CHAPTER TWO

TYPOLOGICAL SYMMETRY IN BINARY SYSTEMS

1.0 INTRODUCTION

One goal of research in metrical theory is to motivate the most restrictive theory which is still adequate to analyze the metrical system of any natural language. The pursuit of this goal is grounded in empirical surveys; accurate typological generalizations can only follow from examining the metrical structures of many languages. Part of the empirical foundation for the approach to metrical structure assignment advocated in the present work will be presented in this chapter.

In the literature on metrical phonology, there are at least two major surveys which organize languages by their stress patterns; these are Hyman (1977a) and Hayes (1985). Hyman's survey is broader in scope (444 languages), including languages with stress and those with pitch–accent. He also includes both languages which have iterating stresses and those with non–iterating stresses. Of these, 138 are claimed to have no pattern, i.e., the stress assignment is considered to be lexical (unpredictable). Sixteen languages in Hyman's survey have no reported stress or pitch–accent.

The survey in Hayes (1985) is restricted to languages which have iterating stress patterns. Fifty–two languages are presented, with the distribution of patterns that was discussed in chapter one. The correlations which Hayes identified on the
basis of this survey partially motivate his claim that iambic systems indicate prominence with length while trochaic systems indicate prominence in other ways, e.g., with pitch or intensity. The developments of metrical theory in Hayes (1987) and Hayes (1991) reflect these generalizations by proposing an asymmetric foot typology. In that theory, feet in which the elements are of even duration are trochaic and those in which the elements are of uneven duration are iambic.

A metrical theory in which the primitives are templates is free to have a symmetric or an asymmetric inventory. On the other hand, deriving the inventory of foot types from primitives which are binary parameters will lead to a symmetric inventory. For example, in Hayes (1981), feet were either right-headed or left-headed and either binary or unbounded, creating four possible foot types.1 Similarly, the binary parameters of Halle and Vergnaud (1987) (henceforth, H&V) generate a symmetric inventory of metrical constituents.

In what follows, several languages will be discussed with the goal of illustrating symmetry in the inventory of metrical constituents. No claims are made about the relative markedness of languages with quantity-sensitive left-headed feet as compared to those with languages with quantity-sensitive right-headed feet. Rather, the claim is that the inventory of foot types is symmetrical.

The two data gaps identified in Hayes (1985) are iterating patterns with either quantity-sensitive left-headed feet or quantity-insensitive right-headed feet.2 One

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1 Hayes (1981) also includes other parameters, such as quantity sensitivity, obligatory branching, etc.; the point about symmetry remains.

2 The first gap is reported to be absolute. Regarding the second gap, Hayes (1985) lists five languages which have quantity-insensitive iambic systems, hence this is reported to be a tendency, rather than an absolute gap. The five languages are Southern Paiute, Winnebago, Seneca, Onondaga and Weri. Hayes (1987) promotes this "tendency" for quantity-insensitive systems to be iambic to the same "absolute" status as that for the quantity-sensitive trochaic systems by claiming that these five languages can be reanalyzed as having trochaic systems with independently motivated
goal of this chapter is to "fill" these gaps, i.e., to present analyses of a number of languages which employ either quantity-sensitive left-headed constituents or quantity-insensitive right-headed constituents. The languages to be discussed are Bani-Hassan Arabic, Cayuvava, Eastern Pomo, English, Old English, Gidabal, Manam, Latin, Selayarese, Southeastern Tepehuan, and Winnebago.

2.0 QUANTITY-SENSITIVE TROCHEES

The remainder of the chapter is organized as follows. Section two investigates trochaic systems and section three investigates iambic systems. Within section two, I discuss iterative and non-iterative cases of left-headed quantity sensitive feet, or, in the terms proposed in chapter one, uneven, strong cases of mapping an (H N) template onto the word. The last part of section two examines the distribution on stress in Gidabal, the Germanic foot of Dresher and Lahiri (1991), and the stress facts of Cayuvava, and analyzes them within the proposed typology as uneven, strong, non-tautosyllabic cases of template mapping.

tools such as extrametricality and degenerate feet. In Rice (1990b), I demonstrated that the proposed reanalyses of these five languages as trochaic systems are in some cases not possible and in others possible only with drastic formal extensions of the theory. This demonstration is not repeated here since Hayes (1991) offers different analyses of most of these languages, making a response to his (1987) claim outdated.
2.1 Iterating quantity–sensitive trochees

The first cases to be presented are those which iteratively construct left–headed uneven feet. The iterative construction of such constituents leads to the correct assignment of stress, or to the characterization of other processes sensitive to metrical structure. Three such cases are presented below; these are Bani–Hassan Arabic, South–Eastern Tepehuan, and Manam.

2.1.1 Bani–Hassan Arabic

The Bani–Hassan dialect of Arabic has several rules of the segmental phonology which interact with the metrical structure of the language. Research into these segmental processes facilitate evaluations of proposals about the metrical structure of the language. Such a line of research is demonstrated in careful detail in Irshied and Kenstowicz (1984). Their work is drawn on in this section to argue for the iterative construction of left–headed, uneven constituents — QS LH feet in the terminology of Hayes (1981) — from left to right across Bani–Hassan words. Arguments for this proposal are based on the distribution of stress, vowel elision and the corresponding shift in the location of stress, a vowel raising rule, and an elision rule evidenced by aspects of the phrasal phonology.

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3 This dialect is spoken in parts of northern Jordan. In addition to the article by Irshied and Kenstowicz discussed in the text, the phonology of this language is also analyzed in Irshied's (1984) dissertation. For a recent, brief discussion, see Kenstowicz (to appear).
The data in (1) illustrate the distribution of stress for di- and tri-syllabic words in BHA. (2) shows stress locations in quadra-syllabic forms; (3) will be considered in the discussion below.

(1a)  
(a)  dá.ras  ‘study’
(b)  há.mal  ‘carry’
(c)  sf.gir  ‘be small’
(d)  fír.ban  ‘they f. drank’
(e)  fíl.báab  ‘youth’
(f)  fál.lámt  ‘I taught’
(g)  fn.sa.ḥab  ‘be pulled’
(h)  fn.ti.saf  ‘be spilled’
(i)  ta.ḥám.mal  ‘be made to carry’
(j)  ta.fál.lam  ‘be taught’

(2a)  
(a)  fàl.la.má.tuh  ‘she taught him’
(b)  sàa.fa.dá.tuh  ‘she helped him’
(c)  stàg.ba.lá.tuh  ‘she greeted him’
(d)  bàa.ra.ká.tuh  ‘she blessed him’

(3)  bee.ḍít.na  ‘our egg’
In disyllabic words, stress can appear on either of the first or the second syllables. A super–heavy second syllable, i.e., one with the shape CVVC or CVCC, will be stressed, as in (1e,f). If the second syllable is not super–heavy, then the first syllable will be stressed, as in (1a–d).

The tri–sylilabic forms in (1g–j) have stress on either the first or second syllables. If the second syllable is heavy, i.e., CVC or CVV, it will be stressed, as in (1i,j). If the second syllable is not heavy, then stress surfaces on the initial syllable, as in (1g,h).

From the data in (1), the observation about final syllables in many dialects of Arabic (cf. Langendoen (1968), McCarthy (1979), etc.) is seen to hold in BHA also: final super–heavy syllables act like heavy syllables do elsewhere, i.e., they attract stress; final heavy syllables act like light syllables do elsewhere, i.e., they do not attract stress. Following Kenstowicz (1983), this is taken as the basis for marking final consonants as extrametrical. Furthermore, a rule removing final feet which dominate only CV(C) is adopted, following Irshied and Kenstowicz.

Foot structure assignment in BHA is iterative; in this dialect of Arabic there is secondary stress. Examples of quadra–sylilabic words showing alternating stress were seen in (2). All of the words in (2) have stress on the first and third syllables; the first syllable has secondary stress and the third has primary. To account for the two stresses in the words in (2), metrical constituent structure is assigned iteratively. The distinction between primary and secondary stress can be captured by projecting the head of the rightmost constituent to a higher level.

Feet are constructed for BHA as in (4); the shape of the template, the direction of construction and the clash resolution rule are defended below.
Bani–Hassan Stress Assignment

a) Template: (H N)
b) Mapping: Uneven: Weak; a final consonant is extrametrical
c) Direction: Left to Right
d) Remove final degenerate feet dominating CV(C)
e) Remove the leftmost of two adjacent heads
f) At the word level: End Rule Right

This procedure is illustrated with examples from (1) and (2) with the following diagrams, which are explicated below. Final consonants are extrametrical and the moraic values for the remainder of the words are represented.

(5)

(6a)  

(x)  
(a)  
μ μ  
d á r a <s>

(6b)  

(x)  
μ μ μ  
ʃ i b á a <b>

I.e., Clash is calculated at the level of the syllable, cf. related discussion of the parameterization of the level for calculating clash in chapter one, §4,
In (5), on foot is constructed in which the first syllable is the head and the second is the non–head. The first syllable receives the only stress in the word.

The second syllable in (6) is bi–moraic and hence cannot be a non–head, leading to the construction of two degenerate feet, as seen in (6a). These adjacent heads clash and the foot over the first syllable is therefore removed by (4e) and the second syllable is stressed.

(7a) shows a full foot followed by a degenerate final foot, which is eventually removed by (4d), as seen in (7b). In (8a), two feet are constructed; the first one is removed by clash resolution, (4e), and the second one receives stress, as in (8b). There are also two feet in (9), however in this case neither is removed; the
stress on the third syllable is promoted by (4f), making it primary and leaving the initial stress as secondary.

The clash resolution which was seen in (6) and (8) removed stress from a light syllable. Clash resolution can also operate to remove stress off of a heavy syllable. Consider the word in (3), as illustrated in (10).

\[
\begin{array}{cccccc}
10a & (x & ) & (x & .) & 10b \\
\mu & \mu & \mu & \mu & \mu \\
bee & g & t & na \\
\end{array}
\]

The foot construction algorithm will build a head over the first syllable, as seen in (10a). Because the second syllable is heavy, it cannot be a non-head, so a second foot is begun with the second syllable as its head; the final syllable is the non-head for the second foot. These two heads are adjacent, hence clash resolution will apply to remove the leftmost one, i.e., the one over the initial syllable. The application of clash resolution is confirmed by the absence of initial secondary stress. This process applies regardless of the weight of the initial syllable.

2.1.1.1 Headedness and Directionality

Two segmental processes are now discussed, to argue that the constituents in BHA must be left-headed and to argue that they are constructed from left to right.
2.1.1.1 Elision There is a segmental rule of BHA which Irshied and Kenstowicz refer to as “elision.” This rule deletes a short low vowel when it is both in an open syllable and when it is followed by a non–final open syllable. They formulate this rule as in (11) (p. 115).⁵

(11) Elision

\[ V \rightarrow \emptyset / \quad \text{C} \quad V \]

\[ \text{R1} \quad \text{R2} \quad \text{where R1 and R2 are non–branching} \]

\[ \text{and where R1 is [+low]} \]

The operation of this rule is illustrated with the data in (12).

(12a)  sá.ḥab  ‘he pulled’

b)  s.ḥá.bat  ‘she pulled’

c)  sá.ḥab.ti  ‘you f. pulled’

In (12b), a suffix /-at/ is added to the form in (12a). This creates a trisyllabic word in which the initial syllable is [sa], as seen in (13).

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⁵ Irshied and Kenstowicz’s formulation does not explicitly encode the obligatory non–finality of the subsequent syllable. This, of course, is possible with a final “X” in the structural description and the requirement the X ≠ \( \emptyset \).
(13)

Underlying  / s a h a b + a t /
Elision  Ø
Surface  [ʃ̾abat]

Due to the suffixation, the open initial syllable is followed by a non–final open syllable, since the stem–final [b] becomes the onset to the final syllable. This is the environment for elision, so the [a] of the first syllable is deleted, resulting in the form in (12b). Note that when a consonant–initial suffix is added, as in (12c), the stem–final [b] remains as part of the second syllable. Hence, the second syllable is still closed, and the [a] in the initial syllable is not in the environment for elision.

Elision can lead to the deletion of a vowel which is the head of a metrical foot. For example, when two suffixes, rather than one, are added to the stem in (12), there will be sufficient material for two feet. Consider the following underlying form.

(13a)

/sa.ḥab + at + ak/  ‘she pulled you m. sg.’

Concatenation and syllabification lead to (13b).

(13b)

/sa.ḥa.ba.tak/
The vowel in the first syllable undergoes elision, giving the surface form in (13c).

(13c)

\[ \text{[shə.ба.tak]} \]

Constructing left-headed binary constituents from left to right on this surface form, (13c), would have the first and third syllables as heads. The final foot would be degenerate and therefore would be removed by (4d), predicting stress on only the initial syllable. Instead, stress is on the first and second syllables. This distribution of stress can be correctly predicted by assuming that stress assignment precedes elision. Metrical constituency will be assigned to the underlying form, which has four syllables. Assigning binary feet from left to right creates two feet, with heads on the first and third syllables, as illustrated in (14a).

(14a)

\[
\begin{array}{c}
(x) \\
(x.) (x.) \\
\text{sa.ha.ba.ta<k>}
\end{array}
\]

When the vowel in the initial syllable is elided, the only remaining syllable in the first constituent becomes the head. The initial constituent is preserved even though the head vowel is elided. The ‘x’ shifts to the remaining potential head and
the surface initial syllable is thereby stressed. The footing of the surface structure is as in (14b).

(14b)

    ( x)
    (x) (x .)
    shà.bá.ta<k>

Other dialects of Arabic show a relationship between elision, stress shift and metrical structure. For example, Al–mozainy, Bley–Vroman, and McCarthy (1985) discuss the facts of a Bedoin dialect in which the shifting of stress is also constrained by the structure of the metrical constituency. In BHA, this analysis of stress shift is possible only with left headed constituents. Assigning right–headed constituents from right to left to the surface form predicts stress on the initial and final syllables, i.e., it would fail to predict the location of stress correctly. Assigning right–headed constituents to the underlying four syllable form would require making a final CVC syllable extrametrical (as in other Arabic dialects, e.g., Palestinian). This would place stress correctly on the penult. However, the antepenult would be the non–head of this constituent so that when the initial vowel is deleted, there would be no potential “landing site” for the stress which was on that vowel since there would be no other vowels in that foot. Based on the stress shift which results from elision in BHA, the constituents are claimed to be left headed.6

6 Because elision applies only to the initial vowel, the only direction which stress could shift is to the right. However, it would not be sufficient to simply posit a rule shifting stress to the right, without regard to the metrical constituent structure since it is presumably not tolerable to shift a stress into a constituent already containing a head. This furthers the suggestion that the constituent boundary in (14a) must be between the second and third syllables, as when left–headed feet are constructed.
2.1.1.2 Raising A raising process in BHA also argues for left-headed constituents. This rule raises [a] to [i] in non-final short open syllables. This rule is formulated in (15), based on Irshied and Kenstowicz (p. 120).

(15) Raising, version 1

\[ [+ \text{ low}] \to [+ \text{ high}] / \ldots \ X \]

\[
\begin{array}{c}
R \\
V \\
\end{array}
\]

where R is non-branching and X is non-null

The rule serves to raise the second vowel of a CaCaC stem when a vowel-initial suffix is added.\(^7\) Irshied and Kenstowicz (1984) order this rule after elision; its effect can be seen in (16).

(16a) \quad \text{x adam} \quad \text{‘he served’}

b) \quad \text{x dimat} \quad \text{‘she served’}

c) \quad \text{s arag} \quad \text{‘he stole’}

d) \quad \text{s rigat} \quad \text{‘she stole’}

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\(^7\) This description suggests that the second underlying vowel of (12b) should be raised. The absence of raising on this form is due to a blocking effect of adjacent gutterals, cf. Irshied and Kenstowicz, p. 119. For further discussion see McCarthy (1989).
The forms in (16b) and (16d) have suffixes added to the basic forms in (16a) and (16c), respectively. Elision eliminates the vowel of the first syllable and the remaining stem vowel is in an open non–final syllable. This is the environment for raising, so the underlying [a] surfaces as an [i]. A derivation is given in (17).

(17)

\[ /x\, a\, d\, a\, m + a\, t/ \]

Elision \[ \emptyset \]

Raising \[ i \]

[ xdimat]

There is a class of exceptions to this rule, represented by the examples in (18).

(18a) \[ /s\, a\, l\, a\, m\, a\, t/ \]

b) \[ /b\, a\, a\, r\, a\, k\, a\, t/ \]

The penultimate vowel in both (18a) and (18b) is in the position to undergo raising, but it does not. Irshied and Kenstowicz claim that there is a further restriction on the raising rule. In particular, the target vowel must be the head of a metrical constituent. The raising rule in (15) is reformulated in (19) to reflect this requirement, following Irshied and Kenstowicz (p. 134).
(19) Raising, version 2

\ [+low] \rightarrow \ [+hi] / _________________________
| R1    R2   |
\ \ /     / Foot

In the apparent exceptions, the first two syllables are a binary foot and the final syllable is a degenerate foot. The footing of these forms is as in (20).

(20)

(x .)  (x)
\  a l l a m a t

Since the penultimate vowels are non-heads, they do not undergo raising. In (16b) and (16d) above the vowels which undergo raising are heads of left-headed feet, as illustrated in (21). In (21a), the initial footing is seen; in (21b), the final foot has been removed by (4d) and the initial vowel has been elided by (11). The application of de-footing and elision leaves the (underlying) second [a] as a head which will undergo (19) and be raised to [i].

(21a) (x .) (x)
    x a d a m a t

(21b) (x)
    x d a m a t

    (x)
    x d a m a t
The ability to distinguish the environment for raising is only possible with left-headed constituents. For example, for the two forms in (18) an analysis with right-headed constituents would have the final syllable extrametrical, as noted in connection with the discussion of (14). Whether construction is from left to right or from right to left, both of the first two syllables will be heads and so raising would be expected in the second syllable.

2.1.1.2 Summary

The discussion of BHA has focussed on the distribution of stress and on the interaction of two rules of the segmental phonology with metrical structure. The distribution of stress alone allows the claim that footing is iterative and quantity sensitive. The operation of elision and raising facilitate arguments that metrical constituents in BHA are left-headed and that the constituents are constructed from left to right. Hence, the algorithm for metrical constituent construction given in (4) is shown to yield correct predictions regarding the location of stress and straightforward characterizations of the examined segmental processes examined.

2.1.2 Southeastern Tepehuan

The metrical system of Southeastern Tepehuan⁸ interacts with a vowel deletion process. The deletion process and the distribution of stress are presented here as the

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⁸ Southeastern Tepehuan is an Uto-Aztecan language spoken southeast of Durango in Mexico.
basis for the claim that the metrical system of SET involves constructing iterating left-headed, quantity-sensitive feet from left to right. This discussion draws on the work of Willett (1982), Kim (1988), and Weeda (forthcoming).

Words in SET have one stress and it falls on the heaviest of the first two syllables of the stem. If the first two syllables are of equal weight, then stress falls on the first syllable. Data illustrating this distribution are given in (22). SET has many complicated phonological rules which do not directly interact with metrical structure, but which can obscure the presentation of the data; see the references given above for a discussion of these processes.

(22a) váavaŋ

b) va-páavaŋ

from underlying /vá+váavaŋaŋ/  

pheasant

pheasants

c) hir-komáarak

d) hir-kóoʔkmarak

e) hin-káakai

‘it’s wide’

‘they’re wide’

‘my thighs’

‘wives’

‘lizard’

f) hahóoŋ?i?

g) víaʔñkai?

The stems in (22a) and (22b) are the same. The long vowel in the initial syllable of (22a) is stressed and the long vowel in the second syllable of (22b) is stressed; as noted above, it is the stem which is the domain for stress assignment. The prefix in (22b) is not in the stress assigning domain. Similarly, in (22c-e), the prefix before the dash does not count in stress assignment. In (22c) and (22f) the
heavy second syllable of the stem is stressed; in (22d,e,f) the heavy initial syllable is stressed. The generalization from these data is that given above: stress falls on the heaviest of the first two syllables of the stem, or on the first syllable if both have equal weight. I propose that stress is assigned by the algorithm in (23). The components of this algorithm will be motivated further below.\footnote{Kim (1988) proposes that a single Obligatory Branching foot is constructed at the left edge of the word, followed by the construction of a left-headed word tree. Her approach has the advantage of not requiring a destressing rule because it does not create clash. An argument is presented here claiming that the foot construction rule is iterative, and that light syllables can be heads. The fact remains that there is only one stress in each word; this is represented in the present analysis by assigning stress only to a syllable which is both the head of a metrical foot and dominated by the word level prominence marking, as determine by (23e).}

(23) \textbf{SET Stress Assignment}

a) Template: (H N)

b) Direction: left to right

c) Mapping: Uneven: Weak

d) Delete the rightmost of two adjacent heads, unless the rightmost head dominates a syllable which is heavier than the leftmost. In that case, delete the left one.


The following illustrations demonstrate the operation of (23). In (24), the initial syllable is heavy and is the head of the first foot. The second syllable is the non-head of that foot. The vowel of the final syllable is removed by an elision process not taken up here. For discussion of this process, see Willett (1982) and (Kim 1988). In (25), the initial syllable of the stem is light and the second syllable is
heavy. The second syllable cannot be a non-head, so the first syllable is the head of a degenerate foot and the second and third syllables constitute the second foot, as illustrated in (25a). The heads of these two feet are adjacent and therefore constitute a clash. The initial foot is removed, following (23d), which results in the structure in (25b); this correctly predicts that stress will appear on the second syllable.

\[(24) \]
\[
(x \\
(x .) (x) \\
\mu \mu \mu \mu \\
V a a V a s i)
\]

\[(25a) \quad (x) \quad (x .) \quad (x) \quad \mu \mu \mu \mu \\
\mu \mu \mu \mu \\
H a H o o n i
\]

\[(25b) \quad (x) \quad (x .) \quad (x ) \quad \mu \mu \mu \mu \\
\mu \mu \mu \mu \\
H a H o o n i
\]

Having seen the distribution of stress, a vowel deletion process which Kim (1988) argues to be sensitive to metrical structure is presented. The forms in (26) begin with two light syllables at the time of stress assignment, as seen in the first row of (26). An elision process subsequently removes the second vowel; the post-elision form is seen in the second row of (26).
(26) | (a)  | (b)   | (c)   | (d)   |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>After stress:</td>
<td>tʃroviŋ</td>
<td>vávasĩk</td>
<td>tótopa</td>
</tr>
<tr>
<td>After elision:</td>
<td>tʃrivĩ</td>
<td>vásvik</td>
<td>tótpa</td>
</tr>
<tr>
<td>Gloss:</td>
<td>'rope'</td>
<td>'rats'</td>
<td>'pestles'</td>
</tr>
</tbody>
</table>

Deletion occurs in the second syllable, which is a metrically weak position.

Deletion also applies to the vowel in the metrically weak position when the first syllable is a heavy syllable, as in (27).\(^{10}\)

(27) | (a) | (b) | (c) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>After stress:</td>
<td>tʃittropiŋ</td>
<td>nátanakamiŋ</td>
</tr>
<tr>
<td>After elision:</td>
<td>tʃitropiŋ</td>
<td>nátanakamiŋ</td>
</tr>
<tr>
<td>Gloss:</td>
<td>'ropes'</td>
<td>'bats'</td>
</tr>
</tbody>
</table>

By positing a template and mapping procedure in which the initial heavy syllable is the head and the second syllable is the non-head, the environment of deletion can still be described as a metrically weak position.\(^{11}\)

Although there is only one stress in the word, the foot construction procedure given in (23) is argued here to be iterative. Stress will be on the left–most

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\(^{10}\) See Willett (1982) for discussion of the segmental rules whose effects are seen in (27).

\(^{11}\) An analysis with moraic trochees, the foot which Hayes (1987) proposes to replace the QS LH foot, will not be able to capture the relationship between elision and stress assignment. Under such an analysis, the deleted vowels from forms such as those in (26) will be in metrically weak positions, as the non–head of a moraic trochee which is headed by the preceding light syllable. In forms such as those in (27), however, the deleted vowels will be in a head position, since the heavy syllable preceding the target vowel will itself constitute a moraic trochee. In light of this, no generalization about the environment for deletion is available with respect to metrical structure in an analysis with moraic trochees. Yet, the alternating character of the elision process, to be seen in (28), suggests a foot–based analysis.
foot, which will be located by the left–headed word tree. The footing is applied iteratively to account for iterative instances of vowel deletion. This is illustrated with (28).

(28)
\[
\text{/tu + maamatu\text{̄}xidya/}
\]
\[
[tum\text{̄}amtu\text{̄}x\text{̄}dya] \quad \text{‘will teach’}
\]

As seen in the surface form of ‘will teach’, which includes the prefix /tu+/, the vowels in the second and fourth underlying vowels are deleted. This can be accounted for by constructing feet as proposed in (23) and deleting the non–head position. The foot structure generated for (28) by (23) is given in (29). A formulation of the vowel deletion rule is given in (30).

(29)
\[
(x 

\)
\[
(x .) \quad (x .) \quad (x)
\]
\[
\mu \mu \mu \mu \mu \mu
\]
\[
\text{maamatu\text{̄}xidya}
\]

(30) Vowel Deletion

\[
V \rightarrow \varnothing / \quad
\]
The formulation of (30) serves to delete a vowel dominated by the weak position of a metrical constituent. The application of this rule to the structure in (29) will delete the vowels of the second and fourth syllables, correctly deriving the surface structure seen in (28). Stress is assigned only to the DTE of the word tree, which in this case is the first syllable of the stem.

The distribution of stress and vowel deletion in SET argues for the iterative construction of uneven, left–headed constituents from left to right across the word.

2.1.3 Manam

Manam has an alternating stress pattern in which the rightmost stress is primary and the preceding ones are secondary. I will demonstrate here that the distribution of stress is correctly assigned by constructing left–headed, quantity–sensitive feet from right to left. The data for Manam come from Lichtenburk (1983) and Chaski (1986); the present analysis is significantly informed by that of Chaski (1986). I proceed by presenting data from the language and illustrating the metrical structure assignment procedure. I demonstrate that constituents are assigned iteratively. Then, I argue against the possibility of an analysis using extrametricality and right–headed feet by showing that there are suffixes which are lexically specified for extrametricality.

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12 As it stands, (30) incorrectly predicts the deletion of certain vowels in the presented data, e.g., the final vowel of [hahooni]. Some discussion of this is found in Weeda (forthcoming), in which it is suggested that a final vowel cannot be deleted. The point here is that the iterative construction of the correct foot type captures the similarity between a light syllable following a heavy syllable and a light syllable following a light syllable, although further work may need to be done to precisely identify the environment in which (30) applies.

13 Manam is an Austronesian language in the Oceanic sub–group. It is spoken in parts of Papua Guinea.
Furthermore, the interaction of these lexically extrametrical suffixes with the syllabification processes in the language affects foot assignment.

The data in (31) illustrate the stress pattern of Manam. As usual, periods mark syllable boundaries, acute accents mark main stress and grave accents mark secondary stress.

(31a) ú 'kind of fish trap'
b) gá 'morinda citrifolia' 
c) máŋ 'bird'
d) mómbwá 'victory leaf'
e) pátu 'stone'
f) dámwá 'forehead'
g) lún'ta 'moss'
h) súru 'soup'
i) ró'a 'spouse'
j) mánám 'lg. name'
k) roágü 'my spouse'
l) sódái 'tobacco'
m) siŋába 'bush'
n) màlabóŋ 'flying fox'
o) tañèpwañína 'real chief'
p) iđàndàñlaláʔo 'he keeps crawling away'
In mono-syllabic words, (31a-c), the only existing syllable is stressed. In di-syllabic words with a light ultima, (31d-i), the penult is stressed. In di-syllabic words with a heavy ultima, (31j), the ultima is stressed. In trisyllabic words with a light ultima (31k-m), the penult is stressed and in tri-syllabic words with a heavy ultima, (31n), the ultima has primary stress and the initial syllable has secondary stress. A word consisting of five light syllables (31o), has primary stress on the penult and secondary stress on the pre-antepenult. When heavy syllables precede the primary stress (31p), they must be stressed, i.e., they interrupt the alternating pattern.

The location of stress is correctly predicted by the following algorithm.

(32) Manam Stress Assignment

a) Template: (H N).
b) Direction: Right to Left
d) Clash is calculated at the level of the mora. Remove the leftmost of two clashing heads, unless it dominates a heavy syllable, in which case remove the rightmost of the two heads.\(^\text{14}\)
e) Word Level: End Rule Right.

\(^{14}\) For a different analysis of the facts compelling this rule, see Ito (1989), in which a grid based analysis uses the parameter [Forward Clash Override], as proposed in Prince (1983).
The requirement that feet be uneven is instantiated at the point of construction by preventing heavy syllables from being non–heads. The algorithm in (32) generates structures such as those in (33). Rather than giving derivations, I represent degenerate feet which are removed by (31d) above with boxes around them. These are ultimately removed, hence there will be no secondary stress on that syllable.

\[(33a)\] (x )
(x .)
sú.ru

c) (x)
(x)

\[(33b)\]

b) (x)
(x .)
sí.ñá.ba

f) (x .) (x)
(x .) (x)

mà.la.bóŋ

\[(33c)\]

c) (x)(x .)(x .)
ta.nè.pwa.tf.na

g) (x)(x .)(x .)(x .)
i.dàn.dàn.la.lá.?o
d) (x)  
(x)  
gā

The words in (33a–d) contain no heavy syllables and therefore present an alternating stress pattern. The destressing rule (32d) applies when there are an odd number of syllables to the left of the leftmost heavy syllable. In (33e) and (33f), the final syllable is heavy and therefore cannot be a non-head. It is footed and bears primary stress since it is the rightmost head. The form in (33g) demonstrates that it is not just the rule for primary stress assignment which is sensitive to stress but that the iterating rule continues with quantity sensitivity such that the second syllable in (33g) cannot be a non-head because it is heavy. Secondary stress appears on both the third and fourth syllables, suggesting the the clash resolving rule which applies to the “boxed” asterisks can in fact only delete the stress from a light syllable.

I turn now to a consideration of an alternative analysis in which constituents are right-headed, and to a discussion of suffixes which are lexically marked as extrametrical. A consideration of these suffixes will allow an argument against the the analysis with right-headed constituents.

Manam stress could be assigned with right-headed quantity sensitive feet, using final mora extrametricality. This analysis would be as in (34).

(34) Manam Stress Assignment (right headed)

a) Extrametricality: Word final mora

b) Template: (N H)
c) Direction: Right to Left

d) Mapping: Uneven, Weak

e) Word Level: End Rule Right

(34a) makes a final (C)V syllable not count in stress assignment because that syllable is mono-moraic. This does not apply in the case of a mono-moraic word due to a prohibition against making the entire domain extrametrical. In words which end with (C)VC syllables, the second of the two moras in that syllable becomes extrametrical; stress still falls on the final syllable in these cases because the metrical constituents are right-headed. In this manner, a right-headed analysis is able to correctly identify the location of stress for the data presented to this point. The following discussion of the special behavior of some suffixes will allow us to distinguish between the analyses in (32) and (34).

The following words have antepenultimate stress.

(35a)  `m.o.a.ga.ru.ŋa. + di`  `their noses`

b)  `ú.do.ʔ + i`  `I took it`

c)  `è.ta.ù.ta.tʃna. + lo`  `far away inland`

Chaski (1986) argues that these words have antepenultimate stress because they have suffixes (as indicated with the “+”) which are lexically marked as extrametrical. To maintain an analysis using right-headed constituents, one would have to assign stress prior to the addition of these affixes. In (35a) and (35c) the suffix is identical to the final syllable, so the analysis with right-headed constituents
can correctly locate stress. In (35b) the suffix is merely the final vowel. This suffix interacts with the syllabification procedures to affect foot construction. If the suffix in (b) is not present at the time of foot construction, the final syllable will be heavy, since the form will be [u.do?]. Making the second mora of the final syllable extrametrical and constructing a right-headed constituent will still put stress on [do]. This is incorrect and hence a challenge to an analysis with right-headed feet.

Lexical extrametricality and its interaction with syllabification is particularly interesting in the case of the third-singular adnominal suffix, which is reported to be a zero-morpheme. When this morpheme attaches to a root, it makes the final syllable extrametrical and hence primary stress is located on the antepenult. This is illustrated in (36).

(36)

/mo.a.ga.ruŋa + Ø/

[mo.a.gá.ruŋa] 'his nose'

This zero morpheme, which is among the set of morphemes which are lexically marked as extrametrical, is incorporated into the root, leading to the extrametricality of the root final syllable. In addition to the interest which this case holds for further development of a theory of extrametricality, it is also devastating to any attempt to analyze the quantity sensitive stress system of Manam with right-headed constituents since one could not plausibly maintain that the final syllable of
the root is added after stress is assigned. The right-headed analysis in (34) incorrectly predicts stress on the penultimate syllable of this word.\textsuperscript{15}

In summary, I have argued here that Manam stress can be predicted by assigning left-headed quantity-sensitive feet from right to left. The presence of secondary stress demonstrates that this rule is an iterating one. Certain suffixes trigger antepenultimate stress and these are treated as having lexical marking for extrametricality. It was demonstrated, however, that these lexically EM suffixes must be present at the time of stress assignment because of their interaction with the syllabification and hence the foot construction processes. In light of this, an analysis with right-headed constituents is not available and Manam is shows to be a case with iterating, left-headed, uneven feet.

2.1.4 Summary

It is well established that there are languages with iambic stress patterns which are sensitive to the internal structure of the syllables of the word, i.e., which are quantity sensitive, cf. Hayes (1981, 1985). What has not been well established is the converse situation. This section has begun to establish those cases by examining patterns which employ iterating, uneven, left-headed feet. The next section briefly examines three cases which are proposed to have non-iterating, uneven left-headed feet.

\textsuperscript{15} An alternative analysis of these suffixes is given in Ito (1989). Her proposal uses left-headed constituents, but a cyclic analysis in which the suffixes are added after stress is assigned to the root. Ito's focus is on the interaction of these suffixes with clitics, however her cyclic analysis is not able to give an analysis for data such as that in (36).
2.2 Non-iterating quantity-sensitive trochees

The first cases I present are those in which one foot is constructed. The three cases discussed below are Latin, English, and Selayarese.

2.2.1 Latin

One well-known rule of metrical phonology assigning a left-headed quantity sensitive foot is the Latin Stress Rule. This rule, or variations thereof, applies not only in Latin, but in English and many other languages.

The main stress in a Latin word occurs on the antepenultimate syllable, unless the penultimate syllable is heavy. If there is no antepenultimate syllable, i.e., in disyllabic words, stress is also on the penult. The final syllable is never stressed.

The data in (37), from Wheelock (1956), illustrate the distribution of stress in Latin and they illustrate that both CV: and CVC constitute a heavy syllable in this language. The data in (37a) show that if the penultimate syllable is heavy, it receives stress. The data in (37b) and (37c) show that if the penultimate syllable is light, the antepenultimate syllable is stressed. The antepenult in the words in (37b) is light while it is heavy in the words in (37c). Long vowels are indicated with cola; syllables are separated by periods.

(37a)  lau.dá::re, mo.né::re, sal.vé::te, ma.gfs.ter
(b)   con.sf.li.um, re.mé.di.um, tem.pó:ri.bus, im.pé:ri.um
(c)   lau.dá::bi.tis, trac.tá:bi.lem, fór:ti.um, tem.pe:rán:ti.a
The traditional metrical analysis of these data is as follows.

(38) Latin Stress Rule
   a) Make the final syllable extrametrical.
   b) Construct left-headed quantity-sensitive feet from right to left, non-iteratively.

Constructing feet non-iteratively results in the construction of one foot. Recall that a quantity sensitive foot cannot have a heavy syllable as its non-head. In the three cases represented in (37), the effect of this procedure will be the following. When the penult is heavy, (37a), it cannot be the non-head of the left-headed constituent, so it becomes the head. Hence, it is stressed and nothing further happens since the rule is non-iterative. When the penult is light, as in (37b) and (37c), it is the non-head of a constituent which will be headed by the antepenult. Hence, the rules in (38) assign the same metrical representation to the words in (37b) and (37c) because both have light penults which are the non-heads and both have the antepenult as the head, regardless of its weight. The only difference is the fact that the syllable which heads the constituent constructed over the words in (37b) is light while that for the words of (37c) is heavy. Representative illustrations are given in (39).

(39)

\[
\begin{align*}
(x) & \quad (x,) \\
\text{ma.gis.<ter>} & \quad \text{im.pe.ri.<um>} & \quad \text{tem.pe. rán. ti. <a>}
\end{align*}
\]
The foot construction rules of (38) generate the structures in (39), (given in the notation on Hayes (1991)), demonstrating that the rules of (38) are able to correctly locate stress in Latin. However, an alternative analysis of Latin stress is advocated in the templatic theory of Hayes (1987, 1991).

In the templatic approach, the final syllable of a word in Latin is also extrametrical and a moraic trochee is constructed at the right edge of the word.\textsuperscript{16} This algorithm gives a result differing from that derived by (38) only for those words in (37c). Those in (37a) will have the penultimate syllable as a complete moraic trochee and those in (37b) will have the antepenultimate syllable as the head and the penult as the non–head, as in (39). In the cases from (37c), the light penult will remain unfooted and a moraic trochee will be constructed over the heavy penult.\textsuperscript{17} The analysis in the templatic approach is given in (40).

(40) Latin Stress Rule (templatic approach)

a) The final syllable is extrametrical.

b) Construct moraic trochees from right to left, non–iteratively.

This results in the structures in (41). Again, the only difference in the metrical constituency posited by the approaches in (38) and (40) is that the

\textsuperscript{16} Recall that a moraic trochee constructs a left–headed foot over a sequence of two light syllables, otherwise over one heavy syllable. The theory in Hayes (1987) includes the third option of constructing a stressless foot if there is neither a sequence of two lights nor a heavy.

\textsuperscript{17} Hayes (1987) would have constructed a stressless foot over a light penult following a heavy antepenult. The "stressless foot" is dropped in the (1991) version of the theory, hence it is not discussed here.
penultimate syllables in the words from (38c) are part of the foot in (39) while they remain unfooted in (41).

(41)

\[(\times)\quad \text{ma.gis.<ter>}\quad (\times \ .)\quad \text{im.pé.ri.<um>}\quad (\times)\quad \text{tem.pe. rán. ti. <a>}\]

Since Hayes (1987, 1991) gives no arguments for the footing in (41) which are specifically based on the phonology of Latin, research to determine the relative merits of (38) and (40) remains to be done.¹⁸ As it stands, Latin is a case in which the metrical system may be seen as utilizing Quantity Sensitivity, Left Headed feet.

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¹⁸ Mester (in progress) pursues this issue. Of course, a successful motivation of the stress–assigning procedure in Latin, e.g., as using the moraic trochee, does not eliminate the possibility that other languages employing the LSR nonetheless determine the location of stress with LH QS feet.

Some research contrasting the moraic trochee analysis of Latin with the LH QS approach has already appeared. For example, Jacobs (1989) compares these two analyses, attempting to find evidence to distinguish them. Three issues are pursued in that work. First, the claim is made that vowel reduction and deletion processes of Latin treat unstressed syllables the same, regardless of whether they follow a heavy or a light syllable, thereby failing to provide any evidence for the moraic trochee approach. Second, Jacobs notes that the theory of Hayes (1987) actually predicts that vowel reduction does not occur in trochaic systems; Latin is a counter–example to this claim. Finally, Jacobs discusses the transition from the stress rule of Latin to the Gallo–Romance stress rule and argues that an analysis of Latin with QS LH feet facilitates a better analysis of the change in the rule than would an analysis of Latin with moraic trochees.

Also, Sluyters (1990) argues that several segmental processes of Italian can be characterized by assuming a traditional quantity–sensitive left–headed foot at the right edge of the word. He claims that the correct characterization of these processes with reference to the LH QS foot constitute further challenges to an analysis with moraic trochees. For example, Sluyters discusses a process by which the heads of feet are lengthened and diphthongized. In a moraic trochee analysis, this process changes a licit (LL) constituent into an illicit (HL) constituent.
2.2.2 English

The distribution of stress in English also reflects the Latin Stress Rule. The analysis here is based on that developed in SPE. As noted in SPE, a contrast can be seen in English nouns; (42a) presents data with penultimate stress, and (42b) presents forms with antepenultimate stress.

(42a)  aróma  
       horízon  
       aréna  
       Minnesótá  

(42b)  América  
       jávelín  
       ásterisk  
       análisis  

As in Latin, the final syllables of these words are considered to be extrametrical. A single quantity sensitive left-headed foot is constructed. If the penult is light, as in the forms in (42b), then the head of the foot will be on the antepenult. However, if the penult is heavy, as in (42a), it cannot be a non-head of the foot, so it becomes the head, and primary stress is located there.

Latin and English and other languages which employ the LSR suggest the need for a QS LH foot in an adequate metrical theory.

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19 Int. al., Damascene Arabic,  
20 The formulation of the LSR has been called into doubt by some in part because of the lack of a mirror image case. I.e., it has been alleged that no language has a stress rule which says “stress the second syllable if heavy, else the third.” This claim is false. The main stress rule in Terena is essentially the mirror image of the LSR. Initial light syllables are made extrametrical and, with sufficient word length, stress falls on the third syllable unless the second syllable is heavy, in which case it falls on the second syllable. For further discussion see Harden (1946), Lee (1989), and Blevins (1990a).
2.2.3 Selayarese

Selayarese, an Austronesian language, has stress on the penultimate syllable in most words. I argue here that this is the result of constructing one uneven left-headed foot at the right edge of the word. Like Latin and English, this is a non-iterative foot construction process. Unlike those other cases, however, the unevenness of the foot follows from a template satisfaction process, filling the obligatory second mora in the head since the mapping is Strong. This discussion is based on Mithun and Basri (1986).

The syllable structure of Selayarese is (C)V(C). There is no underlying length contrast among the vowels and underlying sequences of vowels are hetero-syllabic. Some data illustrating the distribution of stress are given in (43). Syllable boundaries are marked with periods.

(43a)  å1.10  ‘day’
(b)  pà.o  ‘mango’
(c)  já.ma  ‘work’
(d)  a1.ló.ní  ‘this day’
(e)  pà.ó.ku  ‘my mango’
(f)  pà.på1.lú.aŋ  ‘place for cooking’
(g)  a1.lañ.ne.ré.a  ‘I heard’

The stress assignment procedure is proposed to be as in (44).
(44) Selayarese Stress Assignment

a) Template: (H N)
b) Direction: Right to Left
c) Mapping: Uneven: Strong: Tautosyllabic
d) Final consonant is extrametrical
d) Non–iterative

The phonology of Selayarese contains a phonological rule lengthening stressed vowels in open syllables. Mithun and Bağı (1986) give this rule segmentally as in (45) (p. 226). (The “$” represents a syllable boundary.)

(45) Selayarese Vowel Lengthening

\[
V_{\text{[+stress]}} \rightarrow [+\text{long}] / \ldots \$ 
\]

The syllable boundary is a crucial component of the structural description of this rule because a stressed vowel in a closed syllable is not lengthened. The application of (45) to the relevant forms in (43), i.e., those with open penultimate syllables, yields the phonetic forms in (46).

(46a) [pá: o] ‘mango’
(b) [já:i ma] ‘work’
(c) [pa:ói ku] ‘my mango’
(d) [pap:pa1, lú: an] ‘place for cooking’
(e) [a1, lan: ne ré: a] ‘I heard’
The restriction of the lengthening rule to open syllables is particularly clear in
the words in (47). (47a,b) and (47c,d) are pairs in which the first member has an
open penultimate syllable and the second member has a closed penultimate syllable.
In all four words, the penult is stressed, as predicted by (44). However, the
lengthening rule, (45), applies only to (47a) and (47c).

(47a) /sasa/ [sáːsa] ‘cut (grass)’
(b) /sassa/ [sás.sə] ‘wash’

(c) /apə/ [ʔáːpa] ‘what?’
(d) /appaʔ/ [ʔáːp.paʔ] ‘four’

Rule (45) serves to add weight to the head of the constituent. If the head
syllable is closed, then it is already sufficiently heavy to be the head of a foot, i.e., to
bear stress. However, if the syllable lacks a coda consonant, it must be augmented.
In Selayarese, this augmentation takes the form of a vowel lengthening rule. This
rule suggest that there is a well-formedness requirement on the foot: the head must
be heavy. In the terms of metrical constituent construction proposed in §4 of chapter
one, this process in Selayarese is understood as a template satisfaction process. The
specification of the template as “strong” designates a template in which the head must
be bi–moraic. A closed penult is bi–moraic and therefore satisfies a bi–moraic
head. However, an open penult does not satisfy the template and so the vowel spreads to the second mora, creating a long vowel in the stressed syllable.

This case should be understood as an instance of trochaic lengthening and is therefore a parallel to right–headed cases which show lengthening processes affecting heads. The existence of such a case bolsters the claim that the foot typology is symmetric since there are cases of lengthening the head of a foot, regardless of the edge at which the head is to be found.

2.2.4 Summary

In the sub–groups of §2.2, three analyses employing a single left–headed uneven foot have been demonstrated. Latin and English were used to illustrate the Latin Stress Rule. The analysis of Selayarese resembles the LSR insofar as a single left–headed foot is constructed at the right edge of the word. However, in Selayarese a template satisfaction process applies with the effect of augmenting the stressed syllable if it is mono–moraic.

The next section continues providing evidence for the existence of uneven, left–headed feet by turning to a yet–unillustrated mapping procedure, the Strong,

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21 Hence, consonant final forms such as (43f) suggest that a final consonant is extrametrical since a final closed syllable does not attract stress.

22 Such lengthening processes in iambic systems are well documented, cf. Central Alaskan Yupik in which a mono–moraic syllable can be a head, but when this happens, the syllable is subject to augmentation so that the heads of all constituents surface as bi–moraic. (See Woodbury (1987) for extensive discussion and analysis.)
Non-tautosyllabic mapping. This will be illustrated here with Gidabal, Old English, and Cayuvava, and again in chapter three with respect to Chugach.

2.3 Di-syllabic heads

When the head of a metrical constituent must be bi-moraic and the mapping is non-tautosyllabic, syllable boundaries may be crossed to gather sufficient material for a head. Three languages which allow this possibility are presented in this section. Gidabal is discussed in §2.3.1. The stress pattern and a shortening process in Gidabal suggest metrical structure which consists of left-headed feet. It will be shown that at the beginning of a word the head of this foot can be drawn from to light syllables.

The stress pattern of Old English and a vowel deletion process in that language are the topic of §2.3.2. This section constitutes a re-analysis of the data presented in Dresher and Lahiri (1991) and presents that claim that metrical theory does not need to admit their “Germanic foot.” The proposal here is that Old English employs iterating uneven left-headed feet. Of special note is that the bi-moraicity requirement on the head can be fulfilled by crossing syllable boundaries.

In §2.3.3, an analysis of Cayuvava is presented which is essentially the same as the analysis for Old English; the languages differ in that Cayuvava lacks bi-moraic syllables. The analysis of Cayuvava is simply a re-phrasing of that offered by Dresher and Lahiri (1991) and begins to demonstrate the analysis which will be claimed for an iterative ternary pattern based on the proposal in chapter one.
The importance of these analysis is to demonstrate the operation of non-tautosyllabic footing and its tolerance for the violation of syllable boundaries.

2.3.1 Gidabal

The Gidabal language presents a segmental process of vowel shortening which can be characterized with reference to metrical structure. This characterization, along with the distribution of stress, suggests iterating metrical constituents which are left-headed, uneven, strong and exhaustively mapped. Hence, Gidabal will be the first case in which a syllable boundary may be crossed to gather the necessary bi-moraic content for a head. This procedure is illustrated in connection with the initial stresses on these words and is discussed after a consideration of another part of the distribution of stress and the shortening process.

The inventory of underlying vowels in Gidabal, as reported in Geytenbeek and Geytenbeek (1971), consists of [i,i:,e,e:,a,a:,u,u:]. Geytenbeek and Geytenbeek argue that the length contrast is underlying because the eight phonemes “contrast in all vowel positions” (p. 3); i.e., they demonstrate that vowel length is not predictable.

There are two generalizations about the distribution of stress throughout the Gidabal word. Stress occurs on the initial syllable of a word, regardless of weight and stress occurs on every syllable containing a long vowel. There are, however, systematic exceptions to both of these claims, which will be discussed below.

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23 Gidabal is a dialect of the Bandjalang language group of Australia, historically spoken in the north eastern corner of New South Wales and the south eastern corner of Queensland. Geytenbeek and Geytenbeek (1971) reported two dozen remaining speakers.
Geytenbeek and Geytenbeek propose no distinction between primary and secondary stress and, in those forms for which they give careful phonetic transcriptions, multiple stresses within a word are all indicated with the same diacritic. Hence, the stresses are assumed here to be of equal prominence and quality. Some examples of the Gidabal data are given in (48).

(48a)  gáwanj  ‘mother’s brother’

b)  dílingiř  ‘sparks’

c)  mándarài:m  ‘wild raspberry’

d)  gáŋgalé:n  ‘was bringing’

e)  gáwaŋiwa:jla  ‘is definitely running’

f)  námal  ‘a holder’

g)  mánal  ‘ripe’

h)  gábalmiŋ  ‘towards the scrub’

i)  gábalŋinj  ‘scrub-dweller’

j)  námaliŋ  ‘a holding’

Discussion of exceptions to the appearance of initial stress is deferred. The generalization about stress on every heavy syllable is addressed first. As noted, Geytenbeek and Geytenbeek claim that there is stress on every syllable containing a long vowel. However, a study of their grammar and dictionary reveals that there are syllables with underlying long vowels which surface with short vowels and no
stress. The claim that stress occurs on every syllable with a long vowel must be modified to state that in Gidabal there is stress on every syllable which surfaces with a long vowel. Geytenbeek and Geytenbeek put forth the claim that “long vowels do not seem to occur in two consecutive syllables within a word” (p. 2). When morphological concatenation results in adjacent strings of syllables all of which have long vowels, the even numbered syllables in that string surface with a short vowel. That is, the second, fourth, etc., consecutive syllables containing underlying long vowels will surface with short vowels and no stress. Data illustrating this are given in (49).

(49a.1)  /djalum + baː + daŋ + beː/
        fish   locpr  intens  intens

a.2)  [djalumbá:danbéː]  ‘is certainly right on the fish’

b.1)  /gnumim + baː + daŋ + beː/
        stump   locpr  intens  intens

b.2)  [gnumú:mbadáŋbe]  ‘is certainly right on the stump’

c.1)  /geːkiː + inj/
        pour    future

c.2)  [géːkbenj]  ‘will pour’

The di–syllabic stem in (49a.1) consists of two syllables with short vowels. Three mono–syllabic morphemes are suffixed to this stem, each of which
Geytenbeek and Geytenbeek posit as having a long vowel in its underlying representation. The surface form of this word, in (49a.2), shows the shortening of the second of those three suffixes. The di–syllabic stem in (49b.1) has a long vowel in the second syllable; suffixing the same three morphemes as in (49a.1) to this stem generates a string of four consecutive syllables in which there are long vowels. As seen in (49b.2), the second and fourth of these are shortened, i.e., those in the first and third suffixes are shortened. The first syllable of the di–syllabic stem in (49c.1) contains a long vowel. Geytenbeek and Geytenbeek argue that several suffixes, among them the future marker, add length to the final vowel of the stem and they therefore posit this length as part of the underlying representation of the suffix. Adding this suffix to the stem in (49c.1) will lead to the lengthening of the final vowel, hence a sequence of two syllables with long vowels. The second of the syllables is shortened, as illustrated in (49c.2).

I propose that the shortening process illustrated in the preceding data is sensitive to metrical structure. Such sensitivity is suggested by two characteristics of the process: it is iterative and it applies to alternating syllables. The first part of the analysis of the distribution of stress in Gidabal which is presented here is that which will locate stress on the heavy syllables and which correctly predicts the location of vowel shortening. Location stress on the word-initial syllables is considered subsequently.

Gidabal locates stress and the sites for vowel–shortening by constructing left–headed constituents iteratively from left to right across the word. The left–

---

headed templates are mapped in an uneven, strong, exhaustive manner. Heads must be bi-moraic and bi-moraic syllables must be heads; non-heads must be mono-moraic. A degenerate foot is removed under clash, i.e., when there are heads on adjacent syllables. When both of the feet which are in a clash are degenerate, the rightmost one is removed. The syllables which are not in a metrical foot due to clash resolution are stray-adjoined leftward. Vowel shortening applies to syllables with long vowels which are in metrically weak positions. This procedure for assigning stress is stated below, and is then illustrated and defended.

(50) Gidabal metrical constituent assignment

a) Template: (H N).

b) Mapping: Uneven, Strong, Non-tautosyllabic.

c) Direction: Left to Right.

d) Clash: stress on adjacent syllables; Resolution: remove the degenerate foot, else remove the rightmost foot.

e) Stray adjoin unfooted syllables leftward.

As noted above, a discussion of the circumstances in which an initial syllable can surface without stress is being deferred until (50) has been illustrated. However, it is now possible to see how those cases with initial light stress will be assigned. An initial sequence of two light syllables will constitute a bi-moraic head. Part of the evidence for this claim is that a search of Geytenbeek and Geytenbeek’s dictionary reveals that the longest string of light syllables before a heavy syllable is
three. In these words, stress occurs on the initial syllable and on the heavy syllable, suggesting that the three light syllables are equivalent to one foot, i.e., that they are equivalent to a bi-moraic head with a mono-moraic non-head. Because stress is on the initial syllable, the foot is taken to be left-headed. Illustrations of this pattern are seen in (51a) and (51d).

The stress assigning algorithm given in (50) is illustrated with some examples in (51). The moraic content of words is projected above the word. The two moras which constitute a head are placed within square brackets and the remaining notation is familiar.

(51)
a) \((x .)\) b) \((x \quad x)\)
\([\mu \quad \mu] \quad \mu\) \([\mu \quad \mu] \quad [\mu \mu]\)
d\(\text{d\ i\ n\ g\ i\ r}\) m\(\text{\a\n\d\a\ \r\}\) m

c) \((x .)\) \((x .)\) d) \((x .)\) \((x .)\)
\([\mu \mu] \quad \mu\) \([\mu \mu]\) \([\mu \mu]\) \([\mu \mu]\) \([\mu \mu]\)
g\(\text{\a\i\ n}\) n a l e n g\(\text{\a\i\ a\w a\ \r\}\) i w\(\text{\a\i\ l}\) a

There are no syllables with long vowels in (51a); the first two light syllables constitute the head of a foot and the third syllable is the non-head. This correctly predicts the occurrence of stress on the initial syllable, assuming that stress surfaces on the left of the two moras in the head in Gidabal, like Cayuvava and Old English below, but unlike Chugach in chapter three. In (51b), the first two light syllables
again constitute the first head. However, that constituent cannot be completed
without violating the integrity of the third syllable, so a second constituent is begun
with the third syllable. Since the heads are not on adjacent syllables, they do not
clash and stress surfaces on the first and third syllables.

There are two syllables with long vowels in (51c). The first and second
syllables constitute the first constituent and the final syllable is a degenerate foot.
Finally in (51d) there are two full feet. The first foot consists of the first three
syllables and the second one consists of the last two. Stress is correctly predicted to
occur on the first and fourth syllables.

The examples in (53) are cases which illustrate clash and the resolution of
clash. Recall that syllables which lose their metrical structure by clash resolution
will be adjoined leftward. These syllables then undergo a shortening process, with
the result that the feet to which they were adjoined are well formed, with bi–moraic
heads and mono–moraic non–heads. The shortening rule is given in (52).

(52) Gidabal vowel–shortening
A long vowel in a weak branch of a metrical constituent is shortened.\textsuperscript{25}

\textsuperscript{25} After stray–adjunction, but before vowel shortening, the feet which are proscribed have
a heavy syllable in both the head and the non–head. Indeed, it is this situation which is construed
here as compelling shortening. However, feet with heavy heads and non–heads have been proposed
in the literature, in Hammond (1986); this is his Revised Obligatory Branching foot. The Gidabal
foot construction and vowel shortening process could be described in Hammond’s system as
constructing underlying left–headed ROB feet and then converting them to left–headed OB feet.
Hammond’s proposal, however, is to eliminate the OB foot, so it is not clear how Hammond’s
approach to metrical structure assignment would construe the Gidabal facts.
(53a.1)  
(x (x (x (x 
[μ μ] [μμ][μμ][μμ] 
djalumbaidanbbei:

(53a.2)  
(x (x (x 
[μ μ] [μμ][μμ][μμ] 
djalumbaidanbbei:

(53a.3)  
(x (x .) (x 
[μ μ] [μμ] μμ [μμ] 
djalumbaidanbbei:

(53a.4)  
(x (x .) (x 
[μ μ] [μμ] μ [μμ] 
djalumbaidanbbei:

[djalumbaidanbbei]  

(53b.1)  
(x)(x (x (x (x 
μ [μμ] [μμ][μμ][μμ] 
gunuimbaidanbbei:


(53b.2) \( (x) (x) \)
\[ \mu [\mu \mu] [\mu \mu][\mu \mu][\mu \mu] \]
\[ \text{gunú:mba:da:ƞbe:} \]

(53b.3) \( (x \ .) (x \ .) \)
\[ \mu [\mu \mu] \mu [\mu \mu] \mu \]
\[ \text{gunú:mba:da:ƞbe:} \]

(53b.4) \( (x \ .) (x \ .) \)
\[ \mu [\mu \mu] \mu [\mu \mu] \mu \]
\[ \text{gunú:mba:da:ƞbe:} \]
\[ [\text{gunú:mba:da:ƞbe:}] \]

(53c.1)
\( (x) (x) \)
\[ [\mu \mu] [\mu \mu] \]
\[ \text{ge:ƞbii:nj} \]

(53c.2)
\( (x) \)
\[ [\mu \mu] \mu \mu \]
\[ \text{ge:ƞbii:nj} \]
(53c.3)  (x  .)
[μμ]  μμ
gei\text{mbinj}

(53c.4)  (x  .)
[μμ]  μ
definj

[gei\text{mbenj}]

In (53a.1), the first foot consists of just a head, constituted by the first two light syllables. Each remaining syllable is footed as a degenerate foot because all of them are heavy. The first two heads are not on adjacent syllables and therefore do not clash. The second and third heads are, however, in a clashing relationship which results in the remove of the third head, as illustrated in (53a.2). The stray-adjunction of that syllable leftward is illustrated in (53a.3) and the shortening of the long vowel in the metrically weak position is represented in (53a.4).

The derivation of (53b) is parallel to that for (53a), however one point of the derivation requires comment. The first two heads are clashing in (53b.1) because they are on adjacent syllables. In this case, apparently counter to the clash resolution procedure specified for Gidabal, it is the leftmost head which is removed. As will be discussed further below, mono-moraic heads are unstable in this position and this is an example in which de-forestation applies to a mono-moraic foot, even though it is in to the leftmost of the clashing pair. Given this, the initial foot is deleted; that syllable is left unfooted as there is nothing to the left for it to stray adjoin to, and the shortening process correctly applies to the third and fifth syllables.
In (53c) there are only two syllables, both of which have long vowels after concatenation. The rightmost foot is removed due to clash resolution, as shown in (53c.2), and it is stray adjoined, (53c.3), and the vowel is subsequently shortened, (53c.4). The derivations in (53) illustrate the iterative footing, the clash resolution process and the rule of vowel shortening.

Segmental modification to create metrical constituents in which the elements are of uneven duration has been claimed to be characteristic of iambic systems, cf. the discussion of Central Alaskan Yupik in Hayes (1987). In contrast with this asserted generalization, I have argued that Gidabal displays a shortening rule which yields feet with uneven elements, but that these feet are left-headed.

The final points to be discussed are related to the circumstances under which an initial vowel may be unstressed. In connection with this phenomenon, I will also argue that an analysis with right-headed constituents is untenable. This argument is necessary since, as noted above, established characteristics of iambic systems lead to the initial inclination to attempt an analysis of Gidabal which uses such constituents.

There are two related circumstances under which an initial syllable in a Gidabal word is not stressed. The first case is restricted to words which are di-syllabic and which consist of a light initial syllable followed by a heavy second syllable. With a word of this shape, stress is optionally absent from the first syllable. Stress will appear on either the first or the second syllable, but not on both. The second case in which an initial syllable is not stressed is in words which are longer than two syllables, but which begin with the pattern of the di-syllabic words just discussed. In words of more than two syllables in which the initial syllable is
light and the second syllable is heavy, the initial syllable obligatorily lacks stress. Examples illustrating these generalizations are given below.

(54a) djúluːn ~ djulúːn ‘common grass skink’

b) bängaːi ~ bæŋɡáːi ‘kick’ (imp.)

c) djáŋgaːi ~ djaŋgáːi ‘in wickedness’

d) djáŋkáːm ~ djaŋkáːm ‘belt’

(e) yagáːla (*yáɡaːla) ‘fixes’

f) yanfínden (*yáŋínden) ‘went’

g) ŋamáːla (*ŋámaːla) ‘on the goanna’

The first case in which an initial syllable can be absent is illustrated with (54a–d), in which both syllables are potentially stressed. In (54e–g), the first syllable cannot be stressed. The proposed analysis of these cases is as follows.

In the di–syllabic cases, there will be two degenerate feet, with each foot consisting of one syllable. The first foot consists only of a light syllable and the second one consists of a heavy syllable. The clash resolution rule for Gidabal removes the rightmost of two clashing constituents and when this rule is employed, the surface result is stress on the initial syllable. Competition for the clash resolution rule seems to be related to the relative weight of these two syllables. In addition to being lighter than the second foot, the first foot lacks even enough moraic material to have a head. This weight difference apparently makes the initial foot a target for
deletion in this case. In a sense, this is derived from the observation that it is the
degenerate foot which is removed in a clash. In the case in question, both feet are
technically degenerate, but one is more degenerate than the other, and it is apparently
therefore subject to removal regardless of its position.

The words which are longer than two syllables will also have an initial foot
which is mono-moraic, since the second syllable is heavy. In these cases, the
removal of the initial foot follows the observation that it is the degenerate foot which
is removed in a clash. For example, when the third syllable is light, then the second
and third syllables will constitute a full foot which clashes with the initial foot.
Because the initial foot is degenerate, it is removed. When the third syllable is
heavy, as in (53b), then the initial two syllables are both degenerate, parallel to the
situation for (54a–d). The presence of syllables subsequent to the second one (or,
more teleologically, anticipation of the eventual fulness of the second foot) remove
the option of deleting the second foot; only the initial foot may be removed in this
situation.

Note that in the di-syllabic forms, the second syllable is not shortened when
it is de-footed. When it is the second syllable which is de-footed, I assume that
stray-adjunction cannot occur. Such adjunction is impossible here because doing so
would create a foot with a mono-moraic head and a bi-moraic non-head. This
would violate a general condition on foot structures which is that the head must be
equal to or greater than the non-head in weight, or, conversely, the non-head may
not be heavier than the head.26

26 This follows from the “Quantity/Prominence Homology” of McCarthy and Prince
(1986, p. 9). This principle states the for a,b which are elements of a foot, if a>b quantitatively
To conclude the discussion of Gidabal, the possibility of an analysis with right-headed constituents is considered. I assume that an analysis with right-headed constituents would construct feet over each heavy syllable, as with the analysis given above. De-forestation under clash occurs, but with the right-headed analysis, the syllables lacking metrical structure are stray–adjoined rightward. The creates two heavy syllables in a right-headed foot and the shortening rule applies, which in this analysis has the effect of creating a uneven right-headed foot. As noted above, iambic feet are proposed by Hayes (1987, 1991) to have unevenness as their canonical shape, which makes an analysis of Gidabal with right-headed constituents appealing. Unfortunately, this analysis has empirical shortcomings.

Reconsider the forms with iterative shortening, (49), as given in (55).

(55)

a.1) /djalum + baː + daːŋ + beː:/
    fish locpr intens intens
a.2) [djalumbāːdaŋbēː] ‘is certainly right on the fish’

b.1) /gunūːm + baː + daːŋ + beː:/
    stump locpr intens intens
b.2) [gunūːmbadāːŋbeː] ‘is certainly right on the stump’

then a>b stresswise. Adjoining the heavy syllable to the light, stressed syllable under discussion in this section would generate the intolerable situation in which a>b quantitatively but a<b stresswise.
The shortening in (55a) follows from removing the foot on the penult, due to clash, stray–adjoining this syllable to the final foot, and shortening. This creates a canonical iamb at the right edge of the word.

In (55b), the feet over the ultima and the antepenult are removed due to clash. The antepenult is adjoined rightward and shortened. The ultima cannot be adjoined rightward, but it is nonetheless shortened. The shortening of the ultima here deserves two comments. First, the distinction between unfooted syllables and syllables in the weak branch of a foot is eliminated. This result creates problems for a right–headed analysis of the di–syllabic cases. Recall that in words consisting entirely of a light syllable plus a heavy syllable, the initial syllable may be stressed without subsequent shortening of the final syllable. More importantly, however, the conceptualization of the shortening process as one which creates optimally shaped feet cannot be maintained in all cases. The shortening of the final syllable in (55b) does nothing to create a well formed foot since it is not part of any foot. Nonetheless, these conceptual objections aside, an analysis with right–headed constituents can correctly derive the alternating shortening seen in (55).

The analysis with right–headed constituents does not straightforwardly account for the data in (54a–d). That is, the analysis is unable to speak to those cases in which initial stress is optionally absent, as demonstrated below. An iambic analysis will foot as one metrical constituent a di–syllabic word containing a light syllable followed by a heavy syllable. This predicts stress on the second syllable, which is one of the options. However, the analysis is unable to predict stress on the initial syllable. Furthermore, if the iambic analysis were able to make the first syllable a head, since it lacks the distinction between unfooted and metrically weak
syllables, it would be unable to predict the non-application of shortening on the long vowel in the second syllable.

A right-headed analysis of Gidabal metrical structure is undesirable for two reasons. First, it is unable to capture the view that shortening applies to create a well-formed uneven foot, since in the right-headed analysis there are cases in which unfooted syllables must be shortened. Second, the right-headed analysis is unable to address the fact of free variation with respect to stress placement on di-syllabic words consisting of a light syllable followed by a heavy syllable. These deficiencies along side the adequacy of the analysis with left-headed constituents leave the trochaic analysis as the only viable option.

In conclusion, the assignment of metrical structure in Gidabal is interesting for a number of reasons. Heads in Gidabal must be bi-moraic, and the crossing of a syllable boundary is tolerated to meet this requirement, with the only restriction being the assumption from chapter one that syllable integrity may not be violated. Furthermore, Gidabal feet have a surface well-formedness requirement, namely that the non-head be mono-moraic; this requirement is instantiated with a rule which shortens vowels in the weak branch of a metrical constituent. In support of the claim that the inventory of extant foot types is symmetric, the facts of Gidabal are presented as a case in which the feet are uneven but crucially left-headed.27

27 As noted in the discussion and the final sentence of this section, the crucial point in the discussion of Gidabal is that the surface metrification has left-headed constituents with bi-moraic heads and mono-moraic non-heads. Nonetheless, there are aspects of the metrical structure of this language which deserve further research. First, the suffixes which are presented all have length in the proposed underlying representations. This is noteworthy and suggests that one investigate the possibility that the facts of Gidabal are derived with a lengthening process, instead of a shortening process. Given the presence of a short vowel in initial light stressed syllables, a lengthening analysis has not been presented here.

Furthermore, the analysis presented here does not entirely capture the intuition that Gidabal might be construed as a case in which a sequence of two heavies are mapped to a single template and
2.3.2 *Old English*

Dresher and Lahiri (1991) argue from the distribution of primary and secondary stress and from a particular view of the environment for High Vowel Deletion (HVD) that Old English has a stress foot in which the head can consist either of a heavy syllable (H), two light syllables (LL), or a light and a heavy syllable (LH). They name this foot, novel in metrical theory due to its tolerance of an LH head, the Germanic Foot.\(^{28}\) I will argue here that the facts of Old English do not compel this enhancement of the primitives of metrical theory. Rather, the distribution of stress and HVD in Old English can be analyzed within a theory that has a symmetric inventory of feet. The facts of Old English are analyzed as having uneven, strong, non–tautosyllabic mapping of left–headed feet.

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\(^{28}\) Dresher and Lahiri (1991) are concerned with investigating the possibility of "metrical coherence" in "Old English and early Germanic generally" (p. 251). The present concern is restricted to the interaction of High Vowel Deletion and stress assignment in Old English. In addition to the interaction of these two phonological processes, Dresher and Lahiri also discuss Old English poetics and they present an analysis of Siever's Law in Gothic. The poetics issues receive further discussion below.
The data under consideration are given in (56–61); these come from Dresher and Lahiri (1991), except where noted with C, indicating Campbell (1959). The surface forms show both the distribution of stress and the effects of HVD.

<table>
<thead>
<tr>
<th>Underlying</th>
<th>Surface</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>56a) /goodu/</td>
<td>[góod]</td>
<td>‘good’</td>
</tr>
<tr>
<td>b) /wordu/</td>
<td>[wórd]</td>
<td>‘words’</td>
</tr>
<tr>
<td>c) /werudu/</td>
<td>[wérud]</td>
<td>‘troops’</td>
</tr>
<tr>
<td>69a) /heafudes/</td>
<td>[héafdes]</td>
<td>‘head’</td>
</tr>
<tr>
<td>b) /niitenu/</td>
<td>[nítenu]</td>
<td>‘animals’</td>
</tr>
<tr>
<td>c) /lofum/</td>
<td>[lófum]</td>
<td>‘praise’</td>
</tr>
<tr>
<td>d) /ooθer/</td>
<td>[óoθer]</td>
<td>‘other’</td>
</tr>
<tr>
<td>e) /æθeling/</td>
<td>[æθeling]</td>
<td>‘prince’</td>
</tr>
<tr>
<td>70) /lofu/</td>
<td>[lófu]</td>
<td>‘praises’</td>
</tr>
<tr>
<td>59a) /ooθerne/</td>
<td>[óoθèrne]</td>
<td>‘other’</td>
</tr>
<tr>
<td>b) /færeldu/</td>
<td>[færeld]</td>
<td>‘journey’</td>
</tr>
<tr>
<td>c) /cyninga/</td>
<td>[cýninga]</td>
<td>‘king’</td>
</tr>
<tr>
<td>d) /wesende/</td>
<td>[wésende]</td>
<td>‘to be’</td>
</tr>
<tr>
<td>e) /inwidda/</td>
<td>[ínwidda]</td>
<td>(C)</td>
</tr>
<tr>
<td>f) /onsæge/</td>
<td>[ónsæge]</td>
<td>(C)</td>
</tr>
<tr>
<td>g) /singende/</td>
<td>[síngènde]</td>
<td>(C)</td>
</tr>
</tbody>
</table>
60a) /æðelinges/ [æθelinges] ‘prince’
b) /cyninges/ [cýninges] ‘king’
c) /hláafordes/ [hláafōrdes] (C)

As illustrated by these data, primary stress occurs on the word–initial syllable. The distribution of secondary stress is inferred from other phenomena. Dresher and Lahiri note that “what we know of secondary stress is based on indirect evidence such as vowel reduction and verse” (p. 259). They describe the distribution of secondary stress, drawing on Campbell (1959: §§87–92):

“Secondary stress falls on any heavy syllable after a heavy syllable or its equivalent when it becomes internal by addition of an inflection [cf. 59a and 60a]

... There is no secondary stress on a final syllable [cf. 69d and 69e], or on a syllable following an initial light syllable, (59d and 60b)” (p. 259–60).

This description of secondary stress is incorporated into the treatment of metrical structure in the form of two destressing rules. The description noting the absence of stress on final syllables is taken at face value: degenerate feet in final position are removed. Stress on a syllable immediately following a initial light syllable clashes with the stress on that light syllable and is therefore removed.29

29 Dresher and Lahiri follow Campbell by characterizing “a heavy syllable or its equivalent” as LX, in which X can be either a light or a heavy syllable. I note, however, that in all of Campbell’s examples illustrating his description of the distribution of secondary stress, the secondary stress follows either a heavy syllable or a sequence of two light syllables.
The proposed rules for stress assignment and HVD are as follows.

(61a) Template: (H N)


c) (Syllable boundaries may be crossed to gather sufficient material for a head.)

30

d) Allow degenerate feet.

e) End Rule Left

f) Remove high vowels from metrically weak positions. (HVD)

g) Remove the rightmost of two heads on adjacent moras. (Clash Resolution)

h) Remove final degenerate feet.

The components of this process given in (61b,c,d) are from Dresher and Lahiri. The foot type employed here, as stated in (61b), has a bi–moraic head and a mono–moraic non–head. In the terminology of Hayes (1981), this would be a quantity sensitive, left–headed foot, a foot type whose existence has been called into question recently, e.g., in Hayes (1987, 1991). HVD is given in (61f), which also follows Dresher and Lahiri. The restrictions on the distribution of secondary stress are encoded in (61g) and (61h). This proposal is illustrated with the derivations of representative forms from (56–60).

30 This is assumed to follow from exhaustivity and the bi–moraicity requirement on heads and is included here by explicit statement to show the relationship to Dresher and Lahiri’s proposal.
The words in (56) will all have exactly one unbalanced foot, with a bi-
moraic head and a mono-moraic non-head. In (56a) and (56b), the head of the foot
coincides with the first syllable, as is illustrated with (56a) in (62). Note that both
CVV and CVC are heavy.

(62)

\[
\begin{array}{c}
(x) \\
(x) \\
[\mu \mu] \\
g \ o \ o \ d \ u
\end{array}
\]

In both (56a) and (56b), the vowel in the metrically weak position is high
and is therefore subject to HVD, (61f). The head of the foot for (56c), as illustrated
in (63), is drawn from the first two syllables, both of which are light. This is
permitted by (61c) and leads to no violation of syllable integrity, (61b). As with
(56a,b=62), the vowel in the metrically weak position of (56c) is high and is deleted
by HVD.

(63)

\[
\begin{array}{c}
(x) \\
(x) \\
[\mu \mu] \\
w \ e \ r \ u \ d \ u
\end{array}
\]

\footnote{Heavy syllables are CVX; since weight is relevant to the foot construction process, the
moraic content of the word in question is represented immediately above the word. The moras
which constitute the head of the constituent are enclosed in brackets.}
The words in (69) all end a degenerate foot. There is no secondary stress on these words and they serve to illustrate the operation of (61h). In (69a), /heafudes/, the structure for the first two syllables will be as for (56a,b=62). The third syllable, which is closed and hence heavy, is the head of a degenerate foot. This is illustrated in (64).

(64)

\[
\begin{array}{c}
\text{x} \\
\text{x .} \\
\text{[μ μ] μ [μ μ]}
\end{array}
\]

\text{h é a f u d e s}

The high vowel of the second syllable in (64) is in a metrically weak position and is therefore deleted by HVD. The remaining two heads are not on adjacent moras, hence Clash Resolution does not apply. However, the final foot is degenerate and is removed by (61h).

The metrical structure for (69b), /niıtenu/, is parallel to that for (69a=64), except that the final syllable is mono-moraic. Nonetheless, a degenerate foot is built over this syllable, blocking the application of HVD. This degenerate foot will eventually be removed by (61h). The foot building rules of (61) give the following form.
In the disyllabic (69d), /ooθer/, both syllables are heavy. There is no secondary stress on the second syllable. The result of rules (61a–d) is given in (66). The second foot will be removed by (61h) because it is degenerate and final.

The LLH sequence in (69e), /æθeling/, leads to the construction of two degenerate feet. The first two light syllables will constitute the head of the first foot, which cannot be completed without violating the integrity of the third syllable. The final heavy syllable is the head of a second foot, hence the vowel in that syllable is immune to HVD. The absence of secondary stress on the final syllable follows from the removal of the second foot by (61h).
The footing of (70), /löfö/, as illustrated in (68), resembles that of (56c=63 and 69e=67) insofar as the head consists of two light syllables. There is no further material to foot, hence this foot is degenerate. Although the foot is in final position, (61h) does not delete it. A principle requiring that every word be stressed overrides (61h); the effect of this here is that a foot which is the target of (61h) which is also word–initial is not deleted.

The words in (59) begin with a degenerate foot which is then followed by a full foot. In (59a), the initial foot is heavy, so that there is no clash between the heads of the first and second feet. In the remaining forms in (59), the initial foot is light, leading to a clash and the subsequent removal of the second foot by Clash Resolution.

In the process of constructing feet for (59a), /ooθerne/, it is not possible to construct a non–head for the first foot without violating the integrity of the second
syllable. Hence, the second syllable is the head of the second foot, as seen in (69).

Since the second foot is full, (61h) does not apply, and the word surfaces with surface stress.

\[(69)\]

\[
\begin{array}{c}
(x) \\
(x) (x) \\
[\mu \mu] [\mu \mu] \mu \\
\end{array} \]

The remaining words in (59), /færeldu/, /cyninga/, and /wesende/ all have LHL patterns; they differ only in that the final vowel of (59a) is high and will be deleted by HVD.

The illustrations in (70) and (71) give the metrical structures for (59b) and (59d). Because the initial mono-moraic syllable coincides with the initial foot, the head of the second foot clashes with the head of the first foot. These illustrations are particularly important because they illustrate the divergence of the present proposal from that of Drescher and Lahiri. Drescher and Lahiri would group the first two syllables together to make a head, creating a tri-moraic head and a quadra-moraic foot.\(^{32}\)

\(^{32}\) As noted earlier, Drescher and Lahiri claim the facts of “resolution” in poetics as part of their motivation for tolerating the sequence LH in a head position. Resolution involves the possible substitutions which preserve the relevant metrical patterns. For example, they cite a case (p. 262), in which a line should consist of a non-branching foot followed by a branching foot in the first half of the line and a non-branching foot in the second half. The non-branching foot in the second half can consist either of a heavy syllable or of two light syllables; crucially, the second half of the line can also consist of a light syllable followed by a heavy syllable. This is part of the motivation for Drescher and Lahiri’s proposal that the sequence LH can be the head of a foot. The sequence HH cannot appear in the position in question because it constitutes two non-branching feet while the template requires that there be only one.
The words in (60) have three feet, all of which are degenerate. In all three words, the final foot will be removed by (61h). In (60b), the second foot will be removed by Clash Resolution.

In (60a), /əθelinges/, illustrated in (72), the first two syllables are light, hence their moras constitute the head of the foot. This foot cannot be completed without violating the integrity of the subsequent syllable. The third syllable is heavy and is the head of the second foot in the word and the final syllable is heavy and

These facts present no difficulty for the present analysis if conformity to the metrical pattern follows the application of the rules in (6). A heavy syllable will be a non-branching foot, as will two lights. Two heavy syllables will be two non-branching feet and will therefore violate the restriction to one heavy foot. An LH sequence will be footed as two non-branching feet, but clash resolution applies to remove the second one, leaving just one non-branching foot and thereby conforming to the metrical requirements. It seems that there is no motivation for a claim about whether the H is stray adjoined to the foot dominating the L, so no position is taken here on this issue.
hence the head of the third foot. Secondary stress appears on the third syllable, but not on the final syllable since the final foot is removed by (61h).

(72)

\[
\begin{array}{c}
(x) \\
(x) (x) (x) \\
[\mu \mu] [\mu \mu] [\mu \mu] \\
\end{array}
\]

\[\text{cyninges}\]

For (60b), /cyninges/, (73) illustrates the sequence of a light syllable followed by two heavy syllables. In this word, there will be three degenerate feet, only the first of which will surface. This final degenerate foot is removed by (61h) and the degenerate foot over the second syllable clashes with this initial foot and is therefore removed by Clash Resolution.

(73)

\[
\begin{array}{c}
(x) \\
(x) (x) (x) \\
[\mu] [\mu \mu] [\mu \mu] \\
\end{array}
\]

\[\text{cyninges}\]

The approach to metrical constituency construction given in (61) correctly predicts the distribution of both primary and secondary stress and allows the metrical characterization of HVD which Drescher and Lahiri (1991) propose. The analysis in this section improves on Drescher and Lahiri’s by avoiding an innovation allowing
previously undocumented tri–moraic heads. Furthermore, Old English illustrates non–tautosyllabic footing, and is presented as yet another case in which the foot used in the metrical system is uneven and left–headed.

2.3.3 Cayuava

Cayuava is Bolivian language (probably extinct) which has received much recent attention in the literature on metrical phonology because its stress pattern displays a surface ternary alternation. In this section, the derivation of this pattern is shown to follow from specifying an Uneven, Strong, Non–tautosyllabic mapping of templates. Some examples of the Cayuava data are given in (74).

(74a) [sá.ká.hé] ‘stomach’

b) [ki.hí.βe.re] ‘I ran’

c) [a.ru.ká.ja.hí] ‘he has already fallen’

d) [pó.po.he.čé.βa.ka] ‘inside of cow’

e) [ma.ru.ha.ha.é.i.kí] ‘their blankets’

33 For example, the language is briefly mentioned in Hayes (1981), although is not analyzed there. The first metrical analysis of this language which I am aware of is in Levin (1985). Other analyses can be found in Levin (1988), Halle and Vergnaud (1987), and Hayes (1991). The primary sources on Cayuava are Key and Key (1967) and Key (1961). A recent, phonetically oriented study of Key and Key’s tapes and field notes can be found in Fruchter (1990).

34 My analysis of Old English in the previous section diverges from that of Dresher and Lahiri (1991) in crucial regards. For example, when there is a sequence of a light syllable followed by a heavy syllable. For them, such a tri–moraic sequence is a possible head, while in the analysis I proposed it is not. In Cayuava there is no weight distinction, hence there is only a nominal divergence between my analysis and Dresher and Lahiri’s (or that of Levin (1985), except that her ‘sww’ feet are relabeled as ‘sw’ with the ‘s’ subsuming the first ‘w’), as I do not consider Cayuava to have a “Germanic foot.” Rather, I construe the foot structure of Cayuava as a particular instance of left–headed unevenness, or quantity sensitivity.
One analysis of the distribution of stress in these data would be to construct left–headed ternary feet from right to left; another would be to make the final syllable extrametrical and construct amphibrachs from right to left. See the references above for details. All analysis have to confront the absence of initial stress in some of the forms. For example, in (74b) and (74e), there is no stress on the initial syllable. In an analysis in which left–headed ternary feet are constructed, this can be explained by constructing a degenerate foot which would then be removed due to its clash with the previously constructed head. In an amphibrach analysis of (74b) and (74e), the initial syllable would be a non–head of the foot headed by the peninitial syllable and would therefore be stressless.

Deriving the absence of stress on the initial syllables in (74c) and (74f) is more challenging. In neither of these cases would stress on the initial syllable generate a clash with the subsequent stress. In the amphibrach analysis, the second syllables of the words will be non–heads to the stressed third syllables, but it would seem that the initial syllables could constitute degenerate feet and could therefore be stressed. The two published proposals which give an account of this pattern are those of Levin (1988) and H&V. Levin’s proposal involves a straight–forward rule which eliminates a mono–syllabic degenerate foot. This analysis has been criticized recently in Hammond (1990) since it is an allegedly rare instance of a deforestation rule whose structural description does not involve a stress clash, cf. the study of
destressing in Hammond (1984). The H&V analysis of the absence of stress on words such as (74c) and (74f) follows from a proposed element of universal grammar entitled the Recoverability Condition. The presence of stress on the initial syllable in the words in question generates a violation of this condition, i.e., it generates a pattern which is unrecoverable. Presenting the H&V analysis would lead us astray here; that analysis has been critiqued as cross-linguistically inadequate in Rice (1990a).

Analyzing Cayuvava with uneven left-headed feet leads to an analysis of the absence of stress on the initial syllable in (74c) and (74f) which maintains Hammond’s (1984) generalizations restricting deforestation rules to clash environments. The stress assigning algorithm for Cayuvava will be as in (75), following Dresher and Lahiri (1991).36

(75) Cayuvava stress assignment

a) Extrametricality: none.

b) Template: (H N).

c) Mapping: Uneven, Strong, Non-tautosyllabic.

---

35 Hammond (1990) proposes an analysis of Cayuvava in which the absence of stress on the forms in question here is construed as following from a clash violation. He proposes that the second syllable of these words be extrametrical, so that the stresses on the initial and third syllables are metrically adjacent and therefore in clash. For the motivation of “relativized peripherality” which allows word internal extrametricality, cf. Hammond (1990).

36 Not all defooting is motivated by clash, cf. the analyses of Bani–Hassan Arabic and Old English above. This section, then, does not suggest the inadequacy of alternatives but rather highlights this consequence of the primary point here, namely that a binary analysis of Cayuvava is available in the proposed approach to foot construction.

Although our primary concern here is to demonstrate a footing proposal for Cayuvava which is fundamentally binary, it is worth pointing out that this analysis does allow a clash-based view of de-stressing. Clash has not motivated all clashes seen above, e.g., in the analyses of Bani–Hassan Arabic or Old English.
d) Direction: Right to Left.

e) Clash Resolution: Delete the leftmost of two adjacent heads.

The algorithm in (75) is illustrated in (76). Since a head must be bi-moraic, a “remaining” single syllable does not constitute any sort of metrical constituent. If there are two remaining syllables, there is sufficient material for a head, but this head will be adjacent to another and will therefore be removed by (75c). The result of the bi-moraic requirement on heads and the clash resolution rule is that there can be no degenerate feet on the surface in the metrical structure of a Cayuvava word. Square brackets are placed around heads and parentheses are placed around the entire constituent. Explication follows.

76a)  
(x
μ μ]
μ
sá.ká.he

(μ μ) (μ μ)
μ
pó.po.he. cé.βa.ka

d)  
(x
μ μ]
μ
(sá.ká.he)

(μ μ) (μ μ)
μ
pó.po.he. cé.βa.ka

b)  
(μ μ μ]
μ
ki.hi.βe.re

μ [μ μ] μ μ
ma.rá.ha.ha.é.i.ki

e)  
(x
μ μ μ]
μ
ma.rá.ha.ha.é.i.ki

(μ μ) (μ μ) μ μ

f.1)  
(x
μ μ μ]
μ
i.ki.tá.pa.re.ré.pe.ha

(μ μ) (μ μ) μ μ

(x
μ μ μ]
μ
a.ri.ká.ja.hi

i.ki.tá.pa.re.ré.pe.ha
In (76a), the final syllable is the non-head of the first constructed foot and the remaining two syllables each contribute their single mora to the head of the foot. The leftmost mora of the head is projected and stress is correctly predicted to appear on the first syllable. The same procedure applies in (76b). The initial syllable is mono-moraic, like all syllables in Cayuvava, and is therefore inadequate to be a head. No metrical structure is built and stress is correctly located on the second syllable.

In (76c.1), there are two moras left over after the construction of the first foot at the right at of the word. Since a degenerate foot must have a head, both of these moras are used to constitute a head. However, there are now two adjacent heads, and the clash removal rule in (75c) eliminates the first head in (76c.1), yielding the structure in (76c.2), which correctly predicts that this five syllable word will be stressed only on the third syllable.

There are six syllables in (76d), hence two full feet are constructed and no clash is generated. The initial syllable of (76e) is treated like the initial syllable of (76b), such that it belongs to no metrical constituent. In (76f.1), two full feet and one degenerate foot are constructed. Like (76c.1), (75c) applies to this form, yielding (76f.2), which correctly predicts the location of stress in this eight syllable word.
This discussion of Cayuvava suggests that the metrical constituents which derive its stress pattern are fundamentally binary. Following the system proposed in chapter one, the distribution of stress in Cayuvava follows from mapping a (H N) template in a Uneven, Strong, Non–tautosyllabic fashion from right to left. Hence, I follow Dresher and Lahiri (1991) by claiming that the head of the metrical constituent in Cayuvava must have two moras and that this bi–moraic requirement is enforced at the point of foot construction, even if it is necessary to cross a syllable boundary to get the second mora.

3.0 QUANTITY–SENSITIVE IAMBS

The present chapter is concerned to present data and analyses facilitating the claim that the inventory of foot types displayed cross–linguistically is symmetric. Although there are versions of metrical theories of stress which posit symmetric inventories of constituent types, e.g., Hayes 1981, Halle and Vergnaud 1987, Kager 1991, it is necessary to present the case for symmetry in light of recent proposals that there are asymmetries in the inventory. These asymmetries are posited as absolutes in Hayes (1987, 1991) and as tendencies in McCarthy and Prince (1986). The preceding section presented the claim that there are cases in which the appropriate analysis employs uneven trochees, i.e., feet in which the heads and non–heads are quantitatively uneven, and in which the head is at the left edge of the constituent. This fills one of the data gaps suggested in Hayes (1985).
The second gap which was proposed in Hayes (1985) is the absence of stress patterns using iambic constituents in which the heads and the non-heads are of even quantity. This gap is somewhat more challenging to fill since length is a frequent correlate of stress. Nonetheless, there are languages which may fill this gap. I briefly discuss two such candidates here. These are Winnebago, as described in Miner (1979) and Eastern Pomo, as described in McLendon (1975). Both of these sources give careful descriptions of the phonetics of stress and neither mentions length as one of the cues for stress. The distribution of stress in these languages suggests analyses with right-headed constituents. In light of the stress patterns and the descriptions, these languages are presented here as examples of languages in which right-headed constituents are mapped evenly such that the head and the non-head are of equal weight.

3.1 Winnebago

The distribution of stress in Winnebago37 is such that it can be assigned with an even mapping of right-headed templates. The stress facts of this language have received considerable discussion in the literature on metrical theory, e.g., Hale and White Eagle (1980), Halle and Vergnaud (1987), Miner (1990), Halle (1990). The discussion in this section is based on data and descriptions in Miner (1979), which is a primary source on this language. In the noted references, one of the issues of central theoretical interest is the characterization of Dorsey’s Law, an epenthesis

37 Winnebago, according to Miner (1979), is part of the Winnebago–Chiwere branch of Mississippi Valley Siouan.
process which seems to interact with metrical structure. The facts of Dorsey’s Law will not be of concern here and receive no discussion below.

The distribution of stress in Winnebago places stress on the third vowel from the left edge of the word and on alternating vowels rightward. Examples illustrating this pattern are given in (77).

<table>
<thead>
<tr>
<th>Hotaxif</th>
<th>‘expose to smoke’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hipirák</td>
<td>‘belt’</td>
</tr>
<tr>
<td>Hijjasú</td>
<td>‘eye’</td>
</tr>
<tr>
<td>Waarúč</td>
<td>‘table’</td>
</tr>
<tr>
<td>Haapá</td>
<td>‘hit the target’</td>
</tr>
<tr>
<td>Haračábra</td>
<td>‘the taste’³⁸</td>
</tr>
<tr>
<td>Hasajéjá</td>
<td>‘on the far side’</td>
</tr>
<tr>
<td>Hijowíra</td>
<td>‘fall in’</td>
</tr>
<tr>
<td>Hirawáhazrà</td>
<td>‘the license’</td>
</tr>
<tr>
<td>Hokiwarokè</td>
<td>‘swing (n.)’</td>
</tr>
</tbody>
</table>

³⁸ It is not clear why Dorsey’s Law fails to epenthesize and [a] between the [b] and [r]. This form appears as (16a) on page 28 of Miner (1979).
(78) Winnebago stress assignment

a) Template: (N H)
b) Mapping: Even
c) Direction: left to right
d) Extrametricality: initial vowel
e) Remove the rightmost of two heads on adjacent syllables
f) Word level: End Rule Left.

The important point about the constituent assigning algorithm in (78) is that it maps even constituents. Miner (1979) gives a careful description of the manifestation of stress assignment. He notes that “pitch seems to be the chief acoustic correlate of accent” (p. 25). Furthermore, he notes that “when more than one syllable in a word or stretch of utterance is accented, there is a downstep or terracing effect, each successive accented syllable having a slightly lower pitch and intensity than the last preceding” (p. 25). This description is noteworthy from two perspectives. First, this careful description fails to mention length as a correlate of stress. Second, Miner describes a downstepping process; such behavior is characteristic of pitch systems and thereby again suggests that Winnebago stress is primarily indicated by pitch and not by length.

3.2 Eastern Pomo

Eastern Pomo displays three degrees of stress, according to the description in McLendon (1975). I briefly describe the system here, although the data which are
given in the relevant sections of McLendon (1975) focus on irregular patterns rather than on illustrating the stress alternations which are described as regular. Nonetheless, even the description of the regular stress pattern raises the possibility that this language has right-headed, even feet.

Primary stress in Eastern Pomo is lexically assigned to one syllable of every root. There are several cases in which primary stress is assigned to the initial syllable of the roots. The forms in (79) illustrate this pattern.

(79)

dú:ʃux ‘quiet’
thíya ‘big’
cá:mal ‘fly’
káli ‘one’
léima ‘five’

Although these cases have initial stress, McLendon notes that a synchronic analysis of the language would lead to the generalization that stress occurs on the second syllable. She claims that this “tantalizing near-predictability” (p. 12) is challenged by the examples in (79). An alternative perspective, of course, is to propose that the synchronic grammar might mark the forms in (79) as exceptions and posit the construction of a right-headed foot to locate the “statistically frequent pattern” (p. 13) of primary stress on the second syllable. The description of the phonetics of primary stress states that it “consists of relative loudness and a shift in pitch” (p. 13).
Secondary stress in Eastern Pomo results from one of two situations. Either it follows from compounding, in which case the primary stress of one of the elements of the compound is reduced to secondary or it follows from the affixation of suffixes with lexically marked stress. The ability to predict the distribution of secondary stress is therefore possible only with knowledge of morpheme boundaries and any lexically markings for stress. The phonetics of pitch is such that the pitch shift found in the primary stresses is absent; secondary stress "consists of relative loudness without shift in pitch" (p. 14).

In addition to the lexically marked stresses which surface as either primary or secondary according to the conditions described above, there is another kind of stress which appears, which McLendon refers to as "weak stress." Weak stress appears on alternating syllables, beginning with the second one after a primary stress. This iambicity is apparent in McLendon's schematization of the pattern (p. 12) as "da dá da dá da dá." The description of the phonetics of this pattern is the "every second syllable after a primarily stressed syllable is slightly louder than the unstressed syllable immediately preceding or following it." Further evidence for locating these weak stresses with the appropriate right-headed metrical structure follows from a description of clash resolution, which states that the alternating pattern is suppressed in the presence of a secondary stress. Specifically, McLendon notes that a syllable in position to be louder, as described above, is not louder when the following syllable has secondary stress.

These stress facts can be derived by promoting the leftmost lexical accent to be the primary stress and the other lexical accents to be secondaries and constructing
iambs over the remaining syllables. Clash occurs when two adjacent syllables are heads and it is resolved by removing the leftmost of the two offending heads.

The present claim that stress does not involve length and that Eastern Pomo can therefore be construed as a language using even, right–headed constituents comes from three sources. First, the explicit description of the nature of stress specifically singles out loudness as the relevant factor. All three of the stress levels discussed are explicitly described with respect to their phonetic implementation. Length is absent from the description in all of these cases. In addition to the prose descriptions, evidence can be drawn from two aspects of the transcription used. First, McLendon gives some careful, narrow transcriptions for which she creates a system of numerical markings which are glossed as indicating pitch prominence, cf. the description of primary stress. The second piece of evidence which can be drawn from the transcription system involves the transcription of length, which is phonemically contrastive in Eastern Pomo. Under stress we find both short and long vowels. Some examples are as follows.

(80)

/kóːy/ ‘grow’ /kóːy/ ‘sore, wound’
/khúːy/ ‘other, another’ /khúːy/ ‘no’
/diːléː/ ‘middle’ /diːléː/ ‘forehead’

The examples in (80) are minimal pairs in which the only difference between the two words is the length of the stressed vowel. The distinction between these
words would potentially be neutralized were lengthening part of the phonetics of stress assignment.

4.0 Conclusion

The analyses presented in this chapter suggest that the inventory of feet which are available for metrical constituent construction is symmetric. The approach to constituent structure assignment presented here allows not only the mapping of the well-motivated right-headed quantity sensitive foot and the left-headed quantity insensitive foot. It also allows mapping left-headed quantity sensitive feet and right-headed quantity insensitive feet, in the terminology of Hayes (1981).

The cases presented here which are left-headed uneven cases show at least three different means for instantiating their unevenness. As in Bani-Hassan Arabic, etc., unevenness can simply be a requirement that the non-head not be heavy; this allows light syllables to be heads under some circumstances. The second way in which unevenness can be instantiated is by modifying either the heads, as in Seleyarese, or the non-heads, as in Gidabal. Thirdly, languages can also instantiate unevenness with an tautosyllabicity parameter, which can be set to allow a head to draw its content from more than one syllable. This approach has already been seen to be useful in analyzing some phonological systems. In Gidabal, the placement of initial stress on light syllables may be accomplished with this kind of mapping, facilitating some understanding of the apparent maximum length of three for initial strings of light syllables. In Old English, this approach allows for analysis of the
distribution of stress without introducing yet another foot type. In Cayuvava, the uneven left–headed, non–tautosyllabic mapping allows the derivation of a surface ternary alternation. Finally, as we will see in chapter three, this mapping possibility is crucial to understanding the facts of Chugach.