CHAPTER FOUR

TERNARY STRESS PATTERNS

1.0 INTRODUCTION

The analysis of Chugach in chapter three and the analyses of Old English, Cayuvava and initial stress in Gidabal in chapter two illustrate how the approach to metrical structure assignment proposed in section four of chapter one derives ternary alternations. This is accomplished with a formal tool reminiscent of the notion of "resolution" in traditional poetics, which describes substitution possibilities. In the present approach, this is formalized with a tautosyllabicity parameter. The specification of mapping as non–tautosyllabic opens the possibility of mapping the bi–moraic head of a template onto two light syllables. In this chapter, other recent proposals for reducing these ternary alternations to binary systems are presented and critiqued.

The basis of the metrical theory of Hayes (1991), as published in (Hayes (1987), was presented in chapter one. Additional unpublished manuscripts, such as Hammond (1990) and Kager (1991), include proposals for the analysis of ternary alternations which follow the spirit of that in Hayes (1991). I proceed by presenting each of these analyses and my critique of them. I will claim that Hayes' analysis has empirical short–comings and that the analyses of Kager and Hammond

raise unanswered conceptual questions. Due to the "in progress" nature of all three of these proposals, this discussion is kept relatively brief; more thorough evaluations will have to follow when final versions are presented.[1]

2.0 PARAMETERIZING LOCALITY

Ternary stress patterns are rare. The infrequency of the pattern is construed in Hayes (1991) as a fact which should be reflected in metrical theory, i.e., in the specific analysis of a ternary pattern.

Recall that Leer's analysis of Chugach, discussed in §3 of chapter three, derives the ternary pattern by constructing binary feet and then incorporating stray syllables, with the end result that the constituents are ternary. The analyses of Chugach discussed in this chapter adopt this essential characteristic of Leer's approach. In the following sections, I will illustrate the proposal by presenting the analysis of Cayuvava. I will demonstrate that the empirical adequacy which this approach achieves for Cayuvava does not extend to Chugach.

2.1 The foot parsing locality parameter

[1] For example, this chapter refers to fragments of Hayes (1991) received in late 1990 and early 1991. There have been subsequent changes which are not addressed here.

Hayes (1987), as seen in chapter one, proposes that there are only three templates: the syllabic trochee, the moraic trochee and the iamb. These are repeated in (1) for consultation.

(1)

A. Syllabic trochee: Form $\overset{(x\ .)}{\sigma\ \sigma}$ if possible; otherwise form $\overset{(.)}{\sigma}$

B. Moraic trochee: Form $\overset{(x\ .)}{\mu\ \mu}$ if possible, where $\overset{(x\ .)}{\mu\ \mu}$ is either

$\overset{(x\ .)}{\breve{}\ \breve{}}$ or $\overset{(x)}{-}$; otherwise form $\overset{(.)}{\breve{}}$

C. Iamb: Form $\overset{(.\ x)}{\breve{}\ \sigma}$ if possible, otherwise form $\overset{(x)}{-}$ or $\overset{(.)}{\breve{}}$

The mapping procedures for the templates will not create a constituent containing three syllables. It is clear that to account for ternary systems, the theory can be modified in one of two ways. Either the inventory of templates can be expanded or the mapping procedure can be modified. Hayes (1991) adopts the latter approach.

The proposed modification of the mapping procedure augments the theory with a new parameter. With this addition, an analysis of the stress system of a language in the templatic approach includes not only selecting the correct template and determining (i) the direction of foot construction, (ii) whether the feet are assigned iteratively, (iii) whether anything is extrametrical and (iv) whether

degenerate feet are allowed. An analysis must now also include identifying the "value" of the Foot Parsing Locality Parameter, which is stated as follows.

> Foot Parsing Locality Parameter (FPLP, Hayes (1991: 258))
>
> a. Unmarked value: Feet must be constructed adjacently. To be referred to as *strong local parsing.*
>
> b. Marked value: Feet may be constructed separated from each other by a single mora (in effect a single light syllable). To be referred to as *weak local parsing.*

The motivation for FPLP at the most general level follows from a perspective on locality as a fundamental constraint on linguistic rules. Hayes (1991) notes that in phonology, concerns about locality often take the form of "constraining what can be counted: it appears to be a tenable conjecture that rules can count only to two, or even just one, depending on how you count." From the labels "unmarked" and "marked" for the two settings of the FPLP, it seems that adjacency is assumed to be the best instantiation of locality with regard to metrical constituency. However, the adjacency requirement can be relaxed. Hayes argues that non–adjacent feet must still be constructed locally, and that this is accomplished by constraining their separation to one single mora. Due to a constraint against splitting the moras of a heavy foot, being separated by a single mora will be the same as being separated by a single light syllable.[2]

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[2] See Rice (1990a) for discussion of an earlier version of the FPLP.

I turn now to an illustration of the FPLP by presenting the analysis of Cayuvava.

2.2 Cayuvava

I demonstrate this approach with data from Cayuvava as presented in Levin (1988) and H&V. In Cayuvava, stress occurs on every third syllable from the right. In words of four (actually, 3x+1) or five (actually, 3x + 2) syllables, there is no stress on the initial syllable, cf., §2.3.3 of chapter two. The data in (2) are representative from Cayuvava.

(2)

a	[ki.hí.βe.re]	'I ran'
b	[a.ri.ká.ja.hi]	'he has already fallen'
c	[pó.po.he.cé.βa.ka]	'inside of cow'
d	[ma.rá.ha.ha.éki]	'their blankets'
e	[i.ki.tá.pa.re.ré.pe.ha]	'the water is clean'
f	[cá.a.di.ró.bo.βu.rú.ru.ce]	'ninety-nine'

The templatic analysis of these data is to construct syllabic trochees iteratively from right to left. The final syllable is extrametrical and degenerate feet are not allowed. The system has the marked value of the FPLP, i.e., the templates are constructed under weak local parsing. The effect of weak local parsing here is

that a syllable is skipped after each constituent. A six syllable form will appear as in (3).

(3)

```
(x      .)          (x      .)
pó  p o  h e  c é  β a <k a>
```

The final syllable is extrametrical. A syllabic trochee is constructed over the fourth and fifth syllables. The third syllable is skipped due to weak local parsing. A second syllabic trochee is constructed over the first two syllables. This procedure correctly predicts stress on the first and third syllables.

A 3x+1 case will lack stress on the initial syllable because the initial syllable is skipped, as in (4).

(4)

```
        (x      .)
ki  h í  β e <r e>
```

Again, the final syllable is extrametrical. A syllabic trochee is constructed over the second and third syllables and the first syllable is in the position to be skipped due to weak local parsing. Leaving the initial syllable unfooted correctly predicts the absence of stress on this syllable.

The 3x+2 cases lack stress on the initial syllable. Recall that this is the case in which the Recoverability Condition of H&V was used and that this is the case

motivating Levin's deforestation rule. In the templatic approach, the initial syllable is stressless because no degenerate feet are allowed. Cf., the example in (5).

(5)

```
                (x      .)
a  r  i  k á  j  a <h  i>
```

The final syllable in (5) is extrametrical. A syllabic trochee is constructed over the third and fourth syllables. The second syllable is skipped due to weak local parsing and the first syllable remains unstressed because no degenerate feet are allowed.

This analysis correctly locates the distribution of stress. Having illustrated the FPLP by examining the stress pattern of Cayuvava, we can now consider the Chugach pattern.

2.3 Chugach

In this section, I present an analysis of Chugach using weak local parsing. The focus is on two issues. Considered first is the success of this approach for predicting the locations of primary stress; I will demonstrate that there are words for which this approach is inadequate. Second, the fortition facts and the stray–adjunction process are discussed; I argue that this approach must use complicated stray–adjunction rules to achieve the correct results.

2.3.1 Primary stress

The templatic analysis for Chugach constructs iterating iambic templates from left to right under weak local parsing. There is no extrametricality and degenerate mono-syllabic feet are allowed.

The structure generated with the templatic analysis is illustrated on the words in (6), which consist of only light syllables.

(6a)

(. x)
p a l á y a q

(6b)

(. x) (x)
a t ú n n i r t ú q

(6c)

(. x) (. x)
t a q ú m a l u n í

Constituents are constructed from left to right. The first three syllables in each of these cases undergoes the same procedure. An iamb is constructed over the first two syllables and the third one is skipped due to weak local parsing. In (6a), this procedure completes the process. In (6b), there is one remaining syllable; a degenerate iamb is assigned to this syllable. Note that the construction of degenerate feet is one of the differences between the analysis of Chugach and the

analysis of Cayuvava. In (6c), there are two syllables remaining after the skipped third syllable; a full iamb can be constructed over these two syllables. In all three cases, stress is correctly located.

Words with heavy syllables have some complications. Recall that weak local parsing allows one light syllable to be skipped. This is crucial to the analysis of Chugach.[3] This is illustrated with the three syllable word in (7), which has a heavy third syllable.

(7)

(. x) (x)
p a l át k a áq

An iamb is constructed over the first two syllables. Weak local parsing applies to skip a subsequent light syllable. Since the subsequent syllable is heavy, it is not skipped and another iamb is constructed over it. The correctly predicts stress on the second and third syllables.

There is one syllable pattern on which the weak local parsing approach fails to correctly locate stress. When there are two light syllables flanked by two heavy syllables, stress is on each of the heavies and the second light. The Hayes (1991) approach, as illustrated in (8), predicts stress on the heavies but not on the light.

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[3] See Rice (1990a) for critique of an earlier version of Hayes' theory which lacked the "light syllable" restriction.

(8)

(x) (. x)
n a á m a c í q u á

The initial syllable is heavy, so an iamb is constructed over that syllable. The second syllable is light and is therefore skipped due to weak local parsing. The light third and heavy fourth syllables should have an iamb constructed over them. Indeed, a light–heavy sequence is a the canonical iamb. This structure fails to predict stress on the third syllable and hence illustrates an empirical inadequacy of the proposed analysis.

2.3.2 Stray adjunction and fortition

The analyses developed in Leer's work and in chapter three are such that fortis consonants appear in foot–initial position. The success of the template approach should be evaluated not only with regard to correctly locating primary stress but also by considering whether this approach predicts the correct location of constituent boundaries, thereby predicting the location of fortis consonants. In this section, I investigate whether the templatic approach can predict the location of fortis consonants. I will argue that fortis consonants are foot initial in this approach only with a context–sensitive rule of stray adjunction.

The onset to a skipped syllable may be fortis. To construe this consonant as foot initial, the stray syllables will have to be adjoined to feet at some later stage in the derivation, reminding us of Leer's analysis.

The forms from §2.3.1 are repeated below. The syllables which are skipped due to weak local parsing are not yet footed. The syllables in position to have fortis onsets are represented here with a [+f] linked to the syllable. (In a word with four light syllables, the onsets to the first and third syllables are fortis. In the example in (9), this has no effect, since neither vowels nor geminates show the results of fortition.)

(9a)

```
 (.  x)
p a lá y a q
|
[+f]
```

(9b)

```
 (.  x)      (x)
 a t ún n i r t úq
 |           |
[+f]        [+f]
```

(9c)

```
 (.   x)    (.  x)
 t a q ú m a l u ní
 |                |
[+f]             [+f]
```

In (9a), there is only one constituent to which the skipped syllable could be adjoined, so in this word adjunction is leftward. The skipped syllable in both (9b)

and (9c) is between two constituents and could therefore be adjoined either to the left or to the right. Given the fortition facts, it seems that the stray syllable of (9b) should be adjoined rightward so that the onset is foot initial. On the other hand, the stray syllable in (9c) should be adjoined leftward so that the subsequent syllable remains foot initial.

Considering words which contain heavy syllables, we will also see that in some cases the unfooted syllable should be linked to the left and in other cases is should be linked to the right. As examples, consider the two cases in (10).

(10a)

```
  (x)   (x)
taá ta qá
 |     |
[+f]  [+f]
```

(10b)

```
 (x)  (.  x)
naá.qu.ma.lú.ku
 |    |
[+f] [+f]
```

In (10a), the stray syllable should be adjoined to the right to make the onset foot initial. In (10b), there are two skipped syllables and both should be adjoined to the left. The desired post–adjunction constituency of the words in both (9) and (10) is seen in (11).

(11)

(. x .)
p a lá y a q
|
[+f]

(x) (. x)
t a á t a q á
| |
[+f] [+f]

(. x) (. x)
a t ú n n i r t ú q
| |
[+f] [+f]

(x .) (. x .)
naá.qu.ma.lú.ku
| |
[+f] [+f]

(. x .) (. x)
t a q ú m a l u n í
| |
[+f] [+f]

To correctly locate the fortis consonants in strings of all light syllables or in strings which contain heavies, some of the stray syllables need to be adjoined leftward while others need to be stray adjoined to the constituent on the right. It is possible to distinguish these two cases. The basic pattern is that syllables which have been skipped due to weak local parsing are adjoined to the constituent on the left. However, if the constituent to the right is a mono–syllabic foot where that syllable is light – i.e., a mono–moraic foot – then the stray syllable is adjoined to the right. In contrast with the analysis given in chapter three, there is no principle

of the theory here which would predict this variation in the direction of stray adjunction.

The templatic analysis presented here and the analysis presented in chapter three are both able to predict the location of fortis consonants. In the Hayes (1991) approach, this prohibition is enforced by a context sensitive rule of stray–adjunction. In the analysis in chapter three, this is accomplished by insuring that a degenerate foot has sufficient material to be a head, i.e., that it has two moras. There is no difference between these two approaches with respect to the empirical facts they derive for Chugach.

2.3.3 Conclusion

The analysis of Chugach in the templatic approach of Hayes (1987, 1991) uses iambic templates and selects the marked option of the FPLP, i.e., weak local parsing. The preceding section focuses on an empirical evaluation. Just as the templatic theory is able to predict the location of stress in Cayuvava, it is also able to predict the location of stress in Chugach words containing only light syllables. Attempting to analyze words with heavy syllables reveals an empirical deficiencies of this approach and leads to the conclusion that the templatic approach as it stands is inadequate to handle this particular stress pattern.

3.0 THE MORAIC IAMB

Two logical possibilities for expanding the templatic approach were noted in the previous section. Additional templates could be added, or the mapping procedure could be modified. The development of the FPLP allows deriving ternary patterns by extending the mapping procedure. Kager (1990) adopts the FPLP and also introduces a new template. This new template is the focus of this section.

Two of the three templates proposed in Hayes (1987) are trochaic. One of the trochaic templates is constructed over syllables and the other is constructed over moras. The one iambic template is constructed over syllables. Kager (1990) introduces an iambic template which is constructed over moras. As in the previous section, this raises both empirical and theoretical questions.

The moraic iamb is a template constructed over a string of two light syllables or over one heavy syllable. Following the formalism for template mapping given in (1), the moraic iamb will be presented as in (12).

(12)

Moraic Iamb: Form $\overset{(.\ x)}{\mu\ \mu}$ if possible, where $\overset{(.\ x)}{\mu\ \mu}$ is either

$\overset{(.\ x)}{\breve{}\ \breve{}}$ or $\overset{(x)}{-}$

The moraic iamb analysis of Chugach constructs moraic iambs from left to right under weak local parsing. This gives the same results as the analysis with the

syllabic iamb in most cases. One situation where the analyses differ is with the problematic sequence of heavy–light–light–heavy. The analysis with moraic iambs, according to Kager (1990), leads to the representation in (13). ("H" indicates a heavy syllable; "L" a light one.)

(13)

(x)	(.	x)	(x)
H	L	L	H

The first syllable in (12) is bi–moraic and is therefore a complete moraic iamb. The second syllable is skipped due to weak local parsing. The third syllable cannot be a degenerate foot because degenerate feet are not allowed, based on the claim that in Kager (1989) that all metrical constituents have exactly two elements. The fourth syllable is bi–moraic, hence another iamb. This completes the first attempt at footing, leaving the second and third syllables unfooted. However, in Kager's approach, and in H&V, footing is said to be persistent, which means that a foot is constructed whenever sufficient material is available. The second and third syllables are both light and therefore constitute sufficient material for a moraic iamb; persistent footing therefore constructs an iamb over these two syllables, giving the representation above.

The prohibition on degenerate feet also leads to an interesting derivation for a sequence of four light syllables. Recall that stress is on the second and fourth syllables in such a string. The moraic iamb analysis gives the constituents represented in (14).

(14)

(. x) (. x)

L L L L

The first two light syllables are a mapped onto a moraic iamb. The third syllable is skipped and the fourth syllable cannot be footed because feet must be exactly binary. At the end of the first attempt at footing, the third and fourth syllables remain unfooted. Due to persistence, these two syllables get footed as a moraic iamb since they constitute sufficient material for the template.

In this analysis, it is the persistent characteristic of footing which leads to the cooccurence of foot boundaries and fortis consonants. In §2.3.2 of this chapter, rightward stray adjunction was required for words with four light syllables. Here, the construction of a degenerate foot and the adjunction to it of the previous light foot are essentially collapsed, although two steps are still required. Here, the two steps are (i) skip the final syllable because it is inadequate to be a moraic iamb and then (ii) construct a moraic iamb over the final syllable and the preceding light one.

One of the advantages Kager (1990) claims for introducing the moraic iamb is that it eliminates the "mixed" iamb of Hayes (1987). Hayes' iamb is called "mixed" because its first element is a mora (a mono–moraic syllable) and its second element is a syllable. One of psycho–perceptual characteristics which Hayes claims to encode in his theory is the intrinsic inequality of iambic constituents. The fundamental nature of the iamb is claimed to be precisely the unevenness which

Kager's proposal eliminates. Kager (1990) includes no explicit discussion of this point.

Finally, the contribution of Kager (1990) the templatic approach of metrical constituent structure assignment, in the broadest terms, is to introduce a new template. This step must be evaluated against the original motivations for templatic theory. Does it create data gaps? E.g., the "syllabic iamb" which is a right–headed constituent over syllables allows two heavy syllables to be one foot. No example of this is provided. In fact, the only example of syllabic iambs Kager gives is Winnebago, which oddly requires the initial mora to be extrametrical and which could just as well be analyzed with moraic iambs. Does it "fit" with conclusions about extralinguistic parsing? The suggestion made about these conclusions is that iambs are inherently uneven, but the moraic and syllabic iambs seem to be inherently even.

Of course, if new templates can be introduced to respond to new facts or problematic cases, then the facts of Cayuvava and Chugach would suggest introducing a ternary template. This option is resisted because of the conclusions about binarity in Kager (1989), a re–evaluation of which would lead us far astray.

4.0 A MODIFIED TEMPLATIC THEORY

Hammond (1990) develops a templatic approach to metrical constituent structure assignment. In the context of developing this theory, there is a discussion of ternary systems, including Chugach. The purpose of the present section is not to

review the entire theory which Hammond offers, but rather it is to present his treatment of Chugach.

The template used by Hammond (1990) to analyze Chugach is called the "symmetric iamb" and is equivalent to the moraic iamb proposed by Kager (1991), discussed in §3. Hammond's treatment of Chugach generates the same structures as Kager's. There is one notational difference and one procedural difference.

The theory of extrametricality is dramatically extended by Hammond, to allow not only word–peripheral elements, but also foot–peripheral and syllable–peripheral elements to be extrametrical. Where Kager (1991) and Hayes (1991) use weak local parsing, Hammond (1990) uses foot–peripheral extrametricality. I.e., a syllable (implicitly restricted to mono–moraic ones) is made "extrametrical" to the right of each foot. In the case of Chugach, this could be construed as simply an overt marking on the syllable which is skipped by weak local parsing.

The procedural difference involves the two cases for which Kager (1990) critically invokes persistent footing. In Hammond's (1990) analysis, the results are the same, but the construction of a degenerate foot is actually allowed. Then, a requirement that "symmetric iambs" not be degenerate forces the incorporation of the previous syllable, which was marked as extrametrical. This yields a "derivation" as in (15).

(15)

(. *) (*)

L L <L> L

⇓

(. *) (. *)

L L L L

On the first pass, the first two light syllables are footed, the third syllable is marked as extrametrical and a degenerate foot is constructed on the fourth syllable. This degenerate foot is ill–formed since these templates must be bi–moraic. To correct this infelicity, the extrametrical third syllable is made "metrical" and incorporated into the final foot, yielding the second form above. Again, this result is identical with Kager's.

Hammond's (1990) theory is not intended as an extension of that in Hayes (1987). It is independently developed and hence it would be inappropriate to evaluate it against the claims in Hayes (1987). However, there are at least two issues to mention here.

Extrametrical syllables are said to be "invisible" at the point of metrical structure building. Clearly this is not the case above. There, it seems that extrametrical means "visible, but skipped unless necessary for well–formedness purposes." This is precisely the use to which Kager (1991) puts the combination of weak local parsing and exact binarity requirements.

Hammond's (1990) theory has a much richer inventory of templates than the other templatic theories. It includes a distinction between templates which may be constructed iteratively and templates which may be constructed only non–iteratively. The "symmetric iamb" is one of the templates which can be constructed non-iteratively. Nonetheless, it is constructed iteratively in Chugach. An explanation is offered which refers to the extralinguistic parsing research that Hayes (1987) takes as part of the motivation for his theory. In Hammond (1990: 35), these observations are promoted to the status of a law, given as the following.

> Law of Rhythmic Perception (LRP)
>
> A string of elements of even duration is grouped trochaically;
>
> a string of elements of uneven duration is grouped iambically.

It is this law which prevents the iterative construction of symmetric iambs. Such constituents would impose iambic grouping on a string of elements of even duration. In the case of Chugach, according to Hammond (1990:66), the LRP does not prevent the construction of symmetric iambs because "the superficial pattern of iteration is amphibrachic." Of course, there are some cases in which the superficial pattern of iteration is binary. Words of four light syllables have stress on the second and fourth syllables. In Hammond's theory, in which the LRP operates as a monitor of well–formedness, the pattern on the four syllable form could not be parsed with the symmetric iambs. Yet, this is the offered analysis. This theory–internal contradiction casts doubt on the analysis.

5.0 CONCLUSION

The approaches to stress assignment seen in Hayes (1991), Kager (1991) and Hammond (1990) are largely uniform in the perspective they take on iterating ternary patterns: iterating ternary patterns are the result of a particular modification for the mapping algorithm for binary constituents. The modification is to leave single light syllables at the edge of binary constituents unfooted. Beyond this, there are differences in the approaches. I have claimed that the approaches in Kager (1990) and Hammond (1990) differ from that in Hayes (1991) insofar as they correctly derive the locations of stress.