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Stem disyllabicity in Guugu Yimidhirr

René Kager

1. Introduction

Prosodic size restrictions on specific morphological domains occur in many languages. The best-known size limitation (one which is often imposed on stems, and on reduplicants) is the bimoraic minimum, i.e. a single heavy syllable (H), or two light syllables (LL). In terms of prosodic categories, this limitation equals a (bimoraic) *foot*. Recently attention has been drawn to another size limitation, i.e. two syllables regardless of their weight. Just as bimoraicity, disyllabicity may function as a *minimality* requirement, as in Japanese word clippings (Itô 1992), Axininca Campa reduplication (McCarthy & Prince 1993a), or Turkish stems (Inkelas & Orgun 1994). It may also form the *maximum* size of certain categories, as in Arabic canonical noun roots (McCarthy & Prince 1990), and finally, it may be a *strict* delimiter, as in Guugu Yimidhirr verb stems (see § 3.3). In contrast, no languages seem to require specific morphological domains to be (minimally, maximally, exactly) trisyllabic or quadrisyllabic, etc.

A question that naturally arises is whether disyllabicity is reducible to a single prosodic category, just as bimoraicity can be reduced to the quantity-sensitive foot. In this paper I will demonstrate that reduction to foot is impossible, and that (instead) disyllabicity is an effect of the interaction of constraints aligning prosodic and morphological edges.

From a cross-linguistic perspective, there is every reason to assume that disyllabicity is a basic size requirement of morphoprosodic theory. Morpheme disyllabicity requirements are common enough to make us wonder if they are reducible to the *syllabic binarity* of the *foot*[1] (Prince 1980; McCarthy & Prince 1986; Kager 1989, 1993a,b; Hayes 1995):

(1) **FTBIN**
Feet are binary under syllabic or moraic analysis.

If we would simply restrict ourselves to quantity-insensitive languages, the answer to this question would no doubt be positive. Foot binarity (trivially) implies disyllabicity in quantity-insensitive languages, which by definition fail to distinguish light and heavy syllables. Therefore any evidence for *genuine* disyllabicity (as distinct from bi-moraicity) can in principle only be found in quantity-*sensitive* languages, i.e. languages that may satisfy FTBIN by bi-*moraic* analysis.

As I will show below Guugu Yimidhirr is precisely such a language. On the one hand, it is quantity-sensitive in various respects, and it uses the bimoraic (H) foot. Its minimal word is bimoraic (e.g. *míil* 'eye'), and stress falls on every heavy syllable, even when two are adjacent, e.g. *búuɽáay* 'water.' On the other hand, its prosody repeatedly refers to a disyllabic domain at the beginning of the word. For example, vowel length only occurs in the first or second syllable of the word. This restriction is respected by pre-lengthening suffixes, which never lengthen a vowel of a syllable outside the first two, e.g. *ŋalga*[:]*l-ŋu* 'smoke-PURP', versus *baḍibay-ŋu* (**baḍiba*[:]*y-ŋu*) 'bone-PURP.' The first two syllables of the word also determine the style of rhythmic alternation which is copied by secondary stress feet in the remainder of the word, e.g. iambic [(*ma.gíil*).(*ŋay.gù*)] 'just branches', vs. trochaic [(*dúɾ.gin*).(*bì.gu*)] (place name), [(*búu.ɾa*).(*yày.gu*)] 'still in the water.' Finally, strict disyllabicity holds for specific morphological categories (verb stems, adjectival reduplicants).

The main theoretical question that arises is: what is the nature of this disyllabic domain? It cannot be identified as *morphological*, since the restrictions on vowel length and stress are independent of the length of stems and roots (which may freely exceed the disyllabic format). The disyllabic domain must therefore be *prosodic* in nature. Yet it cannot be identified as a strictly disyllabic *foot*, since monosyllabic heavy (H) feet occur. This leaves a strictly disyllabic *Prosodic*

[1] This option was proposed during the presentation of this paper at the HILP-2 conference.

Word as the single analytic possibility. But how to mark off the initial disyllabic portion of a PrWd word that exceeds two syllables?

In this paper I will argue that PrWd structure may be *self-embedding* (Inkelas 1989, McCarthy & Prince 1993a). In contrast to assumptions made in the literature, I will argue that recursive PrWd structure may arise without morphological nested structure, as in [[(*dúr.gin*)].(*bì.gu*)]. Briefly, such structures arise as a result of three constraints. Left PrWd edges coincide with the left stem edge because of ALIGN-WD. PrWds must be minimally disyllabic because of DISYLL, a constraint requiring that both edges of every PrWd align with edges of different syllables. Recursive PrWd bracketing is due to ALIGN-σ, a dominated constraint requiring every syllable to stand at the right edge of some PrWd.

The structure of this paper is as follows. § 2 summarizes the evidence for disyllabicity as a morphology-prosody alignment property on the basis of reduplication in Axininca (McCarthy & Prince 1993a). It extends this alignment theory to maximal disyllabicity (by ALIGN-σ), and generalises it to alignment between PrWd and syllable. § 3 presents the actual evidence for disyllabicity in Guugu Yimidhirr. This evidence includes stem size, distribution of vowel length, word stress, stem size requirements imposed by affix, and adjectical reduplication. § 4 goes into the complex phenomena of vowel lengthening and shortening in second syllables of stems, and how these phenomena are triggered by specific suffixes. § 5 addresses verbal reduplication, demonstrating that reduplicants behave as regular suffixes with respect to lengthening and shortening. Finally, § 6 presents conclusions.

2. Disyllabicity and the prosody-morphology interface

In recent literature quantity-sensitive languages have been identified in which specific morphemes are required to be minimally disyllabic, e.g. Japanese (loan abbreviations, Itô 1992; Itô & Mester 1992), Axininca Campa (reduplicants, McCarthy & Prince 1993a), Turkish (stems, Inkelas & Orgun 1994), and Mohawk (content words, Piggott 1995). Since prosody in each of these four languages is 'quantity-sensitive' by various criteria, their disyllabicity requirements cannot be reduced to a quantity-insensitive disyllabic *foot* (σσ).

An argument of this type has been made by McCarthy & Prince (1993a) for the interaction of epenthesis and reduplication in Axininca. Relevance of the bimoraic foot is evident from word stress, as well as from vowel epenthesis in subminimal stems (e.g. /*p*/ [pAA], *[pA], 'feed'). Bi-moraic epenthesis follows from FTBIN dominating FILL:

(2) **FILL**
Syllable positions must be filled by underlying segments.

The requirement of reduplicant disyllabicity is independent of FTBIN, as the data in (3) show. Polysyllabic roots undergo total reduplication, but prefixes are not reduplicated along (3a.ii). With monosyllabic roots a prefix is reduplicated together with the root if one is available (3b.ii), a form of morphological *augmentation* that is the source of evidence for the (minimal) disyllabicity requirement of the reduplicant. Finally, a monosyllabic stem without a prefix undergoes no epenthesis (3b.i), which shows that the disyllabicity requirement ranks lower than FILL:

(3)	a.i	kawosi-<u>kawosi</u>-waiTaki	'bathe'
	a.ii	noŋ-kawosi-<u>kawosi</u>-waiTaki	'bathe-I-FUT'
		(*noŋ-kawosi-<u>noŋkawosi</u>-..)	
	b.i	naa-<u>naa</u>-waiTaki	'chew'
		(*naaTA-<u>naaTA</u>-...)	
	b.ii	no-naa-<u>nonaa</u>-waiTaki	'chew-I-FUT'
		(*no-naa-<u>naa</u>-...)	

The fact that prefixes are not reduplicated along with polysyllabic stems (3a.ii) shows that R ≤ ROOT (4a) must dominate MAX (4b):

(4) a. **R ≤ ROOT**
The Reduplicant contains only the root.

b. **MAX**
R = B

On the other hand R ≤ ROOT must be dominated by a constraint DISYLL (6), which requires the reduplicant to be minimally disyllabic. Crucial evidence for this is the fact that prefixes are reduplicated along with monosyllabic roots (in violation of R≤ROOT). In its turn DISYLL is dominated by FILL because no reduplicant undergoes vowel epenthesis to satisfy DISYLL. Four individual constraint rankings in (5) can now be established:

(5) a. FtBin » Fill — pAA > pA
b. Fill » Disyll — naa-naa > naaTA-naaTA
c. Disyll » R≤Root — no-naa-nonaa > no-naa-naa
d. R≤Root » Max — noŋ-kawosi-kawosi > noŋ-kawosi-noŋkawosi

A simple ranking argument shows that Disyll cannot be reduced to FtBin: if so, it would have to be ranked both above and below Fill.

Then what is this requirement of minimal disyllabicity, if it cannot be reduced to foot size? McCarthy & Prince propose that it is due to a property of the prosody-morphology interface, and more specifically to the *alignment* of a morphological category (here: Reduplicant), with a prosodic category (here: syllable).

(6) **Disyll** (Align Version)[2]
The left and right edges of the Reduplicant must coincide, respectively, with the left and right edges of *different* syllables.

We may think of Disyll as making three independent assertions in (7) simultaneously:

(7) a. *Left-alignment* $[_{MCat} = [_{\sigma 1}$
b. *Right-alignment* $]_{MCat} =]_{\sigma 2}$
c. *Non-identity* $\sigma_1 \neq \sigma_2$

McCarthy & Prince (1993a: 138) observe that "Disyll cannot be identified with a standard template. Disyllabicity is not an absolute requirement of shape-invariance, like familiar templates, but only a lower bound, since trisyllabic reduplicants are impeccable. Thus it cannot be identified with the category *Foot*, which imposes both upper and lower bounds. Furthermore, a disyllabic quantity-*insensitive* foot would be required, yet this is incompatible with the thorough-going quantity-sensitivity of prosody in Axininca Campa." This argument is

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[2] Ultimately, Disyll is re-stated as a 'segregation' constraint (McCarthy & Prince 1993a: 169):

(i) **Rt-Sfx-Segregation**
A root and a suffix cannot be wholly integrated in a single syllable.

Although this formulation may be adequate for Axininca Campa reduplication, it no longer even captures minimal disyllabicity of single morphological domains (including Japanese and most of the cases to be discussed in § 6).

compelling, and as we will see below, it is directly relevant to Guugu Yimidhirr. Before we may conclude that disyllabicity is a property of the morphology-prosody interface, however, we must solve two problems.

First, DISYLL accounts for *minimal* disyllabicity only, and it fails to extend to *strict* or *maximal* disyllabicity. Maximal disyllabicity occurs in Arabic (where it is required of canonical nouns stems, McCarthy & Prince 1990) and in Sierra Miwok (verb stems, Freeland 1951). Strict disyllabicity, the requirement that the members of some morphological category equal precisely two syllables, is attested in Arabic (verb stems as well as truncated vocatives, McCarthy & Prince 1990), and Guugu Yimidhirr (verb stems, to be discussed in §3.3). See Kager (1994) for an overview of various kinds of disyllabicity requirements reported in the literature.

What strict and maximal disyllabicity have in common is their upper bound. This requires a prosody-morphology interface constraint that is functionally complementary to DISYLL, aligning edges of the syllable with edges of some MCat. For example:

(8) **ALIGN-σ**[3]
Align (σ, R, MCat, R)
("The right edge of every syllable must coincide with the right edge of some MCat.")

When undominated, this constraint has as its effect that every PrWd in the language is monosyllabic, as well a member of MCat. (Since every PrWd must contain syllables, and every syllable must be rightmost in a morphological category MCat.) This situation is indeed absurd, since all languages need a variety of different morphological categories for functional reasons that have nothing to do with their phonologies. (That is, a sensible language will have ALIGN-σ dominated by morphological faithfulness constraints.) But that is not where this story ends. A basic property of OT is that constraints may be *gradualy violated*, even if they cannot be fully satisfied due to some higher-ranking constraint. That is, the candidate is selected that minimally violates the constraint. Even if undominated morphological faithfulness constraints guarantee categorical diversity, ALIGN-σ may still exert its influence by imposing monosyllabicity upon all categories. This situa-

[3] Compare the double-edge alignment constraint ALIGN (FT,RT) proposed in Kager (1995b) which has the effect of imposing an upper bound of two *feet* on the root. ALIGN-σ will be extended below to alignment of syllable and *PrWd* edges.

tion occurs in isolating languages, such as Chinese, where non-verb categories are 'sensibly' allowed, but all categories are monosyllabic.

Even more interestingly, minimal violation of ALIGN-σ produces the disyllabic upper bound that we are looking for, when ALIGN-σ comes to be dominated by DISYLL. In this case the candidate will be selected that minimally violates ALIGN-σ. Here we see disyllabic MCat emerge from a simple constraint interaction DISYLL » ALIGN-σ.

A second aspect of disyllabicity that is not yet covered by McCarthy & Prince's view resides in *non-morphological* disyllabic domains. As I will argue at length below, Guugu Yimidhirr prosody makes repeated reference to a disyllabic prosodic domain: this cannot be equated with any morphological domain, neither root, stem, nor word. This evidence strongly suggests that DISYLL and ALIGN-σ may have counterparts that refer exclusively to PCats ('PrWd' and 'syllable'). With this theoretical background, let us now turn to Guugu Yimidhirr.

3. Recursive PrWd structure in Guugu Yimidhirr

The consonant inventory of Guugu Yimidhirr is presented below (after Haviland 1979: 36):

(9)

	Bilabial	Apico-alveolar	Apico-domal (retroflex)	Lamino-dental	Lamino-palatal	Dorso-velar
Plosives	b	d	ɖ	d̪	ɟ	g
Nasals	m	n	ɳ	n̪	ɲ	ŋ
Lateral		l				
Rhotics		ɾ	ɽ			
Semi-vowels	w				y	

As is usual in Australian languages, the consonant inventory is is very complex as compared to the simple vowel inventory /i, ii; a, aa; u, uu/, i.e. three vowels plus length. The syllable has an obligatory and non-complex onset. Codas must be non-branching too, and coda consonants do no contribute to syllable weight (as will become clear in § 3.2 on word stress). The minimal word is *bimoraic*, but monosyllabic bimoraic stems are in fact rare (8/731, or 1%):

(10) 4 nouns: *dii* 'tea' (loan), *miil* 'eye', *d̪uul* 'guts', *buuɾ* 'bird's nest'

4 particles: *n̪aa* 'that, there' (root /*n̪a*/), *yii* 'this, there' (root /*yi*/), *yuu* 'yes', *aa* (agreement)

This is actually the first diagnostic of quantity-sensitivity, and bimoraic feet (H), in Guugu Yimidhirr. More evidence for bimoraic (H) feet will be presented in § 3.2 on stress. Let us now look at the evidence for disyllabicity from vowel length.

3.1. The distribution of vowel length

One of the striking manifestations of disyllabicity in Guugu Yimidhirr resides in the restrictions which it imposes on vowel length. Without exceptions, long vowels must stand in either the first and/or second syllable of the stem:

(11) a. σ_1:

waad̪a	'crow'
waaɽigan	'moon'
guuɽumugu	'meat hawk'

b. σ_2:

dawaaɽ	'star'
gambuugu	'head'
d̪amaaɽbina	'magpie goose'

c. σ_{1+2}:

buuɾaay	'water'
daaɾaalŋan	'kangaroo'
ɟiiɽaayŋguɽ	'old man'

Statistics about the quantitative composition of polysyllabic stems are given in (12). Observe that initial and second syllable length freely vary, since all four combinations of {L, H} occur in these syllables:

(12)

Total 731	#LL 432	#LH 139	#HL 105	#HH 55
2σ 628	LL 363	LH 119	HL 97	HH 49
3σ 83	LLL 53	LHL 18	HLL 7	HHL 5
4σ 21	LLLL 16	LHLL 2	HLLL 1	HHLL 1

Compounds may have vowel length in the first two syllables of either word member, e.g. *gami=biiba* 'many' (literally 'grandfather-father'), *wuuɾuyu=ŋaad̪aaɾ=manaad̪i* 'curer=CAUS=REF+PAST, became a curer.' This also shows that noun reduplication involves PrWd compounding, e.g. *gaḏii-gaḏii* ‘very far away’ (/*gaḏii*/, lit. ‘far-far’), *dinda=dindaal-gu* ‘quickly’ (/*dindal*/ ‘quick-quick’).

The restriction of vowel length to the first pair of syllables of the stem is enforced in various ways. Significantly, it is respected under affixation, as suffixes never induce vowel length in any other syllable but the second of the stem (see § 4):

(13)	a.	/maŋal-nda/	ma.ŋa[:]l.nda	‘clay-ERG’
	b.	/wuluŋguɾ-nda/	wu.luŋ.guɾ.nda	‘lightning, flame-ERG’
			(* wu.luŋ.gu[:]ɾ.nda)	

Let us now identify the domain of vowel length (in fact, that of syllable *weight*). It cannot be *morphological*. If the stem (or the root) were the domain of weight, this would not explain why weight is restricted to the first two syllables of longer stems (and roots). It would be ad hoc to stipulate some internal morphological structure inside longer stems (or roots). This reveals an important point. Disyllabicity, as it is relevant to the distribution of vowel length in Guugu Yimidhirr, cannot be simply construed as the alignment of prosodic and morphological categories (as McCarthy & Prince 1993a propose) since there is no corresponding disyllabic *morphological* category with which syllable weight aligns.

It follows that the domain with which heavy syllables align (the first two syllables of every PrWd) must be *prosodic*. What can this domain be? For obvious reasons, the mora and the syllable are too small. When we assume the prosodic hierarchy μ–σ-Ft-PrWd, two possibilities[4] are still open: first, a quantity-insensitive *Foot* (14a); or second, a recursive *PrWd* (14b). Consider the two corresponding prosodic structures of a [HH] word, e.g. *búu.ɾáay* ‘water’:

(14) a. *Quantity-insensitive Foot*

```
  PrWd
   |
  Ftσσ
  /  \
 H    H
 buu.ɾaay
```

b. *Recursive PrWd*

```
  PrWd
   |
 PrWdσσ
  /  \
 Ft   Ft
 |    |
 H    H
 buu.ɾaay
```

4 I disregard a third alternative: to set up a new prosodic category (‘Prosodic Stem’, Itô 1992) between PrWd and Ft, and impose strict disyllabicity on it. In my opinion, there is no need for extending the prosodic hierarchy.

Suppose that the disyllabic foot were the domain of vowel length. Then this foot must be *quantity-insensitive* since all possible combinations of light and heavy syllables occur at the beginning of a PrWd: [LL], [LH], [HL], and [HH]. Such a foot would completely contradict the general quantity-sensitivity of Guugu Yimidhirr, which is obvious from the fact that all heavy syllables are stressed (cf. *búu.ɾáay*, see § 3.2), as well as the bimoraic word minimum (cf. *míil*). This leaves as the single option available a recursive PrWd structure (14b).

This immediately raises two questions. First, what forces a recursive PrWd structure in a long word that lacks corresponding morphological bracketing? Second, what causes the distributional restriction of heavy syllables to the innermost PrWd?

The answer to the first question involves alignment. PrWd structures of long words are all of the following kind:

(15) $[_{\text{PrWd}}\ [_{\text{PrWd}}\ \sigma\ \sigma\ ]\ \sigma\ ...]$

This recursive PrWd parsing may be analysed as follows. First, left PrWd edges stack up at the left edge of the stem (or: each left bracket of PrWd must be in absolute stem-initial position). This is achieved by undominated ALIGN-WD:

(16) **ALIGN-WD**
Align (PrWd, L, Stem, L)

("The left edge of every PrWd must coincide with the left edge of some Stem.")

Next, every PrWd is minimally disyllabic because of DISYLL (17), a slight variation on constraint (6):

(17) **DISYLL**
The left and right edges of the PrWd must coincide, respectively, with the left and right edges of *different* syllables.

Together these constraints render all PrWds left-aligned and minimally disyllabic, but there is still nothing that forces recursivity.

Recursivity is due to ALIGN-σ, which makes the surprisingly strong requirement that every syllable stands at the end of some PrWd:

(18) **ALIGN-σ**
Align (σ, R, PrWd, R)
(“The right edge of every syllable must coincide with the right edge of some PrWd.”)

Violations are counted by the distance (in syllables) between the right edge of every syllable and the right edge of the nearest PrWd.

These three constraints are ranked as in (19):

(19) ALIGN-WD, DISYLL » ALIGN-σ

This ranking has the desired effect that the innermost PrWd is strictly disyllabic, while additional syllables are organized into recursive PrWd structure. This is illustrated for a trisyllabic words in tableau (20). Note that for expository reasons, violations of ALIGN-σ have been indicated for each syllable individually:

(20) Input: /waaɽigan/	ALIGN-WD	DISYLL	ALIGN-σ σ_1	σ_2	σ_3
a. ☞ [[waa.ɽi].gan]			*		
b. [waa.ɽi.gan]			*	*!	
c. [[[waa].ɽi].gan]		*!			
d. [[waa].ɽi.gan]		*!		*	
e. [[waa].[ɽi.gan]]	*!	*		*	

Undominated ALIGN-WD and DISYLL rule out non-initial PrWds (20e) and monosyllabic PrWds (20c-e), respectively. Among the remaining candidates, the one is selected that has the fewest violations of ALIGN-σ: the candidate (20a), which has one fewer violation of ALIGN-σ than nonrecursive (20b). Next consider the tableau of a quadrisyllabic word:

(21) Input /guuɽumugu/	ALIGN-WD	DISYLL	ALIGN-σ σ_1	σ_2	σ_3	σ_4
a. ☞ [[[guu.ɽu].mu].gu]			*			
b. [[guu.ɽu].mu.gu]			*		*!	
c. [[guu.ɽu.mu].gu]			**!	*		
d. [guu.ɽu.mu.gu]			**!*	**	*	
e. [[[guu].ɽu].mu].gu]		*!				
f. [[guu.ɽu].[mu.gu]]	*!		*		*	

Candidate (21a) is selected, the one which has double-recursive PrWd structure. More generally, the ranking ALIGN-WD, DISYLL » ALIGN-σ produces a disyllabic PrWd at the beginning of the stem, followed by right PrWd edges after each following syllable. In § 3.2, I will refine this result in favor of the *single*-recursive candidate (21b), which better fits the rhythmic stress pattern.

Before we continue, it should be noted that DISYLL cannot be totally undominated, since it is violated by monosyllabic roots such as [*miil*] ‘eye’, which surface without epenthetic syllables. In Guugu Yimidhiir such violations are tolerated, and actually the language *never* enforces DISYLL by epenthesis. (In this respect it resembles Axininca, discussed in § 1, but differs from a language such as Mohawk.) In terms of constraints, this property can be captured by a ranking FILL » DISYLL.

We may now give a preliminary answer to the question why vowel length cannot occur outside the first two syllables of the stem. Having identified this domain as the innermost PrWd, we are presented with an adequate domain of vowel length, but it takes an analysis of stress (that I will develop in § 3.2 right below) to make the right connection. Tentatively, vowel length and recursive PrWd structure may be seen as related in the following way. First, long vowels create syllable weight, and heavy syllables must be main-stressed in Guugu Yimidhirr. Next, the innermost PrWd is the exclusive domain of main stress; from here on I will refer to this domain as the *Head-PrWd*[5]. These assumptions imply that heavy syllables, in order to be able to have main stress, must stand in the Head-PrWd, that is, in first or second position in the stem.

3.2. Word stress

Haviland (1979: 41-43) describes the Guugu Yimidhirr stress pattern as follows. First, in words that begin with two light syllables, or with a heavy-light sequence, the initial syllable has primary stress, while any remaining odd-numbered syllables have secondary stress (cf. 22a-b). Second, in words that begin with a light-heavy sequence, the second syllable has primary stress, while secondary stresses fall on remaining even-numbered syllables (cf. 22c). Third, in words that begin with a heavy-heavy sequence, both the first and second syllable have primary

[5] Perhaps the term ‘Prosodic Stem’ (Itô 1992) is more accurate, but Itô’s use is rather different.

stress, while remaining odd-numbered syllables have secondary stress (cf. 22d).

(22)	a. #**LL**	ná.mbal	‘stone-ABS’
		máɾ.bu.gàn	‘cave-ABS’
		dúɾ.gin.bì.gu	‘Indian Head (place name)’
		máɾ.bu.gàn.bi.gù	‘cave-LOC-EMPH (still in the cave)’
	b. #**HL**	gúu.gu	‘language-ABS’
		búu.ɾa.yày	‘water-LOC (in the water)’
		búu.ɾa.yày.gu	‘water-LOC-EMPH (still in the water)’
		d̪áa.ba.ŋàl.ŋa.là	‘ask-RED-IMP (keep asking!)’
	c. #**LH**	ma.gíil	‘branch-ABS’
		na.mbáal.ŋan̪	‘stone-ABL (from the stone)’
		ma.gíil.ŋay.gù	‘branch-PL-EMPH (just branches)’
	d. #**HH**	búu.ɾáay	‘water-ABS’
		búu.ɾáay.bì.gu	‘water-LOC-EMPH(still in the water)’

The iambic pattern (22c) and the ‘double-stress’ pattern (22d) highlight quantity-sensitivity of the stress system: heavy syllables attract primary stress. This precludes a *quantity-insensitive* disyllabic foot, particularly since this fails on the double-stressed disyllabic sequence (22d). Such a pattern could, in principle at least, be due to a *double-headed* foot, but that would set up an otherwise unmotivated weakening of the ‘unique-headedness’ principle of foot theory (Hayes 1995; but see Bye 1996 for a different view). Instead I will assume that such sequences are parsed as two consecutive monosyllabic heavy feet, viz. $[(H)\ (H)]_{PrWd}$.

To guarantee that heavy syllables have primary stress, I propose a slight variant of the Weight-to-Stress-Principle (Prince 1992; Prince & Smolensky 1993) in (23a). Primary stressed syllables must stand in the innermost (Head)-PrWd due to undominated HDWD (23b):

(23) a. **WSP**
Heavy syllables have maximal prominence.

b. **HDWD**
The head of PrWd is the innermost PrWd.

The next challenge is how to account for the puzzling secondary stress pattern. Resumption of secondary stress after a heavy syllable in the context ...HLL... follows one of two modes. One is the alternating stress pattern ...**H**L**L**..., which occurs in words beginning with #HL and #LH (cf. 24b-c). The other mode is a 'clashing' pattern ...**HL**L..., which occurs in words beginning with #HH (24d). Hence, in order to predict the resumption mode, one needs information on what *precedes* the heavy syllable. This is highly problematic for a localistic theory of iterative stress assignment, because the preceding context is not strictly adjacent to the locus of foot assignment (Kager 1993a).

Nevertheless, it is possible to predict the resumption mode on the basis of the disyllabic Head-PrWd. Intuitively, the relative prominence of the first two syllables of the word is echoed in the rhythmic pattern (iambic or trochaic) of the rest of the word. The relative prominence of the first two syllables is clearly quantity-based: strong-weak (trochaic) in words beginning with #[**L**L] or #[**H**L], and weak-strong (iambic) in words beginning with #[L**H**]. Judged from the resumption of secondary stress (cf. 24c), the double-stressed #[**HH**] sequence counts as trochaic, an observation to which I will return immediately below.

(24)	a.	[(**L**L)]	[[(dúɾ.gin)].(bì.gu)]	(*trochaic*)
	b.	[(**H**L)]	[[(búu.ɾa)].(yày.gu)]	(*trochaic*)
	c.	[(**H**)(**H**)]	[[(búu).(ɾáay)].(bì.gu)]	(*trochaic*)
	d.	[(L**H**)]	[[(ma.gíil)].(ŋay.gù)]	(*iambic*)

In a slightly more formal way, this generalization may be stated as follows: The headedness of secondary stress feet (trochaic or iambic) *harmonizes* with that of the Head-PrWd[6]. The constraint that predicts type of secondary stress foot is stated as HARMONY (26a).

For (**H**L) and (L**H**), foot headedness follows directly from the WSP, which selects trochaic and iambic feet, respectively. In the case of (**L**L) the choice of a trochee reflects the default status of the trochee for a quantitatively balanced sequence (Prince 1992; Hayes 1995). Finally, the sequence [(**H**)(**H**)], double-stressed by WSP, is counted as trochaic as well. Again this is expected, since it forms a quantitatively balanced sequence. This trochaic default is expressed as RHTYPE=T (26d).

A second aspect of the rhythmic pattern deserves special attention. This is the fact that final secondary stresses are possible that apparently fail to correspond to binary feet, cf. (*máɾ.bu*).(*gàn.bi*).(*gù*) 'still

[6] Kager (1993a) analyses this pattern by strictly disyllabic feet whose internal prominence is due to WSP (which may result in a double-stressed [HH] foot). Default prominence is trochaic. As I mentioned earlier, the major theoretical disadvantage of this analysis is its use of double-headed feet, and the consequent weakening of foot typology.

in the cave.' Kiparsky (1991) and Kager (1995a) propose that such unary feet reflect the presence of a 'silent' syllable at the end of the word, which helps the final syllable to form a binary foot. This proposal is known as *catalexis*. Catalexis is due to the interaction of undominated FtBin and Parse-σ (26b) with Align-R (26c), which requires the lexical word to be absolutely final in PrWd. Priority is given to exhaustive parsing of syllables into feet over avoidance of segmentally void syllables. Hence, words that have odd numbers of syllables require catalexis in order to be fully parsable into binary feet. The structures in (25) present output metrical parsings of the words of (24). Square brackets indicate PrWd edges, while feet are indicated in the bracketed grid notation:

```
(25)  a.   (*          .    )            b.   (*          .         .  )
           (*     .)  (*   .)                 (*    .)  (*    .) (*  .)
          [[dúɾ.gin].bì.gu]                [[[d̪áa.ba].ŋàl.ŋa].là σ]

      c.   (      *         .)           d.   (*     *       .   )
           ( .    *)  (.    *)                  (*)  (*)    (*  .)
          [[ma.gíil].ŋay.gù]                  [[búu.ɾáay].bì.gu]
```

The combined forces of undominated Disyll and Parse-σ predict that an initial #HL sequence will be parsed as an unbalanced trochee (25b), thereby violating RhHrm (26e) (Prince & Smolensky 1993: 59)[7].

An overview of constraints that are relevant to stress is given below:

(26) a. **Harmony**[8] Feet have identical headedness within PrWd.
b. **Parse-σ** Syllables are parsed into feet.
c. **Align-R** Align (LexWd, R, PrWd, R)
d. **RhType=T** Feet are trochaic.
e. **RhHrm** *(HL)

The ranking of these constraints with respect to those introduced earlier (FtBin, Align-Wd, Disyll, Align- σ) is as follows:

(27) FtBin, Align-Wd, Disyll, WSP, HdWd, Harmony, Parse-σ » Align-σ » Align-R » RhType=T, RhHrm

---

[7] Arguments for the unbalanced trochee on the basis of the structure of roots in Kambera are given by Van der Hulst & Klamer (this volume).

[8] McCarthy & Prince (1986) propose a similar foot harmony principle to account for Yidiɲ stress.

In (28) I summarise evidence for rankings of individual constraints:

(28)
a. FTBIN » ALIGN-σ
[[(dúɾ.gin)].(bì.gu)] > [[(dúɾ.gin)].(bì)].(gù)]

b. HARMONY » RHTYPE=T
[[(ma.gíil)].(ŋay.gù)] > [[(ma.gíil)].(ŋày.gu)]

c. DISYLL » ALIGN-σ, ALIGN-R
[[(búu.ɾa)].(yày.σ)] > [(búu)].(ɾà.yay)]

d. PARSE-σ » ALIGN-σ
[[(dúɾ.gin)].(bì.gu)] > [[[(dúɾ.gin)].bi].gu]

e. PARSE-σ » ALIGN-R
[[(máɾ.bu)].(gàn.σ)] > [[(máɾ.bu)].gan]

f. PARSE-σ » RHTYPE=T
[[(ma.gíil)].(ŋay.gù)] > [[ma.(gíil)].(ŋày.gu)]

g. ALIGN-R » RHHRM
[(gúu.gu)] > [(gúu).(gù.σ)]

h. ALIGN-σ » RHHRM
[(gúu.gu)] > [(gúu).(gù.σ)]

i. ALIGN-σ » ALIGN-R
[[(búu.ɾa)].(yày.σ)] > [(búu).(ɾà.yay)]

Next consider tableaux of #LL cases. To save space in the tableaux, some undominated constraints have been omitted:

(29) Input: /maɾbugan/	FT-BIN	HAR-MONY	PARSE-σ	ALIGN-σ	ALIGN-R	R-TYPE=T
a. ☞ [[(máɾ.bu)].(gàn.σ)]				**	*	
b. [[(maɾ.bú)].(gan.ˌσ)]				**	*	*!*
c. [[(máɾ.bu)].gan]			*!	*		
d. [(máɾ.bu).gan]			*!	***		
e. [[(maɾ.bú)].(gàn.σ)]		*!		**	*	*
f. [[(máɾ.bu)].(gàn)]	*!			*		

(30) Input /duɾginbigu/	FT-BIN	HAR-MONY	PARSE-σ	ALIGN-σ	ALIGN-R	R-TYPE=T
a. ☞ [[(dúɾ.gin)].(bì.gu)]				**		
b. [[(duɾ.gín)].(bi.gù)]				**		*!*
c. [[[(dúɾ.gin)].bi].gu]			*!*	*		
d. [[(dúɾ.gin)].(bi.gù)]		*!		**		

f. [[[(dúɾ.gin)].(bì)].(gù.σ)]	*!			**	*	
g. [[[(dúɾ.gin)].(bì)].(gù)]	*!*			*		

In (31-33) I present tableaux of #HL cases. The initial heavy syllable is not parsed as a (H) foot because of undominated DISYLL (31d-32d-33d) or PARSE-σ (31c-32c-33c), or because of ALIGN-σ (31b-32b-33b).

(31) Input: /guugu/	FT-BIN	DI-SYLL	PARSE-σ	ALIGN-σ	ALIGN-R	R-TYPE=T
a. ☞ [(gúu.gu)]				*		
b. [(gúu).(gù.σ)]				**!*	*	
c. [(gúu).gu]			*!	*		
d. [[(gúu)].(gù.σ)]		*!		*	*	
e. [(gúu).(gù)]	*!			*		

(32) Input: /buuɾayay/	FT-BIN	DI-SYLL	PARSE-σ	ALIGN-σ	ALIGN-R	R-TYPE=T
a. ☞ [(búu.ɾa)].(yày.σ)]				**	*	
b. [(búu).(ɾà.yay)]				***!		
c. [(búu).ɾa].yay]			*!*	*		
d. [[(búu)].(ɾà.yay)]		*!		*		
e. [[(búu.ɾa)].(yày)]	*!			*		

Observe that (32a) has one fewer violation of ALIGN-σ than (32b), since violations of this constraint are counted by adding up the distances of all individual syllables from the nearest right edge of a PrWd.

(33) Input:/buuɾayaygu/	FT-BIN	DI-SYLL	PARSE-σ	ALIGN-σ	ALIGN-R	R-TYPE=T
a. ☞ [(búu.ɾa)].(yày.gu)]				**		
b. [[(búu).(ɾà.yay)].(gù.σ)]				***!*	*	
c. [(búu).ɾa].(yày.gu)]			*!	**		
d.[[[(búu)].(ɾà.yay)].(gù.σ)]		*!		**	*	
e. [(búu).(ɾà)].(yày.gu)]	*!			**		

In the tableaux (34-35) of #LH cases the initial iamb is due to WSP, while iambic rhythm is due to HARMONY. The rightmost full syllable in candidate (34a) forms an iamb together with the catalectic syllable, but it remains unstressed because it is in the weak position of the foot.

(34) Input:/nambaalŋaṉ/	WSP	HAR-MONY	PARSE-σ	ALIGN-σ	ALIGN-R	R-TYPE=T
a. ☞ [[(na.mbáal)].(ŋaṉ.ˌσ)]				**	*	**
b. [[(na.mbáal)].ŋaṉ]			*!	*		*
c. [[(na.mbáal)].(ŋàṉ.σ)]		*!		**	*	*
d. [[(ná.mbaal)].(ŋàṉ.σ)]	*!			**	*	

(35)Input:/magiilŋaygu/	WSP	HAR-MONY	PARSE-σ	ALIGN-σ	ALIGN-R	R-TYPE=T
a. ☞ [[(ma.gíil)].(ŋay.gù)]				**		**
b. [[[(ma.gíil)].ŋay].gu]			*!*	*		*
c. [[(ma.gíil)].(ŋày.gu)]		*!		**		*
d. [[(má.giil)].(ŋày.gu)]	*!			**		

Finally consider a tableau of a #HH case[9]. Both heavy syllables are main stressed [H] because of undominated WSP. Since monosyllabic feet have no (iambic or trochaic) headedness, HARMONY does not enter the evaluation, and secondary stress feet are trochaic (RHTYPE=T):

(36)Input:/buuɾaaybigu/	WSP	HAR-MONY	PARSE-σ	ALIGN-σ	ALIGN-R	R-TYPE=T
a.☞ [[[(búu)(ɾáay)].(bì.gu)]				**		
b. [[[(búu)(ɾáay)].(bi.gù)]				**		*!
c.[[[(búu)(ɾáay)].bi].(gù.σ)]			*!	**	*	
d. [[(búu.ɾaay)].(bì.gu)]	*!			**		
e. [[(búu).(ɾàay)].(bì.gu)]	*!			**		

We are now ready to derive the afore-mentioned restriction that long vowels do not occur outside the first two syllables of PrWd. I assume that vowel length in positions outside Hd-PrWd is subject to deletion, in the sense of *mora loss*. More formally, PARSE-μ[10] ranks below the constraints governing the distribution of weight, i.e. WSP and HDWD.

As (37) shows, we may actually rank PARSE-μ with respect to three more constraints, ALIGN-σ, RHTYPE=T and RHHRM. I use the notation

[9] Unfortunately, Haviland (1979) does not exemplify the stress pattern of words of the type HHL. My analysis predicts [[(ˈH)(ˈH)] (ˌL σ)], with a secondary stress on the *third* syllable.

[10] Unfortunately, no alternations illustrate the neutralization of vowel length outside the Head-PrWd. This is due to the fact that Guugu Yimidhirr is an exclusively suffixing language. Loss of length could occur only in case a long stem vowel were 'pushed' outside the initial disyllabic window by a prefix, and consequently were shortened .

H^{-} to indicate a heavy syllable of which a mora remains unparsed in the output (a convention introduced by Prince & Smolensky 1993):

(37)	a.	Align-σ » Parse-μ	[[(**L**L)] (**L**H^{-})]	>	[(**L**L) (L**H**)]
	b.	Parse-μ » RhType=T	[[(L**H**)] (LL)]	>	[[(**L**H^{-})] (**L**L)]
	c.	Parse-μ » RhHrm	[[(**H**L)]	>	[(**H**$^{-}$L)]

3.3. Morpheme-specific disyllabicity

In three contexts, Guugu Yimidhirr morphemes are strictly disyllabic, i.e. *non-recursive* PrWds. These contexts are: *verb stems* (since monosyllabic roots are always augmented), *adjectival reduplicants*, *bases of certain inflectional suffixes* (longer and shorter bases take allomorphs of these suffixes). Of course, the lower bound is due to Disyll. The question naturally arises what causes the upper bound (i.e. 'two and no more than two') in these contexts[11]. I will argue below that the upper bound reflects right-edge alignment of PrWd with MCat, which may be enforced by various factors.

I first consider verb stems. Most (203/215 or 94.4%) are disyllabic by virtue of a disyllabic root, while all nine monosyllabic roots are obligatorily augmented up to the size of a disyllabic stem[12]. Disyllabic verb roots are distributed over three conjugations, named after their (typical though not uniform) final segment in the Nonpast tense stem form. These are the *L*-conjugation (marked by /-*l*/), the *R*-conjugation (marked by /-ɾ/), and the *V*-conjugation (marked by a stem-final long vowel). Examples of Nonpast stems are:

(38)		*L-conjugation*	*R-conjugation*	*V-conjugation*
	LL	gunda-l 'hit'	ŋalbu-ɾ 'shut'	---
	HL	baada-l 'try'	gaama-ɾ 'vomit'	---
	LH	---	gayii-l 'hook'	d̪ada-a 'go'
	HH	---	miidaa-ɾ 'lift'	baaɾŋa-a 'yell'

[11] Similar observations are made by McCarthy & Prince (1994: 18) on reduplication in Diyari and other languages. They argue that the *prosodically unmarked* structures assert themselves whenever faithfulness constraints need not be respected (as is the case in stem reduplicants, which unlike stems, need not respect Parse and Fill). As I will show later, such an account explains the strict disyllabicity of adjectival reduplicants, and apparently selection of disyllabic bases by suffix allomorphs as well. However, it fails to generalize to verb stem disyllabicity, since verbs stems are subject to faithfulness to the input.

[12] Only three (1.5%) verb roots are longer than disyllabic. Haviland (1979: 82) argues that both of the quadrisyllabic roots are best viewed as (semantically opaque) compounds.

The more interesting cases are nine monosyllabic verb roots, which are distributed over three irregular conjugations, 3 in the MA conjugation, 3 in the NA conjugation (one of which is a verbalizing formative), and 3 in the monosyllabic L conjugation (all members of which are actually verbalizing formatives). All monosyllabic verb roots are *augmented to meet disyllabicity*, and maintain the augment under further suffixation, as well as reduplication. For example, while the Purposive of disyllabic roots is based on the root, corresponding forms of monosyllabic roots are based on the augmented (disyllabic) Past or Nonpast stem.

(39)

	Conj	*Root*	*Nonpast*	*Past*	*Purposive*	*Gloss*
	L	/gunda-/	gunda-l	gunda-y	gunda-n̪u	‘hit’
	MA	/n̪aa-/	n̪aa-maa	n̪aa-d̪i	n̪aa-d̪i-n̪u	‘see’
	NA	/wu-/	wu-naa	wu-nay	wu-na-n̪u	‘lie’
	L	/=ma-/	=ma-l	=ma-d̪i	=ma-d̪i-n̪u	INC

Stem disyllabicity is respected by the derivational morphology, which never produces derived stems that are longer than two syllables (except under reduplication, which will be addressed in § 5). Specific derivational suffixes are added by compounding to a so-called *derived stem form*, which is formed by adding *-:l*, *-:y*, or *-:ɾ*. The second type of derived stem, the *reflexive stem form*, is formed by stem vowel lengthening, and it functions as the basis of inflectional suffixes, e.g.:

(40)

	Conjugation	L	R	NA
	Root	gunda-	ŋalbu-	n̪aa-
	Refl. stem	gunda-:	ŋalbu-:ɾ	n̪aa-d̪a-:
	PAST	gunda-:d̪i	ŋalbu-:ɾ=ŋaɾa-:d̪i	n̪aa-d̪a-:d̪i
	NONPAST	gunda-:ya	ŋalbu-:ɾ=ŋaɾa-:ya	n̪aa-d̪a-:ya
	IMP	gunda-:yi	ŋalbu-:ɾ=ŋaɾa-:yi	n̪aa-d̪a-:yi

How can we interpret the strict disyllabicity of verb stems in terms of constraints? As I noted earlier, a verb stem equals a non-recursive PrWd (a ‘Head-PrWd’). Every PrWd is minimally disyllabic because of DISYLL, while maximally two syllables may occur in a Head-PrWd because of ALIGN-σ. The anti-recursivity effect is due to ALIGN-VERB:

(41) **ALIGN-VERB**
Align (PrWd, Right, Verb Stem, Right)

This constraint makes the assertion that *every PrWd must stand final in a verb stem*. Consequently no PrWd edges may occur inside the verb stem. The only structure satisfying this requirement is a nonrecursive PrWd that is right-aligned with verb stem, i.e. disyllabic verb stem.

Although there is no direct evidence from alternations, I assume that (hypothetical) trisyllabic or longer verb roots are actually truncated into the disyllabic PrWd format. This can be modelled as the domination of faithfulness (crucially PARSE) by ALIGN-VERB:

(42) DISYLL, ALIGN-VERB » ALIGN-σ » PARSE

Consequently trisyllabic (or longer) verb roots could never surface in their input form. (As a result of *lexicon optimization*, such roots may be safely assumed not to occur as underlying forms either. See Prince & Smolensky 1993: 51 for a general form of the argument.)

On the minimal side, I argued earlier that monosyllabic stems fail to undergo epenthesis due to a ranking FILL » DISYLL. But in verb roots, DISYLL is enforced by obligatory morphological *augmentation*, with a suffix as an augment (cf. 39). Note that augmentation is no violation of FILL, since 'genuine' morphemes are used[13].

What about nonverbal stems? If undominated, ALIGN-VERB would incorrectly deny MCats other than verb stems (e.g. nouns) the option of having PrWd structure at all. Since this is obviously not the case, there must an undominated constraint to guarantee that any MCat is a PrWd:

(43) **LX ≈ PR**
A member of the morphological category MCat corresponds to a PrWd.

Let us now turn to adjectival reduplication. This process, indicating intensity or repetition, copies the first two syllables of the base (i.e. a string $C_1v_1C_2v_2$), regardless of their quantity (cf. 44c):

[13] To rule out augmentation of longer roots I assume, a 'minimal effort' constraint STEM ≤ ROOT, requiring that a Stem equals a Root (and nothing more). This must be dominated by DISYLL, and also by PARSE-M-FEAT: "Overtly expres morphosyntactic features by affix", since feature-bearing (non-augmentation) suffixes are freely allowed on stems of any length.

(44) a. yimiḏiɾ ‘this way’ yimi=yimiḏiɾ ‘this same way again’
b. gal(a)bay ‘long’ gala=galbay ‘very far away’
c. gaḏii ‘far away’ gaḏii=gaḏii ‘very far away’
d. dindal ‘quick’ dinda=dindaal-gu ‘quickly’

As Haviland (1979: 62) points out, the pattern of vowel lengthening of *dinda=dindaal-gu*, with length on its *fourth* syllable, unambiguously shows that adjectival reduplication produces a double PrWd structure, i.e. a *compound*. (Pre-suffixal lengthening itself is a completely regular process, to be discussed in §4.) Since both the reduplicant and the base form PrWds on their own, strict disyllabicity of the reduplicant cannot be explained in terms of anti-recursivity (as seen earlier in verb stems). Instead compound PrWd status of the construction follows from:

(45) **ADJ$_{RED}$= STEM**
The Adjectival Reduplicant is a stem.

McCarthy & Prince (1994), in their analysis of Diyari reduplication, point out the theoretical relevance of the strict PrWd size of reduplicant morphemes. The reduplicant is not subject to faithfulness (in particular to PARSE); therefore its size approximates the prosodically ideal PrWd, a single foot (this is perfectly aligned, and satisfies exhaustive parsing). This situation they refer to as an ‘emergence of the unmarked.’

Similarly, any adjectival reduplicant in Guugu Yimidhirr that would exceed three syllables would violate high-ranking constraints, PARSE-σ and/or ALIGN-R[14]. (Both are ranked above MAX.)

(46) /yimi-ḏiɾ, RED/	ADJ$_{RED}$ =STEM	FT-BIN	PARSE -σ	ALIGN -R	MAX
a. ☞ [(yí.mi)]=[[(yí.mi)]-(ḏìɾ.σ)]				*	ḏiɾ
b. [[(yí.mi)]-(ḏìɾ.σ)]=[[(yí.mi)]-(ḏìɾ.σ)]				**!	
c. [[(yí.mi)]-ḏiɾ]=[[(yí.mi)]-(ḏìɾ.σ)]			*!	*	
d. [(yí)]=[[(yí.mi)]-(ḏìɾ.σ)]		*!		*	miḏiɾ
e. yi=[[(yí.mi)]-(ḏìɾ.σ)]	*!		*	*	miḏiɾ

[14] Note that NOCODA » MAX because *dinda=dindaal-gu* > *dindaal=dindaal-gu*. Lengthening of the second stem syllable is induced by suffix *-gu*, and will be discussed in § 4. The fact that *dinda=dindaal-gu* has no vowel length in the reduplicant (**dindaa=dindaal-gu*) follows from another constraint discussed below.

The third case of morpheme-governed disyllabicity is that of certain inflectional suffixes that select strictly disyllabic stems as their base. An example is the (pre-lengthening) ergative allomorph *-n̪*. (Ergative allomorphs found on longer stems stems are *-ndu* and *-ŋun*.)

(47)	a.	/yugu/	yugu(:)-n̪	'wood-ERG'
	b.	/muuni/	muuni(:)-n̪	'stickiness-ERG'
	c.	/balinga/	balinga-ŋun *balinga(:)-n̪	'porcupine-ERG'
	d.	/waarigan/	waarigan-ndu *waari(:)-n̪-gan	'moon-ERG'

Subcategorisation of disyllabic stems by the affix /-*n̪*/ may be analyzed by the constraints of (48a-c), after McCarthy & Prince (1993a), ranked as in (48d)[15]:

(48) a. **AFX-TO-PRWD**
Base of ERG -*:n̪* is PrWd.

b. **RIGHTMOST**
Suffix is located at the right edge of word.

c. **M-PARSE**
Morphemes are parsed into morphological constituents.

d. AFX-TO-PRWD, RIGHTMOST, ALIGN-σ » M-PARSE

The ranking (48d) expresses that it is preferrable for an ergative form to remain 'unrealized' in the output (the 'null-parse' 49c-49b, violating M-PARSE), than to adjoin the ergative -*n̪* affix to a base that is smaller than a PrWd (and thus violate AFX-TO-PRWD):

(49) /balinga, -n̪/	AFX-TO-PRWD	ALIGN-σ	M-PARSE
a. [[ba.lin].ga-n̪]	*!		
b. [ba.lin.ga-n̪]		*!	
c. ☞ /balinga, -n̪/			*

Relevance of RIGHTMOST » M-PARSE becomes clear when we consider the fact that AFX-TO-PRWD cannot be satisfied in Guugu Yimidhirr by infixation into a longer stem (cf. 47d, 50a):

---

[15] Compare the analysis of Dyirbal allomorphy in McCarthy & Prince (1993a: 110-113).

(50) /waarigan, -n̪/	AFX-TO-PRWD	RIGHTMOST	M-PARSE
a. [[waa.ri-n̪]].gan]		*!	
b. ☞ /waarigan, -n̪/			*

In sum, I have shown that strict disyllabicity of specific morphemes has various sources: morpheme-specific alignment (ALIGN-VERB, AFX-TO-PRWD), or a morpheme-specific size requirement (ADJ_{RED}= STEM). In each case constraints aim at an output in which a specific morpheme is right-aligned with Head-PrWd (which produces the disyllabic 'upper bound'), while minimal disyllabicity follows from DISYLL.

4. Suffixal lengthening and shortening

Guugu Yimidhirr possesses three kinds of suffix, *regular, lengthening*, and *shortening*, which are distinguished by their effect on the length of the vowel in the second syllable of the stem to which they attach. As I observed in § 3.1, no suffix affects the length of any vowel other than that of the *second* syllable. This I explained as a combined effect of two undominated constraints, viz. WSP ("Heavy syllables are main-stressed"), and HDWD ("The head of PrWd is the innermost PrWd"). Let us now look into the three kinds of suffixes.

A *regular* (or 'R') suffix, such as *-ŋun* (51a), lengthens a stem vowel if this is followed by a liquid or a glide (i.e., any licit coda consonant, except a nasal). Next, a *lengthening* (or 'L') suffix, such as *-:ŋu* (51b), behaves in every respect as an R-suffix, but in addition it lengthens a stem-final vowel (cf. 51b.ii). Finally, a *shortening* (or 'S') suffix, such as *-in̪* (51c), shortens a vowel if this is followed by a stem consonant.

(51) a. *R-suffix* /-ŋun/
- i. /buɲɟul/ buɲɟuul-ŋun 'frill lizard-ERG'
- ii. /mayi/ mayi-ŋun 'food-ERG'
- iii. /ŋalan/ ŋalan-ŋun 'sun-ERG'

b. *L-suffix* /-:ŋu/
- i. /ŋalgal/ ŋalgaal-ŋu 'smoke-PURP'
- ii. /mayi/ mayii-ŋu 'food-PURP'
- iii. /bayan/ bayan-ŋu 'house-PURP'

c. *S-suffix* /-$in̪/
- /gabiiɾ/ gabiɾ-in̪ 'girl-ERG'

Membership of suffix category (*R*, *L*, *S*) is partly predictable. First, all and only vowel-initial suffixes are shortening. Second, -CCv suffixes of which the first consonant is an oral consonant (a liquid or a glide), are all lengthening, e.g. *-:ygu*, /*bama*/, *bamaa-ygu* ‘Aboriginal person-EMPH.’ All remaining suffixes are either regular or lengthening, but this is unpredictable. I will argue below that a lexical marking underlies the distinction, with L-suffixes lexically represented with a free mora that associates to an immediately preceding stem vowel.

The fact that CV-skeletons are relevant points to a familiar type of sensitivity to syllable structure. Note that vowel-initial suffixes produce open stem syllables, and *shorten* their vowels that stand at the end of the Head-PrWd (52b). This strikingly matches the fact that R-suffixes *fail to lengthen* stem-final vowels in open syllables in the very same context (52c). We thus find a counterpart of ‘open syllable shortening’, in the form of ‘closed syllable lengthening’, applying to every second stem syllable that is not closed by a nasal (52a):

(52)	a.i	/buɲɟul-ŋun/	[[bu.^{ɲ}ɟuul].-ŋun]	>	[[bu.^{ɲ}ɟul].-ŋun]
	a.ii	/bama-ygu/	[[ba.maa-y].gu]	>	[[ba.ma-y].gu]
	b.	/gabiiɾ-in̪/	[[ga.bi].ɾ-in̪]	>	[[ga.bii].ɾ-in̪]
	c.	/mayi-ŋun/	[[ma.yi].-ŋun]	>	[[ma.yii].-ŋun]

In three sub-sections below I will argue that pre-suffixal lengthening and shortening are due to a pair of constraints that both refer to right edges of PrWd. The first of these, ALIGN-H, aligns the right edge of PrWd with a heavy syllable.

(53) **ALIGN-H**

Align (PrWd, R, $\sigma_{\mu\mu}$, R)

(“The right edge of every PrWd must coincide with the right edge of some heavy syllable.”)

Heaviness of PrWd-final syllables automatically attracts stress because of undominated WSP. Moreover, no syllable may be lengthened that is outside the innermost PrWd, because of undominated HDWD. Finally, a lengthened (L**H**) output of /LL/ violates both RHTYPE=T and FILL-μ, and hence these constraints must be dominated by ALIGN-H.

These interactions are summarized by the partial ranking in (54):

(54) WSP, HDWD » ALIGN-H » RHTYPE=T, FILL-μ

Dominating ALIGN-H must be some constraint that induces shortening, as well as the puzzling non-lengthening of open syllables in PrWd-final position (52b-c). This constraint can be identified as FREE-V (Prince & Smolensky 1993: 101)[16]:

(55) **FREE-V**
PrWd-final vocalic segments must not be associated.

I deviate from Prince & Smolensky (1993) in interpreting FREE-V not as an 'anti-parsing' constraint that refers to inputs vowels ("PrWd-final vowels must not be parsed."), but rather as a constraint minimizing the moraic material to which a PrWd-final vocalic segment is associated. This interpretation is motivated by two types of evidence. First, FREE-V may be gradually satisfied by long vowel *shortening* (rather than full deletion) in contexts where full deletion is ruled out by top-ranking syllabification constraints. (Vowel shortening due to FREE-V is alluded to by Prince & Smolensky 1993: 101, who remark that "It appears to be the morphologized reflex of the prosodic weakness of final open syllables, which are liable to de-stressing, devoicing, shortening, truncation, and so on, under purely phonological conditions.")

Even though FREE-V is best satisfied by leaving unparsed both input moras of a long input vowel (i.e. a full vowel-deletion, as in 56c), it is satisfied *gradually* by leaving unparsed one of two input moras (i.e. a vowel-shortening, as in 56b):

(56) a. σ b. σ c.
/ \ /
μ μ μ <μ> <μ μ>
\ / \
a a a

(*input*) (*V-shortening*) (*V-deletion*)

In Guugu Yimidhirr vowels in open second syllables of longer words are shortened, but no vowel, neither long nor short, is ever deleted. We therefore conclude that FREE-V respects an undominated faithfulness constraint PARSE-VOWEL ('vocalic segments must be parsed').

Second, the revised interpretation of FREE-V allows a generalisation of the shortening effects of FREE-V that I just mentioned, to include

[16] Prince & Smolensky add "in the nominative", a specific requirement relevant to Lardil only.

the case of PrWd-final *non-lengthening*. Hayes (1995) has observed that PrWd-final vowels are frequently exempt from lengthening rules that affect metrically strong open syllables (e.g. 'iambic lengthening'). The mora association view of FREE-V covers the non-lengthening of PrWd-final vowels (cf. 52c).

This preliminary analysis still fails to answer a number of questions. First, why do nasal codas inhibit vowel lengthening? Second, why may lengthening suffixes create long open syllables, contra FREE-V? Third, why are long stem vowels shortened only if a consonant follows within the stem, as in /*gabiiɾ-in̪*/ *gabiɾ-in̪* versus *gudaa-ŋun* 'dog-PURP'? (The latter type of example has not been duiscussed yet.) Answering these questions requires a more detailed discussion of the three suffix types.

4.1. Regular suffixes

As we saw earlier, *regular suffixes* lengthen a vowel if it is followed in the stem by an oral consonant, i.e. liquid or glide /l, ɽ, ɾ, y/. Examples of R-suffixes are ERG *-ŋun*, DAT *-bi*/*-wi*, and ERG *-nda*.

(57) *R-suffixes: Lengthening effects*

a.	/buɲɟul/	buɲɟu[:]l-ŋun	'frill lizard-ERG'
b.	/d̪amal/	d̪ama[:]l-bi	'foot-DAT'
c.	/maŋal/	maŋa[:]l-nda	'hand-ERG'

Observe that -CCV suffixes beginning with an oral consonant lengthen a stem vowel in precisely the same context, i.e. when it stands in a syllable that is closed by a liquid or a glide. The only difference is that now the closing consonant is provided by the suffix, rather than by the stem. Examples of -CCV suffixes that behave like this are EMPH *-:ygu*, LOC *-:lŋguɽ*, PAST+NEG *-:lmugu*, and PERF *-:yga*:

(58)	a.	/bama/	bama[:]-ygu	'Aboriginal person-EMPH'
	b.	/guŋga/	guŋga[:]-lŋguɽ	'North-LOC'
	c.	/wud̪i/	wud̪i[:]-lmugu	'ask-PAST+NEG'
	d.	/baawa/	baawa[:]-yga	'cook-PERF'

For these suffixes, the distinction between 'regular' and 'lengthening' is irrelevant. For reasons of generality I treat them among the *regular* suffixes.

Now consider non-lengthening effects. No regular suffix lengthens a vowel that (i) is not in the second syllable in the word (cf. 59a), or (ii) stands in a final syllable (cf. 59b), or (iii) stands in absolute stem-final position (cf. 59c), or (iv) is followed by a nasal (cf. 59d):

(59) *R-suffixes: Non-lengthening effects*

a.i	/wuluŋguɾ/	wuluŋguɾ-ŋun 'light-ERG'	*wuluŋgu[:]ɾ-ŋun
a.ii	/wuluŋguɾ/	wuluŋguɾ-nda 'light-ERG'	*wuluŋgu[:]ɾ-nda
b.i	/baga/	baga-y 'dig-PAST'	*baga[:]-y
b.ii	/d̪amba/	d̪amba-ɽ 'throw-NONPAST'	*d̪amba[:]-ɽ
c.i	/mayi/	mayi-ŋun 'food-ERG'	*mayi[:]-ŋun
c.ii	/biiba/	biiba-wi 'father-DAT'	*biiba[:]-wi
c.iii	/guŋga/	guŋga-ngaɽ 'North-LOC'	*guŋga[:]-ngaɽ
d.i	/ŋalan/	ŋalan-ŋun 'sun-ERG'	*ŋala[:]n-ŋun
d.ii	/bayan/	bayan-bi 'house-DAT'	*baya[:]n-bi

Furthermore, no regular suffix shortens an underlying long vowel in the second syllable, regardless of whether it is stem-final (cf. 60a), or before a nasal (cf. 60b):

(60) *R-suffixes: Non-shortening effects*

a.	/gudaa/	gudaa-ŋun 'dog-ERG'	*[guda-ŋun]
b.i	/diwaan/	diwaan-ŋun 'turkey-ERG	*[diwan-ŋun]
b.ii	/ŋulbaan/	ŋulbaan-bi 'cloud-DAT'	*[ŋulban-bi]

Summarizing, regular suffixes only ever lengthen a stem vowel in a closed syllable in second position that has an oral coda. The analysis of this pattern must answer two questions. First, what causes lengthening of the second syllable? This question relates to the interaction between ALIGN-H and other constraints. Second, why should the restriction hold that this second syllable be closed by a liquid or a glide? This question relates to the 'nasal coda effect' and FREE-V.

With respect to the question of second position, it is relevant to note that underived roots have obligatory vowel length *in the same context*, without exception. A general pattern exists in Guugu Yimidhirr roots such that if the second syllable is non-final, as well as closed by an oral consonant, then it must have a long vowel:

(61) *Length of non-final second syllables in bare stems*:

a.	#L**H**L	b.	#H**H**L
	bul.buuɽ.mbul 'pheasant'		daa.ɽaal.ŋan 'kangaroo'
	d̪a.maaɽ.bi.na 'magpie goose'		ɟii.ɽaay.ŋguɽ 'old man'

No obligatory length of a closed second syllable occurs if this is final. A length contrast occurs in the final syllables of (62a-b) versus (62c-d):

(62) *Non-lengthening of final second syllables in bare stems*:

a.	#L**L#**		b.	#H**L#**	
	ba.wuɽ	'rock wallaby'		ŋaa.d̪aɽ	'dog, dingo'
	bu.gul	'antbed'		wuu.gul	'louse, flea'
c.	#L**H#**		d.	#H**H#**	
	ga.n̪aaɽ	'crocodile'		d̪iil.buuɽ	'jabaroo'
	d̪u.maal	'thorn, splinter'		gaa.ɽaay	'raffia palm'

Concentrating first on the question of position, we may ask how to single out the *second non-final syllable*, where lengthening takes place, from all other positions? Second syllable length in roots (cf. 61) is due to ALIGN-H ('every PrWd must end in $\sigma_{\mu\mu}$'). Recursive PrWd structure presents the context that triggers lengthening: [[(*bul.búuɽ*)].*mbul*].

But what about the *nonfinality* requirement on lengthening (62a-b)? I hypothesise that this is due to a dominating nonfinality requirement on stress. Length on a final syllable would attract stress, due to WSP. This in its turn would violate NONFINALITY (McCarthy & Prince 1993a):

(63) **NONFINALITY**
The PrWd-final syllable is unstressed.

Also, since NONFINALITY is enforced by non-lengthening, but not by *shortening* of vowels in final syllables, it must be dominated by PARSE-μ. Adding this up, we find:

(64) WSP, HDWD » PARSE-μ » NONFINALITY » ALIGN-H » FILL-μ

Important sub-rankings implied by (64) are motivated in (65):

(65) a. PARSE-μ » NONFINALITY (*final non-shortening*)
/gan̪aaɽ/ gan̪áaɽ > gán̪aɽ

b. HDWD, WSP » ALIGN-H (*non-lengthening outside* σ_2)
wúluŋgùɾ-nda > wúluŋgú[:]ɾ-nda, wúluŋgù[:]ɾ-nda

c. NONFINALITY » ALIGN-H (*final non-lengthening*)
/bawuɽ/ báwuɽ > bawú[:]ɽ

d. ALIGN-H » FILL-μ (*second syllable lengthening*)
/buɲɟul-ŋun/ buɲɟu[:]l-ŋun > buɲɟul-ŋun

I now turn to the puzzling fact that second syllables are lengthened if they are *closed*, except when closed by a *nasal*. The fact that vowels in open syllables fail to lengthen before regular suffixes was attributed to FREE-V (55), banning long vowels from the absolute final position in a PrWd. For regular suffixes, FREE-V is enforced by non-lengthening (cf. *mayi-ŋun*, 66b), but not by shortening (cf. **guda-ŋun*, 66a). This points to a ranking of FREE-V above ALIGN-H, but below PARSE-μ.

(66) a. PARSE-μ » FREE-V /gudaa/ gudaa-ŋun > guda-ŋun
b. FREE-V » ALIGN-H /mayi/ mayi-ŋun > mayi[:]-ŋun

(The discussion of shortening affixes in § 4.2 will lead to a small but significant revision of this ranking.)

4.1.1. Nasal codas

In order to see what is special about nasal codas after long vowels, we must first look into some phonotactics. Guugu Yimidhirr disallows word-initial complex onsets as well as word-final complex codas. This suggests that *COMPLEX (Prince & Smolensky 1993) is undominated. The prediction is that intervocalic clusters may contain maximally two consonants (a single coda plus a single onset). However, three-consonant clusters occur in intervocalic position. Such clusters always consists of a *possible word-final coda* /l, ɽ, ɾ, y/ (as the first consonant) plus a *homorganic nasal plus stop* (as the second and third consonants). Ternary clusters occur both after short and long vowels:

(67) a. gaɽ.^{m}bi ‘blood’, wal.^{ŋ}ga ‘heart, breath, insides’
b. yiiɽ.^{m}baaɽ ‘rib’, gaal.^{ŋ}gaan ‘blue-tailed mullet’

This strongly suggest that homorganic NC clusters are actually *pre-nasalised stops*, and therefore mono-segmental. This assumption completely eliminates complex onsets. The fact that prenasalised stops do not occur word-initially must be due to some independent constraint that I will not state here.

In (68) we observe that nasals after *long vowels* must be homorganic with following consonant, always an *oral stop*[17].

[17] Only three exceptions occur, cf. *ɟiin.bal* ‘to tease’, *buduunbina* ‘thunder’, *daangaay* ‘wind.’

(68)	^{m}b	gaa.^{m}bi 'flying fox'	^{n}d	mil.gaa.^{n}duɽ 'seagull'
	^{ɲ}ɟ	ɲuu.^{ɲ}ɟu 'neck, throat'	^{ŋ}g	gaa.^{ŋ}ga 'yam'

In contrast, nasals may, but need not, be homorganic with following consonant after *short* vowels. If the cluster is not homorganic, then the nasal is invariably *coronal*, the unmarked place of articulation[18]:

(69)	n.b	bun.ba 'large dilly-bag', gan.bi 'blood'
	n.g	ŋan.ga 'flower, feather', ba.lin.ga 'porcupine'
	n.m	wan.ma 'dance, song', bun.muul 'sore, swelling'

When homorganic NC clusters are actually pre-nasalized stops, this observation can be restated as a constraint *vvN:

(70) ***vvN**
Long vowels must not be followed by nasal codas.

I will assume this constraint throughout the remainder of this paper, although I suspect that it can be decomposed[19].

Returning to regular suffixes, we may characterize their behavior w.r.t. the nasal coda constraint *vvN as both non-lengthening and non-shortening. That is, while *vvN blocks lengthening (71a), it is not strong enough to produce shortening (71b):

(71)	a.	*vvN » ALIGN-H	/ŋalan/	ŋalan-ŋun	>	ŋala[:]n-ŋun
	b.	PARSE-μ » *vvN	/diwaan/	diwaan-ŋun	>	diwan-ŋun
				diwaan	>	diwan

Or in terms of ranking, PARSE-μ » *vvN » ALIGN-HD. The total ranking of constraints that are relevant to lengthening and shortening found so far are is given in (72):

---

[18] These phenomena point to the conclusion that codas cannot license place features, i.e. the familiar *Coda Condition* (Itô 1986). Accordingly codas must either share place features with a following consonant, or not have any place features at all (be coronal).

[19] Assuming a theory of syllable structure that has constituents *Onset*, *Nucleus* and *Coda* (Prince & Smolensky 1993), *vvN can be reduced to two primitive constraints, i.e. *CODA^{Nas} "No nasal codas" (Zec 1988) and *COMPLEX^{Nuc} "No ternary (or *vvC*) nucleus." Either of these two constraints is necessarily violated in syllabifying a pre-consonantal nasal after a long vowel:

```
(i)      Nuc  *COMPLEX^Nuc     (ii)   Nuc Coda   *CODA^Nas
         / | \                         / \   |
        v v Nas                       v v   Nas
```

(72) WSP, HDWD » PARSE-μ » NONFINALITY, FREE-V, *VVN » ALIGN-H » FILL-μ

From here on I will first discuss shortening suffixes in § 4.2, and then turn to lengthening suffixes in § 4.3.

4.2. Shortening suffixes

Shortening suffixes shorten a long vowel in the second stem syllable if it is open. Examples are ERG -$*in̪* and -$*il,* DAT -$*ay*, and PURP -$*a*:

(73)	a.	/gabiiɾ/	ga.bi.ɾ-in̪	'girl-ERG'
	b.	/nubuun/	nu.bu.n-il	'one-ERG'
	c.	/gaan̪aal/	gaa.n̪a.l-ay	'older sister-DAT'
	d.	/buuɽaay/	buu.ɽa.y-a	'water-PURP'

As I mentioned before, *all and only* vowel-initial suffixes are shortening[20]. Shortening is due to FREE-V, the constraint minimizing quantity of vowels in absolute final position in PrWd. As observed earlier, PrWd-final vowel shortening maximally satisfies FREE-V without violating undominated PARSE-VOWEL.

Ideally, we would like to express that shortening is nothing but the counterpart of the 'non-lengthening' effect found before regular suffixes, e.g. *mayi-ŋun*. However, the constraint ranking given in § 4.1. does *not* predict vowel shortening. In order to explain the non-shortening of long vowels before regular suffixes (e.g. *gudaa-ŋun*), as well as the non-shortening in absolute word-final position, it was necessary to rank PARSE-μ above FREE-V. Now notice that shortening suffixes apparently require the reverse ranking:

(74) a. *Non-shortening*:

PARSE-μ » FREE-V	/gudaa/	gu.daa.-ŋun > gu.da.-ŋun
		gu.daa-∅ > gu.da-∅

b. *Shortening*:

FREE-V » PARSE-μ	/gabiiɾ/	ga.bi.ɾ-in̪ > ga.bii.ɾ-in̪

[20] As vowel-initial suffixes, these cannot take vowel-final stems, since that would create hiatus, and onset epenthesis is ruled out. Moreover, a more optimal C-initial allomorph can always be found (cf. ERG -$*in̪*/-:*n̪*, ERG -$*il*/-:*l*).

Let us assume that the ranking (74b) is correct. Then what causes non-shortening before regular suffixes, and at word-end? No affix-specific property can be involved here, since *all and only* vowel-initial suffixes are shortening, as we saw earlier. Looking closer at both cases, we find that vowel shortening applies if and only if *a consonant follows* the long vowel within the stem (cf. 74b). In contrast, a long vowel standing at the end of both the stem and the Hd-PrWd, is not shortened (cf. 74a).

The contrast looks much like the 'derived context effect' of Lexical Phonology. That is, shortening only applies if its context (the absolute PrWd-final position) is created by a 're-syllabification' of a stem coda as an onset of the suffix syllable. Shortening is blocked in a PrWd-final vowel that meets the rule's context already within the smaller domain of the stem. In nonderivational Optimality Theory, however, the notion 'derived context' has little or no meaning. But an alternative analysis for non-shortening of a stem-final long vowel is possible, one which is based on *stem alignment*.

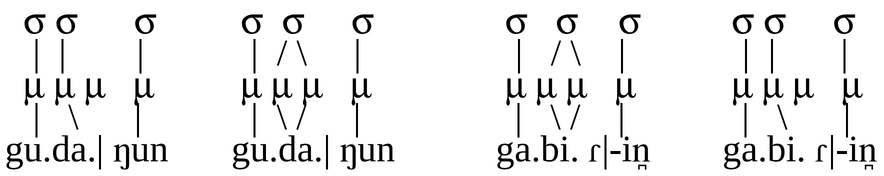
More specifically, if shortening were to apply in (74a), then the right edge of the morphological stem would not align with the right edge of a syllable. This violates ALIGN (McCarthy & Prince 1993a: 46):

(75) **ALIGN**

$]_{\text{Stem}} =]_{\sigma}$

Non-alignment of the shortened candidate is shown in the structure (76a). I assume with Prince & Smolensky (1993a: 60) that vowel shortening amounts to the *non-parsing of a mora by a syllable*. Consequently the right edge of the syllable, which depends on the right edge of its rightmost mora, fails to coincide with the right edge of the stem, which itself depends on its rightmost element, i.e. the syllabically unparsed mora[21].

(76) a. *Mis-alignment avoidable*: b. *Mis-alignment unavoidable*:



[21] The relevance of prosodically unparsed elements to morphological edge alignment is explicitly argued for by Prince & Smolensky (1993: 111).

In the contrasting shortening case (76b), stem mis-alignment cannot be avoided, even if V-shortening were not to 'apply.' This is because the stem-final consonant /ɾ/ is syllabified as the onset of the suffix vowel. There is no way to avoid this because both ONS and FILL$^{\text{ONS}}$ (Prince & Smolensky 1993) are undominated in Guugu Yimidhirr (**ga.biiɾ.iṉ*, **ga.biiɾ. iṉ*). Since alignment cannot be satisfied anyway, the optimal candidate is the one that minimally violates the next-lower constraint, i.e. the one with a shortened vowel. I conclude that ALIGN ranks above FREE-V . The revised ranking is given in (77):

(77) FILL$^{\text{ONS}}$, ONS, WSP, HDWD, ALIGN » FREE-V » PARSE-μ » NONFINALITY, *VVN » ALIGN-H » FILL-μ

This ranking predicts that roots contain no long vowels in their second syllable if this is open and non-final. Indeed, the small number of roots that have a long vowel in this position all have special status, e.g. *muu.luu.mul* 'dove' (onomatopoeia)[22].

4.3. Lengthening suffixes

Lengthening suffixes, when we compare these to regular suffixes, have the additional property of lengthening an immediately preceding stem vowel:

(78)	a.	/mayi/	mayi[:]-ŋu	'food-PURP'
	b.	/ŋamu/	ŋamu[:]-gal	'mother-ADES'
	c.	/dani/	dani[:]-ᵑgu	'slow-EMPH'
	d	/bama/	bama[:]-l	'Aboriginal person-ERG'
	e.	/yugu/	yugu[:]-ṉ	'wood-ERG'

Actually this is the single distinctive property of lengthening suffixes, which behave like regular suffixes in all other respects.

First, they trigger lengthening of a vowel that is followed by an oral consonant, following the general pattern discussed in § 4.1.

(79)	a.	/ŋalgal/	ŋalga[:]l-ŋu	'smoke-PURP'
	b.	/ɟiiɾal/	ɟiiɾa[:]l-gal	'wife-ADES'

[22] Also *gilaaḏa* 'glass' (a loan, English *glass*), *ɲuɽuumu* 'mouth' (only in respectful language).

Second, lengthening suffixes have skeletal shapes that regular suffixes may also have, e.g. they may begin with a single nasal (PURP *-:ŋu*), or a single oral stop (ADES *-:gal*), or a pre-nasalised stop (EMPH *-:*^{ŋ}*gu*), or consist wholly of a single oral or nasal consonant (ERG *-:l*, ERG *-:n*). Lengthening suffixes, again like regular suffixes, may be phonetically empty, e.g. ERG *-:∅*[23]:

(80)	a.	/babi/	ba.bi[:]-∅	‘grandmother-ERG’
	b.	/ŋaaḏaɽ/	ŋaa.ḏa[:]ɽ-∅	‘dog, dingo-ERG’

Third, as is the case with regular suffixes, lengthening is blocked if the preceding stem vowel is not in the second syllable (cf. 81a), or if the second syllable is closed by a nasal (cf. 81b).

(81) *L-suffixes: Non-lengthening effects*

a.i	/baḏibay/	baḏibay-ŋu ‘bone-PURP’	*baḏiba[:]y-ŋu
a.ii	/biḏa-guɽ/	biḏa-guɽ-gal ‘children-ADES’	*biḏa-gu[:]ɽ-gal
a.iii	/ḏaɽamali/	ḏaɽamali-gal ‘thunder-ADES’	*ḏaɽamali[:]-gal
b.i	/bayan/	bayan-ŋu ‘house-PURP’	*baya[:]n-ŋu
b.ii	/bayan/	bayan-ŋgu ‘house-EMPH’	*baya[:]n-ŋgu

Fourth, like regular suffixes, lengthening suffixes never shorten a long stem vowel:

(82) *L-suffixes: Non-shortening effects*

a.	/bulaan/	bulaan-gal ‘3dual-ADES’	*bulan-gal
b.	/ḏawuuṉ/	ḏawuuyṉ-ŋu ‘friend-PURP’	*ḏawuyṉ-ŋu

It is not too difficult to identify the single property that distinguishes lengthening suffixes from regular suffixes. Lengthening suffixes are lexically encoded by an empty mora preceding the suffix:

(83) a. PURP -:ŋu b. EMPH -:^{ŋ}gu c. ERG -:ṉ d. ERG -:∅

a.	b.	c.	d.
μ μ	μ μ	μ	μ
|	|		
ŋu	^{ŋ}gu	ṉ	

[23] Lengthening zero-suffixes may be contrasted with ‘regular’ zero-suffixes, such as ABS -∅, e.g. *babi-∅* ‘grandmother-ABS’, *ŋaaḏaɽ-∅* ‘dog, dingo-ABS.’

Furthermore, the suffixal mora demands realisation by some constraint. Whatever this is, it must be ranked above FREE-V, as *mayii-ŋu* shows. This excludes PARSE-μ, which is ranked below FREE-V (cf. 74b). What we need is a version of PARSE-μ that is specific to affixal material:

(84) **PARSE-μ_{Afx}**
Affixal moras must be parsed.

This constraint is dominated by others, some prohibiting the realisation of affixal length on vowels that are outside Hd-PrWd, others limiting its lengthening effect to adjacent vowels. The former function has been identified already as the pair WSP and HDWD. Limitation of spreading to adjacent vowels is revealed by the contrast of *yuguu-:n̤* ‘wood-ERG’, in which lengthening freely applies, versus *bayan-:ŋu* ‘house-PURP’, in which it is blocked. In sum, the lengthened vowel must *immediately precede* the lengthening suffix, since not even a stem consonant may stand in between[24].

With this in mind, we identify the source of the ill-formedness of *bayaan-ŋu* as RIGHTMOST (McCarthy & Prince 1993a):

(85) **RIGHTMOST**
Suffix is located at right edge of word.

All of a suffix’s input elements must stand at the right edge, *including* its free mora (if any). Now consider the representation that would arise by associating the free mora of *-:ŋu* (indexed as μ_i in 86) to the second stem vowel, as in *baya*[:]*n-ŋu* (86a). This violates RIGHTMOST, since a root element (/n/) stands closer to the right edge than a suffix element (the indexed mora μ_i). Nor can the suffix mora be parsed by the suffix syllable, as in (86b), since that would violate either WSP or HDWD. The single remaining option is non-lengthening, i.e. to leave the suffix mora unparsed by a syllable, as in (86c), thereby violating PARSE-μ_{Afx}:

```
(86)  a.  σ  σ          σ        b.   σ  σ       σ
          |  |\         |             |  |      /|
          μ  μ μi       μ             μ  μ    μi μ
          |  |/         |             |  |      \|
        b a y a [:] n | ŋ u         b a y a  n | ŋ u [:]
        (violates RIGHTMOST)        (violates WSP or HDWD)
```

[24] Observe that *VVN does not predict this contrast: as we have seen before, *VVN must actually be dominated by LINK-μ, as *yuguu-:n̤* confirms.

```
c.  σ   σ      σ
    |   |      |
    μ   μ   μi μ
    |   |     \|
   b a y a n | ŋ u
```

(*violates* Parse-μ_{Afx})

Finally we must rank Align with respect to Parse-μ_{Afx}. Assuming that the suffixal mora that is parsed by a stem syllable violates Align, e.g. *ma.yi-i.ŋu*, it is clear that Parse-μ_{Afx} must be the higher-ranked of the two. This is shown in (87), which also gives the remaining rankings of Align w.r.t Ons, Fill^{Ons}, and Free-V:

(87) a. Ons » Align — ga.bi‹:›.ɾ-iṉ > ga.biiɾ.-iṉ
b. Fill^{Ons} » Align — ga.bi‹:›.ɾ-iṉ > ga.biiɾ.□-iṉ
c. Align » Free-V — gu.daa-ŋun > gu.da‹:›-ŋun
d. Parse-μ_{Afx} » Align — ma.yi-[:].ŋu > ma.yi.-ŋu

Parse-μ_{Afx} can be ranked with respect to some of the constraints that were introduced earlier:

(88) a. WSP, HdWd » Parse-μ_{Afx} — baḏibay-ŋu > baḏiba[:]y-ŋu
b. Rightmost » Parse-μ_{Afx} — ba.yan.-ŋu > ba.ya[:]n.-ŋu
c. Parse-μ_{Afx} » Free-V — ma.yi-[:].ŋu > ma.yi.-ŋu
d. Parse-μ_{Afx} » *vvN — yu.gu-[:]ṉ > yu.gu-ṉ
e. Parse-μ_{Afx} » Nonfinality — yu.gu-[:]ṉ > yu.gu-ṉ

These sub-rankings are integrated into the total ranking in (89):

(89) Fill^{Ons}, Ons, WSP, HdWd, Rightmost » Parse-μ_{Afx} » Align » Free-V » Parse-μ » *vvN » NonFinality » Align-H » Fill-μ

The tableaux (90-91) show a short-vowel-final stem /*mayi*/, which is suffixed by a regular suffix in (90), and by a lengthening suffix in (91).

(90) /mayi, -ŋun/	Fill^{Ons}	Ons	Parse-μ_{Afx}	Align	Free-V	Parse-μ	Align-H
a. ☞ [[ma.yi].-ŋun]							*
b. [[ma.yi-[:]].ŋun]				*!	*		

(91) /mayi, -:ŋu/	FILL^{Ons}	ONS	PARSE $-\mu_{Afx}$	ALIGN	FREE -V	PARSE -μ	ALIGN-H
a. [[ma.yi].-ŋu]			*!			*	*
b. ☞ [[ma.yi-[:]].ŋu]				*	*		

Next consider tableaux (92-93), both of which display long-voweled stems, suffixed by a regular suffix in (92), and by a shortening suffix in (93). These tableaux once more motivate the ranking ALIGN » FREE-V. In the former, we find non-shortening due to ALIGN, while in the latter, shortening is due to FREE-V (violation of ALIGN being unavoidable).

(92) /gudaa, -ŋun/	FILL^{Ons}	ONS	PARSE $-\mu_{Afx}$	ALIGN	FREE -V	PARSE -μ	ALIGN-H
a. [[gu.da‹:›]-ŋun]				*!		*	*
b. ☞ [[gu.daa]-ŋun]					*		

(93) /gabiiɾ, -in̪/	FILL^{Ons}	ONS	PARSE $-\mu_{Afx}$	ALIGN	FREE -V	PARSE -μ	ALIGN-H
a. ☞ [[ga.bi‹:›].ɾ-in̪]				*		*	*
b. [[ga.bii].ɾ-in̪]				*	*!		
c. [[ga.biiɾ].-in̪]		*!					
d. [[ga.biiɾ].-□in̪]	*!						

This analysis of pre-suffixal vowel lengthening and shortening will be independently motivated by verb reduplication in the following section.

5. Verb reduplication

Verb reduplication indicates either repeated action, action in progress, or action done to excess. It copies the second stem syllable including a conjugation-marker /-l, -ɾ, [:]/, if any. Interestingly lengthening of stem vowels occurs under conditions highly similar to those found for pre-suffixal lengthening. Again an orally closed stem syllable is lengthened (94a), while a long vowel at the end of a stem is not shortened (94b). I have marked the reduplicant by underlining:

(94) *Lengthening*

a.i	/balga-l/	bal.ga[:]l-gal	'making'
a.ii	/daga-ɾ/	da.ga[:]ɾ-gaɾ	'growing'
	Non-shortening		
b.i	/biini-i/	bii.nii.-ni	'dying'
b.ii	/maa^{n}di-i/	maa.^{n}dii.-^{n}di	'taking'

The simplest hypothesis is that the reduplicant suffix has all properties of *regular suffixes* w.r.t. lengthening. As we proceed, it will become clear that this is the case without exception. Interestingly, due to high-ranked phonotactic constraints, the verb reduplicant may take a vowel-initial shape -VC. In this case we find shortening of the stem vowel, precisely as is the case in vowel-initial suffixes (e.g. -$*il*).

A preliminary analysis of verbal reduplication requires the following seven constraints (McCarthy & Prince 1993a, 1994):

(95)

a.	**RED = AFFIX**	The verbal reduplicant is an affix.
b.	**RED = σ**	The verbal reduplicant is a syllable.
c.	**RIGHTMOST**	Suffix is located at right edge of word.
d.	**SFX-TO-PRWD**	Suffix RED to PrWd.
e.	**MAX**	Reduplicant = Base.
f.	**ANCHORING**	In B+R, the final element in R is identical to the final element in B.
g.	**CONTIGUITY**	R corresponds to a contiguous substring of B.

The evidence in (96) shows that MAX must be dominated by RED=σ, ALIGN-H, WSP, HDWD, and PARSE-μ.

(96)
a. WSP, HD-WD » MAX
[[da.ga[:]ɾ].-gaɾ] > [[da.ga[:]ɾ].-gaaɾ]

b. RED = σ » MAX
[[da.ga[:]ɾ].-gaɾ] > [[da.ga[:]ɾ].-dagaɾ]

c. PARSE-μ » MAX
[[bii.nii].-ni] > [[bii.ni‹:›].-ni]

d. ALIGN-H » MAX
[[da.ga[:]ɾ].-gaɾ] > [[da.gaɾ].-gaɾ]

We may now integrate the reduplication-specific constraints into the total ranking as in (97):

(97) Fill^{Ons}, Ons, WSP, HdWd, Rightmost, Red=Affix, Red=σ, Anchoring, Contiguity » Parse-μ$_{Afx}$ » Align » Free-V » Parse-μ » *vvN » NonFinality » Align-H » Fill-μ, Max

This analysis is illustrated by the tableaux in (98) and (99). In tableau (98), observe that the shape of the reduplicant is determined by WSP, HdWd, and Align, while the lengthening of the stem vowel is due to Align-H:

(98) /daga-ɾ RED/	WSP, HdWd	Red = σ	Align	Free -V	Parse -μ	Align -H	Max
a.☞ [[da.ga[:]ɾ].-gaɾ]							da, μ
b. [[da.gaɾ].-gaɾ]						*!	da
c. [[da.ga].ɾ-aɾ]			*!			*	dag
d.[[da.ga[:]ɾ].-dagaɾ]		*!					μ
e. [da.ga[:]ɾ].-gaaɾ]	*!						da

In tableau (99), the independently motivated ranking Align » Free-V (see § 4.2) accounts for the fact that reduplicated forms of V-Conjugation stems maintain their stem vowel length (cf. 99b). Also, since WSP and HdWd are undominated (and in particular, since they dominate Max), base vowel length is never copied to the reduplicant (cf. 99d), as this would surface in the third syllable (hence outside the disyllabic Head-PrWd). This is excluded by WSP and HdWd:

(99)/biini-[:]RED/	WSP, HdWd	Red = σ	Align	Free -V	Parse -μ	Align -H	Max
a. ☞ [[bii.nii].-ni]				*			bii,μ
b. [[bii.ni‹:›].-ni]			*!		*	*	bii
c. [[bii.nii].-bi.ni]		*!		*			μ, μ
d. [[bii.nii].-nii]	*!			*			bii

This basic analysis of verbal reduplication will now be extended to cases that involve interaction with other syllabification constraints.

First consider the forms in (100), which show non-lengthening and shortening of the stem vowel under reduplication:

(100) *Non-lengthening*

a. /baawa-l/ baa.wa.l-al (*baa.wa[:]l.-wal) ‘cooking’

b. /d̪ulu-ɾ/ d̪u.lu.ɾ-uɾ (*d̪u.lu[:]ɾ.-luɾ) ‘scrubbing’

Shortening

c. /miiɾii-l/ mii.ɾi‹:›.l-il (*mii.ɾiil.-ɾil) ‘telling, showing’

d. /gayii-l/ ga.yi‹:›.l-il (*ga.yiil.-yil) ‘hooking’

The reduplicant assumes the shape -VC (*-al, -il*) whenever the second stem consonant is a liquid or glide, while the conjugation marker is a liquid /-l, -ɾ/. The output shows the effect of an undominated constraint on syllabification. Guugu Yimidhirr disallows approximant clusters, e.g. /lw, ly, lɾ, ɾl/. An undominated constraint rules out any transitions between a coda of lesser or equal sonority than the onset of the syllable that follows it (the *Syllable Contact Law*, Vennemann 1988):

(101) **σ-CONTACT**

A coda’s sonority must exceed that of the following onset.

This undominated constraint interacts with the ones given earlier as shown in tableaux (102-103):

(102) /baawa-l RED/	σCON-TACT	ONSET	ALIGN	FREE-V	PARSE-μ	ALIGN-H	MAX
a. ☞ [[baa.wa].l-al]			*			*	baaw
b. [[baa.wa[:]].l-al]			*	*!			baaw,μ
c. [[baa.wa[:]l].-al]		*!					baaw,μ
d. [[baa.wa[:]l].-wal]	*!						baa, μ

(103) /miiɾii-l RED/	σCON-TACT	ONSET	ALIGN	FREE-V	PARSE-μ	ALIGN-H	MAX
a. ☞ [[mii.ɾi‹:›].l-il]			*		*	*	miiɾ
b. [[mii.ɾii].l-il]			*	*!			miiɾ,μ
c. [[mii.ɾiil].-il]		*!					miiɾ,μ
d. [[mii.ɾiil].-ɾil]	*!						mii, μ

In sum, verbal reduplication behaves precisely as regular suffixation with respect to both vowel lengthening and shortening. This conclusion supports the proposal made by McCarthy & Prince (1994) to identify reduplicants as genuine morphemes, e.g. stems (RED=STEM), or affixes (RED=AFFIX).

6. Conclusions

The analysis of Guugu Yimidhirr prosody which I have developed in this paper demonstrates that highly complex phonological patterns can be broken down into a fairly limited number of generalisations, stated as hierarchically ranked constraints. No doubt, specific constraints may be questioned and improvements may be found upon closer inspection. But I believe that OT has proved to be an adequate overall theoretical framework with respect to the Guugu Yimidhirr data. Although it may be too strong to claim that derivational theory is in principle incapable of expressing the intricate relationships between word stress, stem size, distribution of length, affix-induced length, and reduplication, it has to face the familiar problem of how to account for rule conspiracies. Such conspiracies are abundant in Guugu Yimidhirr phonology. For example consider the fact that no rule ever creates a long vowel outside the first or second syllable of the word.

The general theoretical question from which I started was to identify the disyllabic domain at the beginning of Prosodic Word as a prosodic constituent. Within the representational vocabulary of prosodic theory, no other possibilities are allowed than disyllabic Foot and PrWd. I have shown that the former is inadequate as the disyllabic domain in Guugu Yimidhirr, because of the overall quantity-sensitivity of the language. With PrWd as the single available choice, the problem arose of how to mark off the initial disyllabic PrWd from the larger PrWd in which it is embedded. The analysis involved recursive PrWd structure, which was modelled by an interaction of alignment constraints. The word-internal PrWd-edges are referred to by the constraints that account for the size of verb stems, distribution of vowel length, secondary stress, adjectival reduplication, suffixal lengthening and shortening, and the distribution of affix allomorphs. In sum, Guugu Yimidhirr is *prosodically coherent* in its reference to PrWd edges.

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