THE PROSODIC HIERARCHY IN METER

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1. INTRODUCTION

The study of phrasal phonology—of rules that apply across word boundaries—has proven fruitful in recent research. The crucial problem has been to develop a theory of syntactic juncture that can predict the domains in which sandhi rules are bounded and locate the points in syntactic structure that trigger phonological rules. One particularly interesting theory of this sort is the Prosodic Hierarchy, developed in the work of Selkirk (1978, 1980, 1981) and extended by Nespor and Vogel (1982, 1983). The essence of the theory is that utterances are PHRASED, in the same sense that musical passages are phrased. As in music, phrasing in language is hierarchical: the lowest units are grouped into small phrases, which in turn are grouped into larger phrases, and so on through several levels. This phrasing, or Prosodic Hierarchy, governs the way in which sandhi rules may be applied.

The Prosodic Hierarchy of an utterance is determined by its syntactic structure but is not identical to it. According to Selkirk, the Hierarchy is derived from syntactic structure by a set of rules that alter bracketing and provide labels for the various levels of phrasing. To give an example, I would claim that sentence (1a) is converted from the syntactic structure shown to the

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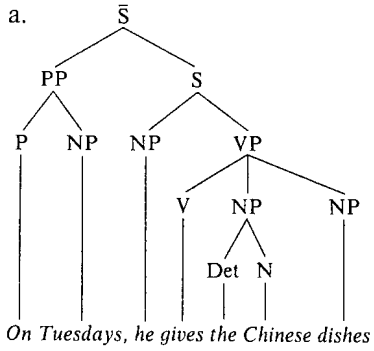
Prosodic Hierarchy given in (1b):

(1) a.



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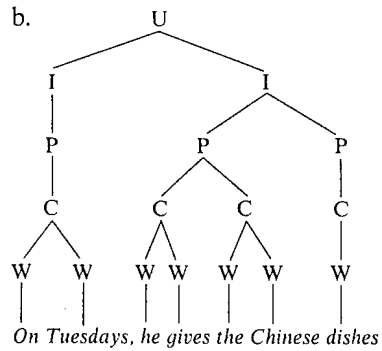


where U = Utterance, I = Intonational Phrase, P = Phonological Phrase, C = Clitic Group, and W = Word. Selkirk, Nespor, and Vogel's work has shown that the theory of the Prosodic Hierarchy permits insightful accounts of the phrasal phonologies of a number of languages.

The study that follows has two parts. The first presents a specific version of the Prosodic Hierarchy along with arguments for it based on a number of languages. The second part provides further support for the Hierarchy by showing that it is crucial to an adequate account of English metrics. The basis of my argument is an examination of some of the metrical rules employed by Shakespeare, Milton, and Shelley, plus a detailed analysis of Longfellow's *Song of Hiawatha*.

2. THE PROSODIC HIERARCHY

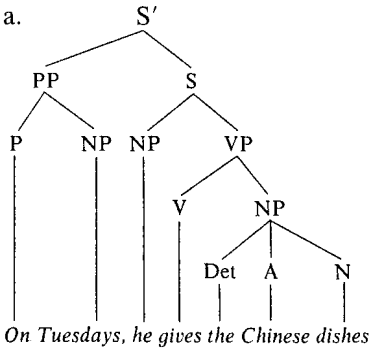
This section first presents some general reasons for believing that the Prosodic Hierarchy constitutes the right theory of juncture and then proposes a specific version of the Hierarchy for English and other languages.

2.1. Why a Prosodic Hierarchy?

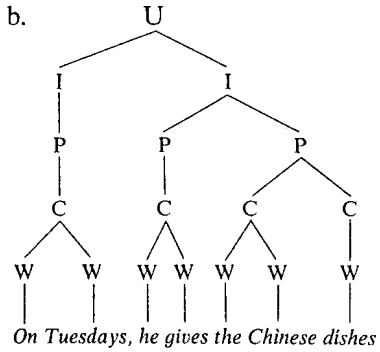
There are two principal phenomena that a theory of syntactic juncture must handle: bounding and reference to edges. When a phonological rule is BOUNDED by a certain domain, it may apply only if both the triggering segments and the undergoing segments are all included within that domain. An example of this sort is the English Rhythm Rule, which shifts stresses leftward under the influence of a stronger stress on the right, as in *thìrteen mén* compared with *thirtèen mén*. As Nespor and Vogel (1982) show, the Rhythm Rule normally applies only when the word undergoing the shift is in the same Phonological Phrase as the strong stress that triggers the shift. Thus in (2), the word *Chinese* may retract its stress under the influence of *dishes*, as

the latter word occupies the same Phonological Phrase according to Nespor and Vogel's phrasing rules.

(2) a.



b.



Sentence (1), in contrast, has a different syntactic structure, meaning 'He gives the dishes to the Chinese,' not 'He gives the Chinese dishes to someone.' By Nespor and Vogel's rules, this structure is phrased so that *Chinese* and *dishes* occupy separate Phonological Phrases, and the Rhythm Rule is normally blocked. In this sense, the Rhythm Rule may be said to be bounded by the Phonological Phrase.

Rules of phrase phonology may also refer to edges of domains. For example, in Chimwi:ni (Kisseberth and Abasheikh 1974) there is a phonological rule requiring that any vowel at the right edge of a Phonological Phrase be short. In a number of languages, for example Polish, a phonological rule devoices obstruents at the right edge of every Word.

A theory of juncture must provide adequate descriptions of these phenomena. To see the advantages of a Prosodic Hierarchy theory, it is useful to compare it to two alternative theories.

2.1.1. BOUNDARY SYMBOLS

Theories of juncture employing boundary symbols have been proposed in Chomsky and Halle (1968), McCawley (1968), Selkirk (1972), and earlier work. In these theories, information about syntactic structure is carried over into the phonology by rules that place boundary symbols at the edges of syntactic constituents. The phonological rules can be blocked by the presence of a boundary, or they can refer to boundaries in their structural descriptions. They do not refer to syntactic bracketing directly.

Selkirk (1980) has presented a number of fairly compelling arguments that favor the Prosodic Hierarchy approach over the boundary symbol treatment. In particular, the boundary theory is too powerful, in that it enables rules to be written that never show up in actual phonologies and that are (crucially) not writable under the Prosodic Hierarchy approach. I would like to add another argument here, because I believe that its logical structure has not been made

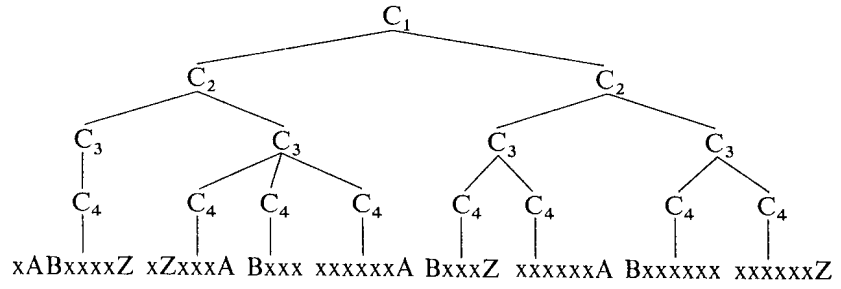
sufficiently clear in the literature, and because its consequences will be crucial to the discussion of metrical rules later on.

It has long been known (cf. McCawley 1968 and other works) that under a boundary symbol theory, the boundaries can be organized into a "strength hierarchy" with the following properties. First, if a phonological rule can apply across one kind of boundary, it can also apply across all "weaker" boundaries. Second, if a rule applies before or after one kind of boundary, then it also applies before or after all "stronger" boundaries. Now, under a boundary theory, these typological observations are unrelated; both must be stipulated in the theory of phonology. But under a bracketing theory, a single (stipulated) principle can account for both. Following Selkirk (1984), I adopt the following:

(3) STRICT LAYER HYPOTHESIS. The categories of the Prosodic Hierarchy may be ranked in a sequence $C_1, C_2, \ldots C_n$, such that
   a. all segmental material is directly dominated by the category C_n, and
   b. for all categories C_i, $i \neq n$, C_i directly dominates all and only constituents of the category C_{i+1}.

If these conditions hold, and if phonological rules refer to brackets rather than boundaries, then both of the typological observations above will follow from the same principle: rules applying across a given boundary necessarily apply across all weaker boundaries, and rules applying before or after a given boundary necessarily apply before or after all stronger boundaries. This is illustrated below with an abstract hierarchy whole categories are C_1, C_2, 3_3, and C_4:

(4)



RULE (a): Z → Y /_____]C_4

→ Y Z Y Y

RULE (b): A → C / ____ B Domain: C_2

→ CB C B A B C B

= [xCBxxxxY xZxxxC Bxxx xxxxxxA BxxxY xxxxxxC Bxxxxxx xxxxxxY]

Because the Prosodic Hierarchy under (4) is strictly layered, Rule (a), which converts Z to Y at the right edge of a C_4, must necessarily also convert Z to Y at the right edge of a C_1, a C_2, or a C_3. Similarly, Rule (b), which converts A to C before B when A and B occupy the same C_2, must also apply when A and B occupy the same C_3 or C_4, though it will not apply if A and B only share membership in C_1. Notice that these are not automatic consequences if we reencode the information inherent in (4) with boundary symbols.

Note also that if only one of the two typological observations made above held true, there would be no argument: the stipulation of the boundary strength hierarchy under a boundary symbol theory would be matched by the Strict Layer Hypothesis under the Prosodic Hierarchy theory. The real argument lies in the ability of the latter theory to explain two observations with the same principle, rather than stipulating them separately.

2.1.2. DIRECT REFERENCE TO SYNTAX

Another alternative to the Prosodic Hierarchy would be to allow phonological rules to make direct reference to the bracketings of the syntax. A disadvantage of such a theory is that it is too strong: it allows for the description of phonological rules that are never found in actual languages. For example, the theory would allow us to write a voicing assimilation rule that applied only within adjective phrases, not in noun phrases, or a rule lengthening the final vowel of verb phrases but not of adjective phrases. What actually happens in languages is that sandhi rules refer to a phrase of a particular "size," regardless of its syntactic category. The Prosodic Hierarchy correctly predicts this: in constructing a prosodic bracketing from a syntactic one, the fairly rich set of syntactic node labels is reduced to the more impoverished phonological inventory.

A second disadvantage of referring directly to syntactic bracketing in phonology is that the bracketings provided by the syntax sometimes differ from the phonologically required ones. To quote a well-known example (Chomsky and Halle 1968:372), the sentence under (5a) has a right branching syntactic structure, but is assigned intonational contours suggesting the ternary structure of (5b):

(5) a. *This is* [$_{NP}$ *the cat* [$_{S'}$ *that caught* [$_{NP}$ *the rat* [$_{S'}$ *that stole* [$_{NP}$ *the cheese*]]]]]
   b. [*This is the cat*] [*that caught the rat*] [*that stole the cheese*]

Chomsky and Halle point out that this argues for some kind of rebracketing between syntax and phonology, which is the central hypothesis of the Prosodic Hierarchy theory.

Note that if the domains of sandhi rules do not have to be syntactic constituents, then a purely syntactic theory of juncture predicts that a

language could have two phonological rules that referred to overlapping domains. Suppose, for example, that English had two sandhi rules, one that applied between all NP boundaries and another that applied between all S′ boundaries. The two rules would parse the structure of (5a) in overlapping, incompatible ways. To my knowledge, no cases of this sort have been found. If two rules in a language refer to different phrasal domains, then the smaller domains must form subparts of the larger ones. This is a direct consequence of the Strict Layer Hypothesis.

Finally, there are languages in which several phonological rules refer to the same syntactically defined domains. A Prosodic Hierarchy theory need define these domains (which may be fairly complex) only once, in the phrasing rules. Under a theory in which rules refer directly to syntax, the domains must be redefined within every rule that refers to them, making the analysis less general.

The result of this discussion is that a Prosodic Hierarchy is to be preferred to the two most obvious alternatives, boundary symbols and direct reference to syntax, because it is inherently more restrictive and because it better fits known typological observations about sandhi rules.

2.2. The Derivation of the Prosodic Hierarchy

Let us now turn from general considerations of the theory of juncture to a specific proposal. I assume here a theory involving five levels of prosodic structure: the Utterance, the Intonational Phrase, the Phonological Phrase, the Clitic Group, and the Word. This is essentially the theory of Selkirk (1980), with the addition of the Clitic Group, itself a restatement in bracketing theory of a proposal made in Selkirk (1972).

2.2.1. The Word

The lowest category on the Prosodic Hierarchy is the Word level. Numerous phonological rules are word bounded, including many rules of stress assignment and vowel harmony. An example of a rule that applies at word edge is provided by final devoicing in several languages, including Russian, Polish, Turkish, and Catalan.

It has been argued that the "phonological word" can sometimes be a subpart of the grammatical word. For example, in *The Sound Pattern of English* (SPE), Chomsky and Halle (1968) assign to the word *singing* the structure /sIng#Ing/, where the stem *sing* is intended to be a phonological word by itself. Note that this is the same structure assigned to the two-word sequence *sing it* (/sIng#It/). In both cases, the word boundary # allows for the appearance of a prevocalic velar nasal on the surface. Recent work in the

theory of Lexical Phonology (Kiparsky 1982; Mohanan 1982) suggests that accounts of this sort should be rejected. It appears that effects of word-INTERNAL juncture are better explained as the result of how the rules of word formation are organized in the lexicon, rather than by extending the Prosodic Hierarchy below the Word level. If this is correct, then *singing* and *sing it* must be juncturally distinct, represented as follows:

(6) a. $[_{w}$ *singing*$]$
b. $[_{c}\,[_{w}$ *sing*$]\,[_{w}$ *it*$]]$

The possibility of prevocalic /ŋ/ in *singing* must be attributed to the attachment of -ing at Level II of the English morphology.

There is phonological evidence to support this view. The forms *visited* and *visit it*, which according to SPE are juncturally identical, differ in their phonological behavior: whereas the /t/ of *visit* may be lightly aspirated in *visited*, it cannot be in *visit it*. Assuming the analysis of /t/ allophony in Kahn (1976), we can explain this by placing the domain of initial syllabification in English at the level of the Word, not the Clitic Group (See Kahn's work for details of the rules involved):

(7) a. $\overset{\sigma\ \sigma\ \ \sigma}{[_{w}\ vIzIt + əd]}$

b. $[_{c}\,\overset{\sigma\ \sigma}{[_{w}\ vIzIt]}\,\overset{\sigma}{[_{w}\ It]}]$

The evidence from English metrics also supports the inclusion of Level-II affixes in the Word. Throughout the English tradition, words such as *sing#ing* are treated by poets exactly like words such as *sign + al* (with only an internal morpheme boundary) and words such as *single* (with no internal boundary at all). As Kiparsky (1975, 1977) shows, the putatively identical sequence *sing#it* is in fact treated quite differently.

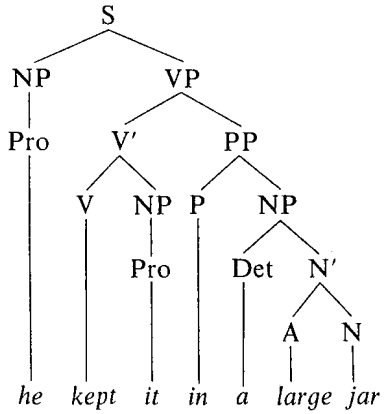
I therefore assume the following: first, the Prosodic Hierarchy should be construed solely as a theory of syntactic juncture, with word-internal juncture handled within the Theory of Lexical Phonology; second, the phonological Word is the lowest level on the Prosodic Hierarchy and is always at least as large as the grammatical word.

2.2.2. The Clitic Group

The next level up on the Prosodic Hierarchy, I would argue, is the Clitic Group, defined roughly as a single content word together with all contiguous grammatical words in the same syntactic constituent. In the sentence (8a), for

example, the Clitic Groups would be as in (8b). The claim is that there are phonological rules that apply within Clitic Groups, but not across their boundaries.

(8) a.



b. [C *he kept it*] [C *in a large*] [C *jar*]

The Clitic Group as I have just described it is too vaguely defined. We can make things more precise by stating explicit rules deriving Clitic Groups from syntactic structure.

(9) CLITIC GROUP FORMATION.
- a. Every content word (lexical category) belongs to a separate Clitic Group.
- b. Definition: The HOST of a Clitic Group is the content word it contains.
- c. Definition: X and Y SHARE CATEGORY MEMBERSHIP in C if C dominates both X and Y.
- d. Rule: Clitic words are incorporated leftward or rightward into an adjacent Clitic Group. The group selected is the one in which the clitic shares more category memberships with the host.

The rules of (9) parcel out the tree of (8a) into the Clitic Groups of (8b), dividing the clitic sequence *it in a* after *it*, in accord with shared category memberships.

The rules just developed are in fact only a translation into bracket notation of the boundary theory of Chomsky and Halle (1968) and Selkirk (1972). A Clitic Group, in the SPE framework, is a maximal sequence not containing the boundary ##. The prediction made by both theories is that phonological contact between a clitic and its host or between clitics attached to the same host should be more closely observed than at other syntactic junctures. Precisely this effect has been demonstrated for several rules of English by

Selkirk (1972). I review two cases below, restating the facts in the bracketing framework.

One rule Selkirk describes is the following:

(10) [v] → ∅/___ [− syllabic] (in fast speech, in certain lexical items)

Within Clitic Groups, the rule deletes [v] in examples such as the following:

(11) a. [C *Please*] [C *leave them*] [C *alone*]
[∅]

b. [C *Will you save me*][C *a seat?*]
[∅]

c. [C *John*] [C *would have left*]
[∅]

d. [C *a piece*] [C *of pie*]
[∅]

But when the triggering consonant occurs in a separate Clitic Group from /v/, deletion is impossible:

(12) a. [C *Give*] [C *Maureen*] [C *some*]
*[∅]

b. [C *We'll save*] [C *those people*] [C *a seat*]
*[∅]

c. *He wouldn't do it this week,* [C *but he would have*] [C *last*] [C *week*]
*[∅]

d. [C *It was thought of*] [C *constantly*]
*[∅]

A second example of a Clitic-Group–bounded process in English is the following rule of Palatalization:

(13) [s,z] → [š,ž] / ___ [š,ž]

$$= [+\text{strid}] \rightarrow [-\text{ant}] \,/\, \_\_\_ \begin{bmatrix} +\text{strid} \\ -\text{ant} \end{bmatrix}$$

Here, the effect is more gradient. Within Clitic Groups, the rule applies more often than not:

(14) a. [C *his shadow*]
[ž]

b. [C *is Sheila*] [C *coming?*]
[ž]

c. [C *as shallow*] [C *as Sheila*]
[ž] [ž]

But when focus and trigger lie within separate Clitic Groups, the rule may apply only in fast or sloppy speech:

(15) a. [C *Laura's*] [C *shadow*]
?[ž]

b. [C *Mrs.*] [C *Shaftow*]
?[ž]

c. [C *those fellas*] [C *shafted him*]
?[ž]

Selkirk adduces additional cases of Clitic-Group–bounded rules in English. Such rules also appear to be fairly common in other languages as well. Thus the "Nati" Rule of Sanskrit (roughly, n → ṇ / Ç . . . ____) was Clitic Group bounded in Vedic, although it retreated to the Word level in the classical language. The stress rule of Cairene Arabic (Broselow 1976) applies within Clitic Groups, which are clearly distinguishable from phonological Words in this dialect. And in Pasiego Spanish (Penny 1969; McCarthy 1984), the Clitic Group forms the domain of two vowel harmony rules.

Metrical evidence also supports the existence of Clitic Groups. In the trochaic pentameter of Serbo-Croatian folk epics (Jakobson 1933, 1952), the fourth syllable in a line must be followed by a Clitic Group boundary, and Clitic Group boundaries in general tend to fall after even positions. Ancient Greek meters often include "bridges," which are sequences of metrical positions that must correspond to syllables in the same word. In less strict metrical styles, bridges may be filled by syllables in separate words, provided they occupy the same Clitic Group (Devine and Stephens 1978, 1981, 1983).

The Clitic Group is not included in the versions of the Prosodic Hierarchy proposed in Selkirk (1980) or in Nespor and Vogel (1982). However, to include it does not complicate the system in any essential way, as in other theories rules that adjoin clitics to their hosts are already present as part of the derivation of higher level categories. For example, Nespor and Vogel (1982:228–229) add to their rule for the construction of Phonological Phrases a special provision that incorporates "non-lexical items . . . (e.g., prepositions, complementizers, conjunctions, copulas . . .)." Bierwisch (1966) similarly proposes that a cliticization rule is one of the rules forming Intonational Phrases (his "Phrasierungseinheiten") in German. Under the theory proposed here, nonlexical items are first incorporated into Clitic Groups. When the Clitic Groups are then combined into Phonological and Intonational Phrases, the clitic elements automatically belong to the right categories. Thus the extra complication of adding a rule to form Clitic Groups is compensated by substantial simplifications in the rules constructing higher-order units.

The rule of cliticization under (9), although adequate for many languages, cannot be universal. Based on the account in Clements (1978), it would appear that cliticization in Ewe applies only to clitics that follow their hosts and that the requirement of maximal shared category memberships is violated under certain circumstances. We will note a further language-particular variation on (9) below.

2.2.3. The Phonological Phrase

The Phonological Phrase (abbreviated: P-phrase) is formed from one or more Clitic Groups. The rules that form P-phrases refer to the X-bar system of the syntax (Chomsky 1970; Jackendoff 1977): they apply within maximal projections, adjoining material to the head. Accordingly I use X-bar notation to describe syntactic structure from here on: N″ = NP, V″ = VP, P″ = PP, and so on.

A particularly clear example of how the X-bar system determines P-phrasing is provided by the phrasal phonology of Chimwi:ni, a Bantu language discussed in an interesting article by Kisseberth and Abasheikh (1974). Several rules of Chimwi:ni, all referring to vowel length, are bounded by the P-phrase. The system works as follows: whereas vowel length is phonemic, it is predictable in word-final syllables where vowels show up short at the end of a P-phrase and long otherwise. However, any long vowel, whether underlying or derived, must surface as short when either a heavy syllable or a three-syllable sequence follows in the same P-phrase. The rules can be stated formally as follows:

(16) Chimwi:ni Length Rules.

$V \rightarrow V: / \_\_\_\_]_{Word}$ (precedes other rules)

$V: \rightarrow V / \_\_\_\_]_{P\text{-}phrase}$

$V: \rightarrow V / \_\_\_\_ \cdots \begin{Bmatrix} VC]_{syl} \\ V: \end{Bmatrix}$ Domain: P-phrase

$V: \rightarrow V / \_\_\_\_ C_0VC_0VC_0V$ Domain: P-phrase

These rules provide a very clear diagnostic for P-phrasing. From them, one can determine that the principal rule of P-phrase formation in Chimwi:ni should be (17):

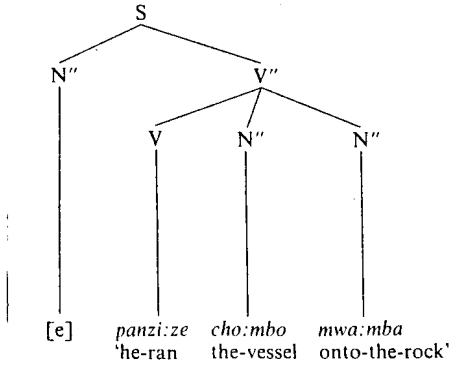
(17) Chimwi:ni P-Phrase Formation.

a. In $[X^0\ Y'' \ldots]_{X''}$, where X^0 is the head of X″, and Y″ is an adjacent complement, the sequence X^0Y'' forms a P-phrase.

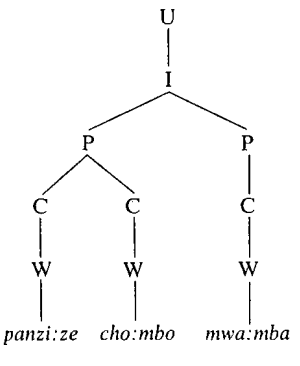
b. All Clitic Groups unaffected by (a) form P-phrases.

An example of how the rules work is shown in (18). In the sentence given, the subject is an implicit pronoun, notated as [e].

(18) a. Syntactic Structure



b. Prosodic Hierarchy



c. Phonological Derivation

[$_P$ *panzi:ze: cho:mbo:*] [$_P$ *mwa:mba:*] V → V: / ____]$_{Word}$
[$_P$ *panzi:ze: cho:mbo*] [$_P$ *mwa:mba*] V: → V / ____]$_{P\text{-phrase}}$
[$_P$ *panzize cho:mbo*] [$_P$ *mwa:mba*] V: → V / . . . ____ V:

In (18), P-phrase Formation adjoins the complement *cho:mbo* 'vessel' to the head of V″, *panzi:ze* 'he drove,' forming a P-phrase. *Mwa:mba* 'rock' is left to form a P-phrase on its own. As shown under (18c), the resulting bracketing leads to the correct phonetic form. Note that any other logically possible bracketing into P-phrases would produce the wrong output: *[$_P$ *panzi:ze*] [$_P$ *chombo mwa:mba*], *[$_P$ *panzi:ze*] [$_P$ *cho:mbo*] [$_P$ *mwa:mba*], *[$_P$ *panzize chombo mwa:mba*].

Through parallel reasoning, P-phrasing can be diagnosed in a number of syntactic contexts. Kisseberth and Abasheikh's data include the cases under (19). P-phrase breaks are notated with slashes.

(19) a. Shared Phrasing

N″: /[N A″]/
/[N P″]/
/[N N″]/

V″: /[V N″]/
/[V A″]/

P″: /[P N″]/

b. Split Phrasing

V″: /[V N″ / N″]/
/[V A″ / P″]/

N″: /[N″ / Conj N″]/

S″: /[N″ / V″]/
/[S″ / S]/ (preposed "if" clause)

It can be seen that the X-bar system plays a crucial role here: only heads of phrases may adjoin with neighboring material, and they only adjoin within

their maximal projections. For example, even if the subject of a clause is a single noun, it will not adjoin with material to the right because such material lies outside of N″.[1]

Odden (1980) has made an intensive study of the phrasal phonology of Kimatuumbi, which, like Chimwi:ni, is a Bantu language. The two rules that diagnose P-phrasing in Kimatuumbi are different from the Chimwi:ni rules: one shortens vowels in words that are nonfinal in their P-phrase; the other deletes high tones in perfective verbs that are not P-phrase final. The P-phrase divisions diagnosed by these rules are as follows:

(20) a. Shared Phrasing

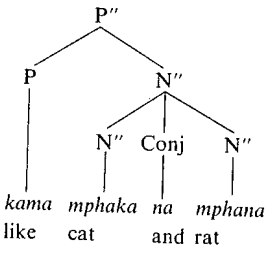
N″: /[N N″]/
/[N A]/
V″: /[V N″]/
/[V Adv]/
/[V Neg]/
P″: /[P N″]/
A: /[A A]/ (reduplicated compound adjective)

b. Split Phrasing

N″: /[N A / A]/
/[N P″ / A]/
V″: /[V N″ / N″]/
/[V N″ / Neg]/
S: /[N″ / V″]/
/[$_S$ [$_{N''}$ [$_S$ V]] / V″] (clausal subject)
/[N″ / V″ / Adv]/ (sentential adverb)

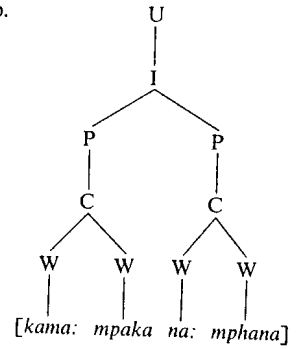
[1] Chimwi:ni also provides support for the Clitic Group, discussed earlier. In (i), we must assume a phrasing grossly incompatible with the syntax in order to get the phonology to come out right:

(i) a.



'like a cat and a rat'

b.



This phrasing follows directly if the nonlexical words *kama* and *na* are adjoined as clitics to the following word.

These phrasings follow from exactly the same rule as in Chimwi:ni. P-phrases are formed by adjoining the closest complement within X″ to the head.

The P-phrases of other languages appear to derive from X-bar structure in somewhat different ways. For example, Clements's (1978) discussion of tonal phonology in Ewe implies a P-phrase constructed over the domain shown in (21):

(21) $\underbrace{[\ldots X^0 \ldots]}_{\text{P-phrase}}{}_{X''}$

That is, the head is grouped together with all material to its left within the maximal projection. This means that the Ewe rules may apply within the structures $[_{N''}\ N''\ N]$ (possessed noun phrases and phrases with nominal postpositions) and $[_{V''}\ N''\ V]$ (verb phrases with a preverbal N″). Tonal sandhi is excluded, however, in verb phrases of the form $[_{V''}\ V/N'']$ where the N″ complement follows the head. Sandhi is also blocked (as in Chimwi:ni) between two verbal complements, as in $[_{V''}\ V/N''/N'']$, and across the subject-predicate break: $[_S\ N''/V'']$.[2]

French appears to employ the same P-phrasing rule as Ewe. The account of Morin and Kaye (1982) suggests that the domain of purely phonological liaison in French consists of the head of a phrase together with all material on its left. Liaison in other contexts has either disappeared from the language or undergone morphological reanalysis.

Italian, according to Nespor and Vogel (1982), derives its P-phrases with an amalgam of the Chimwi:ni/Kimatuumbi and Ewe/French rules: heads are obligatorily joined with all material within X″ on their left, and optionally with the first complement on their right. The latter option may be taken, however, only if the complement "does not branch," in a sense that Nespor and Vogel do not specify. These rules are stated explicitly as follows:

(22) In $[_{X''}\ldots X^0\ Y''\ldots]$
a. $[\ldots X^0]$ obligatorily forms a P-phrase, and
b. $[\ldots X^0\ Y'']$ optionally forms a P-phrase if Y″ does not branch.

[2] Clements notes that $[_{V''}\ V\ Adv]$ forms a phrasal unit (in the present framework, a P-phrase) in Ewe. His explanation of this, restated in our terms, is that adverbs in Ewe do not permit modification: they are isolated heads that lack their own maximal projection. The phrasing $[_P\ V\ Adv]$ can be derived by restating the formula (21) in a slightly generalized way:

(i) $\underbrace{[\ldots X^0 \ldots]}_{\text{P-phrase}}{}_{Y''}$ where Y″ is the smallest maximal projection containing X^0.

The diagnostics that Nespor and Vogel use for P-phrasing in Italian are the gemination rule *Raddoppiamento Sintattico* and a Rhythm Rule.

Nespor and Vogel point out that the interlanguage variation found in P-phrase construction appears to be quite minimal. If we define the "recursive side" of X″ to be the side of X″ on which complements freely occur, we can say the following: P-phrase formation obligatorily adjoins all material on the nonrecursive side, and varies only in whether an adjacent complement is adjoined on the recursive side. In Chimwi:ni and Kimatuumbi, this option is obligatory (understandably, because it is the only possibility for adjunction); in Italian it is optional; and in Ewe and French it is forbidden. The Bantu cases also differ from Italian in that they do not require a complement to be non-branching in order to be adjoined.

In English, P-phrasing appears to follow the Italian model: it adjoins all material to the left of the head obligatorily, and it adjoins one nonbranching complement to the right optionally. As Nespor and Vogel point out, P-phrasing in English can be diagnosed by the Rhythm Rule, the rule that retracts the stress of *thirteen* in phrases such as *thirteen mén*.

Before proceeding with the Rhythm Rule evidence, two difficulties should be noted. First, the English Rhythm Rule is constrained by the Prosodic Hierarchy in gradient fashion: although the rule applies in slow, careful speech only in lower-level prosodic categories, in faster, sloppier speech it may span larger domains. This is in fact an extremely common phenomenon. For example, Clements (1978) notes that although the Ewe rule of Raised Tone Spreading is normally bounded by P-phrases, it applies across their boundaries in "less deliberate" speech. Other cases include Mandarin Third Tone Sandhi (Cheng 1970), Spanish Nasal Assimilation (Harris 1969), Flapping in English, and Glottal Metathesis in Chimalpa Zoque (Knudson 1975). The point here is that in order to use the Rhythm Rule as a diagnostic for P-phrasing in English, one must show that the P-phrase defines a specific level of propensity to apply the rule.

The other difficulty with the Rhythm Rule evidence involves a second kind of gradience. In Hayes (1984a) I tried to show that the rule depends on the spacing in time of the stressed syllables of the input: the farther apart these are, the less likely the rule will apply. A fair test of how syntax affects the Rhythm Rule's application must therefore keep the spacing of the stresses constant. This is done in the examples below.

With these precautions in mind, consider the following data. Standard examples of the Rhythm Rule usually involve a modifier preceding a noun, as in (23a). This is because prenominal position is the most natural and common place for the rule to apply. Note, however, that adverbs preceding adjectives in

A″ and verbs in V″ retract their stress with equal naturalness (cf. 23b and 23c).

(23) a. N″: [A″ N] 2 3 1 *horizontal line*
2 3 1 *Japanese connections*
[N″ N] 2 3 1 *Toscanini's ice cream*
2 3 1 *Tennessee's political situation*
b. A″: [Adv″ A] 2 3 1 2 1 *evidently true* (cf. *evidently*)
c. V″: [Adv″ V] 2 3 1 2 1 *he'll absolutely flip* (cf. *absolutely*)

All three of these cases involve modifiers preceeding the head within X″. If English follows the Italian model of P-phrasing (cf. [22]), we can say that these three most natural environments are precisely the ones in which the word undergoing the Rhythm Rule obligatorily occupies the same P-phrase as the trigger.

The Rhythm Rule may also apply to the head of X″, triggered by the nearest complement:

(24) a. V″: [V N″] 2 3 1 *comprehending everything*
b. 2 3 1 *it'll intersect the origin*
c. [V P″] 2 3 1 *it'll interfere with television*
d. [V Adv″] 2 3 1 *he was persevering endlessly*
e. 2 3 1 *to intervene intelligently*
f. N″: [N P″] 2 3 1 *the Japanese of Honshu*
g. A″: [A P″] 2 3 1 *he's not as Japanese as Sam*

Retraction of stress in these examples seems less natural than in (23). If the Italian rules under (22) also hold for English, this difference becomes plausible:

the syntactic units in (24) may count as P-phrases only as marked option, whereas those in (23) necessarily form P-phrases.[3]

Third, in cases where the rules of P-phrase formation necessarily place the retracting word and the trigger stress in separate P-phrases, retraction seems quite unnatural:

(25) a. S′: [S′/S′] 2 3 1 **When you visit Mississippi, call me*
[N″ S] 2 3 1 **Tennessee, I visited*
b. S: [N″ V″] 2 3 1 *??Mississippi outlawed it*
2 3 1 *??Tennessee will license them*
c. V″: [V N″/P″] 2 3 1 *??He conceded Tennessee to Carter*
[V N″/Adv″] 2 3 1 *??He visited Mississippi twice*
d. N″: [N P″/P″] 2 3 1 *??a book on Tennessee by Knight*

Example (25d) should be compared with *a book on "Tennessee by Night,"* where *Tennessee* and *Night* may occupy the same P-phrase, and retraction is considerably easier.

A final fact to notice is one discovered by Nespor and Vogel (1982). If the complement of a head branches, the ability of the Rhythm Rule to retract stress is lessened relative to when the complement does not branch. Nespor and Vogel compare the following cases:

(26) a. *John pérseveres gládly*
b. *John persevéres gládly and diligently*

(27) a. *Given the chance, rabbits réproduce quickly*
b. *Given the chance, rabbits reprodúce véry quickly.*

This would suggest that English, like Italian, normally does not adjoin a branching complement with its head to form a P-phrase. Here, we can specify the kind of branching that is relevant: a complement resists incorporation if it

[3] Alternatively, we could assume with Nespor and Vogel (1982) that the adjunction of a complement to its head forms a different category of the form P′, which constitutes an intermediate level between the P-phrase and the Intonational Phrase. Because the Rhythm Rule applies less readily in looser categories, this would yield the same result.

contains at least two Clitic Groups. Note that the complements of (24b,c,f,g) contain two words, but only one Clitic Group, and do not resist incorporation.

Summing up these results, we can express the P-phrasing rules of English as follows:

(28) PHONOLOGICAL PHRASE CONSTRUCTION (English). In the configuration $[_{X''} \ldots X^0 \; Y'' \ldots]$
a. The sequence $[\ldots X^0]$ obligatorily occupies the same P-phrase,
b. Y″ may optionally adjoin to the P-phrase of X^0 if it contains only one Clitic Group, and
c. All Clitic Groups unaffected by rules (a) and (b) form P-phrases.

The Rhythm Rule applies readily when the words involved obligatorily occupy the same P-phrase, less readily when the words optionally share a P-phrase, and quite reluctantly when the relevant words must occupy separate P-phrases.

The English P-phrasing rules are supported not just by the Rhythm Rule evidence, but also by their close similarity to the P-phrasing rules of other languages. The relevance of the English rules to metrics will become clear shortly.

2.2.4. THE INTONATIONAL PHRASE

The Intonational Phrase (abbreviated: I-Phrase) is a concatenation of one or more P-phrases. As Selkirk (1978) and Nespor and Vogel (1983) point out, the rules deriving I-phrases vary in their application and are harder to pin down. There are a few syntactic loci that obligatorily correspond to the edge of an I-phrase; for example, the edges of parentheticals, nonrestrictive relative clauses, and constituents displaced by stylistic or root transformations. The boundaries of clauses and the breaks between subject and verb phrases also strongly tend to attract I-phrase breaks. However, in the latter cases syntax can be overridden by phonological factors: the need to produce I-phrases of appropriate length can cause phrases that syntactically belong separately to be grouped together. Similarly, syntactic units that would normally constitute one I-phrase are broken up when excessively long. (See Bierwisch 1966 for some interesting ideas on how the notion of "length" can be made precise). Some examples of English I-phrasing from Selkirk's and from Nespor and Vogel's work are as follows:

(29) a. [$_I$ *The frog*] [$_I$ *ate a fly*] [$_I$ *for lunch*]
[$_I$ *The frog*] [$_I$ *ate a fly for lunch*]
[$_I$ *The frog ate a fly for lunch*] (Nespor and Vogel 1983)

b. [$_I$ *This is the cat*] [$_I$ *that caught the rat*] [$_I$ *that stole the cheese*] (Nespor and Vogel 1983)

c. [$_I$ *In Pakistan,*] [$_I$ *Tuesday,*] [$_I$ *which is a weekday,*] [$_I$ *is a holiday*] (Selkirk 1978)

Case (29a) shows three possibilities, that would vary with speech rate. Note that the preferred bracketing with two I-phrases places the break at the subject-predicate boundary. Case (29b) is repeated from (5) above, and demonstrates the tendency of I-phrase edges to correspond with clause edges. Case (29c) shows how parentheticals demand I-phrase breaks no matter how short the resulting I-phrases are.

I-phrases are clearly audible in English because each one is aligned with a single "tune" of the intonational system. For example, in (30), the three I-phrases would typically be given the tunes [H* L⁻ H%], [H* H* L⁻ H%], and [H* H* L⁻ L%], respectively, under the analysis of Pierrehumbert (1980).

(30) [$_I$ *Emmet,*] [$_I$ *alias the Rat,*] [$_I$ *eats only cheese*]

I-phrases also serve as the bounding domain for ordinary phonological rules. For example, in American English, syllable-final /t/ is realized as a flap before a vowel (cf. all five /t/s in *Might it audit Emmet at Ida's?*). Nespor and Vogel (1982) point out that this rule is blocked across I-phrase boundaries so that the /t/s of *Emmet* and *Rat* in (30) show up unflapped except in rapid speech.

Nespor and Vogel give two examples of I-phrase–bounded rules from other languages: Spanish Nasal Assimilation and the Tuscan/Italian spirantization rule Gorgia Toscana. Another example is a Stress Percolation rule of Chimwi:ni (Kisseberth and Abasheikh 1974). As far as can be determined, the same principles for I-phrase construction hold for these languages as for English, although given the variability of I-phrasing, it is difficult to be certain.

2.2.5. THE UTTERANCE

The Utterance is the largest prosodic category, containing one or more I-phrases. An Utterance comprises a maximal sequence between phonetic, structural pauses. By "phonetic" I mean pauses that are not only heard by naive listeners but that involve the actual cessation of speaking. "Structural" is intended to exclude hesitation pauses and other performance phenomena. Utterances normally correspond to full sentences, though not always (cf. Nespor and Vogel 1983:128). Nespor and Vogel cite British English /r/ Epenthesis as an example of a rule "bounded" by Utterance. The rule clearly

can apply cross I-phrase boundaries, for example in the sentences of (31):

(31) BRITISH ENGLISH /r/ EPENTHESIS.

$$\varnothing \rightarrow r \,/\, \begin{matrix} V \\ [-\text{tense}] \end{matrix} \;]_{\text{Word}} \_\_\_ V \quad \text{Domain: Utterance}$$

a. *Fritz, who lives in Vienna,* [r]*is Austrian.*
b. *If you come from Minnesota,* [r]*everyone asks you about the cold.*

The three speakers I have consulted omit the /r/ from these examples only when they actually pause at the site indicated.

Some further rules that are "bounded" by Utterance or that apply at Utterance edge are discussed in Selkirk (1980) regarding Sanskrit and in Odden (1980) regarding Kimatuumbi.

2.3. Summary

I propose a version of the Prosodic Hierarchy including five levels of structure, plus rules that derive the hierarchy from syntactic bracketing in English and other languages. Obviously, many questions remain. For example, there is little evidence to determine what phrasing should be assigned to compound words. A different problem is posed by VSO languages: because they lack a V″ constituent, the P-phrasing rules at the clausal level must work differently from what we have seen so far. This is in fact the case in Tiberian Hebrew, which is VSO (cf. Rotenberg 1978; Dresher 1981). However, the closely similar behavior of unrelated SVO languages in their phrasing patterns suggests that the overall approach is on the right track.

One naturally wonders whether all five levels of the Hierarchy exist in all languages. It is doubtless true that we will not find phonological rules that clearly reveal their existence (e.g., the Rhythm Rule or *Raddoppiamento Sintattico*) for all categories in all languages. However, there may be subtler ways in which the hierarchy makes it presence felt. Nespor and Vogel (1983) have shown that Italian listeners can distinguish minimal pairs that differ only in their P-phrasing, even when no overt phonological rule such as *Raddoppiamento Sintattico* signals the difference. Clearly, some more subtle phonetic phenomenon—plausibly phrase-final lengthening—manifests the difference in P-phrasing. As a hypothesis, then, one might suppose that the Prosodic Hierarchy is universal, serving principally as an organizing framework for timing in phonetic implementation. The cases discussed above, then, would be only the tip of the iceberg, the rare instances in which a language has obliged phonologists by containing a phrasal rule whose effects are easily heard and analyzed.

3. THE EVIDENCE FROM METER

From here on I take the Prosodic Hierarchy as a given, along with the phrasing rules for English proposed in (28), and I address the role the Hierarchy plays in English metrics. To start, I briefly describe the approach to metrics taken here.

Metrics can be defined as the study of how conventionalized rhythmic patterns are manifested in linguistic material. Poets have intuitive knowledge of which linguistic sequences do or do not properly instantiate a given rhythmic pattern, or meter. To give a brief example: the meter most commonly used in the English tradition is the iambic pentameter, notated in (32) as a sequence of ten alternating weak (W) and strong (S) positions. For most English poets the line (32a) would constitute a permissible realization of the iambic pentameter, whereas (32b), with the same syllable count, would not:

(32) Iambic Pentameter
W S W S W S W S W S

a. *My name is Ozymandias, king of kings*
w | s w s w s w s w s

b. ***Ozymandias** by Percy Bysshe Shelley*
w s w s w s w s w s

In the theory of GENERATIVE METRICS (cf. Halle and Keyser 1971 and later work), the goal is to render this intuitive knowledge completely explicit in a formalized theory, much as generative linguistics attempts explicit formal accounts of linguistic knowledge.

Like generative linguistics, generative metrics is particularly concerned with the task of distinguishing the general from the idiosyncratic. Some recent work, notably Kiparsky (1977), has shown that poets working within the same Modern English tradition employ remarkably diverse rule systems. For example, although the iambic pentameters of Milton and Shakespeare have a similar overall feel to them, the explicit conditions of well-formedness governing the two poets' lines are quite different. An adequate theory of metrics must have the flexibility to describe the varying rule systems of individual poets, at the same time characterizing those general principles, founded in phonological and rhythmic competence, that govern the match-up of rhythm and phonological form.

Linguists have a particular role in this research program: to determine the aspects of metrical patterning that can be explained with deeper knowledge of linguistic structure. It is reasonable to suppose that better understanding of the linguistic basis of metrics will lead to simpler and more explanatory

metrical analyses. I hope to show that the Prosodic Hierarchy forms part of this basis.

3.1. Inversion

As an example, consider the phenomenon of inversion: the appearance of the linguistic sequence STRESSED-STRESSLESS in WS position of the meter. To keep the data tidier, I consider only LEXICAL inversions, in which the stressed and unstressed syllables belong to the same world. Some examples of lexical inversion are shown below:

(33) a. ***Richer*** *than wealth,* ***prouder*** *than garments' cost*
w s w s ws w s w s
(Shakespeare, Son. 91)

b. ***Marry****, my child,* ***early*** *next Thursday morn*
(Shakespeare, *Rom.* 3.5.112)

c. *Of Eve, whose Eye* ***darted*** *contagious Fire*
(Milton, *Paradise Lost* 9.1036)

d. *And yet to me* ***welcome*** *is day and night*
(Shelley, *Prometheus Unbound* 1.44)

e. *And evening airs* ***wander*** *upon the wave* (Shelley, *Hellas* 169)

Most inversions, whether lexical or not, occur at the beginning of the line, as in the first inversions of (33a) and (33b). Our present interest lies in the line-medial inversions. These are traditionally held to be possible only after a pause. However, this view cannot stand up to instrumental testing; for example, in any reasonably fluent reading of lines (33c–33e), there would be no measurable pause before the medial inversion site. What seems closer to the truth is that medial inversion requires a sharp phrasal break and that phonetically untrained listeners tend to hear such breaks as pauses. If this is correct, the real problem at hand is to determine what conditions license a phrasal break salient enough to permit inversion.

Kiparsky (1975) advances an interesting proposal along these lines. Taken literally, his proposal is that, for Shakespeare, inversion is licensed by a combination of two factors, one syntactic and one phonological. The syntactic condition is that the break must coincide with the edge of a syntactic phrase (specifically, N″, V″, A″, or P″). This distinguishes the well-formed line (34a) from its unmetrical counterpart (34b). The phonological condition is based on the system of phonological boundaries proposed in Chomsky and Halle (1968): an inversion site must coincide with a ## boundary, rather than a # boundary. In practice, this means that the beginnings of phrases cannot license inversion if they are preceded by a proclitic word. Kiparsky's phonological condition rules out unmetrical lines such as (34c).

(34) a. *When lofty trees I see #*[$_{A''}$ *#**barren** of leaves*]
(Shakespeare, Son. 12)

b.**With lofty birches* [$_{A''}$ *quite ##**barren** of leaves*] (construct)

c.**When lofty birches* [$_{V''}$ *are* [$_{A''}$ *#**barren** of leaves*]] (construct)

In the texts that I have checked, Kiparsky's rules work quite well: for those poets who, like Shakespeare, restrict lexical inversions to "postpausal" position (some do not), there are vanishingly few inversions in sites not licensed by the rules. However, as Kiparsky recognizes, the rules are odd from a linguistic point of view because they refer simultaneously to an arbitrary combination of syntactic and phonological information. A simpler and more natural formulation of the rule is made possible by referring to the Prosodic Hierarchy: we simply say that inversion is restricted to the beginnings of Phonological Phrases. The examples just discussed, for instance, would normally be P-phrased as in (35), giving just the right results:

(35) a. [$_P$ *When lofty trees*] [$_P$ *I see*] [$_P$ ***barren** of leaves*]

b.*[$_P$ *With lofty birches*] [$_P$ *quite **barren** of leaves*]

c.*[$_P$ *When lofty birches*] [$_P$ *are **barren** of leaves*]

The rules presented above for Clitic Group formation and P-phrasing duplicate quite closely the pattern of inversion sites predicted by Kiparsky's analysis. However, the Prosodic Hierarchy analysis seems to me to have more explanatory value because the P-phrasing on which it depends can be independently motivated as part of the phonology of English. Kiparsky's conditions are specific to the metrical analysis and essentially recapitulate the P-phrasing rules as part of the metrics.

There is in fact a minor difference between the predictions of Kiparsky's proposal and those of the P-phrasing account. Recall that the rules of English P-phrasing normally group the head of a phrase together with its closest complement if this complement fails to branch. This means that the left edge of a nonbranching complement will satisfy Kiparsky's rules but will not ordinarily be initial in a P-phrase. Thus if the P-phrasing account is correct, we should not find inversions in simple objects of verbs or P″ complements of nouns, as shown in (36):

(36)

Syntactic Phrasing + Boundaries	P-Phrasing
a. *He gave #*[N″*#**Alice***] *a book*	[$_P$ *he gave **Alice***] [$_P$ *a book*]
w s ws w s	w s *w s w s
b. *life #*[P″*#**under** the king*]	[$_P$ *life **under** the king*]
s w s w s	s *w s w s

The predictions of the P-phrasing account appear to be borne out by the facts: inversions at the beginning of nonbranching complements adjacent to their

heads are extremely rare. For example, in 4,600 scanned lines of Shakespeare (the *Sonnets* and *Romeo and Juliet*) I found no such inversions. In 7,500 scanned lines from Shelley, there were only two:

(37) a. *And she saw princes* [$_P$ *couched* ***under*** *the glow*]
("The Witch of Atlas" 64.1)
b. *Below far lands* [$_P$ *are seen* ***tremblingly***]
("On the Medusa of Leonardo da Vinci" 1.3)

Thus the P-phrasing account seems to be preferable to Kiparsky's for empirical as well as conceptual reasons. See Section 3.5.4 for further discussion.

3.2. A Hypothesis

Taken as a small improvement over the predictions of Kiparsky's analysis, the above results are insignificant. However, they may be symptomatic of a more general and important pattern. I would like to suggest that metrical rules NEVER refer to syntactic bracketing, only to prosodic bracketing. In other words, syntax has effects in metrics only insofar as it determines the phrasings of the Prosodic Hierarchy. This claim is the metrical counterpart of Selkirk's (1981) contention that syntactic effects in phonology are limited to the determination of phrasing. Intuitively, the hypothesis states that meter is essentially a phonological phenomenon; thus we might call it the Hypothesis of Phonological Metrics.

The most straightforward way to show that the Hypothesis is true is to examine a large set of metrical rules, recording what kinds of bracketed domains they refer to. If the Hypothesis is correct, we will find rules that refer to Clitic Groups, P-phrases, I-phrases, and so on, but no rules that must refer specifically to N″, A″, S, and so forth. To my knowledge, this expectation is fulfilled, and I present part of the evidence in the next section.

A more subtle test of the Hypothesis, however, would be to find a metrical rule that is sensitive to bracketing at all levels. By testing this rule on lines in which the syntactic bracketing and phonological bracketing differ, we could determine in a more direct way which kind of bracketing was relevant to the rule. With this strategy in mind, I turn to the meter of Longfellow's *Song of Hiawatha*, which contains the right kind of rule and which permits the relevant test to be made.

3.3. The Meter of *Hiawatha*

Hiawatha is an epic of 5,409 lines, written in acatalectic trochaic tetrameter; that is, the meter notated informally under (38a). Some lines illustrating the meter are shown in (38b):

(38) a. S W S W S W S W
b. *Gitche Manito, the mighty*
Smoked the calumet, the Peace-Pipe
As a signal to the nations.
And the smoke rose slowly, slowly,
Through the tranquil air of morning
First a single line of darkness,
Then a denser, bluer vapor,
Then a snow-white cloud unfolding,
Like the tree-tops of the forest,
Ever rising, rising, rising
(1.29–38)

To my knowledge, *Hiawatha* is the only long poem written in this meter. Poems written to the pattern of (38a) are common, but they usually permit the final W position to be phonologically unrealized, which seems to play a crucial role in avoiding rhythmic monotony. The implicit rules governing the structure of lines in *Hiawatha* are quite different from the rules found elsewhere in the English metrical tradition. This may be due to freedom from precedent: in composing in a novel meter, Longfellow felt free to assert his own metrical preferences, whereas in his compositions in orthodox meters, his practice is sharply shifted towards the norms of the English tradition.

3.3.1. Preliminaries

An explicit analysis of the meter of *Hiawatha*, as of any other accentual meter, must assume some kind of phonological representation for stress. I assume here without argument that the representation relevant to metrics is the "metrical grid" proposed in Liberman and Prince (1977). Justification of grids on phonological grounds may be found in Prince (1983) and in Hayes (1984). Their relevance to metrics is argued for in Hayes (1983). Formally, a grid is a set of marks arrayed in columns over the syllables of an utterance, with the higher columns designating greater degrees of stress. In order to save space, I will use grids in which the lowest columns are of height zero, annotated with a dot. To give an example: in (39), the grid indicates that the first syllable of *Gitche* bears less stress than the first syllable of *Manito*, which in turn bears less stress than the first syllable of *mighty*. The remaining syllables have null grid columns and are for purposes of prosody stressless.

(39)
```
          x
    x     x
x . x . . x .
```
Gitche Manito, the mighty

The column heights are to be interpreted in relative fashion only: for example, a two-mark column denotes only a degree of stress less than that of a three-mark column and more than that of a one-mark column in the same utterance.

Most of the grids to be used in examples here are, I believe, intuitively plausible and straightforward. Their shape is in large part phonologically predictable; for accounts of the rules involved, see the articles just cited.

3.3.2. An Analysis

For clarity of exposition, I will develop the analysis of *Hiawatha* inductively, presenting three successively more complex but more accurate accounts. Consider first the grids for the first six lines of (38):

(40)

a. *Gitche Manito, the mighty*
s w s ws w s w

b. *Smoked the calumet, the Peace-Pipe*
s w s w s w s w

c. *As a signal to the nations*
s w s w s w s w

d. *And the smoke rose slowly, slowly*
s w s w s w s w

e. *Through the tranquil air of morning*
s w s w s w s w

f. *First a single line of darkness*
s w s w s w s w

In (40), the most straightforward realization of the pattern is clearly (40f): every S position in the meter is realized by a stressed syllable, marked /x/ on the grid; and every W position by a stressless syllable, marked /./. This ideal state of affairs is found only in a small fraction of lines, however. Most lines contain either stressless syllables in S position (cf. *as* and *to* in [40c]) or stressed syllables in W (cf. *Pipe* in [40b] and *rose* in [40d]). However, in one sense, it is clear that the disruptions of alternating rhythm are relatively mild. Following Jespersen (1933) and Halle and Keyser (1971), if we think in terms of rising and falling SEQUENCES of stress rather than single positions, we find that stress sequences seldom directly contradict the meter by rising when the meter falls or vice versa—at worst, the line opposes level sequences to a rise or fall in the meter, as in (40c). This observation can be stated formally in a

straightforward way using the notion of "stress peak," defined in Hayes (1983) as follows:

(41) PEAK: any syllable with a higher grid column than AT LEAST ONE of its neighbors

In the grid of (42), the underlined syllables are all peaks. Notice that under the definition, "shoulders" count as peaks as well.

(42)
x x
. x̲ x̲ x x

The notion of "peak" affords a compact first approximation to the metrical rules of *Hiawatha*, as in (43):

(43) PEAK THEORY. Any stress peak in the line must fall in S position in the meter.

The Peak Theory allows for only the minimal deviations found in (40). Stressless syllables are permitted in S, because nothing forbids them, and those stressed syllables that do occur in W (*Pipe* in [40b] and *rose* in [40d]) are licensed by the fact that they are not peaks.

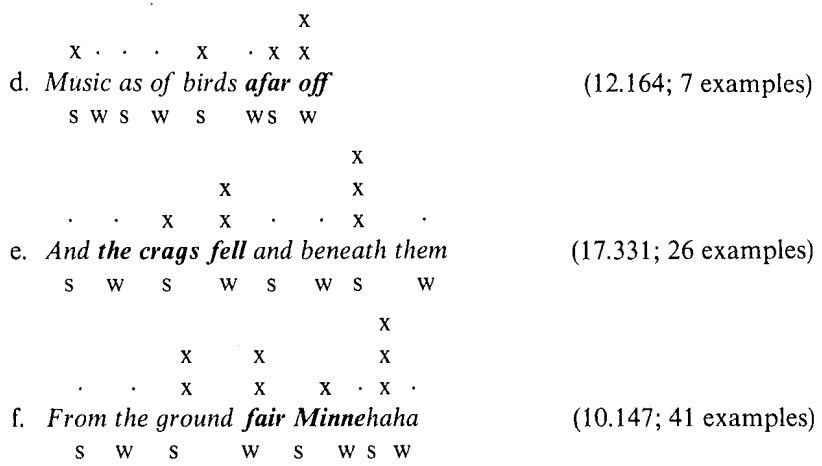
About 91% of the lines of *Hiawatha* conform to the fairly stiff requirements of the Peak Theory. This high percentage suggests that the theory defines the metrical norm of the poem, specifying the lines of low complexity (Halle and Keyser 1971). However, 9% is a large fraction of exceptions, and it is worthwhile to ask whether there are general laws governing what may occur in this marked residue. To this end, consider the lines of (44), which exemplify some of the cadences that violate the Peak Theory. Each line is followed by a number indicating how many lines of similar structure occur in the poem.

(44) Lines that do not Conform to the Peak Theory

a. *From the land of* ***the White Rabbit***
s w s w s w s w (2.7; 72 examples)

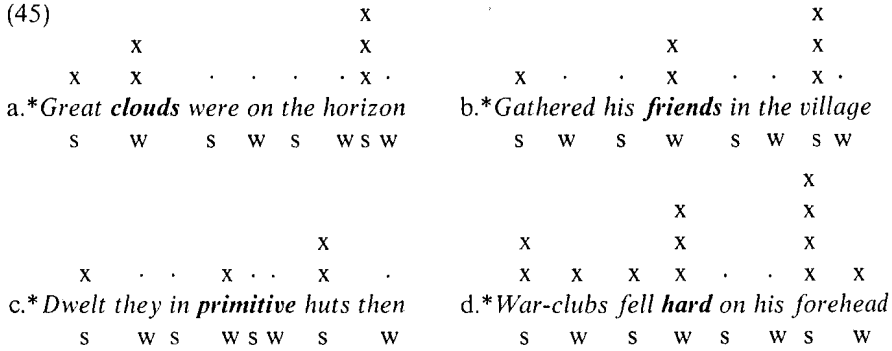
b. *Like* ***the tree-tops*** *of the forest*
s w s w s w s w (1.37; 67 examples)

c. *An attendant and* ***pipe-bearer***
s w s w s w s w (16.130; 28 examples)



These lines all contain stress peaks in W position: *White* in (44a), *tops* in (44b), *pipe* in (44c), *off* in (44d), *fell* in (44e), and *fair* in (44f). However, a moment's inspection shows that the violations are not arbitrary: in every instance, a mismatched peak in W position is located adjacent to a properly matched peak in S position—such as *Rab* in (44a), *bear* in (44c), and so on. No peak is a "sore thumb," in the sense of not being compensated by an adjacent peak. If this principle did not hold, we might expect to find lines in the poem such as (45), which are in fact systematically avoided:

(45)



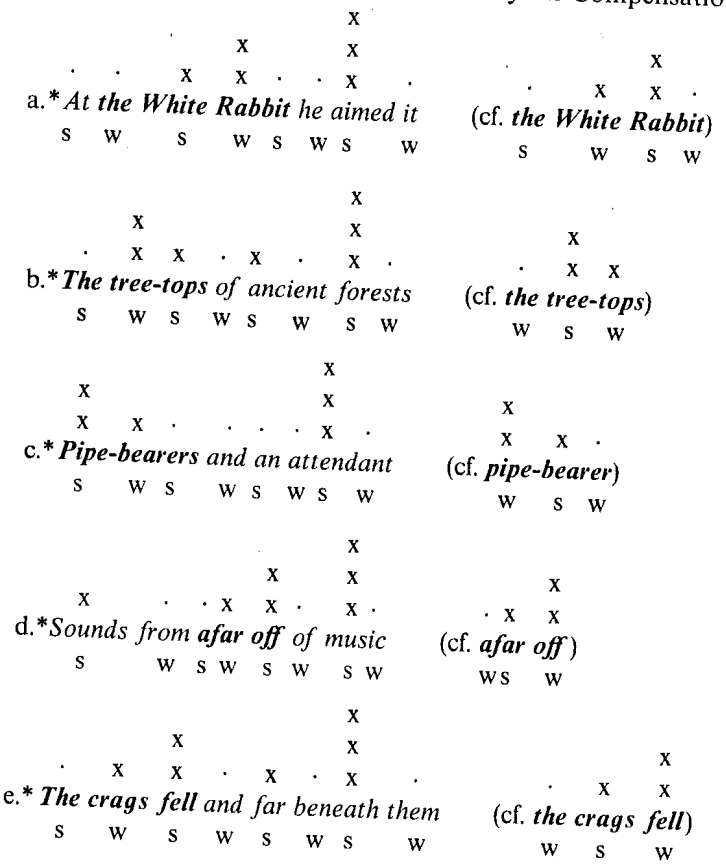
These observations are formalized in (46).

(46) COMPENSATION THEORY. Any stress peak occurring in W must be adjacent to another peak in S.

The Compensation Theory is less strict than the Peak Theory, allowing lines that the latter excludes, but it is more accurate because there are vanishingly few counterexamples to it in the entire poem.

Although the Compensation Theory is an improvement over the primitive Peak Theory, it is unsatisfactory in a different way: it fails to exclude cadences that are systematically missing from the corpus, rather than wrongly excluding attested cadences. To see why, note that if any peak can be compensated by an adjacent peak, then any linguistic sequence containing adjacent peaks should be scannable in two ways, depending on which peak is placed in W position and which peak compensates it. In (47), this prediction is tested out. The underlined cadences of (44), which contain adjacent peaks, have been placed in constructed lines in the opposite relation to the meter—*the White Rabbit*, for example, is scanned SWSW in (44a) and WSWS in (47a). (In [47f] I have substituted *Winnepesaukee* for *Minnehaha* to keep primary stress in S in both cases.) The crucial fact is that all the shifted lines of (47) represent cadences that are systematically excluded from the corpus.

(47) Unattested Patterns Wrongly Predicted by the Compensation Theory



```
                            x
                   x        x                       x
      x       .    x        x             x         x
      x    x  . .  x   .    x  .          x    x  . x  .
f.* Fair Winnepesaukee gleaming     (cf. fair Minnehaha)
      s    w s ws     w   s   w           w    s  ws  w
```

The examples in (44) and (47) are quite representative: with a couple of exceptions to be dealt with later, a given linguistic structure can be scanned in only one way in *Hiawatha*, contrary to the predictions of the Compensation Theory.

To fix the Compensation Theory, one must find out the principles determining which of two adjacent peaks is placed in S, with the other relegated to W. The intuitively obvious answer would be to select the stronger stress for S position. Curiously, this procedure is not followed: in examples (44c–44f) and (47c–47f), it is the weaker of the two stresses that must be scanned S. The problem thus seems to qualify as nontrivial.[4]

The solution I propose can perhaps be grasped most easily through a metaphor. Imagine that the process of scanning a line from *Hiawatha* consists of the following: the metrist writes the line and its grid on a blackboard then steps back and, with a camera, takes a "snapshot" of every linguistic constituent in the line. Each snapshot is carefully trimmed so as to contain only material in its own constituent. Applied to line (44c), this would yield the snapshots of (48):

(48) Snapshots

```
                                          x
      .        . x  .           .         x        x  .
   a. An    b. attendant     c. and    d. pipe   e. bearer
      s        w s   w          s         w         s  w
```

[4]It may be worthwhile to address a commonly made objection: suppose that in cases such as (44c–44f) Longfellow intended the reader to "save" the line by stressing it in accord with the meter rather than the linguistic structure; for example, in (44c) one would say *pipe-béarer* and in (44e) *the cràgs fell.* The metrical rules needed to describe the resulting scansions would then be rather straightforward. I think it plausible that Longfellow DID intend such distorted pronunciations, but the problems faced by the metrist are not thereby solved, as Kiparsky (1975) has pointed out. The difficulty is that distorted stressing is needed only in a certain subset of the lines. There are no lines in the poem like (45a) or (45d), which could be "fixed" by using the stressings *gréat clouds* and *féll hard.* A theory that invokes distorted stressings faces the same questions as a theory that does not, but in revised form: we need to know under what circumstances an artificial pronunciation may be invoked. The Bounding Theory I develop evaluates normal pronunciations against the metrical pattern, but it is not difficult to translate it into a theory that licences distorted pronunciations. As far as I can tell, nothing is gained by doing so.


```
                                 x                              x
     . . x  .                    x   x  .                    .  x   x  .
f. An attendant            g. pipe-bearer             h. and pipe-bearer
    s  w s  w                    w   s  w                 s     w   s  w

                             x
     . . x  .        .       x   x  .
i. An attendant     and    pipe-bearer
    s  w s  w        s       w   s  w
```

Using this metaphor, we can say that a line of *Hiawatha* is well-formed if and only if each of its snapshots, considered as a line in itself, passes the test of the Compensation Theory. Line (44c), for example, counts as metrical by the following reasoning: (I) in the snapshots *attendant, bearer*, and *an attendant*, the only peak is in S position; (II) the snapshots *an, and*, and *pipe* are monosyllabic, hence contain no peak (see the definition of peak under [41]) and pass the test by default; and (III) in all remaining snapshots (*pipe-bearer, and pipe-bearer, an attendant and pipe-bearer*), the misplaced peak in *pipe* is compensated by an adjacent peak on *bear.*

As the reader can verify, all the other lines of (44) are also correctly predicted to be metrical by this account. The unmetrical, made-up lines of (47), however, are all excluded by the theory because each contains at least one ill-formed snapshot. These are shown under (49), with asterisks marking the uncompensated peak in W:

(49) Ill-formed Snapshots in (47)

```
       x            x
       x  .         x   x
    a. Rabbit    b. tree-tops      c. bearers
      *w  s        *w   s             x  .
                                     *w  s

                                                  x
       . x           .     x          x  . . x  .
    d. afar      e. the crags     f. Winnepesaukee
       s*w           s    *w         *w s  ws   w
```

Our proposal thus solves all the problems we have encountered; unlike the Peak Theory, it has extremely few counterexamples, and unlike the Compensation Theory, it can correctly distinguish the examples of (44) and (47). The proposal thus deserves to be freed from its metaphorical interpretation and stated more explicitly:

(50) BOUNDING THEORY. A line L of *Hiawatha* is metrical if, for every constituent C of L, the following condition holds: any peak defined in C that occupies metrical W position is adjacent to a peak also defined in C.

The name of the theory derives from its claim that compensation is bounded: in searching for a peak to compensate a peak in W, one's search is bounded by the minimal category in which the peak is defined.

The Bounding Theory illustrates a principle propounded by Kiparsky (1975;579): metrical rules cannot be defined on stress pattern alone; rather, "the most important, virtually unbreakable constraints on meter in English involve the grammatical structure of the verse, notably the word and phrase units of which it is made up." The *Hiawatha* system illustrates this perhaps more clearly than any other meter. The same sequence of compensating stresses in *Hiawatha* can show up with two scansions that are determined entirely by the linguistic bracketing. This is demonstrated by the sequences in (51):

(51)

a. [*tree tops*] *of* versus *pipe*-[*bearer*]

x / x x · / s w s — versus — x / x x · / w s w

x / x x · / *Fair* [*Minne*(*haha*)] / w s w

b. [*afar*] *off* versus *the* [*White* [*Rab*(*bit*)]]

x / · x x / ws w — versus — x / · x x / s w s

x / · x x / [*the crags*] *fell* / w s w

The *Hiawatha* system also points out a close similarity between metrics and phonology: both make crucial use of bounding domains. Both metrical and phonological rules parse a linguistic sequence into snapshots, and both apply within snapshots rather than within the sequence as a whole.

3.3.3. The Scope of the Bounding Theory's Predictions

Before attempting to hang a further theoretical point on the Bounding Theory, I will reinforce it by pointing out the range of correct predictions it makes.

First, the theory predicts that any sequence of adjacent snapshots that require incompatible scansions, as in (52), will be ill formed no matter how it is scanned, and thus should be avoided.

(52)

a. [*canoe*]-[*bearer*]

x / · x x · / w s *w s / s*w s w

b. [*Ahméek*] [*bit*] [*it*]

x / · x x · / w s *w s / s *w s w

c. [*the bear*] [*ate him*]

x / · x x · / w s *w s / s *w s w

d. [*the crags*] [*tumbled*]

x / · x x · / w s *w s / s *w s w

e. [*immense*] [*pine-trees*]

x / · x x x / w s *w s / s *w s w

f. [*great clouds*] [*gathered*]

x / x x / x x x · / w s *w s / s *w s w

Such cadences are indeed systematically missing from the poem. There are other cadences that consist of subparts that are scannable by themselves but that form an unscannable combination according to the theory:

(53)

a. [*Fred* [*was* [*a bear*]]]

x / x · · x / *w s w s / s w s *w

b. [[*battering*]-[*ram*]]

x / x · · x / s ws *w / *w s w s

These, too, are systematically avoided.

Kiparsky (1977) has discovered that certain secondary stresses in polysyllabic words count as metrically relevant. Specifically, these are the weak stresses labeled S in a tree-based theory of stress (Liberman and Prince 1977) or, equivalently, marked with an "x" in a grid-based theory (Hayes 1983). This provides a further test for the Bounding Theory: long words such as *Winnepesáukee*, with metrically relevant stresses spaced in the wrong way, should be absent from the corpus as unscannable:

(54)

x / x · · x · / *Winnepesaukee* / s ws *w s / *w s w s w

This test holds true. Notice that the absence of words with this stress pattern is unlikely to be an accident. Owing to its subject matter, the poem abounds

in long monomorphemic words that, when pentasyllabic, normally receive the *Winnepesáukee* stress pattern (cf. Hayes 1982). Observe in addition that the poem does contain pentasyllabic words that have properly spaced stresses:

(55) a. *And their wild reverberations* (1.8)
x
· x · x ·
s w s ws ws w

b. *Symbol and interpretation* (14.135)

c. *And the interpretation, "Listen!* (14.143)

A particularly interesting case along these lines is the word *uninterrupted*, which occurs three times in the poem:

(56) a. *Through **uninterrupted** silence* (10.61)

b. *In **uninterrupted** silence* (13.201)

c. *One **uninterrupted** level* (19.25)

By standard assumptions (cf. Chomsky and Halle 1968 and much later work), *uninterrupted* differs from *Winnepesaukee* in having two weak stresses, a secondary on the first syllable and a tertiary on the second. (The absence of vowel reduction is a reliable diagnostic in this case.) In the scansion Longfellow used, the peak in S on the second syllable is able to compensate the misplaced peak on the first, thereby satisfying the rules:

(57)
x
x x
x x · x ·
uninterrupted
w s w s w

Thus the Bounding Theory can in certain cases predict different metrical behavior based on fairly subtle differences of phonetic detail.

It is always possible that the absence of lines in *Hiawatha* violating the Boundary Theory is accidental, resulting merely from the statistical norms of English diction. That this is unlikely is shown in the verse of other poets by the presence of numerous lines that are excluded by the theory. In the following examples written in iambic pentameter, mismatched peaks are marked with asterisks, and the resulting ill-formed snapshots are enclosed in brackets.

(58) Shelley

a. *Pursued or shunned the shadows [the clouds] threw* ("Triumph of Life," 63)
w s w s w s w s *w s

b. *In lonesome values, [making] the wild his home* (*Alastor*, 99)
w s w s *w s w s w s

c. *But its own curvèd prow of thin [moonstone]* (*Revolt of Islam* 1.23.2)
w s w s w s w s *w s

d. *Of [divine] sleep, and on the air-like waves* (*Epipsychidion*, 195)
w s *w s w s w s w s

(59) Shakespeare

a. *Yond light is not [daylight], I know it, I* (*Rom.* 3.5.12)
w s w s *w s w s w s

b. *A thousand [raw tricks] of these bragging Jacks* (*MV* 3.4.78)
w s w s *w s w s w s

c. *[Beauty] provoketh thieves [sooner] than gold* (*AYL* 1.3.110)
*w s w s w s *w s w s

d. *More than your force [move us] to gentleness* (*AYL* 2.7.103)
w s w s *w s w s ws

e. *At [the wood's] boldness by thee blushing stand* (Son. 128)
w s *w s w s w s w s

More surprisingly, even Longfellow violates the Bounding Theory when composing in more orthodox verse forms. The following lines are iambic tetrameters and pentameters from *Tales of a Wayside Inn*, composed a few years after *Hiawatha*:

(60) Iambic Pentameter

a. *Ground out the Governor's sixtieth [birthday]* ("Lady Wentworth," 111)
w s w s w sws *w s

b. *To [my *heart's] level, O my heart's delight* ("Emma and Eginhard," 107)

c. *[*Save me] from Azrael, [*save me] from death!* ("Azrael," 20)

d. *This somber man [*counted] each day as lost* ("Torquemada," 17)

Iambic Tetrameter

e. *To rest beneath its old [oak trees]* ("Prelude," 83)
w s w s w s *w s

f. *'Tis [the *monk] Tetzel. I have heard* ("Cobbler of Hagenau," 94)

g. *There comes to me [*out of the past]* ("Interlude" 3.6.69)

h. *[*Honor] and blessings on his head* ("Prelude," 241)

In his iambic verse, Longfellow seems to have assimilated his practice to metrical precedent. The effects of his "native" practice, embodied in the Bounding Theory, are only statistically present. The crucial point is that the presence of cadences such as (60) in Longfellow's iambic verse shows that their absence from *Hiawatha* is not accidental.

The exceptions to the Bounding Theory in the poem are few in number and of doubtful status. I discuss a few of them here. In some lines we must assume that the Rhythm Rule has applied to get an acceptable scansion:

(61) a. *All the* ***unseen*** *spirits help me* (15.118)
b. *Some old man, bent* ***almost*** *double* (13.224)
c. *Of the* ***unknown***, *crowded nations* (21.213)

All of these applications sound plausible to contemporary ears. In this respect they differ from many cases in Shakespeare and Milton, for which we must assume (Kiparsky 1977) that the Rhythm Rule had considerably broader scope in earlier centuries.

Other applications of the Rhythm Rule that must be posited occur within phrases, rather than within words, and are perhaps more doubtful:

(62) a. ***Sent forth*** *such a wail of anguish* (15.45)
b. ***Came back*** *from the reedy islands* (8.228)
c. ***Rise up*** *from your bed of branches* (5.88)

Several lines containing the sequence verb-preposition-pronoun scan properly if we assume that Longfellow intended a pronounciation in which the stress on the pronoun is subordinated to that on the preposition, rather than vice versa (see Selkirk 1972 for a discussion of these free variants):

(63)
```
                            x
             x              x
       x .   x     x    .   x     x    .
a. Not a woodchuck could [get [through them]]      (6.125)
       s w s      w    s    w     s    w
```
b. *From the sky the moon* ***looked at them*** (10.268)
c. *Onaway! My heart* ***sings to thee*** (11.157)

In (63a), for example, the peak on *through* compensates the mismatched peak on *get*, making the line acceptable. This move also allows us to maintain as a general rule for *Hiawatha* that the seventh position is always filled with a stressed syllable. The only possible exceptions to this rule are the doubtful cases having the form of (63).

The ultimate number of exceptions to the Bounding Theory depends on how far one is willing to supplement the strictly metrical analysis with more or less plausible assumptions about Longfellow's pronunciations and linguistic structures. With a few additional such assumptions, which I will not discuss here, the hard core of unexplainable lines reduces to about seven, listed in (64):

(64) a. *Over [stone walls] grey with mosses* (Introduction, 105)
b. *Touch God's [right hand] in the darkness* (1.97)
c. *[But you,] Bear! sit here and whimper* (2.54)

d. *Wrestled [all night] with the North-Wind* (2.213)
e. *[Big words] do not smite like war clubs* (9.258)
f. *[Take heed] lest his beams fall on you* (12.245)
g. *Gathered [wild rice] in the meadows* (13.18)

In a corpus of 5,409 lines, I would argue that a set of exceptions this small does not strongly threaten the validity of the analysis. Even if weaker assumptions about pronunciation are made, the list of exceptions is still small. I will therefore adopt the working hypothesis that the Bounding Theory is correct and turn to what it can tell us about the Prosodic Hierarchy.

3.4. Bracketing and the Bounding Theory

The *Hiawatha* analysis can serve as a tool for further inquiry because its metrical rule, the Bounding Theory, is a diagnostic for bracketing at all levels. In the formulation of the rule, I have deliberately left open whether the constituents the rule mentions are syntactic units or the phonological categories of the Prosodic Hierarchy. For the great majority of cases, it simply does not matter which type of bracketing one applies the rule to, because the same predictions result. However, there is one kind of cadence in which the two formulations make opposite predictions. If a clitic word precedes a syntactic unit consisting of two monosyllables in rising stress, then the application of Clitic Group Formation (9) will make the syntactic and phonological bracketings conflict. I will call the sequences in which this happens CLITIC CADENCES.

(65) Clitic Cadences

```
   Syntactic Bracketing                 Prosodic Hierarchy
                         x
          .        x     x                             x
a. [N'' the [N' great lakes]]              .    x      x
          s        w     s           [P [C the great] [C lakes]]
                                           w    s        w

                         x                             x
          .        x     x                  .   x      x
b. [P'' in [N'' great flocks]]       [P [C in great] [C flocks]]
          s        w     s                 w    s        w

                         x                             x
          .        x     x                  .   x      x
c. [S' that [N'' old feuds] . . .]   [P [C that old] [C feuds]]
          s        w     s                 w s           w
```

It is clear that in a clitic cadence, the snapshots referred to by the Bounding Theory will differ depending on whether they are based on syntactic or prosodic structure. To accommodate the "inner" snapshot in each case, the contradicting scansions shown under (65) will be required. (In the "outer" snapshots, compensation permits either scansion.) Thus by examining how clitic cadences are metrically positioned in *Hiawatha*, we can find fairly direct evidence for which form of bracketing is being referred to.

The results of such an examination strongly support the claim that it is the Prosodic Hierarchy that is metrically relevant. Of the 199 clitic cadences in the poem, 165, or 82%, occur in WSW position. Such a distribution is, I believe, unprecedented in English metrics: all other poets prefer SWS, often by very wide margins. This follows from the fact that other poets use metrical rules quite different from the Bounding Theory (cf. Hayes 1983 and below).

The facts of *Hiawatha* thus provide strong statistical support for the Hypothesis of Phonological Metrics, in that the rule must refer to prosodic rather than to syntactic bracketing in the crucial cases. However, the existence of a minority of lines (34/199) that go against the theory is disturbing. These lines are worth examining carefully: it turns out that more detailed analysis, in fact, provides further support for our conclusions.

If one breaks down the 199 clitic cadences of *Hiawatha* by syntactic structure, an asymmetrical distribution appears. Specifically, if the clitic cadence has the syntactic structure determiner (article or possessive pronoun) + N′, as in (66a), then the WSW scansion is preferred by a very strong 90.4% majority. If the structure of the cadence is P + N″, or Auxiliary or Pronoun + V″, then the preference for WSW over SWS (60%) is greatly reduced. Finally, if the initial clitic is a complementizer or conjunction followed by a clause, the eight attested cases scan unanimously as SWS. These facts are summarized under (66):

(66) Preferred Scansion of Clitic Cadences in *Hiawatha*

a. Determiner (Art, Poss Pro.) + N′	*From* ***the great lakes*** *of the Northland*	w s w	(Intro, 12; 150 cases)
	Over ***the round ears****, that heard not*	s w s	(2.22, 16 cases)
b. P + N″ Aux + V″ Subj. Pro + V″	*And* ***in long lines*** *waving, bending*	w s w	(21.117; 15 cases)
	Flying ***in great flocks****, like arrows*	s w s	(21.113; 10 cases)
c. Comp + S Conj. + S	(*So* ***that old feuds*** *might be settled*)	w s w	(construct; no cases)
	That old feuds *might be forgotten*	s w s	(10.54; 8 cases)

The syntactic basis for this variation is not haphazard: the more syntactic boundaries that fall between the clitic word and what follows, the more likely the cadence will be scanned SWS. Thus in (66a), only the N′ boundary intervenes, and WSW scansion is preferred. In (66b), both the N′ boundary and the N″ boundary intervene, and the two scansions are equally frequent. Finally, in (66c) there are three intervening boundaries, S, N″, and N′, with the SWS scansion preferred unanimously.

(67) a. *the* $[_{N'}$ *great lakes*
b. *in* $[_{N''}$ $[_{N'}$ *great flocks*
c. *that* $[_{S}$ $[_{N''}$ $[_{N'}$ *old feuds*

This systematic variation clearly needs to be explained. There are two possibilities: one might modify the Bounding Theory in some way to take syntactic differences into account, or one might propose that the differences in scansion reflect differences in prosodic structure among clitic cadences. The latter choice, which retains the Bounding Theory intact, turns out to be the better one. Specifically, I propose to modify the rule of Clitic Group formation in English in the following way:

(68) Clitic Group Formation (modified). Adjunction of clitics to hosts in English is optional. The propensity to cliticize is inversely related to the number of syntactic boundaries separating clitic from host.

The consequences of (68) are as follows. In cases with one boundary, as in $[_{N''}$ *the* $[_{N'}$ *tall trees*]], cliticization is strongly preferred, so that the left branching output structure $[_{P}$ $[_{C}$ *the tall*] $[_{C}$ *trees*]] is favored. If cliticization exceptionally fails to apply, the ternary structure $[_{P}$ $[_{C}$ *the*] $[_{C}$ *tall*] $[_{C}$ *trees*]] will result. If two boundaries follow the clitic, as in $[_{P''}$ *in* $[_{N''}$ $[_{N'}$ *tall trees*]]], the two outputs $[_{P}$ $[_{C}$ *in tall*] $[_{C}$ *trees*]] and [[$_{P}$ *in*] $[_{P}$ *tall trees*]] are more equally favored. Note that if *in* escapes cliticization, it cannot adjoin to the following P-phrase because it is outside the maximal projection N″. Finally, if three boundaries follow the clitic, the right branching option [[$_{P}$ *that*] $[_{P}$ *tall trees*]] is favored over the left branching $[_{P}$ $[_{C}$ *that tall*] $[_{C}$ *trees*]].

Given these predictions, the behavior of clitic cadences is automatically accounted for. If we apply the Bounding Theory to the variable outputs of cliticization, then Longfellow's variable scansions, as well as his preferences

among them, result from the variations and preferences in prosodic constituency. This is shown under (69):

(69) a. One boundary:

	Favored structure	Disfavored structure
	x	x
	. x x	. x x
	[[*the tall*] [*trees*]]	[*the tall trees*]
Scansions:	w s w	s w s
	= favored scansion	= disfavored scansion[5]

b. Two boundaries: (Structures about equally favored)

	x	x
	. x x	. x x
	[*in tall*] [*trees*]]	[[*in*] [*tall trees*]]
Scansions:	w s w	s w s
	(Scansions about equally favored)	

c. Three boundaries:

	Favored structure	Disfavored structure
	x	x
	. x x	. x x
	[[*that*] [*tall trees*]]	[[*that tall*] [*trees*]]
Scansions:	s w s	w s w
	= favored scansion	= disfavored scansion

Thus the hypothesis that metrical rules refer to the Prosodic Hierarchy and the assumption about cliticization under (68) together make the right predictions about how Longfellow should scan clitic cadences.

What is missing in the preceding argument, of course, is any independent reason for believing that the hypothesis of (68) is true. As far as I can determine, the phonological tests for Clitic Group membership in English described in 2.2.2 above are not sensitive enough to bear on the question. However, more indirect evidence can be found. First, the patterning of liaison in French (Morin and Kaye 1982) shows precisely the range of preferences predicted by (68). Liaison is obligatory in determiners, optional in prepositions and auxiliaries, and marginal for complementizers. This follows if we assume that adjunction into a Clitic Group is a necessary condition for liaison.

Second, the evidence from metrical "bridges" in ancient Greek also supports at least one of the predictions of (68). As Devine and Stephens (1983) found, in Greek the combination article + noun forms Clitic Groups that, in their

[5] Notice that because compensation can go either way in this structure, SWS is only a possible scansion, not a required one. This statistically reinforces the effects of near-obligatory cliticization in articles.

ability to cross bridges, behave more like single words than any other kind. Whether the differences between two and three syntactic brackets also has metrical consequences cannot be determined from their article.

More important, there is evidence from English itself that (68) is correct. I present two arguments. A useful source of evidence for phonological phrasing in English is the division of poetry into lines. Line boundaries normally coincide with relatively high-level breaks in the Prosodic Hierarchy, such as that between Utterances or Intonational Phrases; such cases are what we would confidently classify as end-stopped lines. Poets vary in how strictly they observe this tendency; in Pope, for example, lines typically begin and end at the edges of Utterances and Intonational Phrases, and only occasionally at the juncture of mere Phonological Phrases. In contrast, Shakespeare employs a far greater percentage of runons, in which the line boundary coincides with a less significant break in the prosodic structure. These differences in line boundary placement can serve as a diagnostic for the structure of Clitic Groups.

A useful preliminary case to consider is that of Milton's mature verse. This poetry contains some fairly dramatic run-ons, in which a line ends in the middle of a Phonological Phrase:

(70) a. *Now in loose Garlands thick thrown off,* [$_P$ *the bright Pavement*] *that like a Sea of Jasper shone* (*Paradise Lost* 3.363–364)

b. *Eternise here on Earth;* [$_P$ *but those elect Angels*] *contended with their fame in Heav'n* (*PL* 6.374–375)

c. *Whereon a Sapphire Throne, inlaid* [$_P$ *with pure Amber*], *and colours of the show'ry Arch.* (*PL* 6.758–759)

d. *To Judgement he proceeded* [$_P$ *on th'accused Serpent*] *though brute, unable to transfer* (*PL* 10.164–165)

However, despite this freedom Milton does not go one step further and split possible Clitic Groups between lines, as in cases such as (71):[6]

(71) **To Judgement he proceeded then* [$_C$ *on the Serpent*] *though brute, unable to transfer* (construct)

[6] Actually, a handful of lines do involve a split Clitic Group, but in every case the clitic follows rather than precedes its host:

(i) *Of difficulty or danger* [$_C$ *could deter Me*] *from attempting. Wherefore do I assume* (*PL* 2.449–450)

To handle these, the rules must be complicated somewhat, although this does not materially affect the argument.

The crucial cases for our purposes are found in Shakespeare. In his late plays, Shakespeare sometimes ends a line in a clitic word, as in cases such as the following:

(72) *How much you were my conqueror, and* ***that***
My sword, made weak by my affection, ***would***
Obey it on all cause . . . (*Antony and Cleopatra* 3.11.66–68)

A study of just what kind of clitics can be cut off by line boundaries is revealing. As Kiparsky (1975) and Flynn (1979) note, Shakespeare never splits off articles from the words that follow them; that is, there are no line sequences in Shakespeare like (73):

(73) **How much you were my conqueror, and* ***my***
Sword being weak by . . . (construct)

Note that articles are the clitics that are separated from their potential hosts by only one boundary and thus, according to the hypothesis of (68), are the most likely clitics to be adjoined. This suggests the following hypothesis: the likelihood of a clitic being stranded at the end of a line by Shakespeare is inversely proportional to its likelihood of being adjoined to a Clitic Group. I have tested this hypothesis further by conducting a complete count of all the line-final clitics in *Antony and Cleopatra*, which yielded the following results:

(74)

Number of Syntactic Boundaries Following Clitic	Number of Cases in *Antony and Cleopatra*
1. articles	0
2. prepositions, auxiliaries, subject pronouns	60
3. complementizers, conjunctions + clause	26

Initially, the count looks as though it does not confirm the hypothesis: the numbers should have been something like 0, 26, 60 rather than 0, 60, 26. But there is an independent explanation for this: when we count the number of clitics of each type in the play as a whole, it turns out that clitics followed by two syntactic boundaries are about four times as common as clitics followed by three. After suitable statistical adjustments, we can say that had all clitic types been of equal frequency, the numbers would have been, 0, 31, and 55 for one, two, and three boundaries respectively. Thus the statistical link between the number of syntactic boundaries followed a clitic and its tendency to be stranded is validated.

Under our theory, the correlation can be explained straightforwardly. We assume the following: Shakespeare requires a line boundary to coincide at least with a P-phrase boundary but, unlike Milton, does not (for purposes of line division) require clitics to be always adjoined to their hosts. This allows the

effects of the principle in (68) to become apparent: the more syntactic boundaries that follow a clitic, the less likely it will undergo adjunction, and the more likely it will appear stranded at the end of a line.[7]

The evidence of line division in Shakespeare thus supports the hypothesis of (68) about how syntactic boundaries influence the formation of Clitic Groups. By assuming (68), along with the general relevance of the Prosodic Hierarchy, we can establish a connection between two completely different phenomena: the scansion of clitic cadences in *Hiawatha* and the stranding of clitics at line end in late Shakespeare. The clitics that favor WSW scansion in a Hiawathan clitic cadence are the same as those that cannot be stranded in Shakespeare, and the clitics that Shakespeare strands most readily begin SWS clitic cadences in *Hiawatha.*

Finally, there is independent evidence from *Hiawatha* itself that supports the principle (68). Consider cadences such as the following:

(75) a. *To the land of* ***the White Rabbit*** (2.221)
b. *They have saved me* ***from great peril*** (8.206)
c. *Drew his neck in,* ***and looked downward*** (17.242)

These cadences resemble clitic cadences, except that they have an initially stressed polysyllable, whereas clitic cadences have a monosyllable. I will refer to them as "polysyllabic clitic cadences." Now under the Bounding Theory, polysyllabic clitic cadences should be metrical only in SWSW position and, furthermore, only if the option of not adjoining the initial clitic is taken. To see why, consider the two possible structures for the sequence *the White Rabbit*:

(76)

```
                          x
         .      x         x  .
a. [P [C the White] [C [W Rabbit]]] (the cliticized)
         s     *w         s   w
         w      s        *w   s

                       x
         .      x      x  .
b. [P the White [W Rabbit]] (the not cliticized)
      s     w       s   w
      w     s      *w   s
```

If *the* is cliticized to *White*, as in (76a), then the structure is equivalent to the form in *the crags tumbled*, under (52d). Because neither peak is able to

[7] In contrast, the P-phrasing rule (28) applies obligatorily in Shakespeare. This has two consequences. First, unlike Milton, Shakespeare does not divide lines between adjective and noun, as in (70). Second, the rule predicts correctly that the prohibition on stranding articles at the end of a line should be absolute, not statistical: if an article escapes cliticization, it still belongs to the same P-phrase as its head and thus cannot be split off. The Prosodic Hierarchy theory therefore can account for Kiparsky's observation (1975:606) that Shakespeare and Milton each allow line divisions that the other would forbid.

compensate the other in such a sequence, it is unusable. The only way to use a polysyllabic clitic cadence is to suppress cliticization (as in [76b]) and scan it SWSW. This enables the peak on *Rab* to compensate the peak on *White* in all constituents in which the latter peak is defined. SWSW is indeed the only scansion of polysyllabic clitic cadences found in the poem.

This reasoning leads to a prediction: if polysyllabic clitic cadences are usable only when cliticization has not applied, then the population of clitics with which they begin in *Hiawatha* should be weighted toward those clitics that, according to principle (68), particularly resist cliticization, that is, the two-boundary clitics and especially the three-boundary clitics. We can check this by comparing the distribution of clitics among polysyllabic clitic cadences with that among monosyllabic clitic cadences scanned WSW because, by parallel reasoning, the latter should favor the one-boundary clitics.

(77)

Type of Clitic	Type of Clitic Cadence	
	WSW Monosyllabic	Polysyllabic
1. boundary	150 (91%)	45 (62%)
2. boundaries	15 (9%)	16 (22%)
3. boundaries	0 (0%)	11 (15%)

The predicted skewing of the clitic distribution does indeed show up, thus providing additional validation for the principle (68).

Let me now review what these arguments imply. What made them necessary was the existence of about thirty-five clitic cadences in *Hiawatha* that appeared to scan according to their syntactic structure rather than their prosodic structure. Because the Hypothesis of Phonological Metrics predicts this to be impossible, we explored an alternative: the deviant cadences represent deviant phonological bracketings, induced by the principle (68) that governs Clitic Group formation. This move turned out to pay off; principle (68) has several good consequences in other domains: it predicts the variable application of liaison in French, the special status of articles in Greek metrics, the division of lines in late Shakespeare, and the patterning of polysyllabic clitic cadences in *Hiawatha*. Ultimately, the thirty-five deviant clitic cadences are not counterexamples to the theory; the supplementary principle that was needed to account for them turns out to have its own explanatory force. The Hypothesis of Phonological Metrics is confirmed by them, just as it is confirmed by the rest of the *Hiawatha* system.

3.5. Toward a General Theory of Phrasing in Meter

In this final section I examine some metrical rules other than the ones employed in *Hiawatha* and try to show that although the evidence for the

Prosodic Hierarchy from these rules is less direct, it is ultimately just as strong. The basic claim is this: in poetry other than *Hiawatha*, the implicit rules involved evaluate the snapshots differently, but the snapshots are still domains of the Prosodic Hierarchy.

I also try to show that the Prosodic Hierarchy does not influence verse scansion in arbitrary ways and that there exist general laws governing how phonological bracketing may influence metrical well-formedness. What is at issue is the basic form of metrical rules in English. I present here a conjecture, roughly following Hayes (1983), about the phrasal conditions that metrical rules refer to. When coupled with the Prosodic Hierarchy, the conjecture makes fairly powerful predictions about what kinds of metrical rules are found in English.

In all cases, I assume that metrical rules refer to the notion of peak: they require that a certain metrical S position be filled with a peak or, conversely (and more frequently), that a certain kind of linguistic peak occupy metrical S position. My conjecture is that with respect to bracketing, there are exactly three kinds of metrical rules.

A rule is a BOUNDING RULE if it considers only those peaks that are defined within a given prosodic category. (A peak is defined within a prosodic category if it counts as a peak in a snapshot of that category.) For example, if a bounding rule considers only peaks defined within the Word, it will apply to the second peak in (78), but not the first:

(78)

```
                                  x
          .       x               x .
[P [C [W the] [W fierce]] [C [W tiger]]]]
```

RIGHT EDGE RULES apply to rule out structures of the following form:

(79)

```
[D . . . Peak]
      |
      W
```

In (79), "D" is a specified prosodic domain, "Peak" is a peak in metrical W position defined within D, and ". . ." is material included in D that the rule may optionally specify, for example, a stressless syllable. The claim here is that the right edges of prosodic categories are often scanned with special strictness.

LEFT EDGE RULES apply to configurations of the form in (80):

(80

```
[D Peak . . .]
     |
     W
```

where "Peak," "D," and ". . ." are defined as before. The difference here is that left edge rules, rather than forbidding a specified cadence, may overrule other metrical rules, licensing cadences that would otherwise be ill-formed

These three rule types are intended to be an exhaustive typology of the ways in which metrical rules may refer to bracketing. A given rule may belong to more than one type: for example, I discuss below a rule that is both a bounding rule and a right edge rule. I would argue that this three-way typology is supported by the evidence in that all the metrical rules proposed in the literature fit within the limits it specifies. Further, the typology interacts with Selkirk's Strict Layering Hypothesis to make strong predictions about what poets will and will not exclude. These predictions are confirmed by the data I have seen so far.

3.5.1. Bounding Rules

A particularly clear example of a bounding rule was pointed out by Kiparsky (1975), following work by Magnuson and Ryder (1970, 1971). In the metrical system of Shakespeare, a rising peak may be scanned W when it is defined within a Clitic Group, as in (81a). This cadence is not particularly disruptive and is found quite frequently if other conditions hold (see Section 3.5.3). But a rising peak defined within a Word renders the line unmetrical; compare Kiparsky's construct (81b):

(81) a. *Pluck* [$_C$ *the keen*] *teeth from* [$_C$ *the fierce*] *tiger's jaws*
(Shakespeare, Son. 10)
b.**Pluck* [$_W$ *immense*] *teeth from* [$_W$ *enraged*] *tigers' jaws*
(Kiparsky 1975)

The same holds for falling peaks. If we leave out the cases covered by inversion (Section 3.1), falling peaks defined within a Clitic Group are at least marginally acceptable, but falling peaks defined within a Word are illformed:

(82) a. *Or how* [$_C$ *haps it*] *I seek not to advance*
(Shakespeare, *1H6* 3.1.31)
b.**They are* [$_W$ *hoping*] *I seek not to advance* (construct)

Thus Shakespeare appears to employ a bounding rule, based on the category Word. Leaving inversion temporarily aside, we can formulate the rule for both (81) and (82) as follows:

(83) The correspondence Peak, where Peak is defined on the domain Word, is ill-formed.
|
W

The rule under (83) holds not just for Shakespeare but for a large number of English poets. Owing to its prevalence in English metrics, Kiparsky (1977) coined the term "lexical stress" for a peak defined within the domain Word.

In general, a special salience is attached to lexical stresses in scansion. For example, to my knowledge there are no poets for whom (81b) and (82b) would be well-formed lines and for whom (81a) and (82a) would be ill-formed. It is worth asking whether this observation is accidental or follows from more general principles. I would argue that it follows directly from the nature of bounding rules, together with the Strict Layer Hypothesis. Because prosodic categories are strictly layered, any two syllables that occupy the same Word necessarily occupy the same Clitic Group, the same Phonological Phrase, and so on. Therefore, any bounding rule that rules out peaks defined on the Clitic Group necessarily rules out peaks defined on the Word as well. More generally, a bounding rule that forbids peaks in W defined on any given prosodic category must also forbid peaks in W defined on all lower categories. It thus follows from our hypothesis that whereas it is possible to have a metrical rule that would rule out (81b) and (82b) but not (81a) and (82a), it would not be possible to have a rule that went the other way.

The "Bounding Theory" for *Hiawatha* represents a bounding rule that applies on all levels of the Prosodic Hierarchy. In *Hiawatha*, a peak defined within a given prosodic domain may not occur in W, unless it is compensated by a peak that is defined on the same domain.

3.5.2. Left Edge Rules

Left edge rules license inversions at the left edges of prosodic categories; that is, they render inoperative the constraints imposed by other metrical rules when a peak is initial in some domain. Thus in Shakespeare, the ban on lexical stress peaks in W is lifted if the peak is initial in its Phonological Phrase (Section 3.1). The rule may be stated as follows:

(84) A peak has special license to occur (overriding other rules) when in the environment / [$_P$ ____

However, a complete account of inversion turns out to be somewhat more complex. A syllable that begins a P-phrase often begins an I-phrase or Utterance as well. These prosodic categories also play a role in inversion, as we will see.

As evidence, consider the line-internal lexical inversions in *Romeo and Juliet*, which number forty-seven by my count. All forty-seven inversions meet the requirement of rule (84); however, most of them exceed it. For example, eighteen of the inversions occur initially in an Utterance, as in the following examples.

(85) *Good night, good night!* ***Parting*** *is such sweet sorrow* (2.2.184)
Hark how they knock! Who's there? ***Romeo****, arise;* (3.3.74)
But soft! What day is this? / ***Monday****, my lord* (3.4.18)

Of the remainder, 23 are in positions that would normally count as the

beginning of an Intonational Phrase. Note that in all of the examples below, an intonational contour would normally end just before the inversion site:

(86) a. Vocatives (6 lines)
*Welcome, **gentlemen**! Ladies that have their toes* (1.5.16)
*We are undone, **lady**, we are undone!* (3.2.38)
b. Clause Boundaries (8 lines)
*And weep ye now, **seeing** she is advanc'd* (4.5.73)
*Or I am mad, **hearing** him talk of Juliet* (5.3.80)
c. Dislocated Constituents (5 lines)
*Doth with their death **bury** their parents' strife* (Prol., 8)
*Some word there was, **worser** than Tybalt's death* (3.2.108)
d. Lists (4 lines)
*Unwieldy, slow, **heavy**, and pale as lead* (2.5.17)
*Of fair demesnes, **youthful**, and nobly liened* (3.5.182)

Two inversions occur at the NP-VP break, which according to Nespor and Vogel (1982) may optionally induce an I-phrase boundary:

(87) *What cursèd foot **wanders** this way tonight* (5.3.19)
How oft tonight
*Have my old feet **stumbled** at graves! Who's there?* (5.3.122)

There are only four lines that satisfy just the minimal condition that an inversion begin a P-phrase:

(88) *Now will he sit **under** a medlar tree* (2.1.34)
*I will, and know her mind **early** tomorrow* (3.5.112)
*Can vengeance be pursued **further** than death?* (5.3.55)
*As I did sleep **under** this yew tree here* (5.3.137)

The numbers obtained are definitely skewed from what one would expect, given the statistical distribution of Utterance beginnings, I-phrase beginnings, and so forth in the line. For example, based on a rough survey, Utterance-initial inversions are about three times as common as would be statistically expected, and P-phrase initial inversions are only one fourth as common.[8]

[8] For comparison, I counted juncture types in the first one hundred lines of *Rom.* 3.5, counting only the positions marked with slashes (W S W S/W S/W S W S) because these are by far the most common medial inversion sites. Results were as follows:

(i)

	Sample (n = 98)	Inversion Sites (n = 47)
Edge of Utterance	13%	38%
Edge of I-phrase	51%	53%
Edge of P-phrase	36%	9%

Thus for Shakespeare we might write a "fuzzy" metrical rule as follows:

(89) A peak has special license to occur in W when in the environment $[_D$____. Acceptability depends on rank of D:

W	C	P	I	U
*	*	worse ↔ better		

I have found that similar rules hold for the *Sonnets*, for *Julius Caesar* (Hayes (1983:374)), for a 7,500-line sample of Shelley, and for Milton.

These observations support Youmans's (1983) claim that metrical well-formedness is often gradient, because there is no obvious dividing line between acceptable and unacceptable inversions. The observations also show that the gradience is STRUCTURED in accordance with the Prosodic Hierarchy: the lower the category on the Hierarchy, the less it is able to sanction an inversion.

This link is an intuitively plausible one, but it is not a logical necessity. One could imagine, for example, a poet who placed inversions at the beginnings of I-phrases but not at the beginnings of P-phrases or Utterances. The virtue of the format I have proposed for left edge rules is that it predicts that such a system could not exist. This follows from the Strict Layering Hypothesis: because any syllable that is initial in an Utterance is also initial in an I-phrase, any rule that invoked the left edge mode to sanction inversions initially in an I-phrase would also sanction Utterance-initial inversions.

This example illustrates a twofold connection between the behavior of phonological rules and metrical rules. Just as with phonological rules, if a metrical rule applies next to a given juncture, it applies next to all stronger junctures (cf. Section 2.1). Second, metrical rules refer to the Prosodic Hierarchy in gradient fashion. As noted in Section 2.2.3, phonological rules sometimes refer to a range of prosodic categories, applying in one category as the normal case and in other categories only in casual speech. Metrical usage appears to have no analogue of the careful versus casual speech distinction. But the same gradient reference to the Prosodic Hierarchy still shows up, reflected in metrically simple versus metrically complex (hence, common vs. rare) lines.

3.5.3. Right Edge Rules

Right edge rules are perhaps the most interesting of the three types because they have apparently gone unnoticed in the traditional literature. A right edge rule is negative in character, forbidding peaks in W that occur at the right edge of some prosodic category. As an example, let us consider in detail a rule for Shakespeare discussed in Magnuson and Ryder (1971), Kiparsky (1977:205–211), and Hayes (1983:382–384), using the *Sonnets* as data. The cadence at

issue is the sequence "stressless-stressed" (. x on the grid) occurring mismatched in SW position. It is well known that such cadences are normally followed by a stressed syllable, so that a "stress maximum" (Halle and Keyser 1971) is avoided. I will not formulate a rule for this, however,[9] and will focus instead on an apparently independent JUNCTURAL restriction on the . x cadence: it may not appear at the right edges of high-ranking prosodic categories, even when a stressed syllable follows.

Here is some evidence. Scanning the *Sonnets*, I found 241 instances of . x in SW position and classified them according to the phrasal break (or lack thereof) following the mismatched peak. In 194 cases, or 80%, the mismatched peak would obligatorily be nonfinal within its Phonological Phrase, as in the following examples:

(90)
```
                                  x
                          .  .    x    x
With beauty's treasure ere [P it be self-kill'd]                (Son. 6)
  w   s  w   s  w   s     w  s  w    s
```

[P *By **their rank** thoughts*] *my deeds must not be shown* (Son. 121)
What e'er thy thoughts [P *or **thy heart's** workings*] *be* (Son. 93)
Yet do not so, but since [P *I **am near** slain*] (Son. 139)

In thirty-six additional examples (15%), the peak in W is medial in its P-phrase, provided the option of adjoining a nonbranching complement to the head is taken (cf. Section 2.2.3):

(91) *When others* [P ***would give** life*] *and bring a tomb* (Son. 83)
O benefit of ill, now [P ***I find** true*] (Son. 119)

There are only eleven cases (4.6%) in which the cadence occupies the right edge of a P-phrase:

(92) *Against that time, if ever* [P ***that time***] *come* (Son. 49)
[P *Give **my love***] *fame faster than time wastes life* (Son. 100)
Alas, 'tis true [P *I **have gone***] *here and there* (Son. 110)

In all of these, the peak appears not to be final in its I-phrase, judging by the naturalness of placing an intonational break after it. There are no cases at all, then, of . x scanned SW at the end of either an I-phrase or an Utterance.

The constraint on phrase-final . x in SW thus acts as the mirror image of the conditions on lexical inversion. We can write the rule involved as a right edge

[9]The correct formulation of the rule, whatever it is, must take into account a fairly large set of apparent counterexamples; cf. lines such as (82a), also Kiparsky (1975:592, 1977:212).

rule:

(93) [. . . . x]D is disfavored. Acceptability depends on rank of D:
W

C	P	I	U
better	worse	*	*

Here again, we have a rule that applies gradiently, structured in accordance with the Prosodic Hierarchy.

Other poets have different right edge rules. In Milton's mature verse (Kiparsky 1977:210; Hayes 1983:377), the right edges of I-phrases may not contain a peak in W, even if the preceding syllable is stressed. Thus the line (94a), from Shakespeare, would represent an aberrant line type in late Milton. Milton does place the same sequence at the right edge of P-phrases, as (94b) shows.

(94) a. [I *To do a great right*], *do a little wrong* (Shakespeare, *MV* 4.1.216)
b. *Drew after him* [P *the third part*] *of Heav'n's Host*
(Milton, *PL* 5.710)

Shelley's metrical practice at right edges is looser than either Milton's or Shakespeare's because he occasionally writes lines with . x peaks in W-ending I-phrases or even Utterances:

(95) *And **they fled**, scattering—Lo! with reinless speed*
(*The Revolt of Islam* 6.19.2)
*Like **a child**, half in tenderness and mirth* ("The Question," 2.6)
*Thou darest **to speak**—senseless are the mountains* ("Hellas," 475)
*Then **was heard**—"He who judged, let him be brought"*
(*The Revolt of Islam* 5.32.1)

(See also Kiparsky 1977:211). However, this does not mean that right edges are free for Shelley; he does impose a right edge constraint on lexical stresses. Note first that Shelley differs from Milton or Shakespeare by occasionally allowing word-final lexical stresses in SW position, as in the lines of (96).[10]

(96) *Are dead, indeed,* [P *my **adored** Nightingale!*] (*Epipsychidion*, 10)
[P *A **divine** presence*] *in a place divine* (*Epipsychidion*, 135)
[P *She **replied** earnestly:*]—*"It shall be mine"* (*Revolt of Islam* 2.38.1)
The battle [P ***became** ghastlier*]—*in the midst*
(*Revolt of Islam* 6.16.1)

[10]Note that in the examples of (96), the misplaced iambically stressed word has a completely stressless initial syllable and, by standard assumptions (cf. Liberman and Prince 1977; Kiparsky 1977:220), could not be made metrical by applying the Rhythm Rule to it.

However, the . x peaks involved must never occur finally in the P-phrase; lines of the type shown in (97) are missing in Shelley.

(97) *The dead [$_P$ might **adore**] songs of Nightingales (construct)
*[$_P$ She **replied**]—"Ernest, it shall ne'er be mine" (construct)
*But what the battle [$_P$ **became**] horrified us (construct)

Thus in Shelley, we appear to have a rule that is simultaneously a bounding rule and a right edge rule:

(98) The cadence [. . . Peak]$_P$, where Peak is defined on the domain Word, is ill-formed.
|
W

This rule suggests that the "one-domain-only" constraint on metrical rules that I proposed in Hayes (1983:366) is too restrictive because it fails to allow for rules that refer both to an edge and to a bounding domain.

A final example of a right edge rule is found in Milton. In his mature verse, Milton will, on rare occasions, place a lexical stress in W, even when the conditions for inversion are not met. Some examples are as follows:

(99) ***Universal*** *reproach, far worse to bear* (*PL* 6.34)
Burnt after them to the ***bottomless*** *pit* (*PL* 6.866)
And ***Tiresias*** *and Phineus prophets old* (*PL* 3.36)
In the ***bosom*** *of bliss, and light of light* (*Paradise Regained* 4.597)

As Kiparsky (1977) discovered, these lexical mismatches never involve the final stress of a word; that is, there are absolutely no lines in Milton like (100):

(100) *He **decreed** a reproach far worse to bear (construct)
*Burnt after them who **denied** the deep pit (construct)
*What **remained** of their bliss, and of that light (construct)

This suggests that Milton employed a right edge rule based on the domain Word, as in (101):

(101) The cadence [. . . Peak]$_{Word}$ is ill-formed.
|
W

The same rule applies to the iambic poetry of Hopkins, who modeled this aspect of his verse after Milton (Hopkins 1948:7). Notice the difference between Milton's treatment of mismatched iambically stressed words and Shelley's: Milton forbids them in all positions by invoking a right edge rule based on the Word; whereas Shelley limits them to nonfinal position in the P-

phrase by invoking a right edge rule whose rank is P-phrase, but which also contains a bounding condition restricting the rule to lexical stresses.

3.5.4. Evaluation

The typology of left edge rules, right edge rules, and bounding rules encompasses all the metrical rules I have seen proposed in the literature. Given the embryonic present state of metrical investigation, this is perhaps not surprising, but it is encouraging. If counterexamples to the typology exist, it should be easy to identify them; these would include rules that assign extra metrical strictness to left edges or extra laxness to right edges, rules that apply only if the relevant configuration is not next to an edge at all, and "anti-bounding" rules that apply to sequences specifically required not to be in the same category. So far, none of these has turned up.

The other way in which the typology can be validated is if it can add insight to the description of individual metrical practice. As a final argument I will present a case of this sort.

The case involves the interaction of three factors: the rules for P-phrasing in English, listed in (28); the left edge rule for Shakespeare under (89); and the right edge rule for Shakespeare, (93). Recall that, according to the Rhythm Rule evidence, the complement of a head may be adjoined to the head to form a P-phrase only if it contains just one Clitic Group. If the complement contains two Clitic Groups, it must form a P-phrase on its own. Recall also that the P-phrase forms a crucial dividing point for both the left edge rule and the right edge rule: inversions are minimally acceptable only if they begin a P-phrase, and . x cadences become relatively ill-formed if they are final in a P-phrase. The syntactic locations that allow inversion after them and the syntactic locations that allow the . x ↔ SW correspondence before them are therefore in something close to complementary distribution. Combined, the phrasing rule and the two metrical rules predict that some fairly subtle differences in linguistic structure can produce large differences in metrical acceptability.

As an example, consider the following line from the *Sonnets*:

(102)

```
                                       x
                       x               x
  .  x  .     .  x     x    .    .  .  x
  We sicken [P to shun sickness] when we purge        (Son. 118)
  w  s  w     s  w     s    w    s  w  s
```

The line contains a . x sequence, *to shun*, in SW position but, by rule (93), is predicted to be acceptable: because *sickness*, the complement of *shun*, consists

of a single Clitic Group, it may be adjoined with *to shun* to form a P-phrase. The rising sequence *to shun* is thus nonfinal in its P-phrase, and it is permitted in SW by rule (93). Line (102) should be compared with (103), which has been rewritten so that the complement of *shun* contains two Clitic Groups:

(103) **We sicken* [$_P$ ***to shun***] [$_P$ *danger of disease*] (construct)
w s w s w s ws ws

In this case, the sequence *to shun* must occur finally in its P-phrase, so rule (93) marks the line as relatively ill-formed. In fact, lines with the structure of (103) are completely missing from the *Sonnets* and are rare elsewhere in Shakespeare. Significantly, the stress pattern of (103) is essentially the same as that of (102).

When we look at inversion, the situation is reversed. Here, if the complement of a verb contains two Clitic Groups, it will constitute a separate P-phrase, and rule (89) will marginally license inversion at its left edge:

(104) *We daily purge* [$_P$ *to shun*] [$_P$ ***danger*** *of sickness*] (construct)
w s w s w s w s w s

Although (104) is a constructed example, it represents a line type that can be found at least a few times in the Shakespeare corpus:

(105) *And peace proclaims* [$_P$ ***olives*** *of endless age*] (Son. 107)
To make [$_P$ ***William*** *Lord Hastings*] *of our mind* (*R3* 3.1.162)
When workmen strive to do [$_P$ ***better*** *than well*] (*Jn.* 4.2.28)

If we revert to a construction in which the first complement of the verb contains only one Clitic Group, then the object no longer forms a separate P-phrase, and we get a completely unattested structure:

(106) **We daily strive* [$_P$ *to shun* ***sickness***] *with purging* (construct)
w s w s w s w s w s

Again, the stress pattern of (106) is identical to that of the acceptable line (104).

The upshot of this is that the left edge rule (89) and the right edge rule (93) refer to more or less complementary stretches of the Prosodic Hierarchy. The left edge rule assigns special freedom to junctures of P-phrase rank or higher, and the right edge rule permits the mismatched sequence . x only at P-phrase rank or lower. At the boundary, where P-phrase assignment depends on the number of Clitic Groups in a complement, the dependence of well-formedness on bracketing is shown in an especially subtle way. Furthermore, in all cases, the SYNTACTIC juncture is the same: it is the break between a verb and its direct object. The bracketing effects here are therefore unlikely to be based on syntax; they follow only if we assume the bracketings of the Prosodic Hierarchy.

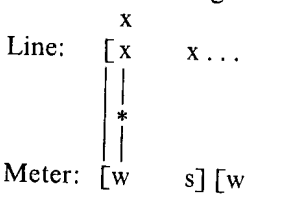
3.5.5. CONCLUSIONS

The arguments I have presented for the relevance of the Prosodic Hierarchy to meter have been of three kinds. First, the Hierarchy allows a number of metrical rules to be stated in simpler and more accurate fashion. Second, a particular rule, that of the Bounding Theory for *Hiawatha*, is sufficiently general to serve as a diagnostic for bracketings, and it appears to invoke the bracketings of the Hierarchy. Finally, the theory of the Prosodic Hierarchy, and particularly the Strict Layer Hypothesis it includes, provides the basis for a restrictive but empirically adequate typology of metrical rules in English.

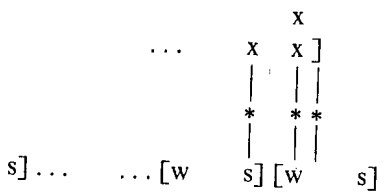
As the study of metrics is clearly in its infancy, I think it is appropriate to conclude by mentioning some questions for further research, which the work presented here raises.

First, if it is true that left edge rules specify metrical freedom and right edge rules metrical strictness, why should this be so? Kiparsky (1977) provides a possible explanation based on the idea of the metrical foot. At a left edge, a misplaced stress peak retains the redeeming feature of reinforcing the bracketing structure of the foot, as in (107a). At a right edge, however, a peak violates both the prominence and the bracketing pattern of the meter and would be expected to be more disruptive.[11]

(107) a. Left Edges



b. Right Edges



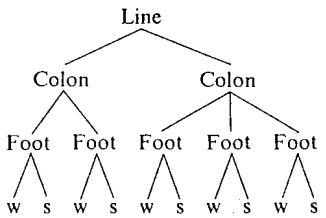
Kiparsky's proposal is in principle easy to test: in trochaic meter, the foot bracketings go the opposite way, and one should find strictness at prosodic left edges and laxness at prosodic right edges. The evidence from *Hiawatha* is equivocal: the meter of the poem is definitely unusual in NOT making right edges more strict or left edges more lax, but it does not go the opposite way either; its only rule is a bounding rule, not an edge-based rule. Still, it is suggestive that in his iambic verse, Longfellow is relatively orthodox and treats right and left edges just as other poets do.

A second question concerns the possibility that metrical patterns, just like phonological representations, are phrased hierarchically. Piera (1980) and

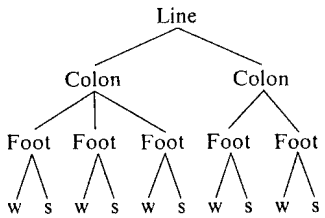
[11] Kiparsky's proposal is actually based on the tree structures of the so-called "metrical" theory of stress (Liberman and Prince 1977), but the argument is the same if we substitute the tree structures of the Prosodic Hierarchy.

Youmans (this volume) have suggested that the iambic pentameter forms a three-level hierarchy, representable as follows:

(108) a.



b.



As (108) shows, the line can be divided in two ways into cola, which form an intermediate level of grouping. Poets apparently differ in which structure, or which mixture of structures, they prefer to use. The evidence for cola comes from a number of sources. For many poets, the strongest phrasal break in a line tends to coincide with the colon boundary (cf. Oras 1960). Inversion also tends to occur following possible colon boundaries; that is, in the first, third, and fourth feet. Poets avoid second or fifth-foot inversion, even when the prosodic juncture in that position would permit it (cf. König 1888; Chisholm 1977). The "stress profiles" compiled by the Russian school of metrics (cf. Tarlinskaja 1976) reveal that the most frequently stressed strong positions in the iambic pentameter line are usually the colon final ones. This observation also holds for *Hiawatha* and other tetrameter verse: if we take the colon boundary to fall after the fourth position, the rightmost S positions in the colon are filled with stressed syllables more often than the leftmost ones, producing a dipodic effect. In the Spanish *endecasillabo* (Piera 1980), the colon-final position at midline is normally stressed and must, at the very least, not contain a "stress valley."

The bracketed units Line, Colon, and possibly Foot are thus supported by the metrical rules that must refer to them. As Tarlinskaja (this volume) points out, the effects of bracketing within the metrical pattern sometimes even override the effects of linguistic bracketing. For example, Milton treats the line boundary as an "honorary pause," freely placing inversions there that would not be permissible (Kiparsky 1977:211–212) given only the linguistic context. Examples of such lines may be found under (70). In contrast, Shakespeare restricts his inversions to genuine phrasal breaks and therefore never places them at the beginning of a run-on line (Kiparsky 1975:599–602).

What is of interest here is the close similarity between the hierarchy of a metrical pattern (which I will call the Metrical Hierarchy) and the Prosodic Hierarchy. Just as with the Prosodic Hierarchy, the domains of the Metrical Hierarchy provide extra freedom at left edges and extra strictnesss at right edges; compare the tendency toward inversion at the left edges of cola and lines, the greater tendency to fill the rightmost position of cola and lines with stressed syllables, and more generally, the tendency of all metrical patterns to be realized more strictly at their right edges than their left, irrespective of the phonological basis (stress, quantity, tone) of the metrical system (Kiparsky 1968, Hayes 1983:373).

The Metrical Hierarchy also resembles the Prosodic Hierarchy in that it is strictly layered: every line is composed uniquely of cola, which in turn are composed uniquely of feet. Lines, in turn, may optionally form the constituents of couplets, which can group into quatrains (Attridge 1982; Hayes 1984b). Suppose now that metrical rules refer to the Metrical Hierarchy in the same way they refer to the Prosodic Hierarchy, that is, as left edge rules, right edge rules, and bounding rules. We find then that the strict layering of the Metrical Hierarchy makes just the same kind of correct predictions that the strict layering of the Prosodic Hierarchy does. For example, poets will frequently permit inversion freely at the beginning of a line and reluctantly at the mere beginning of a colon. No poet works in the opposite way. This makes sense, given that every line beginning is also a colon beginning. The same reasoning explains why the end of a line strongly demands a stress in S position; the end of a colon not so strongly (cf. Tarlinskaja 1976 for English; Piera 1980 for Spanish). In the trochaic pentameter of Serbo-Croatian oral epics (Jakobson 1933, 1952), foot boundaries preferably coincide with Clitic Group boundaries, but colon boundaries MUST do so. This is again the only possible difference, given strict layering, because every colon boundary is also a foot boundary but not vice versa.

This sharp parallelism between Metrical and Prosodic Hierarchies, if valid, raises a number of questions. For example, if the "beginnings free, endings strict" principle extends to metrical as well as to prosodic units, Kiparsky's account of why it holds for prosodic units is thrown into question because it cannot be generalized to handle both cases. It may be that the principle must be accepted as a basic postulate of metrics, unless it follows from deeper psychological principles unknown to me.

The parallelism also calls into mind two competing views of what metrical patterns are. In Halle (1970) and in Halle and Keyser (1971), it is maintained that metrical patterns are abstract in content, consisting of purely algebraic entities. Thus one could just as well represent the iambic pentameter with a row of ten trees of alternating height as with the symbols S and W. In contrast, Kiparsky (1975, 1977) proposes that metrical patterns are modeled on linguistic representations; depending on the phonological theory one assumes, they are a sequence of stress levels or of stress trees. The strict layering of the Metrical Hierarchy supports Kiparsky's view because the Hierarchy is clearly an analogue of a linguistic structure, just as W and S can be thought of as the analogues of degrees of linguistic stress.

Finally, I speculate about the role of the Prosodic Hierarchy in a future theory of universal metrics. Standard typologies of versification systems are based on the phonetically observable bases of metrical rules: stress, syllable count, syllable quantity, and tone. Metrical systems obviously differ in which of these elements they regulate in verse. But as Lotz (1960) points out, languages show a striking unity in that they always regulate linguistic bracketing as well. At the very least, phrasal breaks are constrained to occur at regular intervals in demarcating the division of verse into lines; to my knowledge there are no metrical systems that do not mark line divisions with phrasal breaks, nor are there metrical systems that lack lines entirely and employ continuous, unbounded metrical patterns. Furthermore, in most metrical systems that have been carefully studied, linguistic bracketing turns out to play an additional role. For example, although ancient Greek meters and the meter of the Finnish *Kalevala* (Kiparsky 1968) are primarily quantitative, they regulate the placement of word boundaries as well. In Chinese "regulated verse," which is basically tonal (Chen 1979), there is a very strong correlation between phrasal bracketing and that of the metrical pattern. In fact, there are some metrical systems in which linguistic bracketing forms the principal or only metrical basis, as in the Serbo-Croatian folk epics or Japanese.

The universality of bracketing effects raises two final questions. First, we can ask about other languages the question we asked about English: are the bracketings above the word level syntactically or phonologically defined? Devine and Stephens's work (1978, 1981, 1983) on ancient Greek meter suggests that the answer comes out "phonology" for Greek as well as for English. The question is otherwise completely open. More fundamentally, why is bracketing, both in the linguistic representation and in the metrical pattern, a necessary ingredient of metrical form? The answer to this question, if ever found, will form a central part of the theory of universal metrics.

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