prosodic word

Most Burmese words either are monosyllabic, or have an initial minor syllable followed by a major syllable. In either case, the word can be seen as consisting of one PrWd and one foot (37).

(37)

- | | | |
|----|---------------------------------------|------------------|
| a. | [(θwàː)] _ω | 'go' |
| b. | [(lɛː)] _ω | 'be heavy' |
| c. | [(səː)] _ω | 'writing' |
| d. | [(ʔɛiN)] _ω | 'house' |
| e. | [θə(yɔː)] _ω | 'mock, satirize' |
| f. | [k ^h ə(louʔ)] _ω | 'knob' |

Words of more than one foot (henceforth, polypodic words) are chiefly compounds (38a) or loanwords (38b) in Burmese. Very few polypodic words are apparently neither compounds nor loanwords (38c). I shall refer to noncompound polypodic words, such as (38b–c), as "superlong" words. I shall discuss the status of the PrWd in polypodic words later.

(38)

- | | | |
|----|--|---------------------------|
| a. | (nɛː)(t ^h aiN) = (nɛː) + (t ^h aiN) | 'reside' = 'stay' + 'sit' |
| b. | (c ^h ɔː)kə(lɛʔ) | 'chocolate' < English |
| c. | (mɔuN)(dàiN) | 'storm' |

4.1 Nonreducing compounds

There are two types of compounds in Burmese; I call them NONREDUCING and REDUCING compounds.¹⁴ Nonreducing compounds are straightforward: two or more words are strung together to form a single word. The individual members of these compounds probably retain their original PrWds, which are then parsed recursively into a single, larger PrWd, as shown in (39).¹⁵

- (39) Nonreducing compounds: $\omega + \omega > [\omega \omega]_{\omega}$
- a. $[(n\epsilon\zeta)]_{\omega} + [(t^h\grave{a}iN)]_{\omega} > [[(n\epsilon\zeta)]_{\omega}[(t^h\grave{a}iN)]_{\omega}]_{\omega}$
‘stay’ + ‘sit’ > ‘reside’
- b. $[(y\grave{a}uN)]_{\omega} + [(w\epsilon\zeta)]_{\omega} > [[(y\grave{a}uN)]_{\omega}[(w\epsilon\zeta)]_{\omega}]_{\omega}$
‘sell’ + ‘buy’ > ‘trade’
- c. $[(c\epsilon\zeta)]_{\omega} + [(s^h\grave{a}iN)]_{\omega} > [[(c\epsilon\zeta)]_{\omega}[(s^h\grave{a}iN)]_{\omega}]_{\omega}$
‘fowl’ + ‘elephant’ > ‘turkey’
- d. $[? \grave{a}(y\epsilon\zeta)]_{\omega} + [? \grave{a}(c^h\grave{a}iN)]_{\omega} > [[? \grave{a}(y\epsilon\zeta)]_{\omega}[? \grave{a}(c^h\grave{a}iN)]_{\omega}]_{\omega}$
‘qualification’ + ‘quality’ > ‘standard’
- e. $[(p\acute{o}\zeta)]_{\omega} + [(p^h\acute{o}\zeta)]_{\omega} + [(k^h\grave{a}iN)]_{\omega} > [[(p\acute{o}\zeta)]_{\omega}[(b\acute{o}\zeta)]_{\omega}[(k^h\grave{a}iN)]_{\omega}]_{\omega}$
‘send’ + ‘to’ + ‘tell’ > ‘tell (him) to send (it)’
- f. $[(c\acute{i}\zeta)]_{\omega} + [(l\acute{o}\zeta)]_{\omega} + [(k\grave{a}uN)]_{\omega} > [[(c\acute{i}\zeta)]_{\omega}[(l\acute{o}\zeta)]_{\omega}[(k\grave{a}uN)]_{\omega}]_{\omega}$
‘look’ + ‘-ing’ + ‘be good’ > ‘be good to look at’
- g. $[(k\grave{a}u?)]_{\omega} + [(p\grave{\epsilon}\zeta)]_{\omega} + [? \grave{a}(\theta\acute{i}\zeta)]_{\omega} + [? \grave{a}(n\grave{a}N)]_{\omega} > [[(k\grave{a}u?)]_{\omega}[(p\grave{\epsilon}\zeta)]_{\omega}[(\theta\acute{i}\zeta)]_{\omega}[(n\grave{a}N)]_{\omega}]_{\omega}$
‘paddy’ + ‘peas’ + ‘fruit’ + ‘grain’ > ‘crops’
- h. $[(? \grave{d}\zeta)]_{\omega} + [(? \grave{a}iN)]_{\omega} + [(k^h w\epsilon?)]_{\omega} + [(y\grave{a}u?)]_{\omega} > [[(? \grave{d}\zeta)]_{\omega}[(? \grave{a}iN)]_{\omega}[(k^h w\epsilon?)]_{\omega}[(y\grave{a}u?)]_{\omega}]_{\omega}$
‘pot’ + ‘bowl’ + ‘cup’ + ‘ladle’ > ‘household goods’

(I am not concerned here with certain effects of compounding, such as voicing, as seen in (39e), or the loss of the prefix $? \grave{a}$ in some forms (39g), but not in others (39d).)

¹⁴It is not unknown for a language to have more than one type of compound. Mohanan (1982, 1986), Aronoff and Sridhar (1983), Sproat (1986), and Inkelas (1989) discuss compounds in Kannada and Malayalam, where “sub-compounds” and “co-compounds” have different phonological effects from each other. Unlike Kannada and Malayalam, Burmese does not seem to have an obvious semantic distinction between the two types of compounds.

Examination of the glosses in the examples will show that many “compounds” in Burmese are not compounds in the traditional sense at all, but rather “concatenation[s] of lexical words and grammatical formatives, presumably under a single X-bar category (X_0)” (Bennett and Lehman 1994, where the reader is referred also to Lehman 1986 and 1993).

¹⁵See Inkelas (1989) and McCarthy and Prince (1993a) on the recursiveness of the PrWd.

Compound words consisting of more than one PrWd are well attested: in Igbo (Zsiga 1992), Malayalam (Sproat 1986, Inkelas 1989), Sanskrit (Selkirk 1980), and Turkish and Hungarian (Nespor and Vogel 1986), for example, certain compounds must contain more than one PrWd. Also in the history of Welsh, as described by Jackson (1953), the boundary between members of a compound word functions like any other word boundary.¹⁶ Further evidence that the members of nonreducing compounds in Burmese keep their original PrWds will be presented in section 5 below.

4.2 Reducing compounds

In reducing compounds, the penultimate member of the compound becomes a minor syllable, losing its tone and its second mora (whether vocalic or consonantal), and reducing the vowel quality to ə. Prosodically speaking, in reducing compounds, two PrWds are combined into one monopodic PrWd (40a–e). Three PrWds are combined into two monopodic PrWds, which may themselves be part of a single, larger PrWd (40f–i).

- (40) Reducing compounds: $\omega + \omega > \omega$
- a. [(càN)]_ω + [(pò:)]_ω > [cə(bò:)]_ω
‘floor’ + ‘insect’ > ‘bug’
- b. [(ŋà:)]_ω + [(?ú:)]_ω > [ŋə(?ú:)]_ω
‘fish’ + ‘egg’ > ‘fish-spawn’
- c. [(θwà:)]_ω + [(yɛ:)]_ω > [θə(yɛ:)]_ω
‘tooth’ + ‘juice’ > ‘saliva’
- d. [t^hə(mìN)]_ω + [(yɛ:)]_ω > [t^həmə(yɛ:)]_ω
‘rice’ + ‘water’ > ‘rice-water’
- e. [kə(là:)]_ω + [(pyɛ:)]_ω > [kələ(byɛ:)]_ω
‘Indian’ + ‘country’ > ‘India’
- f. [(lu?)]_ω + [(pi:)]_ω + [(là:)]_ω > [[(lu?)]_ω[pə(là:)]_ω]_ω
‘free’ + ‘is’ + Q > ‘is (he) free?’
- g. [(nɛ:)]_ω + [(mɛ:)]_ω + [(là:)]_ω > [[(nɛ:)]_ω[mə(là:)]_ω]_ω
‘stay’ + IRREALIS + Q > ‘will (he) stay?’

¹⁶Specifically: the final vowel of the first member drops just like the final vowel of a word, but there is no general rule of internal syncope; also certain consonants (*g, s, y, w*) pattern at the beginning of the second member of a compound as they pattern at the beginnings of words, rather than as they regularly pattern in word-internal position. So, for example, the Proto-Brittonic sequence **-ogn-* developed into Welsh *-oen-* internally (**ognos* > *oen* ‘lamb’), but **-o+gn-* became *-Ø+n-* (**oino+gne* > *un+ne* ‘having one color’, like **eso gne* > *ei ne* ‘his color’).

- h. [(meiN)]_ω + [(má:)]_ω + [(wu?)]_ω > [(meiN)]_ω[(mə(wu?)]_ω_ω
 ‘woman’ + fem. + ‘clothing’ > ‘women’s clothing’
- i. [(làn)]_ω + [(má:)]_ω + [(tɔ:)]_ω > [(làn)]_ω[(mə(dɔ:)]_ω_ω
 ‘road’ + ‘main’ + honorific > ‘main road’

Whether a compound will be of the reducing or nonreducing type cannot be determined phonologically. There is no phonological reason why (34a) ‘reside’ must be *nɛ:thaiN*, not **nəthaiN*, nor why (35a) ‘bug’ must be *cəbò:*, not **càNbò:*. For our purposes, we may assume that *nɛ:thaiN* is generated with two PrWds, and *cəbò:* with one.

4.3 Superlong words

There are in Burmese very few superlong words, by which I mean morphologically simplex (i.e. not compound) polypodic words. Most but not all of them are loan words (41).

(41)

- | | | |
|----|---------------|----------------------------------|
| a. | cáuNcá: | ‘be anxious’ |
| b. | mouNdàiN | ‘storm’ |
| c. | tʰə:pəna: | ‘enshrine’ < Pāli <i>tʰapanā</i> |
| d. | bou?dá: | ‘Buddha’ < Pāli |
| e. | ?əpəri:fəyei? | ‘appreciate’ < English |
| f. | cʰɔ:kəle? | ‘chocolate’ < English |

It is unclear at first whether these superlong words have a single PrWd, or whether they are like the polypodic compounds in (39) and (40f–i), each foot being parsed into a PrWd, and then the PrWds being parsed into a larger PrWd. If this latter suggestion is true, the words in (41) have the prosodic structures in (42).

(42)

- | | |
|----|--|
| a. | [[cáuN)] _ω [(cá:)] _ω _ω |
| b. | [[mouN)] _ω [(dàiN)] _ω _ω |
| c. | [[tʰə:)] _ω [pə(nə:)] _ω _ω |
| d. | [[bou?)] _ω [(dá:)] _ω _ω |
| e. | [[?əpə(rì:)] _ω [fə(yei?)] _ω _ω |
| f. | [[cʰɔ:)] _ω [kə(le?)] _ω _ω |

Although there is no direct evidence for the internal, monopodic PrWds, we shall see below that this analysis is theoretically advantageous.

5. Maximum size of prosodic categories

Let us next consider the maximum size of the prosodic categories word, foot, and syllable in Burmese. We have seen that the PrWd, in most cases at least, takes just one foot: The vast majority of words in Burmese consist either of a single foot (43a–c), or an unfooted minor syllable followed by a foot (43d–f). We may therefore make the generalization stated in (44).

(43)

- | | | |
|----|---------------------------------------|------------------------|
| a. | [(mɛʔ)] _ω | ‘girl’ |
| b. | [(ʃauʔ)] _ω | ‘address (a superior)’ |
| c. | [(pyèiN)] _ω | ‘be stupid’ |
| d. | [k ^h ə(louʔ)] _ω | ‘knob’ |
| e. | [pə(lwɛʔ)] _ω | ‘flute’ |
| f. | [θə(yɔʔ)] _ω | ‘mock’ |

(44) A PrWd preferably contains at most one foot.

We have also seen that the foot in Burmese consists of just one syllable. Thus, while in theory bimoraic feet may be either of the form (H) or of the form (L L), in Burmese (L L) feet are not allowed: there are no words of the shape *zəbə. We can therefore make the generalization stated in (45).

(45) A foot contains at most one syllable.

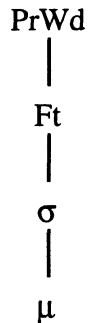
Let us now examine the possibility of collapsing the generalizations stated in (44) and (45) into a single generalization that a prosodic category contains no more than one of the next lower prosodic category. This generalization may be stated as an optimality-theoretic constraint named UNARITY, as in (46).

(46) UNARITY

A prosodic category π contains no more than one of the next lower prosodic category $\pi - 1$.

This constraint depends, of course, on the prosodic hierarchy (47), as discussed in Selkirk (1980), McCarthy and Prince (1986, 1993a), Nespor and Vogel (1986), Zec (1988), Inkelas (1989), and elsewhere.

(47) Prosodic Hierarchy



The most striking prediction UNARITY makes is that syllables should be monomoraic; as we saw in (43), most syllables are in fact major syllables, and therefore bimoraic. But we can propose that FTBIN outranks UNARITY in Burmese, and that a syllable may be bimoraic only in order that FTBIN not be violated. UNARITY predicts that unfooted syllables must be monomoraic, since FTBIN is not an issue, and we have seen that unfooted syllables in Burmese are indeed all minor and therefore monomoraic. This is the reason why the first syllable in a reducing compound such as *cəbð:* 'bug' (40a) is reduced to ə: a bimoraic syllable would induce an extra violation of UNARITY at the syllabic level, and since this word has a single PrWd, footing the first syllable violates UNARITY at the PrWd level. Leaving syllables unfooted violates PARSE- σ (48), but this constraint is not ranked high.

(48) PARSE- σ

Syllables are parsed into feet.

UNARITY is not a single constraint so much as a family of constraints: UNARITY^{PrWd}, UNARITY^{Ft}, and UNARITY ^{σ} can—in this instance in fact, must—have separate rankings.

The ranking $\text{UNARITY}^{\text{PrWd, Ft}}, \text{FTBIN} \gg \text{UNARITY}^{\sigma}, \text{PARSE-}\sigma$ is shown in the tableau in (49). The relative ranking of UNARITY^{σ} and $\text{PARSE-}\sigma$ cannot be determined.

(49) Candidates	$\text{UNARITY}^{\text{PrWd}}$	$\text{UNARITY}^{\text{Ft}}$	FTBIN	UNARITY^{σ}	$\text{PARSE-}\sigma$
$[\text{c}\text{ə}(\text{b}\text{ò}:\text{z})]_{\omega}$				*	*
$[\text{c}\text{ə}(\text{b}\text{ò})]_{\omega}$			* !		*
$[(\text{c}\text{əb}\text{ò})]_{\omega}$		* !			
$[\text{c}\text{àN}(\text{b}\text{ò}:\text{z})]_{\omega}$				** !	*
$[(\text{c}\text{àN})(\text{b}\text{ò}:\text{z})]_{\omega}$	* !				

$\text{UNARITY}^{\text{Ft}}$ and FTBIN both appear to be unviolated in Burmese: there is no circumstance under which either a (L L) foot or a (L) foot is permissible. If my analysis of reducing compounds is correct, $\text{UNARITY}^{\text{PrWd}}$ is certainly ranked above UNARITY^{σ} , and may be unviolated, as implied by the tableau in (49).

We are now in a position to determine the prosodic structure of superlong words. The tableau in (49) shows that the candidate $[(\text{c}\text{àN})(\text{b}\text{ò}:\text{z})]_{\omega}$ fails in comparison with $[\text{c}\text{ə}(\text{b}\text{ò}:\text{z})]_{\omega}$. Therefore, a superlong word like (41b) ‘storm’ must be generated as $[(\text{m}\text{òuN})]_{\omega}-[(\text{d}\text{àiN})]_{\omega}$, since a candidate $[(\text{m}\text{òuN})(\text{d}\text{àiN})]_{\omega}$ would fail in favor of $*[\text{m}\text{ə}(\text{d}\text{àiN})]_{\omega}$ by virtue of $\text{UNARITY}^{\text{PrWd}}$.

6. Other constraints

In order to account fully for what is and is not a permissible word in Burmese, some other constraints must be discussed.

As mentioned in the discussion of major and minor syllables (cf. especially (27d)), no word may end in a minor syllable: $*\text{b}\text{w}\text{è}:\text{z}\text{ə}$ is not a permissible word. The constraint ALIGN-R (50) says that the right edge of every PrWd corresponds to the right edge of some foot. M-PARSE (51) is violated when there is no output for a certain form generated by Gen. This absence of output is also called the null parse.

- (50) **ALIGN-R** (McCarthy and Prince 1993b, 32)
Align(PrWd, Right, Foot, Right)

(51) **M-PARSE** (McCarthy and Prince 1993b, 112)

Morphemes are parsed into morphological constituents.

Like FTBIN and UNARITY^{Ft}, ALIGN-R is undominated and unviolated. This means that every PrWd must end in a foot—in other words, must end with a heavy syllable. The null parse—the candidate in which there is no morphological structure, and no phonetic realization—violates no constraints except M-PARSE, and is optimal only when all other candidates violate undominated constraints. The null parse is indicated by angled brackets $\langle \rangle$. The tableaux in (52)–(56) show the interaction of these constraints. (52) shows that an open syllable must be made long, in violation of FILL, in order to meet FTBIN.

(52)	/bè/	FTBIN	ALIGN-R	NF(ə)	UN ^{Ft}	M-PARSE	FILL	UN ^σ	PARSE-σ
	☞ [(bè̃)] _ω						*	*	
	[(bè)] _ω	* !							

In (53), we see that because a syllable with ə cannot be footed, the null parse is the optimal candidate for a word whose only vowel is ə.

(53)	/bə/	FTBIN	ALIGN-R	NF(ə)	UN ^{Ft}	M-PARSE	FILL	UN ^σ	PARSE-σ
	[(bə)] _ω	* !		* !					
	[(bə̃)] _ω			* !			*	*	
	☞ ⟨bə⟩					*			

(54) shows that a [L L] word cannot be footed (L L) because of UNARITY^{Ft}; since the last syllable contains a full vowel (i.e. not ə), it can be lengthened in violation of FILL in order to be footable.

(54)	/zəbwè/	FTBIN	ALIGN-R	NF(ə)	UN ^{Ft}	M-PARSE	FILL	UN ^σ	PARSE-σ
	☞ [zə(bwè̃)] _ω						*	*	*
	[(zəbwè)] _ω			* !	* !				
	[zə(bwè)] _ω	* !							*

(55) shows that because of the unfootability of ə, a [L L] word in which both syllables contain ə can never surface; the null parse is optimal.

(55)	/zəbə/	FTBIN	ALIGN-R	NF(ə)	UN ^{Ft}	M-PARSE	FILL	UN ^σ	PARSE-σ
	[(zəbə)] _ω			*!	*!				
	[zə(bə)] _ω	*!		*!					*
	[zə(bə̃)] _ω			*!			*	*	*
	[(zə)bə] _ω	*!	*!	*!					*
	☞ ⟨zəbə⟩					*			

In (56) we see that ALIGN-R means that any word that ends with ə can never surface; again, the null parse is optimal.

(56)	/bwèzə/	FTBIN	ALIGN-R	NF(ə)	UN ^{Ft}	M-PARSE	FILL	UN ^σ	PARSE-σ
	[(bwè̃)zə] _ω		*!				*	*	*
	[(bwèzə)] _ω			*!	*!				
	[bwè(zə̃)] _ω			*!			*	*	*
	☞ ⟨bwèzə⟩					*			

7. Conclusions

We have discussed several aspects of the prosodic structure of Burmese, and have addressed several problems. The complementary distribution of diphthongs and mid monophthongs is explained by hypothesizing that the Coda Condition in Burmese applies to both vowels and consonants; this prohibits diphthongs from occurring in open syllables.

The constraint UNARITY^σ prefers a syllable to be monomoraic, but FTBIN forces a foot to be bimoraic. Since FTBIN dominates UNARITY^σ, a footed syllable must be bimoraic. The constraint ALIGN-R forces a word to end with a foot. These facts explain the distribution of major and minor syllables.

The constraint UNARITY^{Ft} forces a foot to be monosyllabic, which is why (L L) feet do not occur in Burmese. UNARITY^{PrWd} forces a PrWd to have only one foot; therefore, words with more than one foot—even the superlong ones seen above in (41)—have more than one PrWd.

The constraints we have discussed are listed in (57) according to their relative ranking. In (58) are listed the specific rankings that have been established, along with the example number where the ranking is proved.

- | | | |
|------|---|--|
| (57) | Unviolated constraints: | ALIGN-R,
CODA-COND,
FTBIN,
LX≈PR,
NON-FOOT(ə)
UNARITY ^{Ft} ,
UNARITY ^{PrWd} |
| | Violable constraints: | » M-PARSE
» PARSE,
FILL
» *COMPLEX ^{Nuc}
» PARSE-σ,
UNARITY ^σ |
| (58) | ALIGN-R » M-PARSE
CODA-COND » *COMPLEX ^{Nuc}
CODA-COND » PARSE
FILL » PARSE
FTBIN » FILL
FTBIN » M-PARSE
FTBIN » UNARITY ^σ , PARSE-σ
LX≈PR » FILL
NON-FOOT(ə) » M-PARSE
NON-FOOT(ə) » UNARITY ^σ , PARSE-σ
M-PARSE » FILL
PARSE » *COMPLEX ^{Nuc}
UNARITY ^{Ft} » M-PARSE
UNARITY ^{Ft} » UNARITY ^σ , PARSE-σ
UNARITY ^{PrWd} » UNARITY ^σ , PARSE-σ | (55)
(23)
(21)
(21)
(11)
(56)
(49)
(11)
(53)
(54)
(52)
(23)
(53)
(49)
(49) |

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