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Aspects of Minimality and Prosodic Constituenthood*

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1. Introductory Remarks

Prosodic categories such as mora (M), syllable (σ), foot (F), and phonological word (PWd) share various properties with syntactic categories like NP, AP, VP, and PP. First, both categories function as constituents with respect to some prosodic or syntactic phenomena. A second characteristic common to these categories is that they have a parametric nature in the sense that they are specified across languages for the direction of the head.[1]

There are several differences, however, between the two sorts of categories. For example, the former categories do not appear recursively in prosodic structure, whereas the latter ones can recur in syntactic structure. Furthermore, structures made up of prosodic categories are assigned to a given phonological string, while a given phonological string is inserted to (a terminal position of) structures consisting of syntactic categories. But these and other differences can be attributed to a more fundamental difference between the two, that is, the difference of the theory governing the well-formedness of each kind of structure: prosodic theory vs. X'-theory.

In the prosodic theory put forward by Tanaka (1990, 1991a, 1991b), there are three distinct principles which govern the arrangement of each prosodic category in the general hierarchy: the Strict Layer Hypothesis, the Minimality Condition, and the Extraprosodicity Condition. When there occurs a violation of any of the principles, one of the four rules is taken to apply to repair the ill-formed structure; moreover, which rule applies relies solely on which principle is violated and in what way.

This paper is devoted to adducing full evidence for the Minimality Condition, which can be formulated in the following way:

◎ Minimality Condition (MC)
For all categories C_i, $i \neq 1$, C_i contains at least one constituent of the category C_{i-1}.

The condition can be restated formally, using the ***Min*** predicate, as Min $(C_i) = [C_{i-1}]^{C_i}$. In particular, a syllable contains at least one mora, a foot contains at least one syllable, a phonological word contains at least one foot, and so on; thus, Min $(\sigma) = [M]^{\sigma}$, Min $(F) = [\sigma]^{F}$, Min $(PWd) = [F]^{PWd}$, etc.[2] When the MC is violated in some way or other, Stress Deletion must apply to wipe out the violation as a repair strategy.[3]

There are, however, some languages in which the condition works more restrictively, hence more idiosyncratically: in such cases, the MC is not simply stated as Min $(C_i) = [C_{i-1}]^{C_i}$. We will show in section 2 that the MC proves to be all the more valid precisely for its idiosyncracies, scrutinizing the stress facts of Cayuvava, Gaalpu, Warao, and Creek. Section 3 will introduce some intriguing cases where apparently intricate stress is derived from the interaction between the MC and other processes, in light of Lenakel and Diyari stress. Taking advantage of the MC instead of some other theoretical devices employed by Halle and Vergnaud (1987) or Haraguchi (1991a, 1991b) gives rise to some consequences in prosodic theory in general, which will be discussed in section 4.

2. Case Studies: Applications of Minimality

2.1. Cayuvava and Gaalpu

It has been pointed out in the literature that although vast majorities of languages have binary feet, there are some languages in the world that are taken to have ternary feet. Among those are Cayuvava and Gaalpu, and we demonstrate in this section that the stress facts of such ternary-footed languages are more naturally accounted for by the MC than by any other theoretical apparatus that has been utilized thus far. We arrive at the conclusion that in any language with ternary feet, a foot dominates at least two moras; namely, Min $(F) = [M\ M]^{F}$.

Cayuvava was the first, as far as we know, to be analyzed as having ternary feet in a string uniformly. Stress in this language falls on every third mora from the end of the word as in (1a), with the proviso that words other than those with *3n* moras do not have initial stress as shown in (1b) and (1c):[4]

(1) a. 3n moras

cáadiróboBurúruce	'ninety-nine'[5]
ráibirínapu	'dampened manioc flour'

b. 3n+1 moras

maráhahaéiki	'their blankets'
kihíBere	'I ran'

c. 3n+2 moras

ikitáparerépeha	'the-water-is-clean'
Bariékimi	'seed of squash'

We assume that Cayuvava has the parameter settings in (2) for prosodic categories and extraprosodicity, and sample derivations proceed as in (3):[6]

```
(2) a. Mora - - - - - - - - - -     all vowels in the rime
    b. Extraprosodicity - - - -     the right mora
    c. Foot (Type)  - - - - - -     (. * .)
                                     M M M
           (Directionality)  -      Right-to-Left
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```
(3) a. (* .)(. * .)(. * .) .         b. (. * .)(. * .) .
        M M  M M M  M M M <M>            M M M  M M M <M>
       cá a diróbo Burúru ce            maráha ha é i ki
    c. (*)(. * .)(. * .) .
        M  M M M  M M M <M>
      * í kitápa rerépe ha
```

The parameter settings, as they stand, would predict incorrect results in the case of words with *3n+2* moras like those in (3c), because such words do not have initial stress. We propose here, following Tanaka (1990), that ternary-footed languages have the MC to the effect: Min (F) = $[M\ M]^F$, as evidenced by examining Chugach Alutiiq stress; that is, in languages with ternary feet, all feet must contain at least two moras. The unary foot on the initial syllable in (3c), then, violates the MC, which triggers the application of Stress Deletion, and the required result is obtained:

```
(4)  (*)(.  *  .)(.  *  .)<.>      (.)(.  *  .)(.  *  .)<.>
      M  M  M  M  M  M  M   M       M  M  M  M  M  M  M   M
   • í kitápa rerépe ha  →  i kitápa rerépe ha
```

This account of Cayuvava stress with MC is, we believe, quite natural and straightforward, and does not suffer from any conceptual defect or contradiction, since a unary foot seems to be too small and incomplete to be licensed in any ternary system.

Now let us address our attention to previous analyses of Cayuvava stress, where some theoretical devices are appealed to instead of the MC. First, Halle and Vergnaud's (1987) account is as follows:

(5) a. Stress-bearing elements: all vowels in the rime
    b. Extrametricality: the right vowel
    c. Line 0 parameter settings:
       [- HT, + BND, right-to-left]

```
(6) a.  *        *        *          b.     *        *
       (*  *)(*  *  *)(*  *  *)<*>       (*  *  *)(*  *  *)<*>
       cá a diróbo Burúru ce             maráha ha é i ki
```

Though their representations are different from ours, basic parameter settings in (5) produce the same effects as those in (2). The fundamentally different respect from our account lies in the treatment of words with *3n+2* moras like those in (1c). Halle and Vergnaud claim that in such cases, feet (or more strictly, constituent boundaries) can be assigned ambiguously as illustrated in (7), which leads to a violation of the Recoverability Condition in (8):

```
(7)   *     *        *                   *        *        *
     (*)(*  *  *)(*  *  *)<*>           (*  *)(*  *)(*  *  *)<*>
      i kitápa rerépe ha        or      iki tápa rerépe ha
```

(8) Recoverability Condition
    The location of the constituent boundaries must be unambiguously recoverable from that of the heads, and conversely the location of the heads must be unambiguously recoverable from that of the constituent boundaries.

Specifically, in (7), the location of the constituent boundaries is not recoverable uniquely from that of the heads. Halle and Vergnaud continue to claim that the initial foot, either unary or binary, then, is not constructed and stress does not surface in the word-initial position.

Unfortunately, however, the reasoning runs in clear contradiction, as Halle (1989) and Haraguchi (1991a) point out, because the latter way to locate the constituent boundaries in (7) is excluded by another condition proposed by Halle and Vergnaud, the Maximality Condition; namely, constituent construction must be maximal, but the latter structure in (7) is not being constructed as such. There is thus no ambiguity in structures of words with $3n+2$ moras, and the Recoverability Condition cannot be invoked to account for such words.

On the other hand, Haraguchi (1991a) adopts dactylic feet for Cayuvava stress and devises the Stress Clash Hierarchy and the Resolution Parameter as given below:

(9) a. Stress-bearing elements: all vowels in the rime

b. Line 0 parameter settings:
[+ BND, ternary, left, right-to-left]

c. Stress Clash Hierarchy: Degree 2

d. Resolution Parameter: Delete α

Of special interest here is the fact that Haraguchi (1991a) utilizes the [binary/ternary] parameter instead of [$\pm$ HT], since in his theory non-head-terminal feet are not adopted. Moreover, he proposes the Stress Clash Hierarchy, which defines a stress clash language-specifically (* * = Degree 1, * . * = Degree 2, * . . * = Degree 3, and * . . . * = Degree 4), and the Resolution Parameter, which specifies a rule to alleviate the clash (Move α, Delete α, Insert α, etc.). As indicated in (9c) and (9d), Delete α applies at Degree 2 in Cayuvava, hence both (10b) and (10c) are regarded as containing a stress clash to be wiped out, and correct outputs are obtained indeed:

(10) a.
```
 *  .  . *  .  . *  .  .
(*  *  *)(*  *  *)(*  *  *)
cá adi róboBu rúruce
```

```
b.  *   *         *                 *       *
   (*)(*  *  *)(*  *  *)       * (*  *  *)(*  *  *)
 * má ráhaha  é iki   →   ma ráhaha  é iki

c.  *      *         *                 *        *
   (*  *)(*  *  *)(*  *  *)    *  * (*  *  *)(*  *  *)
 * íki tápa e répeha  →   iki tápa e répeha
```

However, it is not necessarily the case that in any ternary-footed language, Delete *α* applies at Degree 2. In some languages which Haraguchi (1991b) assumes are provided with dactylic feet (such as Mantjiltjara, Walmatjari, and Gaalpu, which are all Australian languages), the following structures are derived and deletion does not apply at all. Rather, unlike Cayuvava, a stress clash is retained even at Degree 2:[7]

(11) a. Mantjiltjara

```
*   .  .  .    .  .    .
(*   *  *  *    *  *)   *
(*   *  *)(*    *)(*    *)
kàyili Rìngu làtju
```

káyili Rìngu làtju 'we went north'

b. Walmatjari

```
*  .  .  .  .
(*  *  *)  *  *
(*  *)(*   *  *)
```

njúmukkùtjiNi 'cause to bathe'

c. Gaalpu

```
*  .  .   .   .  .  .  .
(*  *  *   *   *  *) *  *
(*  *)(*   *   *)(*  *  *)
```

nína tùnkanminjaràwu 'to stand' (gen.-dat.)

It thus follows that there is only one language in the world, as far as we know, that chooses Degree 2 and Delete *α* among the values of the Stress Clash Hierarchy and the Resolution Parameter, respectively. So we have to conclude that there is a good possibility that an account with the Stress Clash Hierarchy is merely an artifact; in contrast, the MC is always true for languages with ternary feet, such as Chugach Alutiiq, Cayuvava, Mantjiltjara, and Walmatjari. Gaalpu is also one such language, to which we turn our attention next.

In Gaalpu, the initial mora bears primary stress, secondary stress falling on every third non-final mora from the primary stress:

(12) a. páT 'after'[8]

b. rákal 'greedy'

c. ráwaktji 'to shrivel up'

d. páyikuya 'that' (gen.-dat.)

e. tjínpulkkuwànam 'to sharpen'

f. kúlngiyinjàrawum 'to enter' (nominalized)

An interesting point is that as Wood (1978) observes, morpheme boundaries found in reduplicated or compound forms prevent the continuation of ternary stress. In such cases, ternary stressing starts again from the boundaries:

(13) a. $\acute{M}$ + $\grave{M}$ M M

b. $\acute{M}$ M + $\grave{M}$ M

c. $\acute{M}$ M + $\grave{M}$ M M

d. $\acute{M}$ M + $\grave{M}$ M M $\grave{M}$ M

e. $\acute{M}$ M + $\grave{M}$ M M $\grave{M}$ M M

(14) a. nína + tùnkanminjàrawu 'to set down' (gen.-dat.)

b. táya + nàramingkàntawu 'to stand' (gen.-dat.)

This pattern can be captured simply by the following parameters for prosodic categories. As specified in (15b), each morpheme constitutes a domain for stress, or for foot assignment:

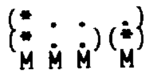
(15) a. Mora - - - - - - - - - - all vowels in the rime

b. Foot (Type) - - - - - - - $(\overset{*}{M}\ \dot{M}\ \dot{M})$

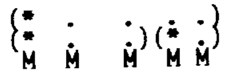
(Directionality) - Left-to-Right

(Domain) - - - - - Morpheme[9]

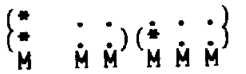
c. Phonological Word - - - $(\overset{*}{F}_1\ \dot{F}_2 \ldots \dot{F}_n)$

(16) a. 

* [páyiku yà]

b. 

[tjínpulkku wànam]

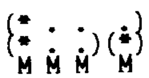
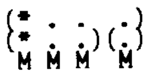
c. 

[kúlngiyinjàrawum]

d. 

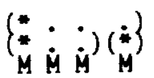
[nína][tùnkanminjàrawu]

As mentioned above, since this ternary-footed language also has the MC (i.e. Min (F) = $[M\ M]^F$), the unary foot in the final position in (16a) undergoes Stress Deletion, which produces the well-formed output:

(17)  

* [páyiku yà] → [páyiku ya]

It generally holds that Stress Deletion applies in violation of the MC, but Refooting is also a candidate to apply optionally in that situation, as discussed in Tanaka (1990) with respect to Chugach Alutiiq stress. Although Refooting usually applies to rule out a violation of the Strict Layer Hypothesis, it is reported to apply in violation of the MC, which is merely a rare case. If so, the only way of alternative reassignment is as in (18), provided that other requirements on constituent structure are satisfied:

(18)  

* [páyiku yà] → [páyi kùya]

Surprisingly, the output in (18) is also attested, as Wood (1978) remarks, and this variable stress is observed in any four-syllabled word.

This natural account is not obtained when we resort to other apparatuses than the MC. For example, Haraguchi (1991b) accounts for Gaalpu stress by adopting basically the same parameter settings in his framework and devising the refooting rule in (19) and the deletion rule in (20):

(19) (* * *)(*) → (* *)(* *)

(20) line 0: (* → (.

The two rules are simply what accounts for the optional stressing of the above word (i.e. *páyikùya* by (19) and *páyikuya* by (20)). But unfortunately, the latter rule is too strong in that it might generate erroneous results when applied to other words in (16); in particular, it might delete secondary stress incorrectly in the case of words in (16b-d). Moreover, (19) is precisely what the MC means, or in other words, the refooting rule is simply a surface manifestation of the MC to avoid a unary foot in the ternary system. The same is also the case with Halle's (1989, 1990) refooting rule, which is the same as (19) and devised merely to account for Alutiiq stress only.

In contrast, the MC allows us to capture a property of ternary-footed languages uniformly: a foot must contain at least two moras in Alutiiq, Cayuvava, Mantjiltjara, Walmatjari, and Gaalpu. The Recoverability Condition, Delete *a* at Degree 2, and language-particular rules such as (19) are all surface reflexes of a deeper characteristic found in ternary systems: the MC.

2.2. *Warao and Creek*

For ternary systems, a unary foot is too small and incomplete, hence ruled out by the MC. One might ask, then, whether this is true for binary systems. In a wide variety of languages with binary feet, feet once constructed are retained, either binary or unary;[10] but there are binary-footed languages, though only a few, in which certain degenerate feet are unlicensed: Warao, Creek, Lenakel, and Diyari. This section introduces sample cases where the MC works well in binary-footed languages, in light of Warao and Creek.

In our framework, these languages have the following parameter values of categories, (21) for Warao and (22) for Creek:

(21) a. Mora - - - - - - - - - - - all vowels in the rime

b. Foot (Type) - - - - - - - $(\overset{*}{M}\ \overset{.}{M})$

(Directionality) - Right-to-Left

c. Phonological Word - - - $(\overset{.}{F_1}\ \overset{.}{F_2} \ldots \overset{*}{F_n})$

(22) a. Mora - - - - - - - - - - - all rime segments

b. Foot (Type) - - - - - - - $(\overset{.}{\sigma_u}\ \overset{*}{\sigma})$

(Directionality) - Left-to-Right

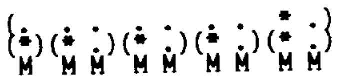
c. Phonological Word - - - $(\overset{.}{F_1}\ \overset{.}{F_2} \ldots \overset{*}{F_n})$

Derivations of stress of the languages proceed as illustrated below:

(23) Warao

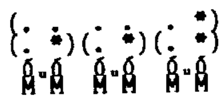
a. 

nàho rò a hàku tá i 'the one who ate'

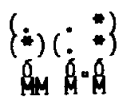
b. 

* è hàho rò a hàku tá i 'the one who caused him to eat'

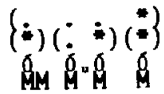
(24) Creek[11]

a. 

isi mahi citá 'one to sight at once'

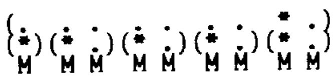
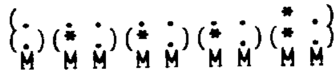
b. 

hoktakí 'women'

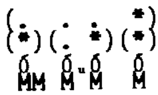
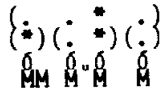
c. 

* alpato cí 'baby alligator'

A difference in foot formation between the two is that the former language is taken to be mora-counting, as was the case with the languages examined in the previous section, while the latter counts as syllable-counting, and moreover, quantity-sensitive. In spite of the distinction of the nature of their feet, they have a common property concerning the size of their feet: Min (F) = $[M\ M]^F$. Thus, the structures in (23b) and (24c) undergo Stress Deletion due to their violation of the MC:

(25) a.  

* è hàho rò a hàku tá i → e hàho rò a hàku tá i

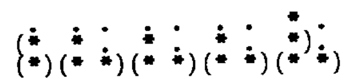
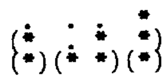
b.  

* alpato cí → alpató ci

Note here that it does not necessarily hold that Creek unary feet are unlicensed by the MC. A unary foot on a light syllable contains a single M, while one on a heavy syllable contains two Ms; that is why the final unary foot in (25b) is deleted while the initial ones in (25b) and (24b) are not.

An account of Warao and Creek stress without the MC brings about somewhat different consequences from the above explanation. For example, the parameter settings proposed by Hayes (1981) for Warao and by Halle and Vergnaud (1987) for Creek produce basically the same structures as those in (23) and (24), hence the words in (25) are provided with the following metrical structures at first:

(26) a. Warao b. Creek

* è hàho rò a hàku tá i * alpato cí

However, to derive the correct outputs of each word, such accounts without the MC have to assume two kinds of deletion rules, one for Warao and the other for Creek, as in (27):

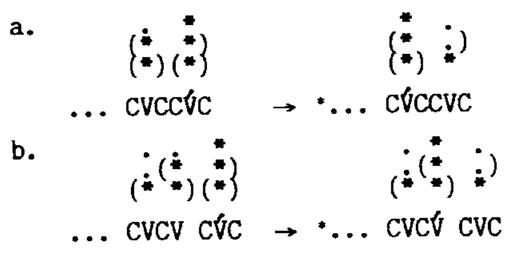
(27) a.  b. 

This analysis seems to overlook a significant generalization common to these languages, which is precisely what the MC captures: both of the deleted stresses are unary feet which contain a single mora. In other words, assuming two distinct rules for the above deletion phenomena seems to be too costly, but the MC accounts for the destressing of binary-footed and ternary-footed languages uniformly. Another problem to be posed is that the deletion rule in

(27b) is counterintuitive, because in general, main stress is never deleted in a clashing context (the Higher Grid Preservation in section 4). As Tanaka (1992b) argues on the basis of a wide variety of languages, what is to be deleted of the two adjacent stresses is secondary but not main stress, and the only possible case where main stress appears to be deleted is a violation of the MC, because the incompletion of a unary or degenerate foot can be crucial for certain languages. Moreover, this claim makes it possible to establish two important generalizations (i.e. the MC and the Higher Grid Preservation). In contrast, the account with the rule in (27b) does not provide a natural answer to the question of why main stress may be deleted although it is higher in grid column than secondary stress. Finally, the most serious problem with (27b) is that it predicts wrong results in the case of words with a final CVC. According to Haas (1977), the final heavy syllable should always attract stress, but (27b) would locate it on the penultimate syllable as shown below:

(28) MC: no violation

(29) (27b):



This fact strongly supports our analysis of Creek stress with the MC.

Summarizing this section, the MC does not generally hold for binary systems, but there are certain languages whose stress would not be given a principled account, either theoretically or empirically, without the MC. Moreover, we also suggest that the MC allows us to establish a significant generalization with regard to

Clash Deletion that only the lower column of grid (i.e. secondary stress) of the two adjacent stresses can be deleted, because the only case in which main stress may be deleted is the presence of a monomoraic foot, a violation of the MC.

3. Some Intriguing Correlation between Minimality and Other Processes

3.1. Lenakel

The Austronesian language Lenakel not only has rather complicated stress patterns, but also an account of Lenakel stress necessarily involves capturing the anomalous behavior of certain suffixes and the idiosyncratic tensing rule. In this section, we show that Lenakel stress is captured straightforwardly if Lenakel foot contains at least two moras (i.e. Min (F)= $[M\ M]^F$), as is the case with all the languages examined so far.

In this language, main stress is usually located on the penultimate syllable, and subsidiary stresses fall on every even-numbered syllable from the main stress in the case of such nominal forms as those in (30a) and on every odd-numbered syllable from the word-initial position in the case of verbal forms like those in (30b), except for the syllable immediately preceding the main stress:[12]

(30) a.
kavÉvaw 'hat'
làgabnə́bən '(in the) morning'
kayÈlawÉlaw 'kind of dance'
lÈdubòlugálUk 'lungs' (loc.)

b.
kə̀namargə́nəm 'they have been pinching it'
tyàgamàrOlgÉygEy 'you will be liking it'
tə̀nagàmyasənə́vən 'you will be copying it'
nàdyagàmEdwàdamnə́mon 'why am I about to be shaking'

In a class of specially marked cases, however, this generalization concerning primary and secondary stresses does not hold true, and they are classified into the following two types. First, words containing such morphemes as *Edyaw*, *an*, and *yav* word-finally bear main stress on the final syllable as in (31a). These morphemes can be analyzed as having stress of their own in their underlying representation. Oddly enough, when such morphemes occur next to each other, the second loses its stress and main stress surfaces on the penult as shown in (31b); but when the sequence contains three lexically-stressed morphemes, main stress is final and only the penultimate suffix surfaces without stress as in (31c):

(31) a. rə̀m-Edyáw 'he arrived'

rə̀sgən-án 'he didn't eat it'

rə̀masOw-yáv 'he went north'

b. rə̀m-Edyáw-yav 'he arrived in the north'

rə̀s-Edyáw-an 'he didn't arrive'

c. rə̀s-Edyàw-yav-án 'he didn't arrive in the north'

Second, in Lenakel, tense and lax vowels are in nearly complementary distribution: high vowels are lax in closed syllables and tense in open ones, and mid vowels are lax before consonants and tense otherwise. To capture this fact formally, it can be assumed that Lenakel vowels are all lax underlyingly and that some of them become tense by the tensing rule applying in open syllables subject to certain further conditions. However, in addition to vowels with a predictable distribution of tenseness, there are underlying tense vowels which always attract stress and cause a violation of the above generalization:

(32) a. así̲s 'to swell up'

abgé̲n 'to be jealous'

b. nəgì̲nílar 'their hearts'

nə̀mansì̲nílar 'their bottoms'

Lexically-tense vowels surface in the final syllables in (32a), which lead to not penultimate but final main stress, and in the antepenultimate syllables in (32b), which bring about unwanted pretonic stress.

We assume following Hammond (1986) that morphemes such as *Edyaw, an,* and *yav* have long vowels underlyingly, and also that lexically-tense vowels are underlyingly long.[13] If so, it is necessary to set the parameter values in (33) for Lenakel prosodic categories. The specifications, however, are not sufficient to account for so complicated patterns; more crucial is that in Lenakel, a monomoraic foot is not licensed, that is, Min (F) = $[M\ M]^F$. Stress of the words in (30)-(32), then, is derived in the way exemplified in (34):

(33) a. Mora - - - - - - - - - - - - all vowels in the rime

b. Foot 1 (Type) - - - - - - - $(\underset{\sigma}{*}\ \underset{\sigma_u}{.})$

(Directionality) - Right-to-Left

(Mode) - - - - - - Non-Iterative[14]

c. Foot 2 (Type) - - - - - - - $(\underset{\sigma}{*}\ \underset{\sigma_u}{.})$

(Directionality) { Right-to-Left (Nouns) / Left-to-Right (Verbs) }

(Mode) - - - - - - Iterative[14]

d. Phonological Word - - - - $(\underset{F_1}{.}\ \underset{F_2}{.}\ \ldots\ \underset{F_n}{*})$

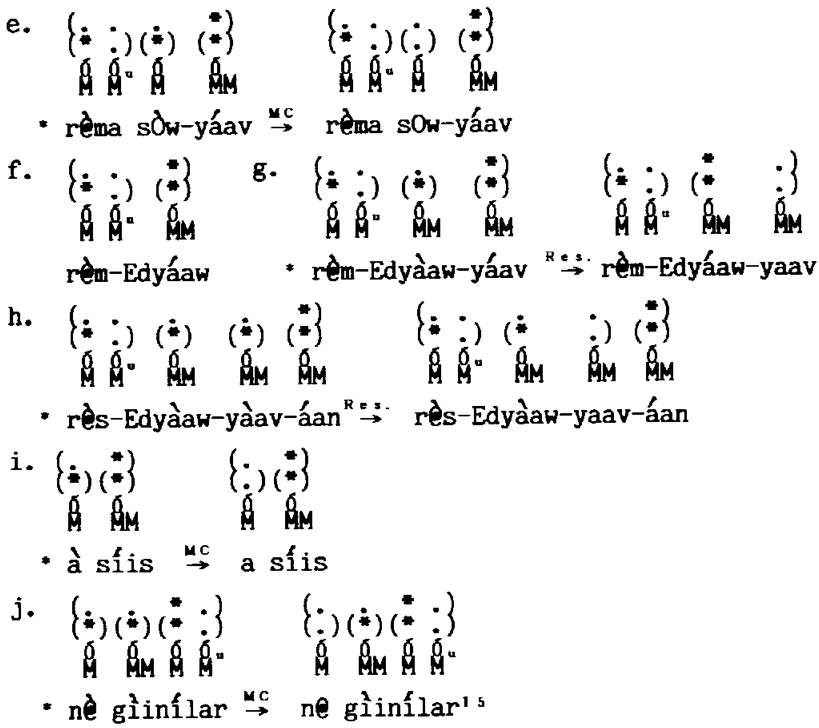
e. Resolution - - - - - - - - - (*)(*) → (* .)

(34) a.
```
{.     .  .    *   }      {.     .  .    *   }
{*)(*  .)(*    .}         {.)(*  .)(*    .}
 σ   σ  σu  σ  σu          σ   σ  σu  σ  σu
 M   M  M   M  M           M   M  M   M  M
```
* kà yÈla wÉlaw $\overset{MC}{\rightarrow}$ ka yÈla wÉlaw

b.
```
{.   .    .   .    *   .}
{*   .)(* .)(*     .}
 σ  σu  σ  σu  σ  σu
 M  M   M  M   M  M
```
lÈdu bòlu gálUk

c.
```
{.  .    .      .    .     *   .}
{*  .)(*       .)(*)(*     .}
 σ  σu  σ      σu  σ   σ  σu
 M  M   M      M   M   M  M
```
```
{.  .    .      .    .     *   .}
{*  .)(*       .)(.)(*     .}
 σ  σu  σ      σu  σ   σ  σu
 M  M   M      M   M   M  M
```
* tèna gàmya sè névèn $\overset{MC}{\rightarrow}$ tèna gàmya sə névən

d.
```
{.      .    .   .    .   .    *   .}
{*      .)(* .)(*     .)(*     .}
 σ     σu  σ  σu  σ  σu  σ  σu
 M     M   M  M   M  M   M  M
```
nàdya gàmEdwàdamnémo



Since there is a unary foot in the words given in (34a), (34c), (34e), (34i) and (34j) that includes only a single mora, they suffer from a violation of the MC, which is wiped out by Stress Deletion as usual. It is crucial, particularly in (34e), that it applies immediately after all prosodic constituents are built in accordance with (33a-d); otherwise, Resolution (33e) would first apply to the word in (34e), resulting in a wrong stress pattern. Resolution (33e) is applied to the words in (34g) and (34h), which merges two degenerate feet into a fully-binary one.[16] This rule as well as the MC reflects the propensity to avoid unary feet in Lenakel: the MC and Resolution rule out monomoraic and bimoraic unary feet, respectively. It is to be noted that this rule scans *from left to right*, which is paticularly crucial in (34h); if it applied from right-to-left, the result would be * *rès-Edyàaw-yáav-aan*.

An account of these complicated stress patterns would be less straightforward without the MC. For example, Halle and Vergnaud (1987) assume that Lenakel has the following rules and parameter settings in the cyclic and the non-cyclic strata and that morphemes such as *Edyaw*, *yav*, and *an* are not only cyclic suffixes but also assigned a line 1 asterisk lexically:

(35) Cyclic Stress Rules

a. Stress-bearing elements: rime head vowels

b. Stress Copy: Copy a line 1 asterisk assigned on preceding cycles.

c. Accent Rule: Assign a line 1 asterisk to lexically-tense vowels.

d. Cyclic Deletion: $* \rightarrow . \;/\; \begin{array}{c} * \\ * \end{array} \;\underline{\;\;*\;\;}\,]_{Wd}$

e. Line 0 parameter settings:
[+ HT, + BND, left, right-to-left]

f. Line 1 parameter settings: [+ HT, - BND, right]

g. Line Conflation: Conflate lines 1 and 2.

(36) Non-Cyclic Stress Rules

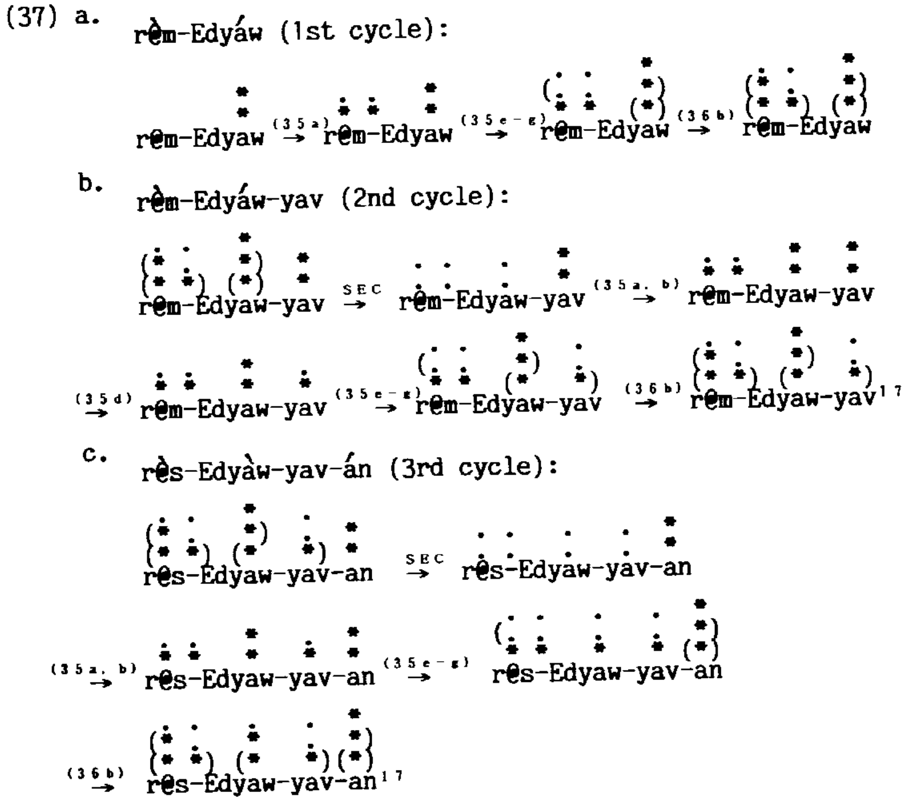
a. Accent Rule: Assign a line 1 asterisk to lexically-tense vowels.

b. Line 0 parameter settings:

[+ HT, + BND, left, $\left\{ \begin{array}{l} \text{right-to-left (nouns)} \\ \text{left-to- ght (verbs)} \end{array} \right\}$]

c. Non-cyclic Deletion: $* \rightarrow . \;/\; \underset{\substack{| \\ [-\ \text{tense}]}}{\underset{V}{\underline{\;\;*\;\;}}} \;\; \begin{array}{c} * \\ * \end{array}$

It is true that these specifications indeed allow us to obtain desired results in the case of words in (30)-(32), but the account is rather costly in the sense that it postulates so many language-particular rules and devices; that is, in addition to usual parameter settings, it involves both cyclic and noncyclic strata, Stress Copy (35b), Line Conflation (35g), the Accent Rules (35c) and (36a), Cyclic Deletion (35d), Non-cyclic Deletion (36c), and the assumption that suffixes like *Edyaw*, *an*, and *yav* are not only cyclic but provided with a lexical line 1 asterisk. Derivations, thus, are not so straightforward as compared to our account. Consider the derivation of the words in (34f-h):



Specific conceptual problems are as follows. First, Cyclic Deletion (35d) is simply an ad hoc rule and lacks an independent motivation: there seems to be no language, as far as we know, where stress is deleted *only word-finally*. Second, two assumptions must be made about morphemes like *Edyaw*, *yav*, and *an*: they are cyclic affixes, and appear in the lexical representation with a line 1 asterisk. It seems to be better to reduce such idiosyncratic markings to a more general property of Lenakel vowels.

Our analysis, in contrast, has only to postulate the MC, Resolution (33e), the [Iterative/Non-Iterative] parameter, and markings of long vowels as well as usual parameter settings; particularly, the MC is a well-grounded condition as demonstrated in the previous sections, and Resolution (33e) is also found in Old English as well as Lenakel (see note 16). Both reflect the tendency in Lenakel to rule out monomoraic and bimoraic unary feet, respectively, hence they seem to be natural and convincing. The [Iterative/Non-Iterative] parameter, which Hayes (1987) and Haraguchi (1991a) assume, is worth adopting, because it makes it possible to do away with the distinction between cyclic and non-cyclic stress rules, and therefore, with Line Conflation (35g); furthermore, if stress rules do not involve both cyclic and non-cyclic strata, the Accent Rule is never split into the two strata, as in (35c) and (36a). Finally, marking certain morphemes (e.g. *Edyaw, yav,* and *an*) and lexically-tense vowels as containing long vowels or two moras carries a significant consequence; for example, it allows us to obtain a general treatment of the two seemingly distinct properties concerning Lenakel's morphemes and vowels. More specifically, the Accent Rule (35c) or (36a) and the assumption that the morphemes are cyclic ones assigned a line 1 asterisk lexically are reduced to a single treatment: lexically-tense vowels and such morphemes contain a long vowel.

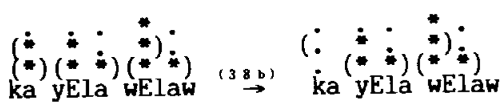
Haraguchi (1991a) basically adopts the parameter settings in (35) and (36), but explains the deletion phenomena by postulating provisions (38a) and (38b) on deletion in stead of Cyclic Deletion (35d) and Non-cyclic Deletion (36c), respectively:[18]

(38) a. The left stress is stronger than the right one.

b. Stress on a full foot is stronger than stress on a degenerate foot.

(38a) works well to derive the stress of words such as (37b), where the right stress is deleted in the cyclic stratum. (38b) also results in desired forms in the case of (39a) and (39b); however, in the case of even-syllabled words with a final lexically-marked suffix or lexically-tense vowel, it does not predict correct results as (39c-f) show (The first form of each example is the stage at which all the (applicable) rules in (35) and (36) have applied except for (35d) and (36c)):

(39) a. kayÈlawÉlaw:



b. tènagàmyasenéven:

```
              *
(*  .  *  .  *  *).
(*  *)(*   *)(*)(*  *)     (38b)   
tena gamya  se  neven       →

              *
(*  .  *  .  .  *).
(*  *)(*   *) * (*  *)
tena gamya  se  neven
```

c. rèmasOw-yáv:

```
          *
(*  .  *  *)
(*  *)(*) (*)
* rema sOw-yav
```

d. tènagamw-ám:

```
          *
(*  .  *  *)
(*  *)(*) (*)
* tena gamw-am
```

e. asís:

```
    *
(*  *)
(*)(*)
* a sis
```

f. negìnílar:

```
       *
(*  *  *).
(*)(*)(*  *)
* ne gi nilar
```

Provision (38b), as it stands, does not predict the deletion of the medial syllable in (39c,d) and of the initial syllable in (39e, f). It is evident that provision (38a) is useless to these examples, since it would make deletion apply to the right of the adjacent stresses, not the left. Other candidates to account for these cases are the following provisions Haraguchi (1991a) proposes, which, together with those in (38), comprise the Strength Hierarchy:

(40) a. *N*-ary stress is stronger than $n+1$-ary stresses, where $n > 0$.

b. Among the *n*-ary subsidiary stresses, the one on the initial syllable is stronger than other subsidiary stresses.

If Lenakel selects the value (40a) in addition to (38a) and (38b), deletion is predicted to apply to the cases in (39c-e), since the stress to be deleted is adjacent to main stress. However, it seems to be very odd for a language to choose three values out of the same parameter (i.e. (38a), (38b), and (40a)). Even worse, the initial deletion in (39f) is still not accountable with any of the provisions in (38) and (40).

To sum up, the MC, again, is indispensable to a natural account for Lenakel stress, with fewer theoretical products and yet with well-motivated rules and assumptions.

3.2. Diyari

The stress distribution of Diyari, a language of Southern Australia, is quite interesting in the sense that it adduces the strongest evidence for the MC; more strictly, other possible alternatives do not seem to provide any plausible account for the odd behavior of Diyari stress.

The stress location in this language can be stated simply as follows: primary stress falls on the initial syllable, secondary stress falling on odd-numbered syllables succeeding the primary stress in simplex and complex even-syllabled words:

(41) a. kána 'man'
b. wílapìna 'old woman'
c. kána-wàra 'man' (pl.)
d. wílapìna-wàra 'old woman' (pl.)
e. kána-wàra-ngùndu 'man' (pl.abl.)
f. táyi-yàtimàyi 'to eat' (opt.)

Stressing gets somewhat complex when it comes to forms with an odd-number of syllables; that is, word-final syllables can never be stressed in either simplex or complex words, as illustrated below:

(42) a. púluru 'mud'
b. pínadu 'old man'
c. kána-ni 'man' (loc.)
d. máda-la 'hill' (charac.)
e. kána-wàra-ngu 'man' (pl.loc.)
f. nánda-tàri-yi 'to hit' (refl.pres.)

The above data might appear to show that it is sufficient to account for stress with left-dominant feet assigned from left to right and with final extrametricality. This analysis at once turns out to be inadequate when exposed to the following examples:

(43) a. púluru-ni 'mud' (loc.)

b. pínadu-wàra 'old man' (pl.)

c. kána-ni-màta 'man' (loc.ident.)

d. máda-la-ntu 'hill' (charac.prop.)

e. púluru-ni-màta 'mud' (loc.ident.)

The examples are aberrant in the sense that not only final but medial syllables are stressless or that secondary stress is falling on even-numbered syllables. Comparing (42a-d) with (43a-d) indicates that the stressless nature of the final syllable in the former words seems to be carried over to the medial syllable in the latter. But this observation will prove to be an epiphemomenon, which follows from a more characteristic property of Diyari feet: the MC.

The parameter settings we propose for Diyari stress are given in (44). One of the properties we can discern therein is that in this language, a morpheme constitutes a distinct domain of foot construction, as is the case with Gaalpu (see section 2.1.).

(44) a. Mora - - - - - - - - - - - all vowels in the rime.

b. Foot (Type) - - - - - - - $\binom{*\quad\cdot}{M\quad\dot{M}}$

(Directionality) - Left-to-Right

(Domain) - - - - - Morpheme

c. Phonological Word - - - $\binom{*\quad\quad\cdot\qquad\quad\cdot}{F_1\ \ \dot{F}_2 \ldots\ \dot{F}_n}$

Applied to the words in (41)-(43), these parameters make prosodic structure construction derive the following structures:

(45) a. {* . (* .) (* . }
{* .) (* .) (* .}
M M M M M M
[wíla pìna][wàra]

b. {* .) (* .) (* .}
{* .) (* .) (* .}
M M M M M M
[kána][wàra][ngùndu]

```
c.  {*                  }        d.  {*       }
    {*  .)  (*  .)(*  .}             {*  .)(* }
     M  M    M  M  M  M               M  M   M
    [táyi][yàti màyi]               * [púlu rù]

e.  {*       }                   f.  {*                }
    {*  .) (*}                       {*  .) (*  .)  (* }
     M  M   M                         M  M   M  M    M
  * [máda][là]                      * [kána][wàra][ngù]

g.  {*             }             h.  {*            }
    {*   .) (* .) (*}                {*  .)(*) (* }
     M   M   M M   M                  M  M  M   M
  * [nánda][tàri][yì]               * [púlu rù][nì]

i.  {*           }               j.  {*                    }
    {*  .) (*)  (*}                  {*  .)(*) (*) (*  .}
     M  M   M    M                    M  M  M   M   M  M
  * [máda][là][ntù]                 * [púlu rù][nì][màta]
```

Examples (45d-j) contain unwanted secondary stress, which is, interestingly, dominated by a monomoraic degenerate foot. It thus follows that Diyari stress is the very case for the MC, Min (F) = $[M\ M]^F$ and that erroneous unary feet are all erased by Stress Deletion as usual. In this way, given the MC, we can obtain right results without difficulty.

An alternative without the MC does not seem to give a principled account of such an odd behavior of the stress distribution. One possible account suggests itself, such as the one advocated by Kager (1989): stress constituency must be strictly binary (at least at the foot level here) and degenerate feet are never constructed, which is dubbed the Strict Binary Hypothesis. If we adopted this constraint in place of the MC, derivations would be somewhat straightforward as shown below:

```
(46) a.  {*  .}  .            b.  {*              }   .
         {*  .}  .                {*  .) (*  .}    .
          M  M   M                 M  M   M  M     M
         [púlu ru]                [kána][wàra][ngu]
```

However, the following facts pose some problems with this kind of approach to Diyari stress. First, consider the structures below, where degenerate feet are not constructed in the medial position of the string:

```
(47) a.  (* .)  .    .          b.  (* .)  .   .
         (*  )                      (*  )
          M Ṁ   Ṁ    Ṁ               M Ṁ   Ṁ   Ṁ
         [máda][la][ntu]            [púlu ru][ni]

     c.  (* .)  .    .  (. .)   d.  (* .)  .  (. .) (. .)  .
         (* .)          (*  )       (* .)     (*  ) (*  )
          M Ṁ   Ṁ    Ṁ   M Ṁ         M Ṁ   Ṁ   M  Ṁ  M Ṁ   Ṁ
         [púlu ru][ni][m̀ata]        [yákalka][yìrpa][m̀ali][na]
```

Although derived structures might appear to predict the stress location correctly, all the third moras above (and the fourth mora in (47c)) violate the Extraprosodicity Condition (or Hayes's (1981) Peripherality Condition) because the moras immune from higher organization are not located at the edge of the string, and the Strict Layer Hypothesis because the feet do not dominate all the moras.[19] This account, thus, predicts the stress patterns in (47) to be ill-formed, but the fact is opposite to the prediction. Second, according to Poser (1989), Diyari has the rule of stem vowel allomorphy, which changes a final high vowel of trisyllabic nominal stems into [a] before all of the case suffixes and the stem-forming suffix *la* :

(48)	Stem	Locative	Ablative	Ergative
	puluru	pulura-ni	pulura-ndu	pulura-li
	matari	matara-ni	matara-ndu	matara-li
	pinadu	pinada-ni	pinada-ndu	pinada-li
	ngapiri	ngapira-ni	ngapira-ndu	ngapira-li

Stems with an even number of moras, however, do not undergo stem vowel allomorphy as illustrated below:

(49)	Stem	Locative	Ablative	Ergative
	tari	tari-ni	tari-ndu	tari-yali
	kanku	kanku-ni	kanku-ndu	kanku-yali
	wadukati	wadukati-ni	wadukati-ndu	wadukati-yali
	wadangantyu	wadangantyu-ni	wadangantyu-ndu	wadangantyu-yali

This allomorphy can be predicted by our proposed system presented earlier, together with the formulation in (51):

```
(50) a.  (* .)(.) (.)          b.  (* .)(.) (.)
         (* .)                     (* .)
          M Ṁ  Ṁ   Ṁ                M Ṁ  Ṁ   Ṁ
         [pulu ru][ni]             [mata ri][ni]

     c.  (* .) (.)             d.  (* .)(* .) (.)
         (* .)                     (* .)
          M Ṁ   Ṁ                   M Ṁ  M Ṁ   Ṁ
         [tari][ni]                [wadu kati][ni]

(51)                (.)
                     |
         V   →  a /  ___]stem
         |
      [+ high]
```

That is, (51) predicts correctly that the change of vowel quality takes place only when the stem-final high vowel is dominated by a unary foot. In contrast, the analysis with the Strict Binary Hypothesis does not predict the occurrence of vowel change since it does not construct degenerate feet:

```
(52) a.  (* .)  .   .          b.  (* .)  .   .
         (* .)                     (* .)
          M Ṁ   Ṁ   Ṁ               M Ṁ   Ṁ   Ṁ
         [pulu ru][ni]             [mata ri][ni]

     c.  (* .)  .              d.  (* .)(* .)  .
         (* .)                     (* .)
          M Ṁ   Ṁ                   M Ṁ  M Ṁ   Ṁ
         [tari][ni]                [wadu kati][ni]
```

The change of vowel quality in (52a,b) might seem to be predicted by saying that the vowels concerned are not dominated by any feet; however, such a rule would be rather difficult to formulate, because it must be conditioned negatively. Or even if the vowels concerned were lowered when preceded by a foot (and it is just in this environment which the well-known high vowel deletion in Old English is claimed to occur by Keyser and O'Neil (1985)), such a formulation would violate the Locality Condition, because the target vowel is neither adjacent to, nor dominated by, the triggering foot (Tanaka (to appear)).[20] In light of these two problems, then, we do not adopt an account with the Strict Binary Hypothesis in place of the MC.

The stress system of Warlpiri, another Australian language, is somewhat similar to that of Diyari, for the former language has main stress on the initial mora and secondary stress on every other mora following the main stress, as in (53a,b). Particularly, it might appear to be the case that a morpheme constitutes a separate stress domain and that a unary feet is destressed by the requirement of the MC, as in (53c-e):

(53) a. wátiya 'tree'

b. mánangkàrra 'spinifex plain'

c. yápa-rlàngu-rlu 'person for example' (erg.)

d. mánangkàrra-rla 'spinifex plain' (loc.)

e. yáparla-ngùrlu 'father's mother' (elat.)

But the following words have unexpected stress, where the third and stem-final syllable is stressed or a monosyllabic morpheme is stressed. The data, then, reflect the fundamental difference between the two languages despite the apparent similarity:

(54) a. wátiyà-rla 'tree' (loc.)

b. wátiya-rlà-rlu 'tree' (loc.erg.)

c. wáti-ngkà-rlu 'man' (loc.erg.)

We claim that unlike Diyari, Warlpiri does not have the MC, but the following parameter settings are sufficient to capture the stress patterns of the language:

(55) a. Mora - - - - - - - - - - - - - all vowels in the rime
b. Extraprosodicity - - - - - - the final mora
c. Foot - - - - - - - - - - - - - $(\overset{*}{M}\ \overset{.}{M})$
d. Superfoot (Type) - - - - - - $(\overset{*}{F}\ \overset{.}{F})$
(Directionality) - Left-to-Right
(Domain) - - - - - Morpheme
e. Phonological Word - - - - - $(\overset{*}{SF_1}\ \overset{.}{SF_2}\ \ldots\ \overset{.}{SF_n})$

It is worth noting that Warlpiri is required to specify final extraprosodicity and left-dominant superfeet. As shown below, the algorithm provides the words in (53) and (54) with expected stress, although a lower grid is deleted by Clash Deletion when there occurs a stress clash (see section 4).

(56) a. M Ṁ M <Ṁ> [mánangkàrra]

b. M Ṁ M Ṁ <Ṁ> [yápa][rlàngu][rlu]

c. M Ṁ M <Ṁ> [wáti yà][rla]

d. M Ṁ M <Ṁ> [wáti][ngkà][rlu]

e. M Ṁ M M <Ṁ> [yáparlà][ngùrlu] $\overset{CD}{\rightarrow}$ [yáparla][ngùrlu][21]

f. M Ṁ M M <Ṁ> [wáti yà][rlà][rlu] $\overset{CD}{\rightarrow}$ [wáti ya][rlà][rlu][21]

Here, the secondary stress in (56a,c) has lower magnitude than the one in all the other examples. This is because any morpheme must have the head of a superfoot due to its own domain and individuality. For example, *rlangu* in (56b) and *ngka* in (56d) are morphemes with their own domain, but *ngkar* in (56a) and *ya* in (56c) do not form morphemes in and of themselves. Hence, the former stress is provided with higher magnitude than the latter. The situation is parallel to the following contrast in English, where the stress on the morpheme *Town* necessarily has higher magnitude than the one onthe mere syllable *sak*:[22]

(57) [Lóndon] [Tòwn] (compound) vs. [Háckensàck] (simplex)

Summarizing up to this point, we have seen that Warlpiri stress appears to be similar to, but essentially different from, Diyari stress in that the former language does not have the MC. The stress distribution found in Diyari, in turn, would not be analyzable if we did not apeal to the minimality requirement. Diyari, thus, is one of the languages that support Min (F) = $[M\ M]^F$ fairly strongly.

4. Consequences of the theory of Minimality

The evidence that we have thus far presented has been aiming at demonstrating that the stress facts of all the languages but Warlpiri require the MC, where any foot must contain at least two moras and an illegitimate unit ceases to be a genuine foot due to the effect of Stress Deletion. The resulting headless constituent may be called *a pseudofoot*. Genuine feet (i.e. feet with the head) are subject to the MC when specified, but pseudofeet are not, any longer. We can point out a number of consequences of the MC in prosodic theory, to which we now turn.

There has been a discussion in the literature of whether metrical structures once constructed will be modified. The strongest position would possibly be that stress rules could never modify existing metrical structures, but empirical evidence suggests that there can be no hard and fast principle to that effect; for example, stress movement and deletion in a clashing context. It is precisely for this reason that Prince (1985) proposes the following condition on metrical operations:

(58) Free Element Condition
Rules of primary metrical analysis apply only to Free Elements —— those that do not stand in the metrical relationship being established; i.e. they are "feature-filling" only.

The invoked condition ensures that feature-filling or "structure-building" rules affect only a syllable that does not belong to a foot. Since rules of moving or deleting a clash are "feature-changing" or "structure-changing" in secondary metrical analysis, they are immune to the Free Element Condition. One might ask, then, whether it is because Stress Deletion seems to be a structure-changing rule of secondary metrical analysis that the application of Stress Deletion required by the MC is immune to the Free Element Condition. Our answer to this question is in the affirmative. In our perspective, rules of primary metrical analysis belong to a cyclic block, and rules of secondary metrical analysis to either a cyclic or a non-cyclic block. Although Stress Deletion applies in a cyclic fashion, it should be of secondary metrical analysis and hence be free from the Free Element Condition, because it is structure-changing. What we have just stated can be schematically shown as below:

(59)

	PMA (Structure-Building)	SMA (Structure-Changing)	
Rule	Cyclic	Cyclic	Non-Cyclic
	PSC	SD	CM CD
Condition	FEC	MC	

PMA = Primary Metrical Analysis; SMA = Secondary Metrical Analysis; PSC = Prosodic Structure Construction; SD = Stress Deletion; CM = Clash Movement; CD = Clash Deletion; FEC = Free Element Condition; and MC = Minimality Condition

The MC gives rise to another significant consequence in accounting for phenomena of movement and deletion in a clashing context, which we call here Clash Deletion and Clash Movement, respectively. In particular, the directionality parameter of Clash Deletion and Clash Movement can be abandoned, given the MC. In Halle and Vergnaud's (1987) framework, for example, there are six possible sorts of Clash Deletions, which should be specified for the direction of deletion across languages:

```
(60) a.  *  *        *  .
         *  *   →    *  *   (e.g. Winnebago, Lenakel)

     b.  *  *        .  *
         *  *   →    *  *   (e.g. Warao, Lenakel)

     c.  .  *        *  .
         *  *        *  .
         *  *   →    *  *   (e.g. Seneca, Creek)

     d.  .  *        .  *
         *  *        .  *
         *  *   →    *  *   (e.g. English, Polish)

     e.  *  .        *  .
         *  *        *  .
         *  *   →    *  *   (e.g. English, Garawa, etc.)
```

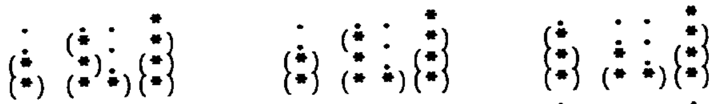
f.  (unattested)

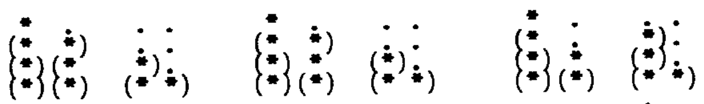
As for (60a), it should be reduced to (60e) in the case of Winnebago as demonstrated by Tanaka (1991a,b), and the MC is replaced for it in the case of Lenakel as shown in section 3.1.; the MC also proves to substitute for (60b), as argued in section 2.2. and 3.1.; and Tanaka (1991b) adduces full evidence against (60c) and for the existence of the MC in Seneca, which is also the case with Creek as discussed in section 2.2. It thus follows from this that Clash Deletion is limited to cases (60d) and (60e), which are not parametrized any more but are generalized into the following general principle (cf. Tanaka (1992b)):

(61) Higher Grid Preservation (HGP)
A grid on a higher column (i.e. of more magnitude) should be preserved at the stage of derivation of non-cyclic rules of secondary metrical analysis.

Thus, recall that in Warlpiri, the lower grid is deleted uniquely by Clash Deletion as seen in section 3.2. The HGP, furthermore, allows us to abandon the directionality parameter of Clash Movement. German, for instance, would have two distinct rules which remove one of the adjacent stresses leftward or rightward in the framework of Halle and Vergnaud (1987):

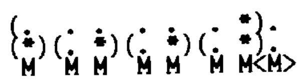
(62) a.  b. 

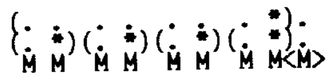
(63) a. 
halbtòte Mánn → halbtòte Mánn → hàlbtote Mánn

b. 
Úrgròssvater → Úrgròssvater → Úrgrossvàter

But with the HGP, which direction a language chooses is not a language-specific property but is fairly clear from the magnitude of the adjacent grids. Therefore, the MC makes it possible not only to abandon undesired parameters of Clash Deletion and Clash Movement but also to establish a significant principle: the HGP.

A third consequence is that there arises an ambiguity, or a case where an analysis either with the MC or with Extraprosodicity is possible. Specifically, this is the case with such languages as Warao, Pintupi, and Bani-hassan Arabic. Warao stress, for example, can be analyzed with right extraprosodicity and right-dominant feet assigned from right to left as well as a right-dominant phonological word, instead of the account with the MC seen in section 2.2.:[23]

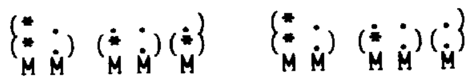
(64) a. 
nà horò ahà kutá i

b. 
ehà horò ahà kutá i

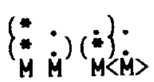
Second, in Pintupi, the first syllable bears primary stress and alternating following syllables receive secondary stress except for the final syllable. Left-dominant feet and a left-dominant phonological word are necessary for this pattern, but to account for the lack of stress on the final syllable, either the MC or right extraprosodicity can be possible:

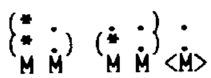
(65) MC:

a. 
mála wàna

b. 
* púlingkàlatjù → púlingkàlatju

(66) Extraprosodicity:

a. 
mála wàna

b. 
púlingkàlatju

Finally, Bani-hassan Arabic has primary stress on the rightmost non-final odd-numbered syllable and secondary stress on alternating syllables preceding primary stress. The basic parameter settings for this language seem to be the same as Pinatupi, except for a right-headed phonological word. Again, the lack of primary stress in the final position can be analyzed in either way:

(67) MC:

a.
```
{.  .)(*  .}
{*  .)(*  .}
 M  Ṁ  M  Ṁ
```
bàara kátna

b.
```
{.  .)(*}        {*  .)(.}
{*  .)(*}        {*  .)(.}
 M  Ṁ  M          M  Ṁ  Ṁ
```
* bàara kát → báara kat

(68) Extraprosodicity:

a.
```
{.  .)(*} .
{*  .)(*} .
 M  Ṁ  M <Ṁ>
```
bàara kátna

b.
```
{*  .} .
{*  .} .
 M  Ṁ <Ṁ>
```
báara kat

In each of the three languages, we are not capable of determining which option should be made only in light of the stress data above. If these languages have no monomoraic word, the analysis with MC is chosen. We suggest, however, that a more unmarked option is the analysis with extraprosodicity because the MC is generally Min (F) = $[\acute{\sigma}]^F$, as noted in section 1, and not Min (F) = $[M\ M]^F$. This is also true for the mirror image of each of the patterns just seen above. For example, in the mirror image of Warao, main stress falls on the second syllable, secondary stress falling on even-numbered syllables after main stress:

(69) The mirror image of Warao

a. MC:
```
{.  *)(.  .}      {.  *)(.  .)(.}      {.  *)(.  .)(.}
{.  *)(.  *}      {.  *)(.  *)(*}      {.  *)(.  *)(.}
 Ṁ  M  Ṁ  M        Ṁ  M  Ṁ  M  M        Ṁ  M  Ṁ  M  Ṁ
```
o ó o ò * o ó o ò ò → o ó o ò o

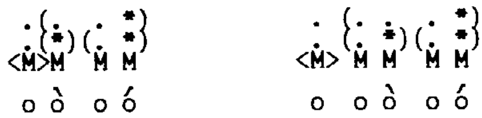
b. Extraprosodicity:
```
 .{*  .)(.}        .{*  .)(.  .}
 .{*  .)(*}        .{*  .)(*  .}
<Ṁ>M  Ṁ  M        <Ṁ>M  Ṁ  M  Ṁ
```
o ó o ò o ó o ò o

And in the mirror image of Pintupi, the final syllable always bears main stress, and every alternating syllable receives secondary stress preceding main stress:

(70) The mirror image of Pintupi

a. MC:
```
{.  .)(.  *}      {.)(.  .)(.  *}      {.)(.  .)(.  *}
{.  *)(.  *}      {*)(.  *)(.  *}      {.)(.  *)(.  *}
 Ṁ  M  Ṁ  M        M  Ṁ  M  Ṁ  M        Ṁ  Ṁ  M  Ṁ  M
```
o ò o ó * ò o ò o ó → o o ò o ó

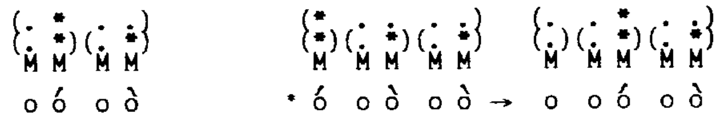
b. Extraprosodicity:



As for the mirror image of Bani-hassan Arabic, primary stress is located on the leftmost non-initial odd-numbered syllable counting from the end of the word and secondary stress on every other syllable after primary stress:

(71) The mirror image of Bani-hassan Arabic

a. MC:

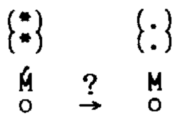


b.

As in Warao, Pintupi, and Bani-hassan Arabic, the unmarked option is extraprosodicity. These mirror images, however, are not attested insofar as we know. This may be related to the fact that in such patterns, the initial position never receives stress.

The final remark we should make upon the MC is about the question of whether a monomoraic word is not stressed in languages with the MC. That is, Min (F) = [M M]^F might predict stress of a monomoraic word to be deleted by Stress Deletion, as below:

(72)



In all languages we examined so far, where we propose that the MC is at work (Cayuvava, Gaalpu, Mantjiltjara, Walmatjari, Creek, Lenakel, and Diyari), monomoraic words are not given in the literature. However, in any language, there seems to be no word that has no stress; hence it is natural to consider that even monomoraic words have stress of their own and that Stress Deletion does not apply to such words. With regard to this problem, we suggest that the general Min (PWd) = $[F]^{PWd}$ takes precedence over the idiosyncratic Min (F) = $[M\ M]^F$, since the former is derived from Min (C_i) = $[C_{i-1}]^{C_i}$ (see section 1.). If Stress Deletion were applied in (72), the foot would cease to be a genuine foot but a pseudofoot and Min (PWd) = $[F]^{PWd}$ would be violated. That is why monomoraic words have stress even in languages with Min (F) = $[M\ M]^F$. We note in passing that in the Osaka dialect of Japanese, monomoraic words undergo vowel lengthening to amend the violation of Min (F) = $[M\ M]^F$:

(73) a.

há	→	háa	'tooth'	í	→	íi	'stomach'
ké	→	kée	'hair'	sé	→	sée	'height'

b.

```
{*}        {.}        {*}      {* .}
{*}        {.}        {*}      {* .}
 Ḿ          Ḿ          Ḿ        Ḿ M
ha   →  *  ha   →  *  ha   →   ha a
```

In (73b), Stress Deletion might apply due to the fact that the foot does not contain two moras, but is prohibited by the general Min (PWd) = $[F]^{PWd}$; hence, the word undergoes lengthening to satisfy both Min (F) = $[M\ M]^F$ and Min (PWd) = $[F]^{PWd}$. We leave open the question, for the moment, of whether this is true for monomoraic words of other languages with Min (F) = $[M\ M]^F$, because of the lack of the relevant data at hand. The possible options seem to be three-fold: monomoraic words do not exist, or undergo vowel lengthening, or are retained as they are due to Min (PWd) = $[F]^{PWd}$. Cases in which Stress Deletion applies (i.e. Min (F) = $[M\ M]^F$ takes precedence over Min (PWd) = $[F]^{PWd}$) are quite rare.[24]

5. Summary

We have shown full arguments in favor of the MC by examining the stress facts of Cayuvava, Gaalpu, Mantjiltjara, Walmatjari, Creek, Lenakel, Diyari, and the Osaka dialect of Japanese. Chugach Alutiiq is also claimed as having Min (F) = $[M\ M]^F$ (Tanaka (1990)), and Seneca and Khalkha Mongolian as having Min (F) = $[\sigma_{\mu\mu}]^F$ (Tanaka (1991b)). Since in general, Min (C_i) = $[C_{i-1}]^{C_i}$ (i.e. Min (F) = $[\sigma]^F$), the two requirements exhibit somewhat idiosyncratic aspects of the MC, but it has been shown that the stress location of the above languages is better accounted for by the two-mora requirements, although it is somewhat unclear whether monomoraic words do not exist, or undergo vowel lengthening, or are licenced as they have stress of their own.

We have also demonstrated that there are some languages in which the MC might appear to be at work but actually it is not (e.g. Warlpiri) and that in cases where an analysis either with the MC or with extraprosodicity is possible, the latter option is more unmarked (e.g. Warao, Pintupi, and Bani-hassan Arabic). And we have given sample languages where a (super)foot constitutes a separate domain: Gaalpu, Diyari, Warlpiri as well as Japanese (Tanaka (1992a)) and Old English (Tanaka (to appear)).

Finally, we have argued that the MC with the concomitant application of Stress Deletion does not cause a violation of the Free Element Condition because the condition and the rule belong to the block of secondary metrical analysis. Moreover, the MC makes possible a significant generalization to the effect that in a clashing context, the higher column of grids (i.e. main stress) is never deleted but the lower (i.e. secondary stress) is. Taking into consideration all parameters, rules, and principles, our proposed posodic theory can be schematically shown as below:

(74)

	PMA (Structure-Building)	SMA (Structure-Changing)	
Parameter	PC (M, F, SF, etc.) Exp (MinC)		
Rule	Cyclic	Cyclic	Non-Cyclic
	PSC Exp	SD Rfg Dfg	CM CD LI
Condition	FEC MaxC[25] EC[25]	MinC SLH EC[25]	HGP EP

PC = Prosodic Category; Exp = Extraprosodicity; Rfg = Refooting; Dfg = Defooting; LI = Lapse Insertion; MaxC = Maximality Condition; EC = Extraprosodicity Condition; MinC = Minimality Condition; SLH = Strict Layer Hypothesis; and EP = Eurhythmy Principle

In this framework, all the rule applications of both primary and secondary metrical analyses, are governed by the corresponding conditions: Which rule applies and in what context depend solely on the requirements of the conditions in each block.

NOTES

[*] I am indebted to the following people for their invaluable comments and discussion on the present article: Shosuke Haraguchi, Yukio Hirose, Masao Okazaki, Yukiko Kazumi, Toru Nakashima, Junko Matsui, and Hideki Zanma. I accept sole responsibility for any inadequacy or misconception.

[1] As for prosodic constituents below feet, the direction of the head is universal; namely, the heads of mora and syllable are always the ones on the vowel nucleus.

[2] The minimality requirement is initiated by McCarthy and Prince (1986), but the original one is quite distinct in effect from ours: our expected effects of the condition, though having some idiosyncracies, are the ones just sketched above, whereas for McCarthy and Prince, it generally obtains that Min (F) = $[\sigma_{\mu\mu}]^F$ and Min (σ) = $[\sigma_{\mu}]^{\sigma}$ (here and below, $\sigma_{\mu\mu}$ represents a heavy syllable and σ_{μ} a light syllable). In other words, a foot contains at least one heavy syllable and a syllable contains at least a light (or core) syllable (McCarthy and Prince (1986: 8)). But these requirements do not capture all the stress phenomena examined below, and McCarthy and Prince do not say that Stress Deletion applies in violation of the condition.

[3] For details, see Tanaka (1990, 1991a, 1991b). Stress Deletion is different from Clash Deletion, since the latter applies to rule out a stress clash (or adjacent stresses) while the former can apply in a non-clashing context. For arguments in favor of rule applications in violation of the Strict Layer Hypothesis and/or the Extraprosodicity Condition, see the studies just cited above.

[4] Words with less than three moras may have initial stress but weak (Key (1961)). So such words are not given here.

[5] Hereafter, a bilabial voiced fricative is depicted as *B*.

[6] We follow Halle and Vergnaud (1987) in assuming that Cayuvava has amphibrachic feet, while Haraguchi (1991a) adopts dactylic feet for this language. For space limitations, we do not discuss the problem of whether ternary feet should be head-terminal (dactyls) or non-head-terminal (amphibrachs). As argued below, if both dactyls and amphibrachs are entried into the foot inventory (the former feet for Gaalpu, and the latter for Cayuvava and Chugach Alutiiq), ternary-footed languages can be analyzed as having the MC uniformly. Our position, then, is that both kinds of feet are postulated for the moment.

[7] In what follows, *R* and *N* represent an apico-alveolar and an apico-domal nasal, respectively.

[8] *T* stands for an apico-domal stop here.

[9] In unmarked cases, the domain of foot construction is a word, which is specified by default, but there are some languages where that domain is a morpheme. This is true for Diyari (section 3.2.), Warlpiri (section 3.2.), Japanese (Tanaka (1992a)), and Old English (Tanaka (to appear)). Here and below, morpheme boundaries are represented as *]* and *[*.

[10] Of course, what has just been stated is at the stage before the application of deletion or movement of a stress clash.

[11] In Creek, the highest column of grids (i.e. the position marked as *,*) is the position of tonal accent and not of main stress. In other words, it is phonetically interpreted as the position associated with a high tone, as is the case with Japanese (Haraguchi (1991a), Tanaka (1992a)).

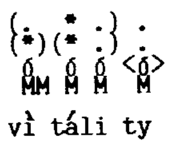
[12] Hereafter, @ stands for a schwa, and capital letters such as *E*, *U*, and *O* represent lax vowels.

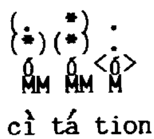
[13] This assumption is strongly motivated by the fact that in Lenakel, all the vowels but the lexically-specified ones are lax and short in the underlying representation (although some vowels are made tense by rule in certain environments noted above). Hence, assuming the specified vowels as long not only reflects the

tendency to attract stress to such vowels but also the distinction between such vowels and all other short and lax vowels.

[14] We assume, following Hayes (1987), that the unmarked value is Iterative, which makes foot formation across-the-board and is specified by default, and that the Non-Iterative value limits foot formation to assign only a single constituent. This parameter corresponds to Haraguchi's (1991a) [± Exhaustive], but is claimed by Halle and Vergnaud (1987) to be abandoned. One of the arguments for this parameter is that we can do away with the split into the cyclic and the noncyclic stress rules, and Line Conflation in Halle and Vergnaud's framework. Our assumption is that all structure-building stress rules are cyclic (see section 4).

[15] There is a stress clash in (34j), but secondary stress is not deleted by Clash Deletion, because it dominates a long vowel (or a vowel with two mora). The situation is just the same as that of English:

i) a. 

b. 

This fact, thus, also motivates the assumption that lexically-tense vowels are long in the underlying representation.

[16] Old English also has the exact rule, (33e), hence it has an independent motivation. See Tanaka (to appear) for details.

[17] The SEC (Stress Erasure Convention) erases information about stress generated on the previous cycle when cyclic affixes are attached. For discussion, see Halle and Vergnaud (1987).

[18] This is called the Strength Hierarchy, which is comprised of four provisions (38a,b) and (40a,b). They are assumed to be parametrized across languages.

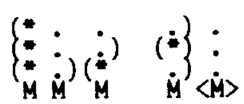
[19] The Extraprosodicity Condition states that a prosodic category free from the higher organization should be located at the edge of the phonological string (cf. Hayes's (1981) Peripherality Condition), and the Strict Layer Hypothesis states that a prosodic category should dominate all and only constituents of the category immediately below it.

[20] Tanaka (to appear) claims that the locality involved in general rule application should be two-fold: adjacency (horizontal locality) and dominance (vertical locality). Hence, the Locality Condition required should be as in ii):

ii) Locality Condition
A rule can apply only if ① the target is adjacent to the trigger in the same tier or ② the target is dominated by the trigger.

In this respect, Archangeli and Pulleyblank's (1987) Locality Condition is insufficient, since it does not take dominance into consideration. The notion of dominance is crucial in the case of segmental rules triggered by metrical feet. Taking the environment of allomorphy to be just after a foot induces a violation of either version of the condition, because the target (i.e. the stem-final vowel) is not adjacent to the trigger (i.e. the foot) in the same tier (and not dominated by it). This situation stands in clear contrast with the formulation in (51), where the target is dominated by the trigger.

[21] The fact that a morpheme forms a domain for superfoot formation implies that it also forms a domain for foot formation. For example, if foot formation applied across the morpheme boundaries, a violation of the Strict Layer Hypothesis would occur:

iii)


* [yáparla][ngùrlu]

It follows then that when a morpheme constitutes a domain for a category, it is true for all the categories below it.

[22] Here, we omit detailed representations and parameter settings for English. What is to be noted is that there is an essential difference in the organization of categories between Warlpiri and English, as schematized below:

iv)


[wáti][ngkà][rlu] vs. [Lóndon] [Tòwn]

In Warlpiri the top and the second-top levels are phonological word and superfoot, while in English they are phonological phrase and phonological word. This difference comes from the fact that in the former language the morphemes given above constitute a domain for superfoot formation, while in the latter they constitute a domain for phonological word formation. To put it shortly, Warlpiri morphemes are bound forms and cannot be treated as phonological words whereas English morphemes given above are free forms and can be treated as such.

[23] In fact, Halle and Vergnaud (1987) suggest an analysis of Warao stress with right extrametricality and right-headed feet, unlike Hayes's (1981) with deletion.

[24] The only case is reported in Tanaka (1991b); in Seneca, Min (F) = $[\sigma_{uu}]^F$ takes precedence over Min (PWd) = $[F]^{PWd}$ and Stress Deletion applies. In other words, words consisting exclusively of light syllables have no noticeable stress in this language, as Stowell (1979) observes. According to Key (1961), words with less than three moras have weaker stress than those with three or more moras. This can be related to the incompleteness of degenerate feet, either binary or unary. In fact, a monomoraic word, if it exists, may have no noticeable stress, as in Seneca. If so, Cayuvava may be the case in which Stress Deletion applies.

[25] The Maximality Condition states that a prosodic constituent should be formed maximally over the string in accordance with the specified values for constituents (cf. Halle and Vergnaud (1987)). The Extraprosodicity Condition is at work in both primary and secondary metrical analyses: when the specified category is made extraprosodic by Extraprosodicity, the category is invisible to Prosodic Structure Construction (derivational extraprosodicity); after Prosodic Structure Construction, there can arise a case where a certain category is immune from the higher organization (representational extraprosodicity). In both cases, the category concerned is located at the edge of the phonological string. The former extraprosodicity is seen in primary metrical analysis, and the latter in secondary metrical analysis.

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