CHAPTER ONE

METRICAL THEORIES

1.0 INTRODUCTION

Research suggests that the languages of the world distribute stress throughout words in a manner which is sufficiently systematic to allow generalizing to a cross-linguistic theory of stress assignment. It is the primary goal of this dissertation to present such a theory. The present approach, in its simplest statement, consists of selecting and mapping constituent templates onto a word. Variation across languages is formalized by the parameterization of the mapping process. This approach to the derivation of stress patterns leads to a modified view of quantity sensitivity and to a characterization of a number of stress patterns which are currently problematic for metrical theories of stress assignment. Because the patterns are derived from a set of binary parameters, the approach also predicts a symmetric inventory of constituent types. The five chapters here are unified by their contribution to the motivation and explication of the proposal; for purposes of orientation, I briefly mention highlights of each chapter in the following paragraphs.

The first chapter contains a brief review of metrical theory and a presentation and illustration of the metrical theory advocated in Hayes (1987, 1991), which is a templatic approach with an asymmetric foot. I will argue in chapter two that there is a symmetry to the inventory of metrical constituents; hence, Hayes’ approach is
presented here both for purposes of contrast and as a reference point for discussion in subsequent chapters. Chapter one concludes with an outline of the approach to metrical theory to be pursued in the remaining chapters.

In chapter two, the stress systems of several languages are analyzed. The specific purpose of this chapter is to provide the foundation for my claim that the inventory of metrical constituents is symmetric.

Chapter three is a case study, illustrating the complex word level prosody of the Chugach dialect of Alutiiq and arguing for an analysis in which the foot type of this language is a strong version of what appears as a left-headed quantity sensitive foot. I also describe the pitch accent system in this language and demonstrate the support which it offers for my analysis of main stress.

In chapter four, I return to a discussion of the theory argued for in Hayes (1987, 1991), and some other proposals which are similar to that one. Hayes' theory allows an analysis of ternary systems, of which Chugach is taken to be an example. I challenge both the empirical and conceptual motivation for this analysis. Also examined in this chapter are two other recent proposals, which follow the spirit of Hayes', namely those in Hammond (1990) and Kager (1991).

Finally, in chapter five, I present a study, in part designed to replicate earlier psychological work on tendencies in rhythmic parsing based on non-linguistic stimuli (Woodrow 1951). I will argue that this study does replicate some earlier findings, but that work in this field is not sufficiently compelling for the absolutes which have been drawn from it in recent versions of metrical theory (Hayes 1991, Hammond 1990).
2.0 METRICAL THEORIES OF STRESS

Metrical theories of stress assignment depart from SPE by, among other things, characterizing stress as the instantiation of relative prominence relations rather than the instantiation of an n-valued feature on specific segments. This shift in perspective can be traced to Liberman (1975), and Liberman and Prince (1977). In this section, I give a brief overview of a metrical approach to stress assignment. Section three presents recent developments by Hayes (1987, 1991). Section four presents an overview of the approach advocated here.

I take Hayes (1981) to be representative of a "standard" metrical theory, which has a series of parameters as its primitives. Parametric approaches do in fact have significant differences between them, although what is important here are their similarities; for a discussion of some of these differences, see Halle and Vergnaud (1987), Hammond (1987) and Blevins (1990b).

Some examples of the parameters which can be found in these theories are given in (1).

(1)

a) Constituents are maximally binary or maximally unbounded.
b) Constituents are constructed iteratively or non-iteratively.
c) Constituents are sensitive to the quantity of syllables or not.
d) Constituents are left headed or right headed.
e) Constituents are constructed from left to right or from right to left.
f) A peripheral prosodic constituent is extrametrical or not.

The parameters lead to the generation of constituents, or feet, which indicate relative prominence. The distinction between main and subordinate stresses can be represented by constructing additional levels of constituency over the first level. The fundamental point here is that prominence, or stress, is indicated relatively by representing prominence in the context of the other syllables of a word, rather than by representing it through variations in the values for some particular feature. This characteristic is the defining one of metrical theories.

3.0 A REVISED METRICAL THEORY

The title of this section alludes to Hayes (1987, 1991), in which several revisions of metrical theory are proposed.¹ In this section, Hayes’ critique of previous metrical theories are presented and his alternate proposal is presented and illustrated.

¹ The reference here and throughout to Hayes (1991) requires brief clarification. While this dissertation was being written, my primary reference for Hayes’ recent work was Hayes (1987). Some sections of Hayes (1991) became available to me in 1990 and are discussed in chapter 4. The reference to Hayes (1991) is included to make the reader aware of it and not to suggest that the present dissertation is either a thorough consideration of that work or a response to it.
3.1 A critique of previous metrical theories

Generalizations about differences between trochaic and iambic systems began to enter the metrical theory literature with Hayes (1985) and find their most comprehensive expression to date in Hayes (1991). As discussed below, these generalizations facilitate a critique of parametric theories. The two primary faults which Hayes (1987) finds with other metrical theories are presented in the following sections.

3.1.1 Data gaps

Metrical theories can be evaluated with cross-linguistic observations about variation in stress patterns. The parameters which are proposed as primitives in a theory derive a specific set of stress patterns. This set can be evaluated against the inventory of attested stress systems. If there are patterns which do exist in natural language which cannot be made to follow from the inventory of parameters then the set of parameters needs to be enriched. On the other hand, if the set of parameters allows patterns which are not known to exist in natural language, then the theory can be improved by modifying it so that these non-attested options cannot be derived.

Hayes (1987) claims that parametric approaches to metrical theory suffer from the problem of over-generation. That is, one deficiency of those theories is that they allow the derivation of patterns which are unattested. Specifically, those theories allow for the possibility of iterating quantity sensitive left-headed feet and for the possibility of iterating quantity insensitive right-headed feet. Based on a
survey presented in Hayes (1985), Hayes (1987) claims that neither of these patterns exist.

The survey of stress rules in Hayes (1985) examines fifteen quantity sensitive rules and thirty–seven quantity insensitive rules. Of the fifteen QS rules, all are claimed to have right–headed constituents, i.e., all are iambic. Thirty–two of the thirty–seven QI rules show iterating left–headed constituents. Based on this particular survey, it seems reasonable to claim that allowing QS left–headed constituents is a deficiency since they never appear in iterating patterns. It would also be reasonable to claim that there is a tendency for QI systems to be left–headed; however, with nearly fourteen percent of the iterating QI systems in the survey showing right–headed constituents, the claim that it is a deficiency of a metrical theory to allow the generation of such a pattern remains debatable.

These observations about data gaps are part of the motivation for the revisions which Hayes (1987, 1991) proposes. The revised theory will more closely reflect the results of the survey since it will “predict” the absence of QI right–headed systems and QS left–headed systems by lacking the formal means to derive these two patterns. However, both of the suggested gaps can actually be filled, thereby challenging this criticism. Five QI right–headed patterns are actually identified in Hayes’ (1985) survey, although Hayes (1987:277) claims that these can be reanalyzed as having left–headed constituents. QS left–headed cases will be presented in chapter two.

3.1.2 Extralinguistic Evidence
The second motivation for Hayes' (1987, 1991) revisions of metrical theory appeals to extralinguistic criteria. The extralinguistic factor is a "general law of rhythm" dictating that a series of stimuli in which prominence is indicated with length will be grouped iambically while a series in which prominence is indicated otherwise, e.g., by intensity or pitch, will be grouped trochaically. The survey in Hayes (1985) discussed above suggests that stress patterns in languages follow this general law of rhythm. As we will see in chapter four below, a particular version of this law plays a crucial role in the revisions to metrical theory developed in Hammond (1990).

A review of the literature from which Hayes reports this claim will be deferred until chapter five, in which my own study on this topic is also presented. Based on that literature review and my own study, I conclude that tendencies do emerge, but that there is inadequate evidence for the motivation of a law regarding the perception of the studied stimuli.

3.2 Metrical templates

The developments of metrical theory in Hayes (1987, 1989, 1991) are motivated by the deficiencies in the standard parametric approach discussed above. That is, a revised theory is proposed which should avoid the pitfall of overgeneralization and bring metrical theory into line with general claims about the nature of rhythm.

The problem of overgeneration is treated by restricting the inventory of possible foot types. This restriction is accomplished by replacing some of the parameters which serve as the primitives of the theory with templates, which are
themselves now taken to be primitives. This section presents an illustration of those templates.

Three templates are proposed in Hayes (1987), along with instructions for their possible instantiations. Figure (2) presents a replication of Hayes' figure, parentheses indicate constituency, an “x” marks the head of a constituent, a period marks the non–head of a constituent, a sigma represents a syllable of unspecified weight, a macron is a syllable which is necessarily heavy, a breve is a syllable which is necessarily light, and a mu represents a mora.

(2)

\[ (x .) \quad (.) \]

A. Syllabic trochee: Form \( \sigma \sigma \) if possible; otherwise form \( \sigma \)

\[ (x .) \quad (x .) \]

B. Moraic trochee: Form \( \mu \mu \) if possible, where \( \mu \mu \) is either

\[ (x .) \quad (x) \quad (.) \quad \sim \sim \text{ or } \sim \sim \sim \text{; otherwise form } \sim \]

\[ (x) \quad (x) \quad (.) \]

C. Iamb: Form \( \sim \sigma \) if possible, otherwise form \( \sim \) or \( \sim \)

In a language with iterating syllabic trochees, for example, the binary constituent in (A) is constructed over pairs of syllables across the word. The unary constituent will be constructed over the final syllable when the number of syllables in the scansion is odd. Note that this degenerate constituent has only a non–head, i.e., this constituent does not assign stress to any syllable. In fact stressless constituents
are possible for any of the three templates when no other form of the template can be constructed. However, in Hayes (1991), the mapping procedures for the templates given above are modified so as to eliminate the stressless foot as an option.

The theory which is presented in Hayes (1987, 1991) retains two familiar parameters. The first of the remaining parameters allows templates to be mapped across the domain from right to left or from left to right. The second parameter allows templates to be mapped either iteratively across the entire domain, or merely once at the edge of a domain. Although these parameters remain available, since the most salient characteristic of the theory under discussion is the use of non-derived templates, I will refer to it as the “templatic approach” to stress assignment.

With the templatic approach to stress assignment, an analysis of the stress system of a language consists of determining (i) which template is to be used, (ii) the direction in which the templates are assigned, (iii) whether they are assigned iteratively, (iv) whether any peripheral prosodic constituents are extrametrical, and (v) whether there are stressed mono-syllabic feet. To illustrate this system, I present two cases which Hayes (1987:276) gives to illustrate the parametric approach. I am converting them based on his (p. 279) statements about the “match-ups” of the parametric and templatic approaches.
3.3 Illustrations

3.3.1 Maranungku

The stress pattern of Maranungku is well known in the stress literature. Primary stress appears on the initial syllable and secondary stress appears on alternating syllables to the right.\(^2\)

Stress is Maranungku is located by constructing syllabic trochees iteratively from left to right. There is no extrametricality in this language, however, successfully locating stress requires that stressed mono-syllabic feet are allowed. This procedure, illustrated with the two forms in (3), locates the syllables which are to be stressed.

(3)

\[
\begin{align*}
\text{(x . )} & \quad \text{(x . )} & \quad \text{(x . )} & \quad \text{(x .) (x .) (x)} \\
\text{wé le pè ne mèn' ta} & \quad \text{làñ ka rà te tè}
\end{align*}
\]

'kind of duck' 'prawn'

The Maranungku forms require two comments at this point. First, note that there is stress on the fifth and final syllable of the form for 'prawn.' This is a

\(^2\) With stress on alternating odd numbered syllables, it would seem to be ambiguous as to whether the appropriate template is the syllabic trochee or the moraic trochee. Both templates can describe this pattern since there are only light syllables in this language. Based on the provided examples and the discussion of the templates, I assume that the moraic trochee is restricted to cases where syllable weight is relevant.
situation where the (1987) version of template mapping would have constructed a stressless foot; the presence of stress on this syllable shows the need for stressed degenerate feet in the theory.

Maranungku does show a distinction between primary and secondary stress. In the representations above, a second level of constituent structure is built to indicate that the word-initial syllable is the most prominent. Hayes (1987) does not propose a non-iterative application of one of the templates for the word level (i.e. above the foot level). Rather, he claims that at the word level the theory makes use of End Rule Left/Right, as proposed by Prince (1983). Therefore, in addition to the templates which are primitives and which indicate metrical structure at the foot level, grid marks which follow from an application of the End Rule are also primitives which are available only at the word level. Hayes, departing from Prince (1983), indicates constituency at this level, rather than just adding a grid mark.

3.3.2 Munsee

Munsee is an Eastern Algonquian language, related to Unami and Delaware. Stress is described by Goddard (1982) as appearing on even numbered syllables, counting from the left; the penultimate stress is the primary one. This pattern can be derived by constructing iambic iteratively from left to right. The parsing formula for the iamb allows monosyllabic stressed feet if they are heavy; in Munsee, both CVV and CVC syllables are heavy. To derive primary stress on the penultimate foot, the final foot is marked as extrametrical at the word level (indicated with angled brackets), and then End Rule Right is applied. Although the final foot is extrametrical, its head still
receives secondary stress. The examples in (4) illustrate this procedure. (Again, these forms are each one word, the spaces are to accommodate the templates.)

(4)

(  x  )
(  .  x ) (  .  x ) (  .  x )
\( \text{na kà ka tă ka kà} \)

'I do a fast dance'

(  x  )
(  .  x ) (  .  x ) (  .  x )
\( \text{sa kà ta kà nfi ka nàl} \)

'reins'

(  x  )
(  .  x ) (  .  x ) (  .  x ) (  .  x )
\( \text{na sa kàh ta kà nîl ka nàmàl} \)

'my reins'

3.4 Summary

The previous section has presented a recently developed theory of stress assignment, which is based on an inventory of three types of templates. It formalizes the observation that there is an asymmetry in stress patterns by having right–headed elements whose canonical shape is one of uneven duration and by having left–headed elements whose canonical shape is one of even duration.
4.0 PARAMETERS FOR TEMPLATE MAPPING: A PROPOSAL FOR METRICAL STRUCTURE ASSIGNMENT

This section outlines a proposal for assigned metrical constituency. A metrical theory of stress assignment is presented containing two types of primitives, namely templates and parameters. The templates in this system function to identify the headedness of the constituents. These are represented as either (H N) or (N H), the former denoting a left-headed constituent and the latter denoting a right-headed constituent. Four parameters are proposed; these function to specify the nature of the mapping between templates and syllables. A discussion of the specific parameters is preceded with a discussion of one aspect of the context for the present proposal.

The first major presentation of a metrical theory of word level stress in generative grammar is that of Hayes (1981). That work and all subsequent work on the topic acknowledges the possibility that the internal structure of syllables can affect the distribution of stress in a language. This phenomenon is called quantity sensitivity, due to the characterization of the relevant aspect of syllable structure as the quantity of segments in the nucleus or rime. The theory of metrical constituent assignment developed in this dissertation departs from two recent proposals on the treatment of quantity sensitivity.

---

3 The use of (HN) and (NH) to indicate headedness rather than a parameter (left-headed / right-headed) is somewhat arbitrary. The (H,N) notation is a convenient way to indicate headedness since the focus here is not on the determination of headedness, but rather on the determination of the mapping procedure between templates and terminal elements.
The metrical theory which is proposed in Hayes (1987, 1991) is one in which quantity sensitivity is not an independent parameter of the theory. Rather, in this approach, quantity sensitivity is a function of headedness. Languages which have iambic constituents are proposed to show sensitivity to quantity, following the general observation that iambic systems mark prominence with length. On the other hand, languages which have trochaic templates fail to show sensitivity to quantity, following from the observation that these systems indicate prominence with non-length intensity. In other words, the elements of iambic constituents are inherently uneven in duration while those of trochaic ones are inherently even. In this sense, as noted above, sensitivity to quantity follows from the determination of headedness.

Halle and Vergnaud (1987) propose a metrical theory in which constituent construction is accomplished without reference to the internal structure of the syllable. The theory must nonetheless capture the well-established effects of quantity sensitivity. This is accomplished by treating heavy syllables in quantity sensitive systems with the same tools as "lexical" stress. When the location of stress is unpredictable, it may be said to be "lexical," which means that the syllable which bears the unpredictable stress must be marked as such in the lexical entry of the word. The approach to metrical constituent construction developing in Halle and Vergnaud (1987) respects lexically marked stresses by projecting those syllables as heads of constituents prior to constituent construction. In the case of a system which in quantity sensitive, heavy syllables are treated as though they idiosyncratically bear

---

4 However, Blevins (1990b) notes several places in which rules in Halle and Vergnaud's work do indeed refer to the internal structure of the syllable, their claim to the contrary notwithstanding.
stress and they are also projected as heads prior to the assignment of metrical constituents.

The proposal in the present work treats quantity distinctions as facilitating the derivation of the specified constituent type. Specifically, a parameter for mapping constituents is proposed by which constituents are designated as having one of the two values (Even, Uneven). With these terms reference is made to a phonological level at which the weight of syllables is either relevant or irrelevant to constituent construction. In addition to subsuming some of the traditional characterizations of different kinds of quantity sensitivity, this approach also facilitates an understanding of systems such as that of Germanic (cf. Dresher and Lahiri 1991) and Chugach (cf. Leer 1985, Rice 1988, 1989, 1990a).

The proposal in this section includes three parameters specifying the precise manner in which the templates are mapped to constituents. These parameters are construed hierarchically, as seen in figure (5). The following paragraphs are a discussion of the model presented in (5), the definitions given in (6) and the assumptions given in (7). The first parameter which must be set is the one mentioned above: the mapping of templates has one of the two values (Even, Uneven). When the mapping is designated as Even, the head and the non-head are mapped to units of arbitrary weight. No further parameters are necessary on the “Even” branch of the hierarchy given in (5). In fact, our primary concern in the following chapters will be the discussion of the Uneven cases, as it is this branch which has three mapping possibilities.

Systems which are designated as “Uneven” show mapping which is sensitive to the internal structure of the syllable. All Uneven constituents share the
characteristic of preventing a light syllable from being a non-head. The constituent is schematically represented as ( [m (m) ], m). This representation suggests a constituent in which the non-head is mono-moraic and the head is maximally bi-moraic. Further details of mapping are specified by the setting of two additional parameters.

All constituents which are to be mapped unevenly must be specified for one of the values {Strong, Weak}. Each of these values can be defined with an implicature relation. Strong constituents are defined by a bi-conditional between heads and two adjacent moras, although this is constrained by syllable integrity, as discussed below. Weak constituents, on the other hand, are defined by “if bi-moraic, then a head.”

The head of a Strong constituent is necessarily bi-moraic, while Weak constituents are not constrained by this requirement. Constituents which are “Uneven, Strong” are approximately equivalent to what have been called Obligatory Branching feet, although at least one point of variation emerges below. On the other hand, a Weak mapping is one in which heads may be mono-moraic. Such a system is traditionally known as a Quantity Sensitive system; again, some variation from the traditional conception will be discussed below.

Summarizing to this point, two of the parameters describing the mapping of templates to syllables have been described. The {Even, Uneven} parameter distinguishes between cases which have been traditionally called quantity insensitive and quantity sensitive (and its variants). The {Strong, Weak} parameter for Uneven mapping distinguishes approximately between those cases which have been called
Obligatory Branching and Quantity Sensitive (in this case, referring specifically to QS feet, not to other varieties of quantity sensitivity).

The Strong cases must be specified according to one further parameter which is represented as \{Tautosyllabic, Non–tautosyllabic\}. This parameter can allow the two moras constituting the head of a constituent to be drawn from different syllables. However, this parameter setting does not subvert the requirements of syllable integrity, to be discussed below. As we will see in chapters two and three, specification as "Strong: Non–tautosyllabic" can also provide the motivation for limited metrical restructuring or de–footing. Four cases will be analyzed as employing Non–tautosyllabic footing; these are Gidabal, Old English, Cayuvava, and Chugach.

When the parameter setting is Tautosyllabic, some syllables may not be incorporated into metrical constituents at the point of constituent construction. Since these constituents are Strong, the heads must be bi–moraic. With Tautosyllabic mapping, a mono–moraic syllable which is in the position to be the head of a metrical constituent is simply skipped over and scanning continues until a bi–moraic syllable is located, which then becomes the head of a constituent.

Both Tautosyllabic and Non–tautosyllabic mapping generate feet which are similar to the previously identified Obligatory Branching feet. OB feet are explicitly required to have bi–moraic (i.e., branching) heads and mono–moraic (i.e., non–branching) non–heads. The constituents which are generated by Tautosyllabic and Non–tautosyllabic mapping do have bi–moraic heads and mono–moraic non–heads; the difference between the two is the possibility of having two syllables in the head for those systems in which mapping is Non–tautosyllabic.
The terminology and the constituent types in (5) and (6) have been discussed to this point. The mapping of templates is also constrained by (7), which is presented as two assumptions. The first of these introduces the notion of syllable integrity and forbids its violation. This means that the moras of a bi-moraic syllable cannot be separated into different feet or the head and non-head of one foot. The principle will become clear in the discussions of Old English in chapter two and of Chugach in chapter three. Syllable integrity follows from a hierarchical view of prosodic constituents. It is particularly clear that when templates are construed as being mapped onto syllables, there is no tool available for splitting a syllable. Awareness of the moraic content of the syllable is required in the case of Uneven mapping, but this awareness does not compel the re-conceptualization of the prosodic hierarchy. In short, syllable integrity follows from a hierarchical view of the arrangement of moras, syllables, and metrical feet.

The second assumption given in (7) is a well formedness condition. The proposal developed here allows for the generation of a degenerate foot when there is insufficient material to map a full foot. Degenerate feet can appear either at the edge of a word or they can occur word-internally when this is the only option which heeds syllable integrity. The relevance of this requirement will also become clear with the illustrations in subsequent chapters.

The possibility of degenerate feet creates the possibility of constructing two heads without an intervening non-head. Adjacent heads may be disallowed in a language if they are construed as creating an intolerable clash. As will be demonstrated in subsequent chapters, adjacency and clash may be calculated at either the level of the syllable or at the level of the mora. The possibility of parametric
variation regarding the calculation of clash does not directly affect the initial mapping of metrical constituents.
(6) Definitions

a) Uneven: (U) Syllable weight is relevant; a non-head may not dominate a heavy syllable.

b) Even: (E) Heads and Non-heads are mapped onto elements of arbitrary weight.

c) Strong: (S) head $\leftrightarrow$ set of two moras

d) Weak: (W) set of two moras $\rightarrow$ head
e) Non-Tautosyllabic: (~T) Generate well-formed heads without regard to syllable boundaries.
f) Tautosyllabic: (T) Generate well-formed heads heeding syllable boundaries.

(7) Assumptions

a) Do not violate syllable integrity, i.e. the moras of a bi-moraic syllable cannot be split among metrical constituents or elements of metrical constituents.

b) A degenerate foot may consist of a head without a non-head but may not consist of a non-head without a head.

In summary, this section contains a proposal for imposing metrical structure onto words and thereby deriving the parametric variation seen in stress patterns cross-linguistically. The fundamental nature of the approach is to select a template and map it onto a word. The mapping procedure varies across languages and is specified by determining the appropriate values for a number of parameters. The specific proposal is one in which there are three different systems which have Uneven mapping. This proposal and the systems it generates are illustrated in the ensuing chapters. It will be shown to accurately reflect the documented inventory of stress patterns, compelling the symmetric characteristic of the footing templates. Furthermore, this approach solves several problems associated with quantity sensitivity. Recent proposals regarding potentially ternary feet are subsumed by this proposal in a way which not only shows them to be fundamentally binary systems,
but in a way which solves residual problems in those analyses, e.g., destressing in Cayuvava and metrical structure modifications in Chugach.