

CHAPTER 4

CHAPTER 4

RHYTHMIC ALTERNATION

4.1 Introduction

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The constraints required to account for the stress patterns of words in Warlpiri are given in Chapters 2 and 3. These constraints generate well-formed outputs such as [(máli)ki(lilki)] from an input **maliki-rli-lki** 'dog-ERG-then'. In casual speech, a variation to the stress pattern of this output may occur, as in [(máli)(kili)lki]. This variation in stress patterns is an option available in casual speech. Stress patterns in monomorphemic words may also vary, for example, from **(yínka)(rdàku)(rdàku)** 'owlet nightjar' to **(yínka)rda(kùrda)ku**. This is a context-free variation. Both kinds of variation result in a binary or ternary alternating rhythm.

This chapter is concerned with variant stress patterns in Warlpiri and with characterising these rhythmic patterns. By focussing on this issue an attempt is made to advance our understanding of rhythm within the theoretical paradigm of Optimality. I show that rhythmic patterns are constrained by the constraints RA and FtBin, generating binary and ternary patterns. As a consequence, it can be argued that rhythm is a result of foot adjacency and not necessarily foot alignment to the edge of a prosodic constituent. I argue that rhythmic variants can be generated at the same level as other forms, if it is assumed that some constraints are relaxed under specific conditions. The benefit of this approach is that an additional derivational level is not required and thus, is consistent with the principles of OT.

The structure of this chapter is as follows. The theoretical characterisation of rhythm is discussed in 4.2. This is followed by presentation of the data on stress variation in casual speech in Warlpiri. In 4.4, an account of the variation is given, where I argue for constraint relaxation. Alternatives to the analysis are considered in 4.5, and the role of AlignFt is considered in 4.6. Concluding remarks are given in 4.7.

4.2. Theoretical Characterisation of Rhythm

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In this section, I briefly outline the treatment of rhythm prior to OT, and then suggest how this may be interpreted in OT.

4.2.1 Previous accounts of rhythm

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Prior to OT, one of the concerns in Metrical Theory was to characterise the observations regarding manifestations of rhythm in languages (Hayes 1984, Prince 1983, Selkirk 1984). In many languages, rhythm tends to be generated by the alternation of stressed and unstressed syllables.

A rhythmic pattern, where stress is on every alternate syllable, may not always be adhered to. For instance, there may be unfooted syllables or even adjacent stressed syllables. Rhythm may be defined by what it should avoid, as shown by the following statement from Hayes (1984):

- (1) Eurhythmy Principle

A process is evaluated higher to the extent that it minimizes rhythmic ill-formedness.

Rhythmic ill-formedness is defined by two notions, they are Clash and Lapse (Prince 1983, Selkirk 1984). A clash is when there are two adjacent stressed elements (syllables or moras), eg, $\sigma'\sigma'$. A lapse is defined by the presence of two adjacent stressless elements, eg, $\sigma\sigma$.

In metrical theory, if a word in a phrase had a different stress pattern from its pattern in isolation this was accounted for by a stress movement rule. Stress movement might occur to avoid stress clashes or lapses when words combine together.

Previous metrical theories rely on the representation of stress in the metrical grid to characterise rhythm. A metrical grid indicated the location of stress, as well as the degree of stress. (2) has examples of metrical grids, where 'x' indicates stress; the greater the number of x's the greater the degree of stress.

(2) a. x b. x
 x x x
 sixteen bees

When the two words in (2) combine, the stress pattern on one of the word alters. Under Metrical theory, it is argued that the stronger stress in **sixteen** moves to the left, as shown in (3).

(3) x x x x
 x x x x x x
 sixteen bees > sixteen bees

One of the primary questions in Metrical theory was to determine what principles made one grid more eurhythmic than another. The metrical grid sees rhythm in terms of a linear sequence of strong, ie those with more x's, and weak positions. Here the concept of eurhythmy is based on the number of positions that occur between other positions.

The metrical grid is mostly concerned with prominence relations and less concerned with constituency, which means that stress is seen to move independently of prosodic constituent structure.

It is currently acknowledged (including Hayes 1991, Kager 1990, McCarthy and Prince 1990) that rhythmic patterns are better accounted for by foot constituency, rather than by a string of positions. Establishing the constraints on foot constituency has been of more current concern. In OT, foot size is constrained by FtBin, which accounts for the lack of stress clash and degenerate feet.

A sequence of strong and weak positions can be generated by parsing feet. This does not necessarily mean that rhythm is binary alternating only. As we will see in this chapter, foot size alone does not determine rhythmic alternation, as stress patterns may be binary or ternary, where the ternary patterns are not determined by morphological edges.

4.2.2 *Rhythmicity*

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In Chapter 2, I noted that the rhythmic pattern in Warlpiri is ternary and binary. Binary alternation is a result of the constraints FtBin, RA and AlignFt which together ensure that stress alternates on odd-numbered syllables, as in (**kúru**)(**wàrri**) 'variegated'. The binary pattern of alternation may be disrupted by the presence of morphological boundaries, which are aligned with foot edges under the interface constraints Taut-F, LE and LEXSTRESS. Where there is an odd number of syllables

in morphemes, a ternary pattern of alternation may emerge, for example (**máli**)**ki**-(**kìrla**)**ngu** 'dog-POSS'. This ternary pattern is not because feet are ternary, but is a result of the conflict between AlignFt and the interface constraints. These constraints require morpheme and foot alignment which interrupts the alternation of stress, as, for example, in (**wángka**)-**ja**-(**jána**). As a consequence, unfooted or trapped syllables may be found word-internally like the syllable **ja** in (**wángka**)**ja**(**jána**). By the constraint RA, optimal outputs will have only one unfooted syllable between feet. An unfooted syllable together with a preceding foot creates a ternary pattern. While the trapped syllable is not incorporated into the preceding foot (due to FtBin), the presence of such syllables is nonetheless responsible for a ternary rhythmic pattern.

In Warlpiri, RA allows for a single unfooted syllable adjacent to a foot, ie $(\sigma\sigma)\sigma$. FtBin bans ternary feet $*(\sigma\sigma\sigma)$, but has nothing to say about the form $(\sigma\sigma)\sigma$. Together $(\sigma\sigma)$ and $(\sigma\sigma)\sigma$ underlie the organisation of rhythm in Warlpiri.

The tendency for binary and ternary alternation, but not for other alternating patterns such as quaternary, is, according to Selkirk (1984), a reflection of a general rhythmic principle, the Principle of Rhythmic Alternation (ibid:52). According to this Principle, stress clash $*\sigma'\sigma'$ should be avoided and the spaces between stresses should be no more than two weak positions $\sigma'\sigma\sigma\sigma'$. This is interpreted as allowing binary and ternary alternation.

As I show in this Chapter, binary and ternary alternation occurs not because of principles operating to ensure clash and lapse are avoided, but through a combination of constraints on the location of feet. Adjacent feet are preferred in monomorphemic words (due to AlignFt) in Warlpiri, but non-adjacent feet may be generated in polymorphemic words. The extent to which feet may be non-adjacent is constrained by RA. RA contrasts with Parse σ in this sense as Parse σ simply notes how many syllables have not been parsed and not their location with respect to other unfooted syllables. For instance, the outputs $(\sigma\sigma)\sigma\sigma$ - $(\sigma\sigma)$ and $(\sigma\sigma)\sigma$ -($\sigma\sigma$)- σ score an equal number of violations to Parse σ because both have two unfooted syllables, but RA ensures that the latter is the optimal output, because in the former two unfooted syllables are adjacent. RA and FtBin are the constraints which allow for rhythmic alternation:

(4) Constraints on Rhythmic Alternation

FtBin: feet are binary $(\sigma\sigma)$

RA: no adjacent unfooted syllables $*\sigma\sigma$

FtBin rules out feet other than binary ones, $*(\sigma\sigma\sigma)$ $*(\sigma)$. Adjacent unfooted syllables $*(\sigma\sigma)\sigma\sigma$, which would generate a quaternary alternation, are ruled out by RA. FtBin constrains foot size and RA constrains the distance between feet. Thus, while ternary feet are not possible, ternary alternation is.

Rhythm is essentially based on adjacency; non-adjacent feet create a ternary rhythm and adjacent feet create a binary rhythm. Foot size is constrained by FtBin and nonadjacent feet by RA. The constraints allow for both ternary and binary alternation.

In other languages, such as Estonian (Hint 1973, Prince 1980, Kager 1994, Hayes 1991), ternary alternation is an option along with a binary alternating pattern. Syllables are parsed into binary feet and stress may be binary or ternary alternating. Some examples of these patterns are given in (5).

(5) Estonian Binary and Ternary patterns (Hayes 1991)

Ternary

pímestavàle

Binary

pímestàvale 'blinding,ill.sg.'

ósavamàleki ósavàmalèki 'also more skillful abl.sg'
 hílisemàtele hílisèmatèle 'later,all.pl'

Hayes (1991) cites other languages with reported binary and ternary rhythmic patterns. In Karelian (Leskinen 1984), secondary stress can sometimes occur on the third rather than the fourth syllable, and so on. Both binary and ternary patterns are also possible for Hungarian (Balassa 1890 cited in Kerek 1971 and Hall 1938; Sovijarvi 1956, Szinnyi 1912, Lotz 1939).

Some analyses of ternary stress patterns have proposed that such patterns arise by constructing ternary feet (including Levin 1988, Drescher and Lahiri 1991, Rice 1992). Others have argued that Weak Local Parsing (Hayes 1991, Kager 1993a) where binary feet are separated by unparsed syllables gives rise to ternary patterns. The advantage of Weak Local Parsing is that ternary feet are not postulated as a prosodic constituent. Unlike binary feet, the ternary foot is not well-supported cross-linguistically. The foot inventory is thus restricted to binary feet in the Weak Local Parsing analysis.

I have shown in Chapter 2 that ternary alternation is possible even when a constraint on foot size, ie FtBin, is dominant. This has also been demonstrated by Kager (1994) for languages with ternary alternations such as Cayuvava and Estonian. Ternary alternation does not have to be generated by parsing ternary feet. Thus, the notion of a ternary foot $*(\sigma\sigma\sigma)$ is rejected here (following Hayes 1994, Kager 1993a, M&P 1990, among others).

4.2.3 *The data*

The data on phrasal stress comes from a number of sources and informants. The primary data are from a tape-recording (archive tape 430A) made by Ken Hale (1966) of Paddy Stuart Jupurrula (Lanta River Warlpiri). A copy of the tape is provided with the thesis. The tape is approximately 50 minutes in length and consists of a number of stories about the old days, all of which are monologues. Hale made hand-written transcriptions of the recording. These were later typed up by Nash (1982) and the typed version was used in the analysis of stress.

Another recording (archive tape 4545a) made by Hale (1959-60) is of Mickey Connell (from Yuendumu) telling a number of short stories. A total length of 30 minutes was analysed. Hale's hand-written transcriptions, which included words marked for a single stress, of the recording assisted in the analysis. No translations of either of these Hale texts are available. The translations given for each example here are my own and I am therefore responsible for any errors.

A more recent recording of connected speech is of Mary O'Keefe Napurrula, recorded at Alekurenge in 1990 by Mary Laughren. The recording is of a short story, approximately 15 minutes long, titled 'Yapuntakurlu' transcribed and translated by Peggy Rockman Napaljarri and Lee Cataldi.

Throughout this chapter any example taken from Hale's tape recording is labelled with the page and line number corresponding to the typed transcription (Nash 1982) accompanying the tape. The page number corresponding to Hale's (1966) notes is also given and is indicated by 'HN'. Some pages of the transcription are provided in Appendix 2. Samples from the recording of Mickey Connell will be indicated by 'MC/HN', and for Paddy Stuart 'PC/HN'. Examples taken from the Mary Laughren recording will be indicated by 'MOK'.

4.3 *Stress Patterns in Casual Speech*

Casual speech is defined following Browman & Goldstein (1990:359) as 'that subset of casual speech in which reductions typically occur.' This definition is based on the frequent observation that

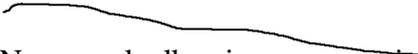
of Warlpiri intonation patterns³.

In an intonation phrase only one main stress is heard in an utterance of one or many words. Based on my perceptual interpretation, primary stress is not present in all words. Stress is perceived on all words, but this stress is heard as relatively equivalent to all other stresses in the utterance. The exception to this is prominence located in initial or final position in an utterance.

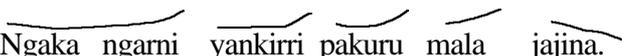
When a word appears in isolation, the syllable with primary stress is the initial syllable. When a word is combined into a sentence, there may be no primary stress on its initial syllable depending on its position in the sentence. In non-initial position in a sentence, a word has no distinction between the stresses it carries. That is, there is no significant differentiation between stresses present on the first, third or other moras of a word. Perceptually, all stresses are relatively similar.

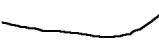
On the other hand, a word at the beginning of a sentence or after a pause will carry a main prominence on its initial syllable. This main prominence is generally the most salient compared to the stresses which follow.

Two main types of intonation patterns were noted in the data, a declarative type and a listing type. In a declarative type intonation pattern, the more prominent tone is that located on the first syllable of the initial word in the utterance. The end of the utterance is marked by a low boundary tone, as shown in (14)⁴.

- (14)  Nyampu-rla=lku yi=rna purra-mi [p2.5:HN1102]
 here-LOC=now RELCOMP=1sS cook-NPST
 'I am here now to cook'

The pitch range is small; the beginning of the utterance is at around F0 200 and the end at around F0 150. In a listing-type pattern where a number of items are listed, each listed item except for the final one ends with a high tone (around F0 250). Examples of this pattern are given in (15).

- (15) a.  Ngaka ngarni yankirri pakuru mala jajina.
 by-and-by ingest;move emu bandicoot rat-kangaroo mouse.
 'by-and-by they move the emu, the bandicoot, the rat kangaroo and the marsupial mouse'
 [p11.19:HN1131]

- b.  pakarninjarla [LB] (see Appendix 2, Fig 3c)
 strike-NPST-INF-SERCOMP
 'while striking'

The high and low tones mark the boundaries of an utterance (or an intonation phrase). Following a pause, an utterance is always aligned with the beginning of an intonation contour. The beginning of an utterance is defined as coinciding with a pause. In the following examples the full stop coincides with a pause and following the pause is the beginning of an intonational phrase. Note also that the intonation pattern is similar whether for a single or a multi-word phrase.

³ Heather King (University of Edinburgh) is currently undertaking a study of intonation in Warlpiri.

⁴ The intonation contours are the F0 contours as interpreted by the Waves acoustic program. The contours here approximate with those generated by the program, except that I have not included voiceless consonant breaks in the contour.

(16) a. ~~Kapi miyi yarla warru-karla. Nyampurlalku yirna~~
 FUT food yam around-dig for. Here-LOC=now RELCOMP=1sS

~~purrami. Yamangka. [p2.5:HN1102]~~

cook-NPST shade-ERG

'dig around for yams. I also continue to cook here in the shade'

b. ~~Pirramirli ngularna pakarnu. Ngulalku.~~
 yesterday-ERG that one=1sS strike-PST that one=then

~~Ngarninjarla yantarli nyinanjarla yarda nguna.~~

eat-NPST-INF-SERCOMP staying at home again lying down

~~Yantarliiki. [p2.17:HN1104]~~

at home then

'Yesterday, I killed that one and I ate it, after staying at home lying around.'

The nature of IP, that is, whether it is a prosodic or semantic constituent, or both, is uncertain. Therefore, the relationship of IP with the prosodic constituents, PW, F and σ is not clear. What is certain is that the IP serves as a domain for the alternation of rhythmic units. This domain is delimited by the edges of intonational phrases, which coincide with pauses.

Prosodic constituents do not straddle IP boundaries. Based on this observation, I propose a constraint requiring the left edge of the foot to align with the left-edge of the IP. The IP edge is indicated by '{'.

(17) **AlignIP:** the left edge of a foot aligns to the left edge of an intonational phrase.

The edges of the IP constrain the alternation of the feet. For instance, within an IP, a foot or syllable may straddle word boundaries but not intonational boundaries. For instance, $\ast(\sigma\{\sigma\})\dots$ is not possible. Only one foot is required to align to an IP in contrast to AlignFt which requires all feet to align to a PW edge. I argue later that edge alignment is required for one foot, but the location of other feet is not determined by alignment, but rather by adjacency.

It would be expected that IPs align with morphosyntactic structure, rather like the alignment of the left edge of a stem with the left edge of a prosodic word. Thus, the left edge of an utterance, a morphosyntactic category, aligns with the left edge of an intonational phrase. In examples (15-16), the edges of the IP are where breaks occur in the contour due to slight pauses in speaking. This may mean, as in the example in (15), that each word in a sentence is aligned with its own intonation contour.

A string of words in an intonational phrase is like a single word. Word boundaries are blurred and main stress occurs only at the beginning of the intonational phrase. This main stress would appear to be the combination of stress and a high intonation tone. The notion of prosodic word in intonational phrases may be somewhat flexible, but further research is required to investigate this.

When words are in phrases, the edges of these phrases or strings are the crucial edges for alignment. This is the case whether speech is slow or fast. It appears that word or morpheme edges are less important under casual speech conditions than intonational phrase edges. The higher the constituent on the prosodic scale, ie an IP, the more relevant its edges are for alignment, in comparison to lower constituents, ie a prosodic word.

There is little data on phrasal rhythmic patterns in other languages apart from some Indo-European languages. Bruce (1984) reports that in Swedish stress movement occurs across word boundaries in phrasal contexts. Schutz (1985) gives a small amount of information regarding stress movement across words in Fijian.

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4.3.5 *Summary*

As the data shows, word boundaries are not always relevant in casual speech, as evidenced by stress placement (examples (8) & (9)) and by syllabification across word boundaries (eg (13)). The requirement that prosodic words are bimoraic and vowel-final does not always hold when word-final vowel deletion occurs.

Non-parsing of word-final vowels may mean that unsyllabifiable elements delete (or are not parsed) (examples (11) & (12)), and that consonants syllabify across word boundaries resulting in word-initial glides vocalizing (examples (13) & (12e)). Foot structure is adhered to as there are no degenerate feet or stress clashes.

While feet and syllables may cross word and word-internal morpheme boundaries, they do not cross intonational phrase boundaries.

The align constraints that are violated in casual speech are AlignL, AlignPW, Taut-F, LE, LEXSTRESS, AlignFt. PARSE-SEG is also violated. The constraints that hold are FtBin, RA and FtForm.

In the next section, I develop an account of the stress patterns in casual speech.

4.4 *An Account*

Variation in stress patterns across morpheme boundaries in Warlpiri can be considered a connected/casual speech phenomenon which is sensitive to pause and insensitive to morphological structure (Kaisse 1985). This contrasts with other connected speech processes, such as sandhi, which are sensitive to morphosyntactic contexts. Processes that occur under casual speech conditions are optional.

As noted, word boundaries do not always restrict the rhythmic organisation of an utterance. This is exemplified in (22), where, if prosodic word boundaries were present, a foot straddles prosodic word boundaries.

- (18) a. [(ká-nyí)-rni] [(kúyu)]
 b. [(ká-nyí)(rù)][(ku)yu]

(18a) is the optimal word generated by the constraints and contrasts with (18b), where the final syllable in the first prosodic word is stressed and the second prosodic word lacks stress.

Syllabification may occur across prosodic word boundaries (if present) when a word-final vowel is not parsed, as shown in (19).

$$(19) \quad \begin{array}{cccccccc} \sigma & \sigma \\ \wedge & \wedge & \wedge & \wedge & \wedge & \wedge & / \ \backslash & \wedge \\ [(ká.nyi.)rni.][(.yáng.ka.)] & > & [(yá.nyi.)(<i>rn</i>)] & & [(ang.)ka.] \end{array}$$

The problem is to account for the variant forms that arise under casual speech conditions. Constraints govern well-formedness of outputs, but outputs generated under casual speech conditions are not always well-formed by the constraints. There are a number of possibilities that may provide an explanation for the problem. Before these are addressed, it is necessary to discuss prosodic constituent structure under casual speech conditions.

4.4.1 Prosodic word in casual speech

Since word boundaries are ignored in both stress placement and syllabification in casual speech, the issue of prosodic word structure is relevant. Within an IP, internal prosodic word structure appears non-existent or irrelevant. To account for this, two main alternatives are considered. The first is that in casual speech the presence of prosodic word structure is optional, and the second is that prosodic word structure is present, but it is irrelevant to other prosodic constituent structure. The former possibility is discussed first.

As mentioned in the section on intonation, a string of words bounded on either side by a pause resembles a single word. Main stress occurs on the initial syllable in the string and no other differentiation between main and secondary stress is made. This observation, together with the fact that feet and syllables may straddle word boundaries, indicates that prosodic word structure internal to an IP is not present. In such cases, we could say that generating prosodic word structure is optional under casual speech conditions, that alignment of stems with prosodic word edges is not always required. Under this analysis, there is the option of viewing phrases as consisting of one prosodic word or of a number of prosodic words. Furthermore, if we say that it is optional, we account for the cases where prosodic word structure is present. This means that from an input /σσσ/σσ/ the prosodic word structure may be [σσσ][σσ] or [σσσ σσ].

If generating prosodic word structure is optional, there will be violation to the requirement that particular morphological categories, ie stems and roots, correspond to prosodic words. Having some constraints as optional is explored further in the following section.

The other alternative is that the prosodic word is generated, but is irrelevant. This will mean that feet straddle prosodic word boundaries, and that syllabification occurs across such boundaries.

Such structures are not permitted by the Prosodic Hierarchy. The question is why would prosodic word structure be generated if it was subsequently ignored? An answer may lie in the notion of mismatched representations.

McCarthy (1986) and Blevins (1995) argue that mismatches between phonological representations and phonetics in the phonetic interpretive component are possible. In other words, changes that occur in the phonetic component do not effect the phonological representation. For instance, where vowel deletion has occurred, the phonological representation of the syllable is not affected, as represented in (20). In such cases, the phonetic target is not quite reached.

$$(20) \quad \sigma \quad \sigma$$

$$\begin{array}{c} \wedge \quad \wedge \\ [(C \quad V \quad C <V>)] \end{array}$$

Consider the possibilities if syllable structure, which affects foot and prosodic word constituents, did not alter. If a final vowel in a disyllabic word was not parsed, as in (20), we would expect stress clashes in the phonetic interpretive component when adjacent to another word, shown in (21).

(21) $\begin{array}{c} \sigma' \quad \sigma \quad \sigma' \quad \sigma \\ \wedge \quad \wedge \quad \wedge \quad \wedge \\ [(C \quad V \quad C <V>)] [C \quad V \quad C \quad V] \end{array}$

In the mismatch analysis, resyllabification of the stranded consonant should not occur if the syllable node remained after deletion. However, in the data presented here resyllabification does occur (see (12) b, c and e). Furthermore we would expect stress clashes in (21) because the second syllable is only representational, but since we do not find these, we can assume that non-parsing of vowels simply means that no mismatch between phonological and phonetic representations exists, or that it cannot be characterised in this way.

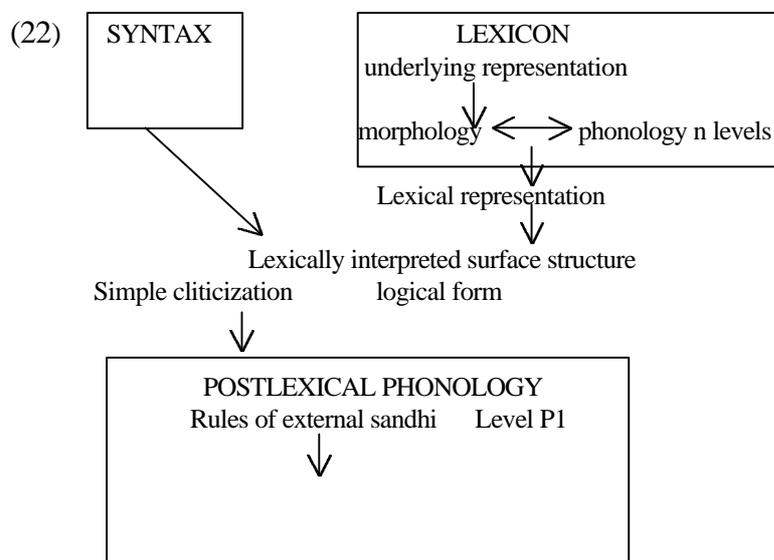
An alternative to the mismatch analysis is to say that the phonological component is 'hidden' under phonetic implementation. This is based on claims by Browman & Goldstein (1990) that the gestures or articulation of segments can be reduced and/or overlap resulting in hidden or blended gestures. Phonetic and phonological variation can be a result of overlapping gestures. Thus, if segmental gestures overlap, this would mean syllables do as well and that, at word edges, prosodic word boundaries are overlapped or blurred. Under these conditions, prosodic words are no longer distinct entities. Hidden and blended gestures are discussed more in 4.4.4.

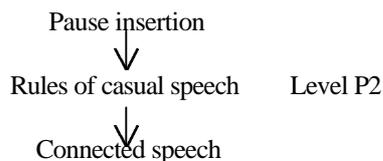
In conclusion, the solution where prosodic words are optionally parsed is preferable to the alternative of parsing prosodic words and allowing violation to the Prosodic Hierarchy.

Now that the nature of prosodic word in casual speech is established, we need to ascertain whether these forms are generated on a different level or on the same level as the optimal forms in the tableaux presented in Chapters 2 and 3.

4.4.2 Constraint Relaxation

In previous derivational accounts, casual speech processes applied to outputs from a word level. This is characterised in a model (simplified) from Kaisse (1985:20):





In this model, derived outputs from the lexicon are submitted to postlexical phonology. In the postlexical component, outputs may undergo two types of rules, P1 and P2 rules (Kaisse 1985). P1 rules are rules of external sandhi which apply in specific morpho-syntactic environments, while P2 rules are connected/casual speech rules which are sensitive to notions of adjacency, in particular, the absence of pause between segments or constituents.

In OT outputs are generated from underlying representations through a constraint system avoiding the need for derivation from one level or component to another. However, since the variant forms in the data violate many of the constraints, positing another level may be necessary. One reason why we might want to generate variant forms on a different level is to allow Bracket Erasure (Pesetsky 1979, Kiparsky 1982, Mohanan 1982, Inkelas 1989) of internal structure. Bracket Erasure (BE) occurs at the interface between different levels in the grammar. As discussed above, feet may cross word boundaries and if prosodic word brackets were present this would violate AlignPW and AlignFt. If there were no internal prosodic brackets present, then prosodic constituents straddling the boundaries of other prosodic constituents would not occur and would not be a problem.

However, Bracket Erasure would be the only reason why we would want different levels, as no other motivation exists. Since the processes that occur under casual speech are optional and infrequent, positing a different level is unnecessary. Additionally, BE is not required if prosodic word structure is not constructed in the first place.

It has been argued that variant forms can be generated through one set of constraints at one level (including Kager 1994, Anttila 1995). This analysis has been applied to languages where there is a high frequency of variation, which is not dependent on speech rate or sociolinguistic factors, as shown by Kager and Anttila for Estonian and Finnish respectively. Re-ranking or the partial ranking of two constraints is able to generate the variant forms (discussed in 4.5.2).

Following a similar line of investigation, I propose that the casual speech variants in Warlpiri can likewise be generated at the one level. However, in contrast to re-ranking or partially ranking constraints, I propose that some constraints are 'relaxed'⁵ or 'by-passed' under casual speech conditions.

Constraint re-ranking does not occur under specific conditions; where two constraints, X,Y, are unranked in the grammar of a language, X is dominant over Y in one tableau, and in the other tableau the ranking is reversed $Y > X$. Re-ranking accounts for a high frequency of variation and is suited to cases involving two constraints.

In contrast, variant forms are produced under casual speech conditions and are less frequent and may violate a larger number of constraints, than non-casual speech variants. In addition, variants under casual speech occur across word strings and are not confined within words. Casual speech conditions are determined by rate of speech and context. Variants produced under casual speech conditions tend to show more changes to phonological structure, including lenition and glide vocalisation, than other (non-casual speech) variants.

In derivational accounts of phonology, casual speech rules are optional and apply to outputs from another level. If the OT principle of simultaneity is pursued, casual speech variants

⁵ This terminological suggestion was made to me by Avery Andrews.

can be generated at the same level as other forms without invoking an additional level. Relaxed constraints are like optional rules; we can equate optional rules with constraint violation which may or may not be ignored. Hence, where constraint violations can be ignored, we can say the constraint is relaxed. Since constraints not rules generate outputs, it must be the status of violations to constraints that is fundamental to the generation of casual speech variants.

Determining how and when constraints can be relaxed is then a necessary step. I propose a principle governing the relaxation of constraints where specific conditions determine when relaxation is upheld.

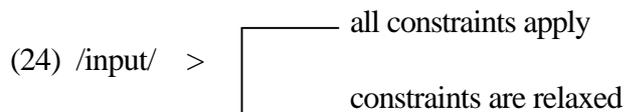
(23) Constraint Relaxation⁶

Under casual speech conditions, constraint(s) can be nominated as relaxed in tableaux.

Where constraints are relaxed, more than one optimal output will arise in tableaux. This contrasts with the standard view in OT, whereby a single optimal form is generated in tableaux. There may be two possible outputs as a result of casual speech conditions⁷.

Since casual speech is produced under specific conditions, tableaux will be specific to such conditions and contrast with tableaux where constraints are not relaxed. Thus, there will be two tableaux: one which generates the optimal forms according to all the constraints in the grammar and another in which the relaxed constraints have been de-activated.

In the model I am proposing, all outputs are generated at the one level, but it is the conditions that determine whether all constraints apply or not. This model is schematised as:



Under casual speech conditions, a number of constraints are nominated as optional. Since feet may cross morpheme and word boundaries, the constraints AlignL, AlignPW, AlignFt, LE, Taut-F are nominated as optional. These constraints involve prosodic word and foot alignment. Feet optionally align with lexically marked syllables and with specific morphemes, and thus LEXSTRESS is also nominated as optional. In contrast, the dominant constraints AlignIP, RA and FtBin are not optional and cannot be violated. As RA is dominant, Parse σ is also an optional constraint.

The optional constraints operate as a set, although it is possible that constraints requiring alignment to prosodic word, ie AlignL, AlignPW and AlignFt function independently of the foot and morpheme alignment constraints, as discussed in 4.6.

In the tableaux in this section, I consider only those words which have variant stress patterns unaffected by vowel deletion.

⁶ This constraint was originally introduced in a paper presented at the Australian Linguistics Conference 1995.

⁷ Avery Andrews has suggested an alternative ranking possibility. At a particular point on the ranking scale, the scale divides into a fork and the choice is to take either the top or bottom path, eg $\text{---}\diamond\text{---}$. The top path road may be taken under casual speech conditions. However, there needs to be a number of these forks on the ranking scale for Warlpiri, since the constraints that are relaxed under casual speech conditions are at various points along the scale. The question to be resolved is whether this is more complicated than relaxing certain constraints. My present view is that it is.

When all constraints are obligatory, there is a single optimal output, as the following tableau illustrates:

(25) ka-nyi-rni kuyu	AlignPW	LE	Taut-F	AlignFt
%a. [(kányi)rni][(kúyu)]		**	*	
b. [(kányi)(rni)][ku]yu	*!	**	**	2:σσ

If violations against the constraints in (25) were ignored then there would be two optimal outputs, as in the following tableau where the relaxed constraints are omitted.

(26) ka-nyi-rni kuyu	AlignIP	FtBin	RA
%a. {[kányi)rni][(kúyu)]			
%b. {[kányi)(rni) ku]yu			

Another possible output is {[ka-(nyí-rni)][(kúyu)]}, which violates AlignIP because a foot is non-aligned with the left edge of the IP.

Since the dominant constraints AlignIP, FtBin and RA cannot be violated, they restrict the range of possible variation. This is the case in the following tableau involving a word located at the beginning of an intonational phrase.

(27) ngajulu-ngurlu	AlignIP	FtBin	RA
%a. {[ngáju)(lù-ngu)rlu]			
%b. {[ngáju)lu-(ngùrlu)]			
c. {[nga(júlu)-(ngùrlu)]	*!		
d. {[ngáju)lu-ngurlu]			***!

(31a,b) are the optimal candidates. (31c,d) are ruled out by AlignIP and RA. Ternary variants can likewise be generated under constraint relaxation, as in the following tableau.

(28) wurna=lku=lpa ya-nu	AlignIP	FtBin	RA
%a. {[wúrna)=(lkù=lpa)][(yá-nu)]			
%b. {[wúrna)=lku=(lpà ya)-nu]			
c. {[wúrna)=lku=lpa][(yá-nu)]			*!
d. {[wu(rná=lku)=lpa][(yá-nu)]	*!		

In monomorphemic words, it is necessary to ensure that AlignFt is relaxed to account for

the variant ternary patterns.

(29) yinkardakurdaku	AlignIP	RA	FtBin
%a. (yínka)(rdàku)(rdàku)			
%b. (yínka)rda(kùrda)ku			

The constraints that account for the stress patterns in Warlpiri are part of the grammar. Under casual speech conditions some constraints do not always hold. What is interesting is that the dominant rhythmic constraints hold and we should expect a similar situation in other rhythmic languages displaying binary and ternary patterns. This is in fact the case with Estonian, discussed in section 4.5.2.

Instead of nominating constraints to be relaxed, it may be preferable to regard morphological boundaries as not present or irrelevant. However, this would mean accounting for instances where alignment has occurred with morphological boundaries at certain locations throughout a word or strings of words. Recall that the morphological structure of a word determines binary and ternary patterns when constraints are obligatory, eg $(\sigma\sigma)\sigma-(\sigma\sigma)\sigma-(\sigma\sigma)$, $(\sigma\sigma)(\sigma-\sigma)-(\sigma\sigma)$. Given that ternary patterns arise from morphological alignment, such patterns would be difficult to explain in the absence of boundaries, particularly since ternary variants are much less frequent than binary variants.

In casual speech, morphological boundaries have less relevance and the interface constraints AlignL, LE, Taut-F, LEXSTRESS play a lesser role in the assessment of outputs under these conditions. The conflict between morphological and prosodic dominance is somewhat alleviated under casual speech, generating a range of variant forms. The advantage of the analysis presented here is that casual speech variants can be accounted for without introducing an additional level in the grammar, and is thus consistent with the principles of OT. In addition, with the proposed model, it is possible to account for different speech styles.

4.4.3 *PARSEs and RA*

In 2.3 I argued that the specific parsing constraint, RA, is required to account for stress patterns in Warlpiri. The analysis of rhythmic alternation in this chapter further supports this constraint. Under $PARSE\sigma$, ternary patterns could not be generated, since they would incur more violations of $PARSE\sigma$, as shown in (30).

(30)	RA	$PARSE\sigma$
		**!
		**
	**!	**

RA says nothing about $(\sigma\sigma)\sigma$, but prevents sequences of adjacent unfooted syllables. RA is a more sophisticated parsing constraint which also ensures rhythmic alternation and this may be a reason to abandon $Parse\sigma$ in favour of RA.

4.4.4 *Segments in Outputs*

Under casual speech conditions, changes occur to segments in outputs which would violate the

Correspondence constraints requiring exact identity between inputs and outputs. This prompts us to consider the kinds of identities acceptable in casual speech. We can think of segmental alterations in terms of the gestural model of Browman & Goldstein (1989, 1990). In this model, gestures are described as a combination of inherent spatial and temporal aspects. The spatial aspect is the constriction formed by the articulators and this action occurs within some inherent time. Browman and Goldstein propose the segment deletions, insertions, assimilations and weakenings that occur in casual speech can be explained as resulting from two kinds of changes: (1) a reduction in the magnitude of articulation; (2) an increase in overlapping of articulations. As a result of these changes segments can be hidden or blended.

An example of a hidden gesture is the /t/ in ‘**perfect memory**’ which is present when the word **perfect** is said in isolation, but in the phrase it is not heard, eg [□★□↗★&∫○↖∞:○★□)(]. When Browman & Goldstein examined the articulation data, they found that an alveolar closure was produced, but it was completely overlapped by preceding and following closures. Thus in articulation terms the gesture is present, but due to overlapping, the /t/ is acoustically hidden. The same explanation is given for other segmental changes.

Given these facts, there is the sense that segments are not deleted or altered, at least in articulation terms. This would mean that the Correspondence constraints, ie MAX-IO, DEP-IO and IDENT(F), could be fine-tuned to account for articulatory and acoustic dimensions in casual speech. When speech is carefully pronounced, both dimensions would be evenly matched, but in casual speech we can expect the articulatory dimension to compromise the acoustic one. The details on how either dimension would function as constraints in casual speech require more space than is available here, and research on whether all languages support the hidden segment theory is needed.

We should note that the gestural explanation will not let us off the hook when word-final vowel deletion occurs at the end of an utterance, since it is not overlapped by a following consonant, although it could conceivably be overlapped by a preceding one. To account for final-vowel deletion, a constraint requiring words to end in vowels would be relaxed. Final vowels are not parsed in the variant in (31b):

- (31) a. [(yán.ki.)(rri.ki.)][(yá.ni)]
 b. [(yán.ki.)rri.(k<i>)][ían.<i>]

In sum, in casual speech gestures are modified so as to produce overlapping articulations. The gestures may be modified because a speaker is paying less attention to what he/she is saying (Dressler & Wodak 1982; Barry 1984) or because the speaker is articulating faster. In either case, gestural modifications result in relative variations.

4.4.5 *Binary vs ternary alternation*

As shown by the data, ternary alternation as an option is not as common as binary alternation. While ternary alternation is generated by the constraints, it is less common as a variant on binary patterns. One possible reason for this imbalance may be because binary patterns tend to be easier to generate. Binary patterns are generated by ensuring feet are adjacent to each other. Generating ternary patterns may be slightly more difficult as it is necessary to ensure that one syllable intervenes between feet. However, it is interesting to note that in Martuthunira phrasal stress patterns (Dench 1987), ternary alternation occurs contrary to the expected binary pattern as in the examples below (no glosses given).

(32)	<i>word stress</i>	<i>phrasal stress</i>
	pátha-rrálha-rru	pátharralhárru
	máni-ngká-npa-rra	máningkanpárra
	yákarrángu-la	yákarrangúla
	kányará-npa-rrá-rru	kányaranpárrarru

Dench notes that in words with five syllables, stress often occurs on the penultimate syllable showing a preference for a ternary+binary pattern over a binary+ternary pattern. Sometimes the stress pattern of a word is altered so that it is similar to that of other words in a phrase.

The examples of ternary alternation suggest that there is a greater control over such patterns than what was previously thought and that generating such patterns may not be related to ease of production.

4.4.6 Summary of analysis

In the analysis presented in this section, I have argued that under casual speech conditions certain constraints can be relaxed. The variants produced are constrained by the rhythmic constraints.

The constraints and their ranking allow for both binary and ternary rhythm. If only binary was permitted, then we would expect ternary rhythm to be eliminated by vowel deletion and we would not expect ternary alternation where binary was expected. Word-final deletion applies to a word of any size, disyllabic or trisyllabic, etc. Vowel deletion is unconstrained by the prosodic structure of an utterance and can be interpreted as a way of ensuring a particular kind of rhythmic pattern.

In Warlpiri, there is tension between the rhythmic organisation and the morphological organisation of an utterance. Under casual speech conditions, this tension is eased, giving rise to variation, eg $(\sigma\sigma)\sigma(\sigma\sigma) \sim (\sigma\sigma)(\sigma\sigma)\sigma$. The prosodic word is not a crucial player in the rhythmic organisation of texts, nor is it crucially relevant as a constituent in connected speech. This is evident in cases involving syllabification across word boundaries and word-final vowel deletion.

The advantages of the analysis are, firstly, that it avoids positing an additional level for derivations. An additional level would suggest that differences in stress patterns were due to obligatory rather than relaxed constraints. Secondly, the variants can be explained as a different style of speech and that different speech styles require a different system of constraint ranking. Casual speech requires a ranking system involving constraint relaxation. As will be discussed in section 4.5.2, a further advantage is that an additional constraint to generate ternary patterns is not required.

4.5 Alternative Analyses

As previously mentioned, stress variation under casual speech conditions is accounted for in rule-based analyses derivationally. Consequently, the difference in stress patterns is described as stress movement and rules to account for the movement of stress are required. Hayes (1991) lists commonly found phrasal stress operations:

- (33)
- a. End rules - prominence among phrases
 - b. Move stress under clash
 - c. Destressing under clash

d. Eurhythmmy

Adjustment or deletion of stress operates in line with rhythmic principles, which include the avoidance of stress clash and regular spacing of stresses. These operations would be required in a derivational analysis of the Warlpiri data. For instance, to derive a ternary variant from a binary form of **(yinka)(rdaku)(rdaku)**, a stress deletion rule must first apply followed by a stress movement rule. This process is shown below:

(34)	input:	/yinkardakurdaku/
	output from word level stress rules and input to next level:	(yínka)(rdàku)(rdàku)
	1. delete the second stress:	(yínka)rdaku(rdàku)
	2. move stress one syllable to the left:	(yínka)rda(kùrda)ku

Stress is assigned at the word level, but is optionally altered at the next level by deletion and movement rules. The stress movement rule captures the observation that stress typically moves to the left. However, the deletion rule is more arbitrary in terms of which stress to delete. The rule requires a particular stress to delete to enable stress movement to the left, but the deleting stress could be anywhere in a string and there may be more than one stress deleting. Thus, movement is dependent on deletion. The phrase in (35) would be the output from the word level and may be altered in casual speech (see (36)):

(35)	(ngári)rli(pàr̀la) (ngápa) (nyámpu) (nyányi)
	foliage:tea leaves water this see-NPST

To achieve the altered output, the fourth and fifth stress have to be deleted and stress movement to the left then applies twice, as shown in (36):

(36)	(ngári)rli(pàr̀la) nga(pà nyam)(pù nyany<i>)
------	--

Stress deletion can apply anywhere in a string, but the stress deletion rule is unable to capture this. Particular stresses have to be nominated, and while the tendency (evident in the data) is for second stresses in a string to delete, this is not always the case.

In a derivational analysis, variations to rhythmic patterns in casual speech contexts are accounted for by rules which operate on outputs from the word level. However, one of these rules, the stress deletion rule, is unexplanatory and unable to indicate which stress deletes. Furthermore, it appears that stress movement can only occur because of stress deletion but there is no reason why it cannot occur independently.

The benefit of an OT analysis is that stress is assigned to outputs without the need to posit different levels of stress assignment. This avoids the need for unmotivated rules, for assignment, deletion, and reassignment steps. With the constraints on IP alignment and RA, the prediction is that the stress patterns will be binary and ternary.

4.5.1 Levels

As previously mentioned, casual speech processes have been typically assigned to a separate level in derivational accounts of phonology. Casual speech processes apply to derived forms. In the theory

of Lexical Phonology/Morphology (Kiparsky 1982, Mohanan 1982), the output of one level is the input to another level. At the interface between levels, Bracket Erasure applies to eliminate boundary information and is necessary to avoid violating well-formedness conditions, when additional structure is added to a derived form.

M&P (1993a) claim that the grammar of Axininca Campa has three levels: prefix, suffix and word. At each level, there are different constraint rankings, and outputs are selected on the basis of best satisfying the constraints at that level. At the interface between the suffix level and word level in Axininca Campa, M&P argue that BE occurs eliminating word-internal prosodic structure. Inputs to the word level contain only the outermost prosodic word brackets. This accounts for the difference in stress patterns between suffix level and word level outputs. This difference is shown in the following example where constraints at the suffix level generate (37a) but the observed output (37b) is that generated at the word level.

- (37) a. [[[nomà) na]-(pit à)(Cáa)]-ri
 b. [(nomà)(napi)(t aCáa)ri] [M&P 1993a:147]

At the suffix-level, suffixes are required by the constraint SFX-TO-PW to attach to prosodic words. If the syllable **na** in (37a) was parsed into a foot, a foot would straddle prosodic word boundaries which is not permitted by the Prosodic Hierarchy. The solution is to eliminate all feet and internal prosodic word structure at the interface between levels. At the word level, SFX-TO-PW is ranked below the stress constraints and is consequently unable to rule out attested forms such as (37b).

If a levels analysis was adopted, we could say there are two levels, word level and a postlexical level where casual speech processes apply. For instance, the optimal form of /ngajulu-ngurlu/ at the word level is [(ngáju)lu-(ngùrlu)]. Bracket Erasure occurs at the interface between levels resulting in [ngajulungurlu]. This output then serves as the input to the postlexical level, as shown in (38).

(38) [ngajulungurlu] FtBin RA

a. [(ngáju)(lùngu)rlu]	
b. [(ngáju)lu(ngùrlu)]	

However, the alignment constraints involving prosodic words, ie AlignFt, would still need to be relaxed to account for variants. As in the tableau above, (38b) would incur more violations to AlignFt than (38a). Furthermore, without boundaries we would expect one particular rhythmic pattern, rather than a combination of binary and ternary which arise from the presence of prosodic or morphological boundaries.

If Bracket Erasure and levels were introduced, constraints would still need to be relaxed. Bracket Erasure only adds complexity to the model proposed here and contributes little to our understanding of the stress patterns in outputs. The rationale behind different levels is to explain prosodic or morphological structure on one level that would not be permitted at another level. However, we are trying to explain permissible variations to forms whose phonological structure violates constraints.

4.5.2 Re-ranking

Under the notion of re-ranking, constraints may be re-ranked with respect to each other to achieve

a variant form. Re-ranking has been considered by Kager (1994) for Estonian. In this analysis two constraints are involved in re-ranking.

As discussed in section 4.2, Estonian may have a binary or ternary rhythmic pattern. The examples from (5) are repeated in (39).

(39) Estonian Binary and Ternary patterns

Ternary	Binary	
pímestavàle	pímestàvale	'blinding,ill.sg.'
ósavamàleki	ósavàmàleki	'also more skillful abl.sg'
hílisemàtele	hílisemàtele	'later,all.pl'

There is a three-way distinction of syllable weight: light, heavy and overlong. I will discuss words with overlong syllables after presenting Kager's analysis of the binary and ternary patterns. The ternary pattern is constrained by the presence of heavy syllables, CVC and CVV. In word-final position, CVC is light and CVCC is heavy. To account for CVC syllables being light in this position, I suggest that a consonant in word-final position is not mora-bearing, and therefore does not contribute to the weight of a syllable.

(40) kávalàtt	'cunning,part.sg.'	*kávalatt
párimàttelt	'the best,abl.pl.'	*párimattèlt
pímestàttuse	'blinding,ill.sg.'	*pímestattùse
úsaltàttavàmattèks	'...'	*úsaltattàvamattèks

The third syllable in the examples in (40) is a heavy syllable and must be stressed. However, stressed syllables cannot be adjacent. The following patterns are not possible ***párimàttèlt**, ***pímestàttùse**. To account for the stress patterns, Kager proposes the following constraints:

- (41) FtForm: Feet are Trochaic
 *Clash: No adjacent stressed syllables
 Parse-2: One of two adjacent stress units (syllable or mora) must be parsed by a foot⁸.
 *FtFt: Feet must not be adjacent.
 AlignFt: The left edge of a foot aligns to the left edge of a prosodic word.
 Align-L: Every prosodic word begins with the main stress foot.

Ternary alternation is guaranteed by *FtFt which demands feet to be non-adjacent. The ranking of these constraints is:

- (42) FtBin, *Clash, Parse-2, FtForm, AlignL >> AlignFt, *FtFt

In Kager, the binary alternating pattern is derived by ranking AlignFt above *FtFt. The ternary pattern is generated by reversing the ranking of these two constraints.

(43) pímestavasse	AlignFt	*FtFt
a. (pímes)ta(vàsse)	2:σσσ!	

⁸ This constraint operates similarly to RA.

% b. (pímes)(tàvas)se	2:σσ	*
	*FtFt	AlignFt
% a. (pímes)ta(vàsse)		2:σσσ
b. (pímes)(tàs)se	*!	2:σσ

Under AlignFt, binary alternation is achieved by assessment to the prosodic word edge, and every non-initial foot incurs a (gradient) violation. In contrast, under *FtFt, ternary alternation is achieved by assessing foot adjacency rather than by assessment to the prosodic word edge. Violation to *FtFt is not gradient, but is outright. Given the way each constraint assesses violations, they must be ranked with respect to each other. Consequently, to derive a binary or ternary rhythmic pattern the ranking of AlignFt and *FtFt must change.

Heavy syllables must be parsed into feet, and, when heavy syllables are adjacent, Parse-2 and *Clash ensure that the alternating pattern is primarily binary. This is shown below:

(44) usaltattavamatteks	Parse-2	*Clash
a. (úsal)tat(tàva)(màtteks)	*!	
b. (úsal)(tàtta)va(màt)(tèks)		*!
%c. (úsal)(tátta)va(màtteks)		
%d. (úsal)(tàtta)(vàmát)(tèks)		

Binary and ternary patterns of alternation are also present in words with overlong syllables. Overlong syllables are heavy syllables with additional length, CVV:, CVVC:, CVCC:.

- (45) a. káu:kèle káu:kele 'far away'
 b. jál:kètest jál:ketèst 'trick,el.pl.'
 c. toos:tùsele tóos:tusèle 'industry,ill.pl.'
 d. téot:tàttüttelt téot:tàttüttelt 'backer,abl.pl.'

In the binary patterns, adjacent stressed syllables are permitted and, in the ternary patterns, heavy syllables may remain unfooted. This suggests that there is no ranking between *Clash and RA, as shown in (46).

(46) /teot:tàttüttelt/	*Clash	RA
%a.(téot:)(tàttut)(tél)t	*	
%b.(téot:)tat(tüttelt)		*
c.(téot:)(tát)(tüttelt)	**!	
d.(téot:)tattut(tèl)t		**!

Another possible pattern is **(téot:tat)(tüttelt)**, where a heavy syllable is parsed into the same foot as an overlong syllable. This would be ruled out if the maximum number of moras in a foot was three.

In Warlpiri, re-ranking may explain variant stress patterns in frozen reduplication words

which appear to be undergoing some regularisation (Nash 1986). To explain the stress patterns of words such as (**míji**)li-(**jíli**), the constraint LE was introduced (Chapter 2). A variation to this pattern is (**míji**)(**líji**)li. Variation in the stress patterns may be accounted for by re-ranking the constraints LE and AlignFt. However, re-ranking will only account for a small percentage of the variation evident in the data and introduces complexities in the ranking system. To give one example, LE, Taut-F, LEXSTRESS dominate AlignFt and as a result many polymorphemic words have ternary alternating patterns. To achieve binary alternation, AlignFt would have to be re-ranked with each one of these more dominant constraints. Recall that the ranking of the constraints is:

(47) FtBin, RA, AlignL, FtForm, AlignPW >> LE, Taut-F >> LEXSTRESS >> AlignFt

The relationship of AlignFt with these constraints varies because these constraints are ranked differently with respect to each other and with AlignFt. Re-ranking between one of the constraints and AlignFt will involve consideration of the ranking of the other constraints. For instance, when AlignFt is ranked above LE, it is important to ensure that AlignFt is also ranked above LEXSTRESS and Taut-F. Thus, the re-ranking analysis involves not just two constraints, but also the other constraints that are not directly involved in re-ranking. And because other differently ranked constraints are involved, re-ranked constraints would have to ‘jump’ over other constraints, thereby weakening the ranking system.

Given the re-ranking scenario above, it would be simpler, more constrained and more economical to compute the dominant rhythmic constraints (ie FtBin, RA, AlignIP) as always obligatory and other constraints as relaxed, than to compute a number of re-rankings in certain contexts.

One question which has not been considered in re-ranking analyses is the relationship between non-ranked constraints. It is assumed that unranked constraints can be ranked with respect to each other to generate variant forms. This suggests that any set of unranked constraints can be re-ranked, which undermines the stability of the system.

Note that there is no ranking between the constraints LE and Taut-F due to the fact that there is no conflict between the two constraints. If one of the constraints was ranked above the other, there would be no effect on outputs. Under the re-ranking analysis, generating two tableaux with different constraint ranking, ie LE >> Taut-F or Taut-F >> LE, would be automatic. However, this process would be unnecessary given that exactly the same output would occur in the tableaux.

In conclusion, relaxation of constraints allows for a straightforward and constrained analysis of casual speech.

4.5.3 Non-ranking

Another alternative is to consider non-ranking of the alignment constraints under casual speech conditions. For instance, we could say that there is no ranking between LEXSTRESS, LE, Taut-F and AlignFt. However, as argued in Chapter 2, under Ranking Equity, non-ranking of crucial constraints is not possible between gradient and non-gradient constraints. Since AlignFt is a gradient constraint, non-ranking between it and the other constraints is not permitted.

4.5.4 An alternative to the Estonian analysis

In the analysis given for Warlpiri, binary and ternary patterns are generated without the constraints

AlignFt and *FtFt. This analysis could be extended to account for similar rhythmic patterns in Estonian. In fact, the analysis could account for other languages with reported binary and ternary patterns such as Hungarian and Karelian mentioned in 4.2.

Without AlignFt and *FtFt in tableaux, either a binary or ternary pattern can be generated. The dominant constraints rule out any other ungrammatical patterns, as shown for Estonian in the tableau below.

(48) pimestavasse	AlignL	FtBin	*Clash	RA
%a. (pímes)(tàvas)se				
%b. (pímes)ta(vàsse)				
c. (pímes)tavasse				**!

The dominant constraints decide against outputs other than (48a,b). AlignL ensures that the main stress foot is located at the left edge of the word. RA and FtBin constrain alternation to binary and ternary. The rhythmic alternation pattern is further constrained by *Clash. With these dominant constraints, AlignFt and *FtFt are unnecessary.

If AlignFt is present in tableaux, and none of the dominant constraints are in a conflicting relationship with AlignFt, then a constraint that conflicts with AlignFt is needed. Thus *FtFt is forced into service.

Since RA allows either binary or ternary alternation, AlignFt is superfluous in languages showing equal frequency of either pattern. The question of AlignFt is addressed in the following section.

4.6 *AlignFt*

As discussed in 4.2 our notion of rhythm is based on adjacency. Syllables within a foot are adjacent; adjacent feet create binary rhythm; non-adjacent feet, constrained by RA, create ternary rhythm. Rhythmic patterns can be generated without alignment constraints on all feet as shown for the Warlpiri (casual speech) and Estonian data. If rhythm is an adjacency phenomenon, then what of the constraint AlignFt?

Under Kager's analysis the rhythmic patterns are determined by AlignFt and *FtFt. These constraints assess the location of feet differently, AlignFt by alignment to the prosodic word edge, and *FtFt by adjacency with other feet. Under this analysis, rhythm is achieved by both alignment and adjacency; binary by alignment and ternary by adjacency. As a consequence, there is some inconsistency in generating rhythmic patterns. We would expect the generation of both patterns under the same type of constraints, particularly since rhythmic patterns are not confined to speech or morphological edge alignment.

AlignFt could be replaced by a constraint requiring feet to be adjacent, such a constraint, call it BINARY, would reflect the notion that rhythm is an adjacency phenomenon. BINARY predicts a binary rhythm and does not rely on an edge to ensure this.

In languages which exhibit high frequency in both binary and ternary patterns, constraints such as AlignFt or *FtFt are not required. Where the tendency is for binary patterns a constraint like BINARY is necessary. In such cases the rhythmic patterns are more constrained. This would give us the following typology:

(49) binary and ternary FtBin RA Align(foot to edge)

(50) binary only FtBin RA Align(foot to edge) BINARY

There are some languages with reported ternary only patterns of alternation, such as Cayuvava (Key 1961). As analysed by Kager (1994) the constraints AlignFt and *FtFt are crucial to derive ternary alternation. AlignFt ensures that at least one foot is located close to a prosodic word edge, while *FtFt ensures ternary rhythm.

In Chapter 1, the stress patterns of Pintupi, Warao and Ono are accounted for by the constraints FtBin, AlignFt and PARSE σ . These patterns can also be derived by FtBin, RA, Align(foot to an edge) and BINARY, where Align and BINARY replace AlignFt. The question is which is the most appropriate set of constraints?

The most appropriate would be those that account for the widest possible range of data. AlignFt and PARSE σ overly constrain rhythmic alternation, thereby not allowing ternary variation. Nor does this set of constraints allow for alignment to anything other than prosodic word edges. We need to allow for alignment to other prosodic structures, such as intonational phrases, as we have seen from the data examined here that the IP, the higher prosodic constituent, constrains feet at IP edges.

Constraints on the adjacency of feet determine rhythmic patterns. If rhythm is computed through adjacency we can say that rhythm is adjacent dependent. In contrast, alignment is required to locate one foot with respect to one prosodic word edge and/or intonational phrase edge. Thus, feet are adjacent dependent as well as alignment dependent. In languages with a single foot per word, a foot is aligned to one particular edge. This contrasts with rhythmic languages, where one foot is aligned to an edge, and rhythmic alternation is in relation to this and other feet.

In conclusion, rhythm should be interpreted as an adjacency phenomenon, rather than only an alignment phenomenon and constraints should reflect this.

4.7 Concluding Remarks 4.8 Concluding Remarks

The rhythmic constraints are defined in terms of adjacency, and these constraints ensure binary and ternary rhythmic patterns. To achieve this I have proposed that certain constraints, interface constraints and foot alignment to prosodic word can be relaxed under specific conditions. This means that an additional level for derivations on derived forms is not required, thus simplifying the grammar as a whole. Constraint Relaxation accounts for variant rhythmic patterns, and could be extended to account for other speech styles.

Rhythmic alternation in casual speech is confined within an IP, and to account for this I have introduced a new alignment constraint, AlignIP, which demands that the left edge of a foot align with the left edge of an IP. This accounts for the absence of non-aligned constituents at the edges of intonation phrases.