

CHAPTER 2

FOOT ALIGNMENT

2.1 Introduction

One of the basic tenets of Optimality Theory is that there is no serial derivation, that prosodic operations on inputs apply simultaneously (M&P 1993,1994). This is the principle of Parallelism. Parallelism is examined in this chapter in relation to stress assignment in Warlpiri. It will be shown that the analysis of stress supports the theory.

Stress patterns in Warlpiri vary depending on the morphological organisation of a word. In monomorphemic words, stress alternates on every odd numbered syllable. The pattern in polymorphemic words is dependent on the presence of morphemes and the number of syllables in each morpheme. The patterns show that stress is sensitive to morpheme boundaries. To account for these patterns, I assume that each morpheme is a domain for stress assignment. For instance in **(máli)ki-(kìrla)ngu** 'dog-POSS' and **(yápa)rla-(ngùrlu)** 'father's mother-ELAT', stress is on the first syllable of each morpheme. If stress was not sensitive to the presence of morphemes then stress would alternate on every odd numbered syllable.

Not all morphemes receive initial stress. In some cases monosyllabic morphemes are stressed as in **(wáti)ya-(rlà-rlu)**. However in other cases, they are not stressed, as in **(wángka)-ja=(jàna)**. The challenge is to account for these patterns.

Previous accounts of this data have also acknowledged that morphemes constitute stress domains. Nash (1986) formulates a rule that assigns stress to all polysyllabic morphemes. In a modified cyclic analysis, as suggested in Poser (1989), each morpheme constitutes a cycle for stress assignment. The analysis I present in this chapter builds on these insights.

I will depart from previous models in one significant respect. This departure will be in the way the domains of the phonology and morphology are treated. These domains are inextricably linked in Warlpiri and I argue that a successful analysis must treat them simultaneously. In OT, constraints on the interaction between phonology and morphology are simultaneous. In this system, simultaneous interaction provides an explanation for the stress patterns in Warlpiri.

The organisation of this chapter is as follows. The stress patterns in monomorphemic words are presented in 2.2 with discussion of the constraints required to account for these patterns. In 2.3, the stress patterns in polymorphemic words are given. To account for these patterns I propose an alignment constraint to ensure correspondence of morpheme edges with foot edges. The analysis is compared to noncyclic and cyclic models in 2.4. In 2.5, the analysis and constraints introduced are extended to Wambaya, Diyari and Dyirbal. The constraints on parsing syllables into feet are discussed in 2.6. The chapter closes with a summary of the constraints.

The data for the analysis of word stress come from a variety of sources including Nash (1986;indicated by [DGN:page number]) and tape recordings from Berry (1992;[LB]), Breen (1980;[GB]), Laughren (1987;[ML]).

2.2 Stress patterns in monomorphemic words

In this section the stress pattern for monomorphemic words is presented, followed by discussion of the constraints required to account for these patterns. These are general constraints proposed by M&P (1993a,b).

In monomorphemic words, stress falls on the first syllable and on every following odd-numbered syllable. Main stress is on the first syllable.

- (1)
- | | | |
|----|--------------|----------------------------|
| a. | mánangàrra | 'spinifex plain' [DGN:102] |
| b. | kúruwàrri | 'variegated' [GB] |
| c. | wápuṛnùṅku | 'ghost gum' [GB] |
| d. | kárlarnjìrri | 'lizard' [GB] |
| e. | wíjipìtirli | 'hospital' (loan) [GB] |

Stress on word-final syllables is not permitted. This means that in trisyllabic words there is only one stress.

- (2)
- | | | |
|----|----------|--------------------|
| a. | wúrlampi | 'stone knife' [GB] |
| b. | wátiya | 'tree' [DGN:102] |
| c. | yújuku | 'humpy' [GB] |
| d. | ngípiri | 'egg' [GB] |

The majority of words in Warlpiri consist of monomoraic syllables; however, some words have syllables with long vowels. According to Nash (1986:65), long vowels occur in the first syllable of nominal and verbal roots, with a few exceptions. Exceptions are when a preverb with a long vowel is reduplicated (3c) and when glide coalescence occurs (3a). Long vowels are always stressed as shown in the following examples:

- (3)
- | | | |
|----|---------------------------------|-------------------------|
| a. | yárdijìnyipà-rlu | 'black ant sp.' |
| | black ant sp.-ERG [DGN:101] | |
| b. | túrl-pì-nyi | 'split down the middle' |
| | (PVB)-bite, hit, kill-NPST [LB] | |
| c. | wúurr-wúurr-wàngka-mi | 'howling..of wind' |
| | RED- whirr-speak-NPST [GB] | |

A number of monosyllabic preverbs are of the form CVV, but these are always prefixed to the verb root and never occur finally, eg **jaa-karri-mi** 'to be agape'.

The account for these patterns is straightforward. Feet are assigned across the word. Syllables are parsed into feet and these feet are binary. The necessary constraints for these facts are introduced below. I will not be concerned with the different levels of stress, that is, primary versus secondary stress levels, in this chapter. This aspect of the analysis is addressed in Chapter 4.

The general observation that feet are binary is captured in FtBin introduced in Chapter 1 and repeated here:

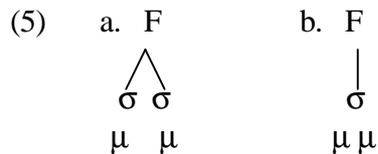
- (4) **FOOT BINARITY (FtBin):** Feet are binary under some level of analysis (syllable or mora).

FtBin is a dominant constraint which ensures that only binary feet occur in well-formed outputs. I assume that stress on word-final syllables in words with an odd number of syllables is ruled out by FtBin. Word-final stress could also be ruled out by NON-FINALITY, a constraint

introduced by P&S (1993) which has the same effect as extrametricality (see 6.2.2 for discussion) in ruling out prominence on word-final syllables¹.

The type of foot required to parse words is a moraic trochee foot, ie a foot containing two moras where the leftmost one is stressed. (3) shows that the trochaic foot in Warlpiri counts moras.

A long vowel contributes two moras. Moras rather than syllables are the minimum stress bearing units in Warlpiri. CVV syllables are heavy, while CV and CVC syllables are light. The relevant foot in Warlpiri is the moraic trochee, which could be:



As a constraint this can be stated simply as:

- (6) **FOOT FORM (FtForm):** The moraic trochee is the foot form: ($\mu \Leftrightarrow \mu$)

In the majority of forms, the syllable is equivalent to the mora. FtForm rules out feet where the head is the rightmost syllable, ie an iambic foot.

The requirement that syllables are parsed into feet is captured in the constraint PARSE-SYLL, introduced in Chapter 1.

- (7) **PARSE-SYLL (PARSE σ):** all syllables must be parsed by feet.

PARSE σ expresses the requirement in rule-based metrical phonology that parsing of syllables into feet be exhaustive. In OT, violation of this constraint is possible. In examples such as (yúju)ku, the final syllable is not parsed into a foot. This indicates that parsing syllables into feet is dominated by FtBin, and that PARSE σ can be violated. This ensures that syllables are not forced into larger or smaller feet at the expense of binarity. Parsing syllables into feet will be exhaustive in well-formed outputs only if FtBin is also satisfied.

FtForm may not be violated and is therefore a dominant constraint. It thus rules out instances where a single monomoraic syllable is parsed into a foot. FtBin and FtForm are dominant constraints which are not ranked with respect to each other, but are ranked above PARSE σ . The ranking is given in (8).

- (8) FtBin, FtForm >> PARSE σ

The effect of the constraint ranking is shown in (9). ()=foot

¹ Final stresslessness is preferred rhythmically (P&S 1993; Hung 1993) because as pointed out by Hyman (1977) stress is more natural when realised as falling prominence over two syllables.

(9) /yujuku/	FtBin	FtForm	PARSE σ
%a. (yúju)ku			*
b. (yujú)ku		*!	*
c. (yújuku)	*!	*	
d. (yúju)(kù)	*!	*	

(9a) is the optimal candidate even though it records a PARSE σ violation. This is because all other candidates in the tableau violate the higher ranked constraints FtBin and FtForm. (9b) has an iambic foot which violates FtForm. (9c,d) are ruled out by FtBin because they have non-binary feet. When stress is on the final syllable, as in (9d), both FtBin and FtForm record a violation.

Stress occurs on the initial syllable of a word indicating that feet align to the left edge of a word rather than the right edge. Recall from Chapter 1 that this constraint specifies that the left edge of any foot and the left edge of a prosodic word must be aligned.

(10) **Align Ft,L PW,L (AlignFt):** the left edge of a foot is aligned to the left edge of a prosodic word.

AlignFt is a constraint that assesses violations in a gradient manner. All feet in an output are assessed in terms of their distance from the left edge of a prosodic word. If more than one foot is present in an output, there will always be violations of AlignFt since only one foot can logically align to the left edge of a prosodic word. The closer feet are to the prosodic word edge the more optimal the form is. The number of syllables indicates the distance from the designated edge. Each foot is assessed in this way.

To ensure that as many syllables as possible are parsed into feet, PARSE σ must be dominant over AlignFt. If AlignFt was dominant this would generate optimal candidates with only one foot. The effect of the ranking PARSE σ >> AlignFt is shown in the following tableau. F=foot; #=aligned; []=prosodic word.

(11) /wijipitirli/	PARSE σ	AlignFt
a. [(wíji)pitirli]	***!	F1:#
b. [wi(jípi)(ûrli)]	*	F1: σ ! F2: $\sigma\sigma$!
%c. [(wíji)(piti)rli]	*	F1:# F2: $\sigma\sigma$

(11a) is the least preferred output, as it violates the higher ranked PARSE σ . Both (11b,c) have the same number of violations of PARSE σ . The decision on the optimal candidate falls to AlignFt. In (11b), both feet are further away from the left edge of the prosodic word in comparison to the feet in (11c). (11c) is the optimal candidate; it has one foot aligned to the left prosodic word edge and the second foot is only two syllables from the edge.

AlignFt ensures the alignment of the prosodic categories, foot and prosodic word. For this constraint to be completely effective, that is, to be certain that feet are parsed from the leftmost syllable in a word, it is necessary to ensure that the edge of the prosodic word is in fact at the edge

of the word. In **wa[(tíya)]** the first syllable of the stem is not parsed into a prosodic word, although the left edges of the foot and prosodic word are aligned. If segments are not parsed into a prosodic word they have no phonetic content and effectively delete.

Alignment of a prosodic word with a stem is achieved by the interface constraint, **AlignL** (M&P 1993b).

(12) **AlignL**: the left edge of a stem corresponds to the left edge of a prosodic word.

A stem is a word consisting of a root and any number of suffixes. If the left edge of a prosodic word is aligned at a morpheme boundary within a stem this would violate **AlignL**, since this boundary is not at the leftmost edge of the stem. **AlignL** is a dominating constraint which may not be violated and is therefore included in the set of undominated constraints.

(13) **AlignL, FtBin, FtForm** >> **PARSE σ** >> **AlignFt**

In the following tableau '|' indicates a stem edge.

(14) /watiya/

	AlignL	PARSEσ	AlignFt
%a. [(wáti)ya]		*	
b. wa[(tíya)]	*	*	
c. [wa(tíya)]		*	1: σ !

All candidates violate **PARSE σ** . (14a) is the optimal candidate because it violates no other constraints. In (14b), the stem and prosodic word are not aligned which violates the higher ranked **AlignL** constraint. The left edge of the foot is not aligned with the left edge of the prosodic word in (14c).

In (14) I have not included outputs which would violate the constraints **FtBin** and **FtForm**. The outputs in a given tableau have survived evaluation by higher ranked constraints. The practice of restricting the number of outputs considered in any one tableau will be continued throughout this thesis. Those outputs not included are irrelevant since they incur more violations than the ones considered.

The constraints which account for stress in monomorphemic words have been outlined in this section. In the following section, the stress patterns in polymorphemic words which differ from those of monomorphemic words are discussed.

2.3 *Stress in Polymorphemic Words*

In polymorphemic words, the first syllable of a polysyllabic morpheme is stressed. If there is a string of monosyllabic morphemes, the first suffix is stressed. I account for these patterns in terms of the alignment of feet with morphemes.

The difference in stress patterns between (15) and (16) is due to the number of syllables in the root, as well as the presence of following polysyllabic morphemes. Where the first morpheme in the word is disyllabic, stress is on the first and third syllable.

- (15) a. yápa-rlàngu-rlu 'a person for example'
 person-for example-ERG [DGN:101]
 b. pírlí-ngírlí 'from the hill'
 stone,hill-ELAT [LB]
 c. jíljá-wàrdíngkí 'sandhill resident'
 sandhill-DENIZ [LB]

If, on the other hand, the first morpheme is trisyllabic, stress is on the first and fourth syllable.

- (16) a. yápara-ngùrlu 'from the father's mother'
 father's mother-ELAT [DGN:101]
 b. yúwarlí-ngírlí 'from the house'
 house-ELAT [LB]

The following examples show that monosyllabic morphemes do not behave like polysyllabic morphemes. Monosyllabic suffixes cannot make a foot on their own. '=' are clitic boundaries.

- (17) a. málikí-rla-kùrlu 'with (something) on a dog'
 dog-LOC-PROP [ML]
 b. jírramá-rlu=kírlí=pàla 'they two precisely (did something)'
 two-ERG=precisely=3dS [LB]
 c. wángka-ja=jàna '(someone) spoke to them'
 speak-PST=3pNS [ML]
 d. mánangkàrra-rla 'in the spinifex'
 spinifex-LOC [DGN:102]

When there are strings of monosyllabic suffixes or clitics the first one in the string is stressed, as in:

- (18) a. yáma-ngkà=rna 'in the shade I (did...)'
 shade-LOC=1sS [LB]
 b. pálya-ngkù=rna=lu 'with an adze we (did...)'
 adze-ERG=1peS [LB]
 c. mánangkàrra-rlà-rlu 'in the spinifex (modifying an Ergative subject)'
 spinifex-LOC-ERG [DGN:102]
 d. wángka-jà=rna=jàna 'I spoke to them'
 speak-PST=1peS=3pNS [ML]
 e. wángka-mì=rra=lku=jàla [ML]
 speak-NPST=tothere=then=obviously
 'obviously (someone) is speaking in that direction now'
- (19) a. wátiya-rlà-rlu 'in the tree (modifying an Ergative subject)'
 tree-LOC-ERG [DGN:102]
 b. málikí-rlí=lki 'the dog (doing...) now'
 dog-ERG-now [DGN:115]
 c. ngájulu-rlù=lpa=rna 'I was (doing...)'
 I-ERG=IMPF=1sS [LB]

The stress patterns in (18) and (19) are like those of words consisting of polysyllabic morphemes in (15) and (16). The second stress is on the third syllable following a disyllabic morpheme, or on the fourth syllable following a trisyllabic morpheme. A sequence of monosyllabic suffixes are treated as if they were one morpheme.

When there is a single monosyllabic suffix attached to a trisyllabic root, the pattern of stress is like that of monomorphemic words.

- (20) a. wátiyà-rla 'in the tree'
tree-LOC [DGN:102]
b. wámpirli-mi 'whistle'
whistle-NPST [DGN:113]

Trisyllabic suffixes pattern like trisyllabic roots. Stress may or may not be on final syllables depending on the number of syllables in the following suffix, as shown in (21):

- (21) a. wárlu-ngàwurrpà-rlu 'fire dwellers'
fire-DENIZ-ERG [ML]
b. wárlu-ngàwurrpa-kùrlu 'with fire dwellers'
fire-DENIZ-PROP [ML]

Since stress is not always located on every alternating syllable, the constraints given in section 2.3 will not derive the attested stress patterns for many inflected words. The following facts must be accounted for:

1. The first syllable of polysyllabic morphemes is always stressed, $(\sigma'\sigma)\sigma-(\sigma'\sigma)$
2. The first monosyllabic suffix in a string of such suffixes is stressed, $(\sigma'\sigma)\sigma-(\sigma'\sigma)$. A monosyllabic suffix is not stressed if there is an immediately following polysyllabic morpheme, $(\sigma'\sigma)-\sigma-(\sigma'\sigma)$.

2.3.1 Foot and morpheme alignment

To account for the stress patterns in polymorphemic words, I introduce specific constraints². As noted above, stress is always on the first syllable of a polysyllabic morpheme, (**yápa**)**rla**-(**ngùrlu**) 'father's mother-ELAT'. When a monosyllabic and a polysyllabic suffix are present, it is the polysyllabic suffix that is stressed, (**wángka**)-**ja**=(**jàna**) 'speak-PST=3pNS'. When there are a number of monosyllabic suffixes, they behave as if they constitute a polysyllabic morpheme in terms of stress, (**wáti**)**ya**-(**rlà**)-**rlu** 'tree-LOC-ERG'. Two facts are evident from these patterns. Firstly, stress is sensitive to morpheme boundaries and secondly, preference is given to parsing the syllables of polysyllabic morphemes into feet over parsing of monosyllabic morphemes. The second fact can be interpreted as a restriction on footing across morpheme boundaries. However, footing across morpheme boundaries must be permitted if strings of unfooted syllables arise.

The pattern of stress is interrupted by the presence of morpheme boundaries. This is particularly noticeable where morphemes consist of an odd number of syllables. A final odd-numbered syllable will not be parsed into a foot if there is a following polysyllabic morpheme. This

² These constraints were first introduced in Berry (1993) and account for the range of Warlpiri data presented in this thesis, some of which have not previously been accounted for in either OT or rule-based analyses.

LE demands alignment with morpheme edges but this is not always possible when monosyllabic morphemes are present. The output with the least violations of LE will emerge as optimal. This is shown in (27) for the form **watiya-rla-rlu** 'tree-LOC-ERG' [wátiya↑↻↻↻↑◆].

(27)	LE	PARSE σ	AlignFt
%a. [(wáti)ya-(rlà-rlu)]	*	*	2: $\sigma\sigma\sigma$
b. [(wáti)(yà-rla)-rlu]	**!	*	2: $\sigma\sigma$

In the optimal form (27a), there are fewer violations of LE because a foot is aligned to the edge of a suffix compared to (27b), where there is no alignment of suffixes with feet. LE is a crucial constraint in accounting for stress at morpheme boundaries.

In words with a number of monosyllabic suffixes, feet are always located at the leftmost suffix in the string, as in [(ngáju)lu-(rlù=lpá)=rna]. This footing could suggest that there are two prosodic word structures within the word, eg [(ngáju)lu]-[(rlù=lpá)=rna], where the first suffix following the root was the head of a prosodic word. Consequently, we would expect this to be consistent across all words. However, in [(máli)(kì-rla)-(kùrlu)], the monosyllabic suffix is not stressed, which indicates that it is not in a different prosodic word from the root.

LE demands foot alignment with morphemes, and for this reason, a string of monosyllabic suffixes gives the appearance of being prosodic words. This appearance is superficial, since when only one monosyllabic suffix is present, it is unfooted.

2.3.3 Tautomorphemic Foot

In candidates with monosyllabic morphemes, feet cannot always align to morpheme edges. For example, in (**wángka**)-**ja**=(**jàna**) speak-PST=3pNS '(someone) spoke to them', the monosyllabic suffix is not aligned with a foot edge. Preference is given to the alignment of feet with polysyllabic morphemes over alignment with monosyllabic morphemes.

Where a foot is aligned to a monosyllabic suffix as in *(**wángka**)-(**jà=ja**)na, LE is violated once. LE is also violated once in (**wángka**)-**ja**=(**jàna**). However, in the latter form, feet do not cross morpheme boundaries. To ensure that the edges of feet are kept as much as possible at morpheme edges, Tautomorphemic Foot (Taut-F) is required. This constraint notes when feet cross morpheme boundaries.

Taut-F has priority over PARSE σ and AlignFt, but not with respect to LE. Taut-F and LE do not compete with each other over candidates. This ranking is:

(28) LE, Taut-F >> PARSE σ >> AlignFt

In the following tableau, because there are equal numbers of violations to LE, Taut-F makes the decision on the optimal candidate.

(29) ngajulu-rlu=lpá=rna	LE	Taut-F	PARSE σ
%a. [(ngáju)lu-(rlù=lpá)=rna]	**	*	**
b. [(ngáju)(lù-rlu)=(lpà=rna)]	**	**!	

(29a) incurs fewest violations of Taut-F and is therefore the optimal candidate. PARSE σ has two violations in (29a) but, because it is ranked below Taut-F, it cannot make any decision on these forms. If the ranking of PARSE σ and Taut-F was reversed this would make (29b) optimal. Another possible output is where the last two syllables are unfooted; the fate of such outputs is discussed in section 2.3.4.

In order to be an active constraint Taut-F must be ranked above AlignFt. The effect of this ranking is demonstrated in (30). The form **wangka-ja=jana** 'speak-PST=3pNS' [wáŋkacacàna] is assessed where Taut-F decides on the optimal candidate.

(30)

	FtBin	LE	Taut-F	PARSE σ	AlignFt
%a.[(wángka)-ja=(jàna)]		*		*	2: $\sigma\sigma\sigma$
b.[(wángka)-(jà)=(jàna)]	*!				2: $\sigma\sigma$
c.[(wángka)-(jà=ja)na]		*	*!	*	2: $\sigma\sigma$

(30a) least violates the higher ranked constraints and is the optimal candidate. When the monosyllabic suffix is incorporated into a degenerate foot, FtBin is violated as in (30b). When a binary foot is aligned to the left edge of the monosyllabic suffix as in (30c), Taut-F is violated.

Taut-F is not an alignment constraint like LE. Taut-F rules out feet straddling morpheme boundaries. When a foot crosses a morpheme boundary, the syllables in the foot are not in the same morpheme. Adjacent syllables are in different morphemes, (σ - σ). In -($\sigma\sigma$)-, the syllables in the foot are in the same morpheme. Syllables in feet must be tautomorphemic which in turn means that feet must be tautomorphemic.

When there are combinations of polysyllabic morphemes with monosyllabic ones, the Taut-F constraint ensures that feet are aligned with polysyllabic morphemes. This avoids non-aligned feet and morphemes. In some cases, misalignment must occur in order to parse the syllables of monosyllabic suffixes into feet. As long as foot and morpheme misalignment is kept to a minimum, well-formed outputs will be produced.

2.3.3.1 LE and Taut-F

LE and Taut-F overlap in their roles of maintaining alignment. For instance, whenever there is a Taut-F violation, there will also be a LE violation, as shown in *(wángka)-(jà=ja)na. The reverse does not have to apply, as for example in (wángka)-ja=(jàna), where there is an LE violation but not a Taut-F violation. Significantly, Taut-F is crucial in these examples where there are the same number of violations to LE. The significance of LE is validated when the same number of Taut-F violations occur, as shown in (31).

(31)

	LE	Taut-F	PARSE σ	AlignFt
%a.[(wáti)ya-(rlà-rlu)]	*	*	*	2: $\sigma\sigma\sigma$
b.[(wáti)(yà-rla)-rlu]	**!	*	*	2: $\sigma\sigma$

Both outputs incur the same number of violations to Taut-F, in which case LE is necessary to rule out (31b).

The outputs ruled out by either Taut-F or LE have one element in common, and this is: a foot straddling the boundary of a polysyllabic morpheme and any other morpheme. These non-optimal outputs are:

- (32) *(wángka)-(jà=ja)na
 *(yápa)(rlà-ngu)rlu
 *(wáti)(yà-rla)-rlu
 *(ngáju)(lù-rlu)=(lpà=rna)

Compare these with outputs which, although violate Taut-F and LE, violate them minimally, and are therefore not ruled out.

- (33) (pálya)-(ngkù=rna)=lu
 (wángka)-(jà=rna)=(jàna)
 (ngáju)lu-(rlù=lpà)=rna

Parsing two monosyllabic morphemes into a foot as in (33) is well-formed. In contrast, parsing a monosyllabic suffix into a foot with a syllable from another morpheme is not well-formed. As will be discussed in 2.3.4, such parsing may be forced by higher ranked constraints.

Given that LE and Taut-F share a common element, one solution to the overlapping problem is to combine them into a single constraint. We want to rule out foot parsings such as $(\sigma\sigma)(\sigma-\sigma)$ and $(\sigma\sigma)-(\sigma-\sigma)\sigma$, but not $(\sigma\sigma)-(\sigma-\sigma)$. The generalisation that captures this is: morphemes may not be split between feet. I will refer to this generalisation as No Split.

No Split would allow monosyllabic morphemes to be combined into a single foot, eg $-(\sigma-\sigma)-$, since they comprise a single syllable. However, No Split would not allow a syllable of a polysyllabic morpheme to be parsed into a foot with the syllable of another morpheme, eg $*(\sigma\sigma)(\sigma-\sigma)$, since this splits a morpheme. No Split could be interpreted as a constraint, replacing LE and Taut-F.

LE is an alignment constraint requiring alignment with morphemes. Taut-F ensures that this alignment is with polysyllabic morphemes. In words consisting solely of polysyllabic morphemes, either LE or Taut-F would be sufficient to guarantee alignment. However, when there are monosyllabic morphemes which require alignment, both LE and Taut-F or No Split are necessary.

In languages with similar stress patterns, such as Diyari and Dyirbal (discussed in 2.5), No Split is unable to account for the range of facts. In these cases, No Split is either too specific or not specific enough.

In Diyari, strings of monosyllabic feet cannot be parsed into feet $*-(\sigma-\sigma)-$. No Split is unable to rule out such instances of foot parsing. In Dyirbal, while root and suffix cannot be split between feet, other morphemes can be. However, No Split would rule out all instances of morpheme splitting.

LE and Taut-F can account for a larger range of stress patterns and would have wider universal application than No Split. It is on these grounds that I reject the No Split generalisation.

An alternative analysis to Taut-F would be to require recursive prosodic word boundaries (Kager pc). The right edge of the prosodic word could then align with the right edge of stems, as in [(pa.lya)]-ng.(ku.=rna.)]=lu.] 'with an adze we (did..)'. However, as is evident, syllabification across prosodic word boundaries occurs, eg **.ly**a)]-ng., resulting in overlapping prosodic constituents. As discussed in 2.3.2.1, harmony does not cross prosodic word boundaries and requiring recursive prosodic word would fail to account for this fact. An additional disadvantage is that verb stems would require a different explanation which is not justified given the data.

2.3.4 Rhythmic Alternation

The ranking of Taut-F above PARSE σ is necessary to ensure that alignment of feet with morphemes occurs in preference to parsing syllables into feet. One consequence of this ranking is the possible lack of foot parsing. The nonparsing of syllables into feet, particularly when there are monosyllabic suffixes, is an effect of Taut-F.

The solution to the non-parsing problem is to introduce a more specific parsing constraint and rank it above Taut-F. This is Rhythmic Alternation (RA), which requires one of two adjacent syllables to be parsed into a foot. Where there is a sequence of two syllables, eg $\sigma\sigma$, one of these syllables must be in a foot, eg $(\sigma)\sigma$ or $\sigma(\sigma)$.

RA is concerned with adjacency. It assesses whether one of two adjacent syllables is parsed into a foot.

- (34) RA
 ($\sigma\sigma$)
 $\sigma)\sigma$
 $\sigma\sigma$ *

This constraint is similar to a constraint called Parse-Syllable-2 which Kager (1994) independently introduces to account for ternary alternating systems exhibited by languages such as Estonian and Chugach. I show in Chapter 4 that RA is a motivating constraint in the rhythmic organisation of the language.

In a word with a monosyllabic suffix, for example, (**wáti**)(**yà-rla**), Taut-F is violated. Taut-F is not violated if the final two syllables are unfooted, as in *(**wáti**)**ya-rla**. PARSE σ cannot rule out the latter form because it is ranked below Taut-F. It is in these cases that Rhythmic Alternation makes a crucial contribution. By RA, a form with adjacent unfooted syllables is ill-formed. In order to rule out such ill-formed outputs RA needs to have priority over Taut-F. This will entail ranking RA above Taut-F.

- (35) RA >> LE, Taut-F >> PARSE σ >> AlignFt

Consider the following tableau showing the word **watiya-rla** 'tree-LOC' [wátiyà \hat{u} a]:

(36)

	RA	LE	Taut-F	PARSE σ
%a. [(wáti)(yà-rla)]		*	*	
b. [(wáti)ya-rla]	*!	*		**

(36a) is the optimal output because it does not violate the higher ranked RA. PARSE σ is ranked below LE and Taut-F and, consequently, has no say in determining the optimal candidate. Without RA, (36b) would be optimal.

If LE and Taut-F were not required to align feet with morpheme edges, PARSE σ would ensure that syllables are parsed into feet. As I have argued, LE and Taut-F are crucial constraints accounting for morpheme and foot alignment.

In outputs where there are no violations to Taut-F, RA is essential as shown in (37) with the word **jirrama-rlu=kirli** 'two-ERG=precisely' [círamá \hat{u} ukì \hat{u} i]:

(37)	RA	Taut-F	PARSE σ	AlignFt
%a. [(jírra)(mà-rlu)=(kírli)]		*		2: $\sigma\sigma$
b. [(jírra)ma-(rlù=ki)rli]		*	**!	2: $\sigma\sigma\sigma$
c. [(jírra)ma-rlu=(kírli)]	*!		**	2: $\sigma\sigma\sigma\sigma$

(37c) violates the higher ranking constraint RA and thus, is judged as the least preferred output in this tableau. There are two PARSE σ violations in (37b), it is therefore ruled out in favour of (37a). Without RA, (37c) would be the optimal candidate since it does not violate Taut-F.

In (37) RA and AlignFt make the crucial decisions on outputs. This is also evident in the next tableau with the word **palya-ngku=rna=lu** 'adze-ERG=1peS' [pá \diamond a ̥ kù ̥ alu].

(38)	RA	LE	Taut-F	PARSE σ	AlignFt
%a.(pálya)-(ngkù=rna)=lu		**	*	*	2: $\sigma\sigma$
b.(pálya)-ngku=(rnà=lu)		**	*	*	2: $\sigma\sigma\sigma$!
c.(pálya)-ngku=rna=lu	**!	***		***	

In (38), AlignFt has the final say. (38a) is the optimal candidate as the second foot in the word is closer to the word edge than the same foot in (b). (38c) is ruled out by the higher ranked RA.

In some cases the conflict is between Taut-F and AlignFt. This is shown in (39) with the word **ngajulu-rlu=lpà=rna** 'I-ERG=IMPF=1sS' [náculu $\hat{\text{u}}$ lpà ̥ a].

(39)	RA	LE	Taut-F	PARSE σ	AlignFt
%a. [(ngáju)lu-(rlù=lpà)=rna]		**	*	**	2: $\sigma\sigma\sigma$
b. [(ngáju)(lù-rlu)=(lpà=rna)]		**	**!		2: $\sigma\sigma$
c. [(ngáju)lu-rlu=(lpà=rna)]	*!	**	*	**	2: $\sigma\sigma\sigma\sigma$

Once RA rules out (39c), the decision on the optimal output is left to Taut-F and AlignFt. (39b) incurs more violations of Taut-F than (39a) and thus (a) emerges as the optimal output.

PARSE σ is not able to rule out an adjacent sequence of unparsed syllables in preference to nonadjacent unparsed syllables. RA, on the other hand, notes instances of unfooted adjacent syllables. PARSE σ simply notes how many syllables have not been parsed into feet. It is not concerned with the location of unparsed syllables, whether or not they are next to each other, as for example in (40).

(40) ngajulu-rlu=lpà=rna	PARSE σ
a. [(ngáju)lu-(rlù=lpà)=rna]	**
b. [(ngáju)lu-rlu=(lpà=rna)]	**

RA is a more specific constraint on parsing and rules out candidates such as those in (40b), where unfooted syllables are adjacent. $PARSE\sigma$ cannot decide on either candidate. RA cannot be violated and must be a dominant constraint. The fact that not all syllables are parsed into feet indicates that exhaustive parsing is not an absolute requirement in Warlpiri.

Unfooted syllables between feet create ternary rhythmic patterns, while adjacent feet create a binary rhythm. In Warlpiri, both patterns are attested. RA predicts the existence of ternary patterns, while $PARSE\sigma$ predicts that only binary patterns are possible. FtBin and RA ensure that rhythm is restricted to binary and ternary alternations. Rhythmic patterns in Warlpiri are discussed in more detail in Chapter 4.

2.3.5 Other Polymorphemic Words

The stress pattern for reduplicated and compound words is consistent with that of other polymorphemic words. Stress is regularly located on the initial syllable of polysyllabic morphemes and prosodic words. RED=reduplicated portion.

- (41) Reduplicated Words
- | | | |
|----|--------------------------------|-----------------------------|
| a. | yàrli-yàrli-ni | 'wetting' |
| | RED -wet -NPST [DGN:139] | |
| b. | wúurr-wùurr-wàngka-mi | 'howling..of wind' |
| | RED- whirr-speak-NPST [GB] | |
| c. | pírilyi-pírilyi | 'black beetle;pupil of eye' |
| | RED -charcoal [GB] | |
| d. | ngàti-nyànu-ngàti-nyànu-rlu | 'their mothers' |
| | RED-mother-POSS-ERG' [DGN:134] | |
- (42) Compounds
- | | | |
|----|-------------------------------|--------------------------------|
| a. | púnju-ngà-rnu | 'drank the whole lot' |
| | PREVERB-eat,drink-PST [GB] | |
| b. | máarrpà-rni-mà-ni-nja-yà-ni | 'coming flashing (lightening)' |
| | flash-hither-INF-go-NPST [LB] | |
| c. | wápa-njà-ngu-wàpa-njà-ngu | 'from walking' |
| | RED- walk-INF-NOMIC [DGN:135] | |

There are also a large number of unproductive reduplications and compounds in Warlpiri. The stress pattern of these forms will be addressed in the next chapter.

2.3.6 Summary

As shown throughout this section, in accounting for the patterns of stress in polymorphemic words, the presence of morphemes and the number of syllables in these morphemes must be acknowledged. The patterns are straightforward: stress is on the first syllable of every polysyllabic morpheme or on the first monosyllabic suffix in a string of monosyllabic suffixes. In the absence of morpheme boundaries, stress alternates on every other syllable. I have proposed specific constraints that account for the stress patterns LE, Taut-F, and RA.

These constraints are ranked above AlignFt and $PARSE\sigma$ and ensure foot alignment with a suffix, as in (**yápa**)rla-(ngùrlu), rather than the iterative footing demanded by AlignFt.

Monomorphemic words have no internal morpheme boundaries and as long as the left edge of the word is aligned with a foot, they will always satisfy LE and Taut-F.

In some cases we can see that LE and Taut-F reflect something of the morphological structure of a word. For instance, in a word consisting of two polysyllabic morphemes, such as **(máli)ki-(kìrla)ngu** dog-POSS, the two morphological domains are clearly delineated by stress. This delineation is overridden by RA, however, if otherwise adjacent unfooted syllables arise, as in ***(wáti)ya-rla**.

In some cases it will be impossible to satisfy LE completely, in which case ensuring that feet do not straddle morpheme boundaries of any kind is imperative. For instance, **(wángka)-ja=(jàna)** is well-formed but ***(wángka)-(jà=ja)na** is not.

Taut-F does not discriminate against the kinds of morpheme boundary that feet may straddle, but demonstrates that morphemes are domains for stress assignment. All morphemes are word-like in this respect, including a sequence of monosyllabic suffixes. Such a sequence is parsed into a foot in words such as **(wáti)ya-(rlà-rlu)**, rather than ***(wáti)(yà-rla)-rlu**. Priority is given to parsing the monosyllabic suffixes into feet.

Other languages, such as Diyari (discussed in 2.5), do not tolerate feet which straddle morpheme boundaries, even if that means having adjacent unfooted syllables.

The crucial constraints for Warlpiri are RA, LE and Taut-F. Their ranking with regard to the more general constraints is:

(43) FtBin, AlignL, FtForm, RA >> LE, Taut-F >> PARSE σ >> AlignFt

The crucial constraints are necessary to account for the more specific cases of morpheme and foot alignment and foot parsing. The inter-relationship between the morphology and phonology is expressed in LE and Taut-F. This inter-relationship is successfully captured in a system that allows for consideration of outputs in parallel and for minimal violations of constraints. As I argue below it is these aspects which provide the most convincing analysis of the stress patterns in Warlpiri.

2.4 Comparison with Alternative Analyses

In this section I consider how other accounts compare with OT. The focus is on derivational analyses.

2.4.1 A Noncyclic Analysis

One of the benefits of OT is that all prosodic structure is built simultaneously. In a serial derivation approach prosodic structure is built gradually. For instance, segments are parsed into syllables, then syllables are combined into feet, and feet are then grouped into a prosodic word. This step-by-step approach of building prosodic structure puts the analysis at a disadvantage, as I will show.

We will consider a serial derivation assuming the constraints given in the analysis presented in 2.3. In a derivational analysis, prosodic word structure is not present at the time that feet are parsed. Consequently, constraints such as AlignL and AlignFt are not applicable at this stage. AlignFt ensures that feet are parsed as close as possible to the edge of the prosodic word, which effectively ensures that feet are iteratively parsed. AlignFt can only apply when prosodic word structure is present. Thus, in a derivational analysis iterative foot parsing must be generated by rule. This rule is given below.

- (44) Rule 1: within morphemes, syllables are parsed into trochaic feet left-to-right.

The rule must specify the domain of parsing to ensure that feet are sensitive to morpheme boundaries, as in (45).

- (45) /maliki-kurlangu/ dog-POSS
Rule 1: (máli)ki-(kìrla)ngu

By Rule 1, a monosyllabic morpheme cannot be parsed into a foot on its own. Thus, to ensure that a string of monosyllabic morphemes are parsed into feet, an additional rule is required stating that unfooted syllables are parsed into feet.

- (46) Rule 2: Parse unfooted syllables into feet left-to-right.

- (47) /yama-ngka=rna/ shade-LOC=1sS
Rule 1: (yáma)-ngka=rna
Rule 2: (yáma)-(ngkà=rna)

Problems arise when there are a number of monosyllabic suffixes following a morpheme with an odd number of syllables. For instance, by Rules 1 and 2, /watiya-rla-rlu/ would be parsed as *(wáti)(yà-rla)-rlu rather than (wáti)ya-(rlà-rlu). The solution to this problem is to ensure that syllables within a morphological domain are exhaustively parsed into prosodic structure. This can be achieved by Stray Syllable Adjunction (Liberman and Prince 1977, Hayes 1981, among others) where a stray (unfooted) syllable is adjoined to preceding foot.⁴

- (48) Stray Syllable Adjunction: A stray syllable within a morpheme domain is adjoined to a preceding foot in the morpheme.

- (49) /watiya-rla-rlu/ tree-LOC-ERG
Rule 1: (wáti)ya-rla-rlu
Stray Adjunction: (wátiya)-rla-rlu
Rule 2: (wátiya)-(rlà-rlu)

A consequence of adjoining stray syllables is having to reassociate a stray adjoined syllable to a foot via a kind of rhythmic principle, as suggested in Berry (1991). This means that some feet have to undergo restructuring, as shown in (50).

- (50) /watiya-rla/ tree-LOC
Rule 1: (wáti)ya-rla
Stray Adjunction: (wátiya)-rla
Rule 2: n/a
Restructure: (wáti)(yà-rla)

⁴ Another solution following Hewitt (1991) is to parse stray syllables into a maximal minimum word (ie a minimum word plus a single light syllable), as proposed in Berry (1991). This solution avoids the creation of ternary feet.

The form after stray adjunction is an ill-formed rhythmic structure. The final syllable cannot stray adjoin to the preceding foot, since this foot already consists of three syllables. As a result, re-footing is forced.

The output in (50) is what would result from a general stress rule. The processes of stray adjoining and restructuring, while superficial and non-explanatory, are necessary steps in a derivational analysis. In (50) it is only after stray adjunction that we can see when restructuring is required, because it is only then that the other unfooted syllables are considered. If there is more than one syllable, these will be parsed into feet, as in (49) (**wátiya**)-(r_là-r_lu); if there is only one syllable; then restructuring is required, as in (50). If it was possible to see the number of syllables in a morpheme or the number of monosyllabic suffixes in a string, this would avoid the need for adjunction and restructuring.

This is possible in OT, where the output in (50) is achieved in a single simultaneous application of constraints, without the need for readjustments. In addition, the observation that stress is dependent on morpheme boundaries is captured and not obscured in OT, a point also noted by Kager (1993b). Another disadvantage is that ternary feet are created and are only required to ensure all syllables are exhaustively parsed into feet.

Additional problems are encountered with certain monosyllabic morphemes. These are monosyllabic verb roots, and a few monosyllabic suffixes (discussed in Chapter 3) which attract stress in certain contexts. In previous accounts (such as Nash 1986) these forms were assigned monosyllabic feet, because as monosyllables they will not be parsed by Rule 1. Assigning monosyllabic feet to them will therefore ensure that they are stressed. Monosyllabic feet never surface in outputs and thus an additional mechanism would be needed to ensure that monosyllabic feet delete or adjoin to other feet.

Monosyllabic feet also violate FtBin. We might consider that such violation is permitted prior to foot deletion or adjunction. In sum, FtBin is violated to ensure that domains are exhaustively parsed and specific morphemes are assigned stress. However, there is no evidence to suggest that ternary or monosyllabic feet are prosodic constituents in Warlpiri.

In a derivational analysis, Stray Adjunction, foot restructuring, ternary and monosyllabic feet are the only ways to account for the behaviour of monosyllabic morphemes. Sometimes these morphemes constitute a domain for stress assignment (eg specific morphemes or a string of morphemes) and sometimes they do not (eg on their own).

Stray Adjunction, foot restructuring and assigning degenerate feet to monosyllabic verb roots are conditions on parsing, and can be characterised in the following statements: If an unfooted syllable occurs within a domain, then adjoin it to a preceding foot; If stray adjunction were to create a quaternary foot, then restructure the foot; If a monosyllabic verb root is not parsed, assign it a degenerate foot.

As noted by Prince & Smolensky (1993) 'if..then' conditions are characteristic of systems which combine well-formedness conditions with rules. A rule may say to do X, but if a condition would be violated, then do not do X, or do something else. Here two conditions are considered relative to each other, but not relative to other conditions in the analysis. This obscures the priorities between all the conditions and forces the analysis to proceed step-by-step. For instance, stray adjunction is not considered in relation to foot restructuring, since restructuring is a consequence of stray adjunction. Stray adjunction would not need to happen if it was known when adjunction was unnecessary, and if that could apply then restructuring would also be unnecessary.

In OT, priorities are explicitly interpreted as dominance of some conditions over others. Conflict between all conditions is resolved through ranking. Since in OT, all constraints assess simultaneously, the interaction between a number of conflicting constraints can be captured.

The disadvantage of a derivational analysis is that conditions and non-binary feet have to be introduced which do not contribute to our understanding of the process of stress assignment. They are stop-gap measures needed during the derivational process. In OT, in contrast, these conditions are unnecessary since it achieves what no other model can, that is, a virtual 'look-ahead' system. For instance, the number of syllables in morphemes and the number of monosyllabic suffixes can be ascertained through the simultaneous operation of constraints on fully formed words.

2.4.2 Cyclic Analysis

In a standard cyclic analysis, morphological and phonological operations are interwoven. After each morphological operation, a form is submitted to the phonology and then resubmitted back to the morphology. Each cycle of affixation constitutes a phonological domain and on each cycle phonological rules are reapplied. In this system, an input such as watiya-rla 'tree-LOC' would go through two cycles⁵.

- (51) cycle 1 (wáti)ya
 cycle 2 (wáti)(yà-rla)

In other morpheme combinations, where some morphemes have an odd number of syllables, the cyclic model is unable to generate the attested stress patterns, as shown in (52).

- | | | | |
|------|---------|--------------------|--------------------|
| (52) | UR | /watiya-rla-rlu/ | /yaparla-ngurlu/ |
| | cycle 1 | (wáti)ya | (yápa)rla |
| | cycle 2 | (wáti)(yà-rla) | (yápa)(rlà-ngu)rlu |
| | cycle 3 | (wáti)(yà-rla)-rlu | |
| | | *wátiyàrlarlu | *yáparlàngurlu |

One solution to this problem is to carry over stress assigned on a previous cycle, and stipulate that each new morpheme is subject to phonological rules, rather than the entire string (as in Poser 1990). This will mean that rules apply only to the morpheme added at each cycle. Parsing monosyllabic morphemes would require additional specifications. This applies whether they are to be parsed into degenerate feet or left until all morphology is completed. Once again problems with monosyllabic suffixes and morphemes with an odd number of syllables are encountered.⁶ Very much the same 'if..then' conditions required for the noncyclic analysis would be necessary.

The drawback with a standard cyclic analysis, is that the morphological organisation of the whole word is only known after the final cycle. To overcome this, the analysis would have to be modified to ensure that each morpheme is a domain for stress assignment. Such a move undermines the essence of a cyclic analysis.

In derivational analyses, monosyllabic suffixes are left to be dealt with by additional rules after polysyllabic morphemes have been parsed. In OT, the conflict between the phonological and morphological requirements of the stress system are addressed at the same time. This is essentially

⁵ Here the root constitutes a cycle, although not all cyclic analyses have a root cycle.

⁶ Poser's analysis would not work for words in Warlpiri consisting of a root with an even number of syllables and an uneven number of monosyllabic suffixes ie $\sigma\sigma\text{-}\sigma\text{-}\sigma\text{-}\sigma$. His analysis assigns monosyllabic feet to these suffixes which then are formed into binary feet by joining them together right-to-left. Any remaining monosyllabic feet form a ternary foot with a preceding foot which would produce the unattested pattern $*\sigma\text{'}\sigma\text{-}\sigma\text{-}\sigma\text{'}\text{-}\sigma$

what makes the OT analysis successful and also the superficial structures (monosyllabic feet or ternary feet) and rules are not required. Once we know what the constraints are on the stress patterns, the priority of each constraint is then established. All the constraints assess an output simultaneously and the output that best satisfies these constraints will be the preferred output. In cyclic and noncyclic analyses, stress assignment occurs by the application of rules step-by-step. If rules are interpreted as conditions on outputs, a more satisfactory account of the stress patterns is provided. OT provides such an account.

The constraint system OT provides allows for effective comparison with other languages. This is shown in the following discussion of the stress patterns in a number of languages.

2.5 Constraint Application in Other Languages

LE, Taut-F and RA are crucial constraints in generating the attested stress patterns in Warlpiri. Other languages submit to a similar analysis. Many other Australian Aboriginal languages display sensitivity to morphological edges in the location of stress. Analyses of the stress patterns of some Australian languages, for example, Diyari (Austin 1981), Dyrbal (Dixon 1972) and Wambaya (Nordlinger 1993) show that feet are sensitive to morpheme boundaries. In this section, the constraints-based analysis proposed here is extended to these languages. We will see that the languages vary as to whether morpheme boundaries may be crossed or not.

2.5.1 Wambaya

Wambaya (Nordlinger 1993) is a non-Pama Nyungan language and a member of the West Barkly language group spoken in north central Australia. The stress patterns in Wambaya are similar to those of Warlpiri, with the exception that monomoraic roots are stressed and long vowels arising from glide deletion are not stressed.

In monomorphemic words with short vowels, stress falls on the initial syllable and every following alternate syllable. Main stress falls on the first syllable of a word and word-final stress is not permitted. The initial syllable of a polysyllabic morpheme and the first suffix in a string of monosyllabic suffixes receive stress. These patterns are shown in the following examples:

- | | | |
|------|--------------------------|--------------------------------|
| (53) | a. gáguwi-nì-ni | 'fish-I:nAbs-LOC' ⁷ |
| | b. búgayì-rna | 'big-II:Abs' |
| | c. náyida | 'woman' |
| | d. gályurrìngi-ni-nmànji | 'water-I:nAbs-ALL' |
| | e. dágumaj-bàrli | 'hit-Agnt:I:Abs' |

The constraints introduced for Warlpiri will account for the forms in (53), but additional constraints are required to account for the words in (54).

- | | | |
|------|----------------------------|---------------|
| (54) | Long vowels and verb roots | |
| | a. galáa | 'bone' |
| | b. gardáala | 'gidgee tree' |
| | c. jány-bu`lu | 'dog-DU' |

⁷ Abbreviations are: I = class I (masculine gender); II = class II (feminine gender); Abs = absolutive gender suffix; nAbs = non-absolutive gender suffix; ALL= allative case; Agnt= agentive nominaliser; DU=Dual.

RA and LE decide on the candidates ensuring that (58a) is the optimal output. In the next tableau, the operation of AlignRt_σ is demonstrated.

(59) jany-bulu	RA	FtBin	AlignRt_σ	LE	Taut-F
%a. (jány)-(bu`lu)		*			
b. (jány-bu)lu			*	*!	*
c. jany-(bu`lu)			**!	*	
d. jany-bulu	**!		**	**	

The same number of violations are incurred by (59a) and (59b) for FtBin and AlignRt_σ and the decision is left to LE. If a verb root is not aligned at the left and right edges two violations are incurred as for (59c).

Since AlignRt_σ is specific to monomoraic roots it has no effect on longer roots such as *dágumaj-bàrli*, as shown in the following tableau.

(60)	RA	FtBin	AlignRt_σ	LE	Taut-F
%a. (dágu)maj-(bàrli)					
b. (dágu)(màj)-(bàrli)		*!			
c. (dágu)(màj-ba)rli				*!	*
d. (dágumaj)-(bàrli)		*!			
e. (dá)gumaj-(bàrli)	**!				

As (60a) incurs no constraint violations it is the optimal output.

2.5.2 *Diyari*

The data from *Diyari*, originally given in Austin (1981), have been previously analysed by a number of linguists (including Poser 1990, Halle and Kenstowicz 1991, Idsardi 1992). A recent analysis of *Diyari*, Dyirbal and Gooniyandi by Crowhurst (1994) has, independently, proposed an analysis along similar lines to the one presented here. With the exception of RA, the constraints and ranking are the same in both Crowhurst and my analysis. In Crowhurst, Morpheme-Foot-Left: $\text{Align}(\text{Morpheme}, L, \text{Foot}, L)$ corresponds to my LE. As will be shown, Taut-F is ranked higher than LE in *Diyari*.

Diyari has very similar stress patterns to Warlpiri with one exception, which is that monosyllabic suffixes are not incorporated into feet. In (61) we see examples of words whose stress patterns are the same as those for Warlpiri⁸.

(61)	a. (pína)du-(wàrda)	'old man-PL'
	b. (ngánda)(wàlka)	'to close'
	c. (kánha)-(wàra)-ngu	'man-PL-LOC'
	d. (kárna)-nhi-(màtha)	'man-LOC-IDENT'
	e. (yákal)ka-(yìrpa)-(màli)-rna	'ask-BEN-RECIP-PART'

⁸ *Diyari* has an additional place series, the lamino-dentals. These are orthographically indicated as th,nh,lh.

The following examples show that monosyllabic suffixes are not parsed into feet in contrast to Warlpiri.

- (62) a. (púlyu)du-nhi 'mud-LOC'
 b. (máda)-la-nthu 'hill-CHARAC-PROP'

From these examples it is clear that the constraint RA is not a dominating constraint in Diyari, as adjacent unfooted syllables are permitted in polymorphemic words. Given that feet are aligned with polysyllabic morphemes, Taut-F must be ranked above AlignFt and RA (here we can replace RA with PARSE σ). Taut-F must also be ranked above LE to ensure that outputs where monosyllabic suffixes are parsed into feet are not optimal.

- (63) Constraint Ranking for Diyari
 Taut-F >> LE >> RA >> AlignFt

The effect of this ranking is shown in (64).

(64) mada-la-nthu	Taut-F	LE	RA	AlignFt
%a. (máda)-la-nthu		**	*	
b. (máda)-(là-nthu)	*!	*		2: $\sigma\sigma$

A foot which crosses morpheme boundaries is not tolerated in Diyari. Unfortunately, there are no monosyllabic roots in Diyari which might prove an exception to this prohibition. (64a) is the optimal output even though there are violations of LE and RA. (64b) violates the higher ranked Taut-F and is thus the non-optimal output.

The hypothetical constraint No Split (feet may not be split by morphemes), introduced in section 2.3.3.1, would not rule out (64b). While such forms are acceptable in Warlpiri, they are not acceptable in Diyari. Taut-F is crucial in ruling out all instances of feet crossing morpheme boundaries in Diyari. This is the situation in the next tableau, where parsing a monosyllabic suffix into a foot violates Taut-F.

(65) karna-nhi-matha	Taut-F	LE	RA
%a. (kárna)-nhi-(màtha)		*	
b. (kárna)-(nhi-ma)tha	*!	*	

Taut-F makes the decision on the optimal candidate, ensuring that (65a) is the preferred output.

In Diyari, feet must not cross morpheme boundaries, while, in Warlpiri and Wambaya, this prohibition is relaxed if otherwise adjacent unfooted syllables occur. Differences in the stress patterns exhibited by various languages can be expressed by differences in constraint ranking. In Diyari, the constraint Taut-F is dominant, that is, it cannot be violated, in contrast with Warlpiri and Wambaya. Violation of the constraint RA is permitted in Diyari and must be a lower ranked constraint.

Kager (1993b) proposes an analysis for Diyari, where prosodic word structure is recursive and a constraint aligns the right edge of the stem with the right edge of the prosodic word. In

Diyari, this accounts for the fact that monosyllabic suffixes are not parsed into feet. As pointed out in 2.3.3, a right-edge alignment constraint on stem and prosodic word cannot account for the facts of Warlpiri. Given this, I adopt Taut-F for the analysis of Diyari on the basis that the constraint has application to other languages.

2.5.3 *Dyirbal*

In Dyirbal, feet are permitted to cross morphological boundaries, with the exception of root and suffix boundaries and, to account for this, a more specific Taut-F constraint is required. The data are from Dixon (1972) and Crowhurst (1994)⁹. My analysis of the Dyirbal facts differs from that of Crowhurst, and is slightly different from Kager (1993b), as discussed in the latter part of this section.

The stress patterns in the data in (66-68) of monomorphemic and polymorphemic words respectively are the same as those found in Warlpiri. Examples from Crowhurst are indicated by MC.

- | | | |
|------|------------------------|---------------------------------|
| (66) | a. múlumíyan | 'whale' [MC] |
| | b. dyúgumbil | 'woman' |
| | c. balan yímalímal | 'welcome swallow' |
| (67) | a. búyba-rrí-nyu | 'hide-REFL-PRES/PST' |
| | b. wáydyi-ngú-gu | 'motion uphill-rel.cl.-DAT' |
| | c. núdil-mál-dya-nyu | 'cut-COMIT-LOC-PRES/PST' |
| | d. bánagay-mbá-rri-nyu | 'return-REFL-COMIT-PRES/PST' |
| | e. wáyndyi-ngu | 'motion uphill-rel.cl.' |
| | f. búrgurúm-bu | 'jumping ant-ERG' ¹⁰ |

Differences between Warlpiri and Dyirbal are evident in the following examples:

- | | | |
|------|---------------------------|------------------------|
| (68) | a. (dyángga)-(ná-mbi)la | 'eat-pron-with' |
| | b. (mánda)lay-(mbál-bi)la | 'play-COMIT-lest' [MC] |

In contrast to Warlpiri, non-initial polysyllabic morphemes in Dyirbal do not always have stress on the first syllable. Feet align with the first suffix following the root regardless of whether the suffix is monosyllabic or polysyllabic. Feet are not permitted to cross over root and suffix boundaries, except when the suffix is monosyllabic. This observation requires a more specific constraint than Taut-F. Such a constraint would prohibit feet from straddling the boundary between a root and suffix, but still allow other boundaries to be straddled. This constraint is proposed in Kager (1993b) and is:

- (69) **Align Root (AlignRt):** Align (Root, Left/Right, PW, Left/Right).

⁹ The data in Crowhurst is from Dixon (1972) and from personal communication with Dixon.

¹⁰ There is conflicting information about the stress pattern of words with trisyllabic roots followed by a monosyllabic suffix. Dixon (1972) states that there is a strong tendency for stress to regularly alternate. This is confirmed by Dixon (pc) for words of the form $\sigma\sigma\sigma\text{-}\sigma$. In Crowhurst and Kager, these forms have the stress pattern $(\sigma\leftrightarrow\sigma)\sigma\text{-}\sigma$.

AlignRt is more specific than Taut-F and consequently renders Taut-F inactive. AlignRt is ranked below RA to ensure that syllables across root and suffix boundaries are parsed into feet. The ranking is:

(70) RA >> LE >> AlignRt >> AlignFt

In Kager (1993b) and Crowhurst (1994) there is no RA constraint. Kager ranks AlignRt above PARSE σ to account for (búrgu)rum-bu.

LE must be ranked above AlignRt to ensure foot alignment with the left edges of roots, as shown in the following tableau.

(71) burgurum-bu	RA	LE	AlignRt	AlignFt
a. [(búrgu)rum-bu]	*!	*		1:#
b. [bur(gúrum)-bu]		**!		1: σ
%c. [(búrgu)(rúm-bu)]		*	*	1:# 2: $\sigma\sigma$

Adjacent unfooted syllables are ruled out by RA in (71a). Neither of the morphemes in (71b) are aligned with a foot, incurring more violations of LE. If LE was ranked below AlignRt, (71b) would be the optimal output, rather than (71c).

In words with a number of monosyllabic suffixes, AlignRt makes the crucial decision, as shown in (72). (72a) is the optimal candidate, least violating the constraints.

(72) banagay-mba-ri-dyu	RA	LE	AlignRt	AlignFt
%a. [(bána)gay-(mbá-ri)-dyu]		**		2: $\sigma\sigma\sigma$
b. [(bána)(gáy-mba)-(rí-dyu)]		**	*!	2: $\sigma\sigma$
c. [(bána)gay-mba-(rí-dyu)]	*!	**		2: $\sigma\sigma\sigma\sigma!$
d. [(bána)gay-mba-ri-dyu]	**!	***!		

As the following tableau demonstrates, it is not essential that preference be given to the alignment of feet with polysyllabic morphemes, as long as the root and suffix boundaries are not crossed.

(73) mandalay-mbal-bila	RA	LE	AlignRt	AlignFt
%a. [(mánda)lay]-(mbál-bi)la]		*		2: $\sigma\sigma\sigma$
b. [(mánda)(láy-mbal)-(bíla)]		*	*!	2: $\sigma\sigma$
c. [(mánda)lay]-mbal-(bíla)]	*!	*		2: $\sigma\sigma\sigma\sigma!$

In (73) the decision on the optimal candidate is left to RA and AlignRt.

AlignRt is a more specific constraint than Taut-F, as AlignRt is concerned only with feet crossing root and suffix boundaries, rather than any boundaries. This contrasts with the other languages discussed here, Warlpiri and Diyari.

In an alternative analysis of Dyirbal by Crowhurst, a constraint on the alignment of feet and morphemes on the right edge is introduced. This is Morpheme-Foot-Right (MFR). This constraint, in addition to FtBin, LE, Taut-F, AlignFt and PARSE σ , is ranked as:

(74) FtBin >> LE >> PARSE σ , AlignFt >> Taut-F >> MFR

Due to the equal ranking of PARSE σ and AlignFt, where AlignFt assesses violations in a non-gradient fashion, MFR is crucial as shown in (75) involving a monomorphemic word.

(75) mulumiyan	LE	PARSE σ	AlignFt	Taut-F	MFR
%a. [(múlu)(míyan)]			**		
b. [(múlu)míyan]		**			*!

Both (75a,b) have an equal number of violations to the equally ranked PARSE σ and AlignFt. In such cases, MFR decides on the optimal candidate.

While the constraints are able to generate the optimal forms, a problem arises with the equal ranking of PARSE σ and AlignFt. PARSE σ assesses violations in an outright fashion, while AlignFt assesses violations gradiently. Given this difference in assessment, equal ranking of the constraints results in an imbalanced assessment.

Under Crowhurst's analysis, the total number of violations incurred by both PARSE σ and AlignFt count against a candidate. This is shown in the following tableau with the input /banagay-mba-ri-dyu/ where PARSE σ and AlignFt decide on the optimal candidate.

(76)	LE	PARSE σ	AlignFt	Taut-F
a. (bána)(gày-mba)-(rì-dyu)	**	**	*****!	**
%b. (bána)gay-(mbà-ri)-dyu	**	**	***	*
c. (bána)gay-mba-(rì-dyu)	**	**	*****!	*

All outputs have an equal number of violations to LE and it is left to PARSE σ and AlignFt to decide on the optimal candidate. (76a,c) have 6 violations, and since (76b) only has 5, it is the optimal candidate (each syllable under AlignFt counts as a violation).

Under AlignFt, the location of a foot with respect to a prosodic word edge is calculated in terms of the number of syllables, if any, that intervene between the edges of the two constituents. If the constraint assessed violations outright, feet that did not align to the prosodic word edge would incur a violation. Gradient assessment is able to make subtle distinctions in comparison to outright assessment, as shown in (77).

(77)	AlignFt (outright)	AlignFt (gradient)
a. ($\sigma\sigma$)($\sigma\sigma$)	*	2: $\sigma\sigma\sigma$!
b. ($\sigma\sigma$)($\sigma\sigma$) σ	*	2: $\sigma\sigma$

Due to gradient assessment, only AlignFt (gradient) can make a decision as to the optimal output, which demonstrates the benefit of a gradient-assessing constraint.

I In general, counting all outright and gradient violations together will often give the wrong result. For instance, the more feet in a word the more violations there will be. As shown in a hypothetical example, candidates with a smaller number of feet will be better off than candidates with more feet.

(78)	PARSE σ	AlignFt
a. ($\sigma\sigma$) σ ($\sigma\sigma$) σ	**	***
b. ($\sigma\sigma$)($\sigma\sigma$)($\sigma\sigma$)		** ****!

(78a) is the optimal candidate, since it has only five violations compared to the six violations in (78b). If PARSE σ was ranked above AlignFt, (b) would be the optimal output.

Counting violations in this way loses the generalisation of AlignFt, because each foot is not assessed with respect to the same foot in other outputs. Instead, the total number of violations incurred by all feet counts against an output, as illustrated in (79).

(79)		AlignFt	
a. ($\sigma\sigma$)($\sigma\sigma$)($\sigma\sigma$)	** ****!		6 violations
b. ($\sigma\sigma$) σ ($\sigma\sigma$) σ	***		3 violations
c. ($\sigma\sigma$) $\sigma\sigma$ ($\sigma\sigma$)	****		4 violations

Under AlignFt the same syllables may be counted a number of times. For instance, in the assessment of F3 and F2 in (79) the first two syllables in the string are counted twice. PARSE σ counts syllables once; if a syllable is not parsed PARSE σ is violated and syllables are not counted again.

Given that assessment is unequal, a gradient-assessing constraint cannot be ranked equally with a constraint which assesses outright. Such ranking is inequitable. This can be stated in a principle of ranking.

(80) Ranking Equity

Two constraints may be ranked equally iff they assess in a non-gradient fashion.

Crowhurst and Hewitt (to appear) discuss an alternative to the equal ranking of PARSE σ and AlignFt in their account of the Diyari facts (Crowhurst pc). They propose using a conjunction of constraints. A conjunction of two constraints will be satisfied if there are no violations to either constraint.

In my analysis of the stress patterns in Dyrirbal, the specific constraints, RA and AlignRt, and their ranking above AlignFt account for the patterns. AlignRt accounts for the fact that root and suffix boundaries cannot be straddled by feet.

2.5.4 Summary

In contrast to Warlpiri, Wambaya and Dyrirbal, stress alternation in Diyari is not restricted to a binary and ternary pattern. Sequences of unfooted syllables are permitted. In all the languages discussed here the rhythmic pattern is constrained by the morphology. However, in Warlpiri and Wambaya the rhythmic pattern is constrained to a lesser extent than in Diyari. Morpheme boundaries in Warlpiri and Wambaya may be crossed, just in those cases where a pattern other than

binary or ternary may emerge. RA is the constraint governing the overall rhythmic organisation of these languages.

RA enables characterisation of rhythmic patterns in various languages, while Warlpiri, Wambaya and Dyirbal do not allow violation of RA. This is not captured by PARSE σ . PARSE σ is not a crucial constraint given its ranking below the more specific RA. The crucial constraints and their ranking for the languages discussed are:

- (81) Diyari: Taut-F >> LE >> RA >> AlignFt
 Warlpiri/
 Wambaya: RA >> AlignRt $_{\sigma}$ >> LE, Taut-F >> AlignFt
 Dyirbal: RA >> LE >> AlignRt >> AlignFt

The sensitivity to foot and morpheme alignment is expressed in the following typology.

- (82) a. Foot and morpheme alignment, adjacent unfooted syllables allowed:
 Taut-F >> LE >> RA >> AlignFt (Diyari)
 b. Non-alignment of foot and morpheme allowed in order to incorporate unfooted syllables:
 RA >> LE, Taut-F/AlignRt >> AlignFt (Warlpiri, Wambaya, Dyirbal)
 c. No word-internal foot and morpheme alignment:
 RA >> AlignFt >> LE, Taut-F (Pintupi, see Ch1)

In sum, there is a strong tendency for feet to avoid crossing morpheme boundaries, particularly the root/stem and suffix boundary. This division confirms that feet do regulate stress and that feet are useful in discovering patterns not previously noticed. What is also interesting about the division between root/stem and suffixes is that a similar divide is found in the pattern of vowel harmony (discussed in Ch5), where, in general, only suffixes undergo harmony.

2.6 Concluding Remarks

This chapter has revealed that Warlpiri exhibits a mix of two stress systems, morphological and rhythmic (or prosodic). Stress is consistently located on the first syllable of a polysyllabic morpheme. This pattern, where stress marks out morphological boundaries, indicates that the prosodic system is conditioned by the morphology. On the other hand, the regularly alternating stress pattern in monomorphemic words shows evidence of a rhythmic system. I have shown that in a language like Warlpiri, which displays morphologically conditioned stress as well as rhythmic stress, the morphological system constrains the rhythmic system in particular ways. The inter-relationship between the morphology and the rhythmic system conflicts in certain contexts. This inter-relationship can only be captured in a system that deals with them simultaneously rather than one at a time. OT provides such a system in which constraints and their ranking prioritise demands and resolve conflicts.

I have shown that an adjacency constraint on syllables, RA, accounts for the stress data in a number of languages better than PARSE σ . Where there are conflicts over alignment, RA, but not PARSE σ , is able to resolve these. RA ensures that, at most, one unfooted syllable occurs between feet. PARSE σ is not able to do this. Thus RA is an important constraint in determining rhythmic patterns. In Chapter 4, this is given further support where we will see that RA is crucial in restricting rhythmic patterns in languages.

The constraints for Warlpiri are summarised in the following table:

(83) Table of constraint ranking

RA >> LE, Taut-F	<i>ensures that a sequence of adjacent unfooted syllables are parsed into feet with minimal violation of Taut-F and LE.</i>
LE, Taut-F >> AlignFt	<i>ensures alignment of feet with morpheme edges at the expense of iterative feet.</i>
RA >> AlignFt	<i>ensures iterative foot parsing over non-iterative parsing.</i>

Note that the interface constraints on stress, LE and Taut-F, are ranked above the prosodic constraint AlignFt. The interface constraints, LE and Taut-F, are in turn dominated by another prosodic constraint, RA. This ranking can be schematised as prosodic >> interface >> prosodic, and characterises the interaction between the morphological and prosodic domains. The interface constraints are specific constraints for word-internal alignment. They are a subset of the constraints that hold for prosodic word alignment.

A large number of words exist which do not have a pattern of binary alternating stress. Some inflected and compound words contribute to these groups of words displaying both binary and ternary alternation. Underlying these patterns is an overriding sensitivity to morphological edges. In the absence of these edges, a binary rhythmic stress pattern is the dominant pattern. However, ternary alternation is an option. This is discussed in Chapter 4.

Despite the appearance of irregularity in the stress patterns in a large number of words in Warlpiri, the stress patterns investigated so far are actually very regular considering the alignment conditions on feet and morpheme edges. There are some stress patterns, however, which do not conform to any of the patterns discussed. These are addressed in Chapter 3.

CHAPTER 3

LEXICALISED STRESS PATTERNS

3.1 Introduction

The previous chapter established that stress in Warlpiri is on the first syllable of a polysyllabic morpheme and on the first monosyllabic morpheme in a string of such morphemes. These facts are complicated by a few monosyllabic morphemes which do not conform to this pattern.

Three monosyllabic morphemes in Warlpiri attract stress in certain contexts. These are the infinitive **-nja**, the inceptive **-nji**, and the aspect clitic **ka**. The stress patterns involving these forms are dependent on the context. For instance, in a string of monosyllabic morphemes, the infinitive, inceptive or the aspect clitic will be stressed in preference to the first monosyllabic morpheme. This is shown in **(páka)-rni-(njà-rla)** 'hit-NPST-INF-SERCOMP', where the infinitive is stressed. However, these morphemes are not stressed if a polysyllabic morpheme follows.

The problem is to account for stress on the infinitive, inceptive and aspect clitic in contexts involving monosyllabic suffixes. The constraints introduced in Chapter 2 would ensure that in words such as **paka-rni-nja-rla**, the first monosyllabic suffix is stressed and not the infinitive suffix **-nja**.

Since they attract stress in certain cases, I introduce a specific constraint requiring that they align with the left edge of feet. The constraint is incorporated into the system of constraint interaction which allows us to see what determines stress placement in well-formed outputs. In this system, the attraction of stress to these forms in certain contexts can be explained.

I show that an advantage of OT over other theories is a straightforward explanation for the contextual variability exhibited by such forms. This variability in OT can be said to result from priorities in the language expressed as constraint ranking.

The chapter is outlined as follows. In 3.2 the data on the infinitive and inceptive are presented. I provide an account of these patterns in 3.2.1. In 3.3 the discussion focuses on the patterns involving the aspect clitic which give the appearance of the clitic being a separate phonological entity from the stem to which it attaches. I consider whether words with once productive morpheme boundaries should be analysed as having lexical stress in 3.4, and in 3.5 the behaviour of a particular morpheme with regard to stress is examined in Martuthunira. In 3.6 some alternatives are considered, followed by concluding remarks in 3.7.

3.2 The Infinitive and Inceptive

The infinitive **-nja**¹¹ and inceptive **-nji** morphemes attract stress. If they were polysyllabic this would be expected; however, these suffixes are monosyllabic. Recall from Chapter 2, that in a string of monosyllabic suffixes, the first in the string is stressed. However, if there is an infinitive or inceptive suffix present in the string, it will always be stressed regardless where it occurs; for example, **(páka)-rni-(njà-rla)** hit-NPST-INF-SERCOMP, 'after hitting (it)'; **(wála)(pàrri)-rni-(nji-ni)** test it-NPST-INCEP-NPST 'began testing (it)'¹². In contrast, when there is a following

¹¹ The infinitive suffix is analysed as distinct from tense morphemes which may cooccur with the infinitive.

¹² Unless otherwise indicated data are from Nash (1986).

polysyllabic suffix, the infinitive and inceptive are not stressed, behaving in the same way as other monosyllabic suffixes in such contexts. This is shown in (**páka**)-(rni-nja)-(kùrra) hit-NPST-INF-SEQCOMP '(doing something) while hitting'.

The patterns for the infinitive are given below, followed by those for the inceptive.

3.2.1 Infinitive

An infinitive is a nominalised verb with an infinitive suffix **-nja**. Infinitives cannot appear as independent lexical items but must be inflected as in **paka-rni-nja-kurra** 'hit-NPST-INF-SEQCOMP', **parnti-nya-nja-kurlangu** smell-perceive-INF-instrument 'instrument for smelling ie nose'. They may be compounded with the verb **ya-ni** 'go-NPST' to form a verb, as in [maarrpa-rni-ma-ni-nja-ya-ni] flash-hither-CAUS-INF-go-NPST 'cause to go flashing here'.

The stress pattern of verbs with the infinitive is presented in the following paradigm for the infinitive-SERCOMP, **-nja-rla**, taken from Nash (1986:113). The interpretation given to these forms is 'after X-ing (it)':

(1)	INF-SERCOMP	Verb class	NONPAST
	a. wángka-njà-rla	V1	wángka/wángka-mi
	speak		
	b. wírnpirli-njà-rla	V1	wírnpirli/wírnpirli`-mi
	whistle		
	c. pí-nja-rla	V3	pí-nyi
	hit		
	d. páka- <u>mi</u> -njà-rla	V2	páka-rni
	strike		
	e. wálapàrri- <u>ni</u> -njà-rla	V2	wálapàrri-rni
	test		
	f. ngá- <u>ni</u> -njà-rla	V4	ngá-rni
	eat		
	g. yá- <u>ni</u> -njà-rla	V5	yá-ni
	go		

With the exception of (1c), stress is consistently located on the infinitive suffix **-nja**. As previously discussed, the first in a string of monosyllabic suffixes is stressed following a polysyllabic morpheme. This pattern is exemplified in examples (1a,b). Note, however, that in (1d,e) there is a tense suffix (underlined) in between the root and the infinitive suffix, and yet the infinitive, rather than the tense suffix, is marked for stress. When the infinitive is suffixed to a monosyllabic verb root of the third conjugation (1c), there is no stress on the infinitive. In these situations, stressing the verb root, which is at the left edge of the word, has priority over stressing the infinitive.

Verbs in the first conjugation can appear without overt marking for tense, in which case the verb is interpreted as a non-past form, eg V1 **wángka/wángka-mi**. When the first and third conjugation verbs (1a,b,c) are marked for the infinitive, none of the tense morphemes are permitted, as they are in the other conjugations (1d-g). Thus, a first conjugation verb is illformed if any tense suffix is present ***wangka-mi-nja-rla** 'speak-NPST-INF-SERCOMP' or ***pi-nyi-nja-rla** 'hit-NPST-INF-SERCOMP'.

As the examples in (2) show, the infinitive suffix is not stressed when a polysyllabic morpheme, or a compounded verb, follows.

- (2) a. páka-rnì-nja-kùrra '(doing something) while hitting'
hit-NPST-INF-SEQCOMP [DGN:113]
b. máarrpà-rni-mà-ni-nja-yà-ni
flash-hither-CAUS-NPST-INF-go-NPST
'cause to go flashing here' [LB]
c. wímpirli-nja-yà-ni 'going along whistling'
whistle-INF-go-NPST [LB]

3.2.2 *The Inceptive*

The inceptive **-nji** behaves similarly to the infinitive with regards to stress. The inceptive is classed as a V5 stem (Nash 1986) and therefore takes an appropriate tense suffix. However, in contrast to other verb stems, the inceptive is not morphologically independent and must be suffixed to a verb stem. Nash claims that the inceptive has some historical connection with the verb **ya-ni** 'go' which is a member of the same conjugation class. The inceptive is a combination of **-nji** and a tense suffix. As with the infinitive, there are the same conditions on tense suffixes for verbs of the first and third conjugations, that is, tense morphemes of the first and third conjugation verbs cannot be present.

In the following paradigms, the inceptive suffix is consistently stressed. The gloss for the inceptive is 'begin X-ing'; data are from Nash (1986:113).

(3)	INCEP-NPST	INCEP-INF-SERCOMP	
	a. wángka-njì-ni	wángka-njì-ni-njà-rla	V1
	speak		
	b. wímpirli-njì-ni	wímpirli-njì-ni-njà-rla	V1
	whistle		
	c. pí-nja-ni	pí-nja-ni-njà-rla	V3
	pí-nja-njì-ni	pí-nja-njì-ni-njà-rla	
	hit		
	d. páka-rni-njì-ni	páka-rni-njì-ni-njà-rla	V2
	strike		
	e. wálapàrri-rni-njì-ni		V2
	test		
	f. ngá-rni-njì-ni	ngá-rni-njì-ni-njà-rla	V4
	eat		
	g. yá-ni-njì-ni	yá-ni-njì-ni-njà-rla	V5
	go		

The monosyllabic verbs of the V3 conjugation are the only verbs which have the alternative inceptive form, as seen in (3c), where the inceptive suffix may be absent.

The analysis proposed in Chapter 2 will not be able to generate all the attested forms involving the infinitive or the inceptive suffixes. For instance, in **paka-rni-nji-ni**, the optimal output would be one where stress was on the first suffix in the string, that is **-rni**. I will argue below that the infinitive and inceptive require a specific constraint.

3.2.3 *An Account*

From the stress patterns involving the derivational suffixes, it appears that there are conflicting morphological and prosodic requirements. As particular morphemes, the infinitive and the inceptive

attract stress. This is evident when they are surrounded on either side by monosyllabic suffixes. However, when a polysyllabic suffix is adjacent, it will be stressed in preference to any monosyllabic morpheme.

In previous analyses, Nash (1986), Poser (1990), the infinitive and the inceptive are assigned monosyllabic feet by a rule prior to other stress rules. Monosyllabic feet do not actually surface in outputs. In their analyses, these feet may become binary by incorporating a following syllable into the foot, or, if that does not happen, they delete.

Since monosyllabic feet do not occur in outputs there would be no point positing them in underlying representation. Such feet violate the dominant constraint FtBin and would be ruled out in favour of binary feet.

In underlying representation, a monosyllabic foot would be a diacritic, since it is debatable whether there is phonological structure present at this level. A diacritic is necessary in underlying representation when stress is unpredictable. The element marked with the diacritic will surface as stressed. Thus diacritics tell us that a particular form is unusual, and that, when diacritics are present in underlying representation, some general constraints will be overridden.

The stress patterns involving the infinitive and inceptive are variable. These suffixes are stressed except when a polysyllabic suffix follows. Given the contextual variability, these facts indicate that the infinitive and inceptive are not prosodic word final. The suffixes override the general pattern of stress assignment to strings of monosyllabic suffixes. In this sense, the stress patterns are unpredictable and require a specific statement. The suffixes do not override the general pattern of stress to polysyllabic morphemes, and here the patterns are predictable. The stress patterns are not fixed and thus lexical marking is not required.

These patterns indicate that there are priorities in the alignment of feet. Feet align to morpheme edges and prefer alignment with the edges of polysyllabic suffixes rather than with monosyllabic suffixes. Of the monosyllabic suffixes, the infinitive and inceptive have priority in foot alignment. To ensure that the infinitive and inceptive suffixes have priority over other monosyllabic suffixes a specific constraint is needed. This is given as:

- (4) **LEXSTRESS:** The left edge of a foot is aligned with the left edges of the infinitive **-nja** and the inceptive **-nji** suffixes.

The infinitive and inceptive suffixes never occur immediately adjacent to one another and thus no conflict involving LEXSTRESS occurs.

If the placement of stress on the infinitive and inceptive is interpreted as a constraint, interaction with the other constraints is possible. Once integrated into the constraint system, variation in stress placement can be captured.

When a polysyllabic suffix follows an infinitive or inceptive suffix, the polysyllabic suffix is stressed, as in **(páka)-(rni-nja)-(kùrra)** 'strike-NPST-INF-SEQCOMP'. This indicates that alignment of feet with polysyllabic morphemes has priority over alignment of feet with the infinitive and inceptive suffixes. LEXSTRESS is ranked below LE and Taut-F, ensuring that polysyllabic suffixes align with the edges of feet.

Where there are strings of monosyllabic suffixes, the leftmost suffix is typically aligned with a foot, this is **-rli** in **(máli)ki-(rli-rna)=lu** 'dog-ERG=1peS'. When LE and Taut-F cannot decide on a candidate, AlignFt ensures that alignment is with the first suffix in the string and not the second one. AlignFt is overridden when an infinitive or inceptive suffix occurs in the string: **(wála)(pàrri)-rni-(nji-ni)**, 'test-NPST-INCEP-NPST'. This indicates that LEXSTRESS has priority over AlignFt and, to ensure that LEXSTRESS is active, it must be ranked above AlignFt.

The ranking discussed is:

(5) LE, Taut-F >> LEXSTRESS >> AlignFt

The ranking of LEXSTRESS above AlignFt is crucial, as the following tableau shows with the form **paka-rni-nja-rla** 'hit-NPST-INF-SERCOMP' [(páka) ɿ(ncà)a].

(6)	LE	Taut-F	LEXSTRESS	AlignFt
a. (páka)-(rni-nja)-rla	**	*	*!	2:σσ
%b. (páka)-rni-(nja-rla)	**	*		2:σσσ

In (6a), the infinitive is not stressed, violating LEXSTRESS. If the ranking between LEXSTRESS and AlignFt was reversed, (6a) would be optimal, as its second foot is closer to the left-edge of the prosodic word than the second foot in (6b).

When a polysyllabic suffix follows the infinitive in the word **paka-rni-njá-kurra** 'hit-NPST-INF-SEQCOMP' [páka ɿncakùra], LE and Taut-F make the decision on the optimal candidate. This is shown in (7) where (7a) is the optimal output, since it least violates the higher ranked LE and Taut-F.

(7)	LE	Taut-F	LEXSTRESS	AlignFt
%a.(páka)-(rni-nja)-(kùrra)	*	*	*	2:σσ
b.(páka)-rni-(nja-ku)rra	**!	*		2:σσσ

An inceptive form is considered in the following tableau. The input is **paka-rni-njí-ni** 'hit-NPST-INCEP-NPST' [páka ɿncìni]. LEXSTRESS makes the decision on the optimal candidate, ruling out (8b).

(8) paka-rni-njí-ni	LE	Taut-F	LEXSTRESS	AlignFt
%a. (páka)-rni-(njì-ni)	**	*		2:σσσ
b. (páka)-(rni-njí)-ni	**	*	*!	2:σσσ

For other words, LE and Taut-F decide on the optimal candidate, as shown in (9) with the form **wirnpirli-njí-ni** 'whistle-INCEP-NPST' [wí ɿpi)incìni].

(9)	LE	Taut-F	LEXSTRESS	AlignFt
%a. (wímpi)rli-(njì-ni)	*	*		2:σσσ
b. (wímpi)(rli-njí)-ni	**	*!	*	2:σσ

In (9) the inceptive immediately follows a trisyllabic morpheme. As long as there is a following monosyllabic morpheme, the inceptive, like any other monosyllabic suffix in this position, receives stress. If this does not occur, LE and Taut-F will incur more violations, as in (9b). Alignment of a foot to the inceptive is a result of LE and Taut-F in these contexts. In other contexts, such as the word in the previous tableau (8), LEXSTRESS will be crucial in ensuring that these suffixes are stressed.

LEXSTRESS is a more specific LE constraint, as it specifies which morphemes align with feet. Unlike other specific constraints, LEXSTRESS is ranked below the less specific constraint. This is due to the fact that alignment with polysyllabic suffixes has priority over alignment with specific morphemes.

3.2.3.1 LEXSTRESS and Prosodic Word Alignment

As discussed above, LEXSTRESS has priority over AlignFt. This ranking poses problems for words consisting of strings of monosyllabic morphemes. For example, when an infinitive suffix follows a monosyllabic verb root, LEXSTRESS will ensure that the suffix rather than the verb root will be stressed, as in *[pi-(njá-rla)] 'hit-INF-SERCOMP'. AlignFt cannot ensure that a foot is aligned to the left edge of the prosodic word, since it is ranked below LEXSTRESS. However, the conflict between these two constraints cannot be resolved by reversing their ranking.

To ensure that one foot is aligned to the left edge of a prosodic word, the constraint AlignPW (M&P 1993b) is adopted. AlignPW assesses whether just one foot is aligned to the left edge of the prosodic word. In contrast, AlignFt assesses all feet in an output.

(10) **AlignPW:** The left edge of a prosodic word is aligned with the left edge of a foot.

It is evident from examples, such as (**pí-nja**)-rla, that AlignPW has priority over LEXSTRESS. The ranking of AlignPW above LEXSTRESS is crucial in ensuring foot alignment to the prosodic word edge and not to the infinitive or inceptive.

The effect of the ranking AlignPW >> LE,Taut-F >> LEXSTRESS is demonstrated in **pi-nja-rla** 'hit-INF-SERCOMP' where the verb root **pi-** is stressed in preference to the infinitive. This is shown in the following tableau.

(11)

	AlignPW	LE	Taut-F	LEXSTRESS
%a. [(pí-nja)-rla]		**	*	*
b. [pi-(njá-rla)]	*!	**	*	

LE and Taut-F are unable to make a decision on the optimal candidate, since both outputs have an equal number of violations of these constraints. AlignPW is crucial in these words in deciding on the optimal candidate, which in this case is (11a). Without AlignPW, alignment of feet to prosodic word edge could not always be guaranteed.

Ranking AlignPW above LEXSTRESS ensures that the conflict over alignment is resolved. The verb root is at the edge of a prosodic word and must therefore be given preference. AlignL requires stem and prosodic word alignment and plays no role in foot and prosodic word alignment.

The fact that the infinitive and inceptive suffix are stressed in some contexts may be due to their verb/root-like behaviour. Like verbs, both suffixes have to be inflected; they cannot occur word-finally. The verb-like behaviour of the inceptive is possibly because it was once a root, as suggested by Nash (1986). Stress may be a reflection of this previous role.

In the next section, the stress patterns involving the aspect clitic **ka** are examined.

3.3 The Aspect Clitic

The present imperfect aspect clitic **ka** (IMPF), has similar stress patterns to the infinitive and inceptive suffixes. Compare the following examples below. '=' represents clitic boundaries.

- (12) a. wángka-mi=kà=rna 'I am speaking'
speak-NPST=IMPF=1sS [DGN:102] [ML]
- b. wángka-mi=kà=lu=jàna 'They are speaking to them'
speak-NPST=IMPF=3pS=3pNS [ML]
- c. ngájulu=kà=rna 'I am ...'
I=IMPF=1sS [LB]
- d. ngárnangàrna-nya=kà=rna=lu 'as for the claypans, we (did something)'
claypans-TOP=IMPF=1peS [LB]

The patterns in (12) are the same as those for the infinitive and inceptive suffixes shown repeated below:

- (13) a. páka-rni-njà-rla 'after hitting (it)'
hit-NPST-INF-SERCOMP
- b. wálapàrri-rni-njà-rla 'after testing (it)'
test-NPST-INF-SERCOMP
- c. páka-rni-njì-ni 'began hitting (it)'
hit-NPST-INCEP-NPST
- d. wálapàrri-rni-njì-ni 'began testing (it)'
test-NPST-INCEP-NPST

ka is not stressed when followed by a polysyllabic morpheme, as is the case for the infinitive and inceptive suffixes.

- (14) a. wángka-mì=ka=pàla 'they two are speaking'
speak-NPST=IMPF=3dS [ML]
- b. Wárlpirì=kà=rli¹³pa 'we Warlpiri'
Warlpiri=IMPF=1piS [LB]
- c. páka-rnì-nja-kùrra '(doing something) while hitting'
hit-NPST-INF-SEQCOMP

The other aspect clitic, the past imperfect **lpa** (IMPF), is stressed depending on its position in the word, in contrast to /ka/ but like other monosyllabic morphemes, as shown in (15).

¹³ **rli_{pa}** is analysed as a single morpheme, however historically it is a complex morpheme **rli-pa**.

- (15) a. wángka-jà=lpa=rna 'I was speaking'
 speak-PST=IMPF=1sS [ML]
 b. yá-nu=lpà=rna 'I was going'
 go-PST=IMPF=1sS [ML]
 c. kúrdu-kùrdu-rlù=lpa=lu 'The children, they were (doing
 children-ERG=IMPF=3pS [LB] something'
 d. ngájulu-rlù=lpa=rna 'As for me, I was (doing something)'
 I-ERG=IMPF=1sS [LB]

The patterns in (15) are the same as those in (16) below, where the first monosyllabic suffix in a string is stressed (repeated from Chapter 2).

- (16) a. pálya-ngkù=rna=lu 'with an adze, we (did something)'
 adze-ERG=1peS
 b. máliki-rli=rna=lu 'with a dog, we (did something)'
 dog-ERG=1peS
 c. wángka-mì=rna=lku=jàla
 speak-NPST=thither=then=obviously
 'obviously (someone) is speaking in that direction now'

In line with all other monosyllabic morphemes, **lpa** is not stressed when followed by a polysyllabic morpheme, as (17) shows.

- (17) a. wírnpirli-jà=lpa=jàna '(someone) was whistling to them'
 whistle-PST=IMPF=3pNS [DGN:110]
 b. máliki-kirli=lpa=pàlangu 'with a dog they two were (doing
 dog-PROP=IMPF=3dNS [LB] something)'
 c. kárnta-jàrra-rlù=lpa=pàla 'the two women, they two were
 woman-two-ERG=IMPF=3dS [LB] (doing something)'

There are two possible analyses of this data. Firstly, the analysis for the infinitive and inceptive suffixes could be extended to **ka**. The second possibility involves parsing **ka** as a prosodic word. **ka** could be parsed as a prosodic word because it is a member of a morphological category, ie particle, which is required to be parsed into a prosodic word. Since the former analysis has been outlined in section 3.2, I will consider the latter one in the following discussion.

Aspect morphemes are in the part-of-speech category of 'particle' (Laughren 1982); and particles, like nominals and verbs, occur as independent words. Independent words are parsed as prosodic words which ensures that they consist minimally of a foot. Any morpheme which is in the particle category would be parsed as a prosodic word.

As discussed in Chapter 1, certain grammatical categories are required to correspond to certain prosodic categories. The items in these grammatical categories occur as independent phonological words. Nouns, verbs, preverbs and particles in Warlpiri correspond to prosodic words.

Since the aspect clitics are members of the particle category, we might expect that they too are parsed as prosodic words. The patterning of **ka** gives some indication that this is possible. For example, in (**wángka**)-**mi**=(**kà**=**rna**) 'speak-NPST=IMPF=1sS', **ka** and not the first monosyllabic morpheme **mi** is stressed. This would suggest that **ka** is in a separate prosodic constituent from the verb stem. As discussed in Hale (1976 et seq. also Laughren 1982, Nash 1986, Simpson 1991),

aspect particles and following clitics form an 'auxiliary word'. An auxiliary word is a single complex of morphemes, which has no morphological head and has a flat structure.

If **ka** was parsed as a prosodic word, then we should expect that it always heads a prosodic word like the monosyllabic verb roots. As previously discussed, the monosyllabic verb roots are always stressed regardless of the size of the following morpheme. However, **ka** is not always stressed, as, for instance, when **ka** precedes a disyllabic suffix, in (**wángka**)-(mì-**ka**)=(pà**la**) 'speak-NPST-IMP=3dS'. Since verbs have a requirement that they must be parsed as a prosodic word, no other parsings are possible without violating highly ranked constraints. Whether verb roots are mono- or polysyllabic, they will always be parsed as prosodic words.

Given these facts, I assume that, because the monosyllabic aspect particles are clitics and are thus phonologically subordinate to prosodic words, they cannot themselves be a prosodic word. I propose to include **ka** in the LEXSTRESS constraint. This will ensure that it will be stressed in preference to other monosyllabic suffixes. LEXSTRESS is revised to:

- (18) **LEXSTRESS (revised):** The left edges of a foot aligns with the left edges of the infinitive **-nja**, inceptive **-nji** and aspect **ka** morphemes.

We do not need to say anything about the other monosyllabic aspect clitic **lpa**, since it behaves like other monosyllabic suffixes.

The word **wangka-mi=ka=rna** 'speak-NPST=IMP=1sS' is considered in the following tableau.

(19)	LEXSTRESS	AlignFt
%a. (wángka)-mi=(kà=rna)		2: $\sigma\sigma$
b. (wángka)-(mì=ka)=rna	*!	2: $\sigma\sigma$

(19a) is the optimal candidate because it does not violate LEXSTRESS. In the next tableau, **ka** is suffixed by a polysyllabic pronominal clitic **pala** 'they two'.

(20) wangka-mi=ka=pala	LE	Taut-F	LEXSTRESS
%a. [(wángka)-(mì=ka)=(pà la)]	*	*	*
b. [(wángka)-mi=(ká=pa)la]	**	*!	

Since there are less violations of LE and Taut-F in (20a), it is the optimal candidate.

If the ranking between Taut-F and LEXSTRESS was reversed, stress would always occur on the morphemes specified in LEXSTRESS. **ka** is not stressed when word-final which could occur if it was parsed into a monosyllabic foot or parsed into an iambic foot. Each of these possibilities is ruled out by FtBin and FootForm respectively.

Requiring a specific constraint for the infinitive, inceptive and aspect clitic is motivated by the observations of their role with regard to stress. The challenge for the analysis is to capture the fact that they are stressed in contexts involving strings of monosyllabic suffixes but not when a polysyllabic suffix follows. They have alignment priority when surrounded by monosyllabic suffixes, but not when they precede polysyllabic suffixes. The challenge is met by the constraint ranking system which ensures the appropriate alignment priority.

3.4 Lexical Stress in Warlpiri

A large number of words in Warlpiri have historically been formed by reduplication, and the reduplication process of these words is no longer productive. Since there is no unreduplicated counterpart, the words may be referred to as frozen reduplications. In the stress patterns of frozen reduplications, stress is always located on the initial syllable of the reduplicated portion. These patterns are given below:

- (21)
- | | |
|--------------------|---|
| a. mǰilijǰili | 'navel' [DGN:121] |
| b. púyukuyùku | 'mist,fog;haze' [DGN:121] |
| c. jákurdukùrdu | 'novice taken on journey'[DGN:121] |
| d. kályakàlya | 'wife's br, sister's husband' [GB] |
| e. kírlilkírlilpa | 'galah' [GB] |
| f. mánjarmànjampa | 'irritation' [GB] |
| g. yínkardàkurdàku | 'owlet nightjar' ¹⁴ [DGN:1136] |

In these examples, the final two syllables have been copied and suffixed to the root. In (21e,f) **pa** occurs at the end of the words to ensure that they are vowel-final. In (21a-c), stress is on the first and fourth syllables, in contrast to the usual pattern for monomorphemic words where stress is on the first and third syllables. In the data, two words have stress patterns similar to some of the frozen reduplications:

- (22)
- | | |
|------------------|-----------------------------------|
| a. járnamiljàmpa | 'generation moiety term' [DGN:68] |
| b. yúwayikirdi | 'babbler, bird sp.' [DGN:68] |

These words are either borrowings like (22a) (Mary Laughren pc) or have been formed historically by compounding as in (22b) where **-kirdi** constituted a morpheme perhaps related to **kurdu** 'child'.

In general, when stress is unpredictable, it has to be lexically marked. The location of stress in the frozen reduplications is predictable. Stress is always on the first syllable of the reduplicated element. The reduplicated element is polysyllabic and patterns in the same way as the polysyllabic morphemes with respect to stress. The reduplicated element is clearly identifiable with or without a morpheme boundary.

The question is whether lexical stress is necessary for these forms? If morphological boundaries were marked in frozen compounds and reduplicated words (as, for instance **mijili-jili**), then lexical stress would be unnecessary. LE would ensure that feet aligned to the left edge of morphemes. Marking morpheme boundaries in frozen word forms operates like lexical stress, but avoids the need to mark syllables with diacritics underlyingly.

The monosyllabic suffixes **-nja**, **-nji** and **ka** are always stressed when monosyllabic, but not polysyllabic, morphemes follow. Since they are monosyllabic, different contexts can have consequences for the stress patterns of these forms. Variation in the stress patterns of the stress-attracting morphemes occurs because they are monosyllabic and because of the priority polysyllabic morphemes have. In contrast, the stress patterns in frozen words do not change and are not affected by changing morpheme concatenations which occur in the infinitive, inceptive and aspect clitic forms and therefore LE will ensure stress occurs on unproductive morphemes.

¹⁴ Nash (1986) notes another stress pattern for this word ie **yínkardakùrdaku**. This will be discussed in Chapter 4.

In sum, LEXSTRESS is required for monosyllabic morphemes, while LE will account for stress in frozen reduplications and compounds. LEXSTRESS has application for a number of languages with lexical stress and can be included in the set of universal constraints.

In Warlpiri, there are patterns of stress involving lexically specified stress as well as those generated by the constraints. Constraints assess all outputs regardless of how stress is assigned. In Warlpiri the relevant constraints are:

- (23) AlignPW, RA >> LE,Taut-F >> LEXSTRESS >> AlignFt

These constraints and ranking will ensure that stress is assigned in order of priority. Note that this is achieved by simultaneous application of the constraints and not step-by-step. A priority scale is illustrated in (24), where '>' = in preference to.

- (24) Word-initial,
 polysyllabic morpheme >
 specific morpheme >
 monosyllabic morpheme >
 adjacent feet

This scale reads: stress is word-initial in preference to morpheme initial, in preference to specific morphemes (that is the infinitive, inceptive and aspect clitic), in preference to monosyllabic morphemes, in preference to adjacent feet. Outputs exhibiting all these priorities are possible.

In the next section we consider a derivational suffix in Martuthunira which attracts stress.

3.5 *The Causative in Martuthunira*

Martuthunira is a Pama-Nyungan language of the Ngayarda group, spoken in the north-west of Western Australia, described by Dench (1987, 1995). In this language the causative suffix **-ma**¹⁵ attracts stress in much the same manner as the infinitive and inceptive suffixes in Warlpiri. One main difference is that stress is always present on the causative suffix regardless of the number of syllables in following suffixes. Recall that in Warlpiri, whenever a polysyllabic suffix follows the infinitive, the infinitive does not receive stress. In general, the causative attaches to a nominal stem and derives a transitive verb.

The stress patterns in Martuthunira are similar to those of Warlpiri. Stress occurs on the first syllable of polysyllabic morphemes, and the first monosyllabic suffix in a string of monosyllabic suffixes is stressed.

- | | | | |
|------|----|-------------------------|-----------------------|
| (25) | a. | pátha-rrngùli-nyìla-a | 'throw-FUT-PrREL-ACC' |
| | b. | kányara-ngàra-la | 'man-PL-LOC' |
| | c. | kányarà-la-ngùru | 'man-LOC-ABL' |
| | d. | wángkarnu-màrri-lhà-rru | 'talk-DerSFX-PST-now' |
| | e. | pányu-rri-rra-rru | 'good-INCH-CTEMP-now' |

¹⁵ This is probably a cognate of the **-ma-** causative in Warlpiri, historically derived from a transitive verb root ***ma** 'get'(Jane Simpson pc).

Dench provides a small amount of data on the effects of vowel length on stress. The generalisation is that stress cannot occur on a syllable following a long vowel, even if the long vowel is not stressed.

- (26)
- | | | |
|----|--------------------------|-----------------------------|
| a. | tháapuwa | 'rotten mouth' |
| b. | tháapuwa-ngàra | 'rotten mouthed fellows-PL' |
| c. | tháapuwa-là-rru | 'rotten mouth-LOC-now' |
| d. | kápun-wìrraa-npa-lhà-rru | 'body-PRIV-INCH-PST-now' |
| e. | ngúrra-arta-npà-rra | 'camp-ALL-INCH-CTEMP' |

In examples such as (26d), stress does not occur on the suffix following a long vowel. In contrast, when the causative suffix follows a suffix with a final long vowel, stress occurs on the causative, as shown in (27a).

- (27)
- | | | |
|----|----------------------------|----------------------------------|
| a. | ngúyirri-wìrraa-mà-rminyji | 'asleep-PRIV-CAUS-FUT' |
| b. | mírru-ngka-mà-lalhà-rru | 'spear thrower-LOC-CAUS-PST-now' |
| c. | wántharni-mà-rminyji-rru | 'how-CAUS-FUT-now' |

When the causative morpheme is present, stress does not occur on the first syllable of a following polysyllabic suffix. The causative is always stressed regardless of the surrounding context. If there is no preceding causative morpheme, polysyllabic suffixes are stressed on the first syllable. In this way, the causative is similar to the monosyllabic verb roots in Warlpiri which are always stressed even when a polysyllabic suffix follows.

Stress is consistently located on the causative suffix. This is unlike the variable stress patterns involving the infinitive, inceptive and aspect clitic in Warlpiri. We can assume that the stress associated with the causative is part of its morphological specification and is captured by LEXSTRESS. We can also assume that Martuthunira has the same constraints as Warlpiri, which account for the general stress patterns.

In Martuthunira, the constraints on foot structure, that feet are trochaic and binary, are not violated; the alignment of the stem and prosodic word is not violated. On the other hand, alignment of feet with the prosodic word (AlignFt) and with polysyllabic morphemes (Taut-F) is violated. The lexical stress is assessed in relation to the other constraints. It does not override all the constraints, only some of them. These facts indicate that the assessment of lexical stress must occur in constraint tableaux.

The constraint LEXSTRESS specifies that a foot aligns to **-ma** and must be ranked above LE and Taut-F (in contrast to the ranking in Warlpiri where LEXSTRESS is ranked between LE and AlignFt). The tableau in (28) considers the form mirru-ngka-má-lalha-rru 'spear thrower-LOC-CAUS-PST-now' [míruNkamàlal5àru].

(28)

	LEXSTRESS	LE	Taut-F	AlignFt
%a.(mírru)-ngka-(mà-la)(lhà-rru)		***	*	2: $\sigma\sigma\sigma$
b.(mírru)-(ngkà-ma)-(lálha)-rru	*!	**	*	2: $\sigma\sigma$

The output in (28a) incurs more violations of LE and Taut-F. However, since it does not violate the higher ranked constraint LEXSTRESS, as does (28b), it emerges as the optimal candidate.

There are no well-formed outputs that violate FtBin, FtForm, AlignL or LEXSTRESS. The fact that LEXSTRESS is a dominant constraint does not have to be stipulated as a separate statement involving lexical stress, but follows from the ranking and interaction of the constraints.

3.5.1 A note on long vowels and stress in Martuthunira

As noted, long vowels in Martuthunira exhibit unusual behaviour. Some syllables have long vowels which, although they are not stressed, can inhibit stress on a following syllable. Word-initial syllables are always stressed whether they have long vowels or not. In the following examples (repeated from (26)), stress is on the syllable with the long vowel. Stress on this syllable is expected since it is word-initial.

- (29) a. tháapuwa 'rotten mouth'
 b. tháapuwa-ngàra 'rotten mouthed fellows'
 rotten mouth-PL

The stress patterns in (29) are like those of other trisyllabic morphemes. Stress is not sensitive to syllable weight in Martuthunira. If stress was sensitive to syllable weight, we would expect the following foot parsing *(tháa)(pùwa) rather than (tháapu)wa 'rotten mouth'. Thus feet are syllabic. In other contexts, syllables with long vowels are not stressed, as in (30).

- (30) a. (kápun)-(wìrraa)-npa-(lhà-rru) 'body-PRIV-INCH-PST-now'
 b. (ngúrra-a)rta-(npà-rra) 'camp-ALL-INCH-CTEMP'

In (30a), the syllable following the long vowel is not stressed, although this would be expected, since the long vowel is incorporated into the preceding foot.

The patterns indicate that syllables with long vowels pattern with light syllables for the purposes of stress. This information would be relatively uninteresting except for one fact. A syllable following one with a long vowel does not, except when the causative is present, get stressed. This fact suggests that a syllable with a long vowel suppresses stress on a following syllable, unless overridden by a more dominant requirement.

The general pattern is that stress is located on every odd-numbered syllable within a morpheme. However, two things throw this pattern out: the presence of a long vowel and the presence of the causative suffix. When these are adjacent in a word the stress of the causative suffix is maintained.

Syllables with long vowels exhibit a kind of prominence which is different from that of stressed syllables, and it appears that a following syllable can be included in this prominent domain. It would be worthwhile conducting further investigation into the phenomenon, but until then I suggest the following informal constraint.

- (31) **NOSTRESS**: A sequence $\sigma_{\mu}\sigma_{\mu}$ is unstressed in outputs

This requirement is overridden when the causative is present which indicates that LEXSTRESS is dominant over NOSTRESS. The dominance of LEXSTRESS ensures the causative is stressed, as shown in (32).

(32)
NOSTRESS

%a.(ngúyi)rrí-(wìraa)-(mà-rminy)ji			*
b.(ngúyi)(rrí-wi)(ráa)-(mà-rminy)ji	*!		*
c.(ngúyi)rrí-(wìraa)-ma-(rminy)ji		*!	

The optimal output is when the causative is stressed, as in (32a).

NOSTRESS is crucial in deciding against outputs with an equal number of violations to LE, as shown in the following tableau. It also must be ranked above AlignFt to ensure that forms like (33a) do not emerge as optimal.

(33) kapun-wirraa-npa-lha-rru	LE	NOSTRESS
a. (kápun)-(wìrraa)-(npà-lha)-rru	**	*!
%b. (kápun)-(wìrraa)-npa-(lhà-rru)	**	
c. (kápun)-wi(rràa-npa)-(lhà-rru)	***!	

(33a) is least optimal because the syllable following a long vowel is stressed, violating NOSTRESS. The decision on the other outputs is made by LE. (33b) has less violations of LE than (33c) and so (b) is the best output.

The unusual stress patterns involving long vowels in Martuthunira are accounted for by assuming that long vowels suppress stress on following syllables.

Instances where stress is suppressed on particular morphemes have been documented for Turkish. In this language, stress generally occurs on the word-final syllable, but not if particular suffixes occur. Compare the data (34a & b) with (34c) cited from Halle & Vergnaud (1987):

- (34) a. adám 'man'
 b. adam-lar-á 'to the man'
 c. adám-im 'I am a man'

The final suffix in (34c) cannot bear stress and so stress occurs on the preceding syllable. Such suffixes behave in the opposite way to morphemes or particular syllables which receive lexical stress. These latter items demand to be stressed, while the Turkish suffix demands no stress. The similarity in both types is that a lexical specification is required to capture their respective behaviour, which is unpredictable. Both require lexical faithfulness. Thus, just as it is necessary to specify foot alignment with specific morphemes, so too it is necessary to specify that feet do not align with specific morphemes.

Given these facts, we can assume that LEXSTRESS and NOSTRESS are of the same constraint family requiring faithfulness in the alignment interaction between lexical elements and prosodic structure. The constraints ensure that in outputs particular items have a particular metrical or prosodic identity which cannot otherwise be obtained.

3.6 *Alternative analysis*

In derivational analyses, assigning degenerate feet would be the only way to ensure that certain monosyllabic suffixes get stress. However, the analysis then has to explain why stress is not always assigned to these forms, and why monosyllabic feet do not surface in outputs. Such analysis faces the dilemma of being able to account for the unpredictable stress patterns, ie stress on specific monosyllabic morphemes, but not for the predictable ones, ie stress on polysyllabic morphemes or the first monosyllabic morpheme in a string.

Dench (1987, 1995) provides a rule-based analysis for the stress patterns of Martuthunira where most morphemes except for the majority of monosyllabic suffixes are assigned lexical stress. In some cases, stress is lexically assigned to syllables which never surface with stress, eg syllables with long vowels. A rule deleting stresses is required for contexts where the causative suffix, which is always stressed, precedes a polysyllabic morpheme with initial stress. The stress deletion rule ensures that adjacent stresses do not occur.

Given that stress is largely predictable, except for the causative suffix it is unnecessary to lexically assign stress. When morphemes have lexical stress, the influence of the causative on following morphemes is obscured, that is, if morphemes have lexical stress, it is not clear why some lose it. In my analysis, only the causative receives lexical stress and this stress is maintained when adjacent to polysyllabic morphemes. It is recognised that this priority is separate from that of other morphemes and this priority can be ranked. In other words, the causative is treated differently from other morphemes as reflected by the way it behaves. This is better than treating a morpheme which happens to occur adjacent to the causative as different. In my analysis, morphemes which behave unpredictably with regard to stress are given a status which sets them apart from other morphemes and is in line with most other analyses involving lexical stress.

3.7 *Summary*

LEXSTRESS accounts for stress on specific morphemes and can be construed as a universal constraint. Those elements that require foot alignment are indicated in the constraint. The ranking of the constraint is subject to individual language requirements.

LEXSTRESS, along with LE and Taut-F, are interface constraints. These constraints dictate the role of morphology in the phonology. In order to be active, that is, to make decisions on well-formed outputs, they must be ranked above AlignFt. Constraint ranking systematically accounts for the order of priority is the assignment of stress. This priority was obscured in rule-based theories.

In other models, the fact that specific monosyllabic morphemes are stressed in preference to other monosyllabic morphemes cannot be expressed in a straightforward manner. Lexically marked stress would predict that stress is obligatory, that stress is always on morphemes that it marks. However, such marking is useful only in one context and, as a consequence, such accounts have difficulty with variable stress.

I have shown that lexically specified stress must be assessed by constraints, since lexical stress may affect the stress patterns generated by constraints. Alignment of feet with lexically specified stress or with specific morphemes accounts for the data in a straightforward way.

Constraints and their ranking for the languages discussed in this chapter are summarised below:

Warlpiri: RA, AlignPW >> LE, Taut-F >> LEXSTRESS >> AlignFt
 Martuthunira: RA, LEXSTRESS >> LE, Taut-F >> NOSTRESS >> AlignFt