A Grid-Based Theory of English Meter
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A Grid-based Theory of English Meter

In recent years, we have seen a real deepening of our understanding of the nature of poetic meter and the English metrical system. In part, this has resulted from the application of the formal methods of linguistics to metrical study—the willingness to formulate metrical rules explicitly and to check out their consequences has naturally led to progress. However, the new results also depend on recent advances in notions of prosodic phonological structure, as an account of a metrical system can only be as adequate as the theory of prosodic structure on which it is based. In particular, the work of Kiparsky (1977) has shown that the metrical theory of stress, as developed in Liberman and Prince (1977) and other works, provides the basis for a more adequate and explanatory theory of English meter than the numerological stress representation of *The Sound Pattern of English*. Kiparsky's work has in turn repaid its debt to metrical stress theory—it is surely an argument in favor of Liberman and Prince's system that it can illuminate the facts of English meter so well. At the level of descriptive adequacy that has now been reached, it is fair to say that the study of meter can serve as a window into phonological structure.

With this purpose in mind, I offer here what I believe to be an improvement on Kiparsky's analysis; one that simplifies the rules, accounts for the data more accurately, and links up the English system with what is known about metrical systems in general. These improvements are the result of basing the rules on a different representation of English stress, drawn again from the work of Liberman and Prince (1977). I argue that the aspects of stress that are relevant to meter are embodied not in metrical trees, as Kiparsky assumes, but rather in metrical *grids,* which Liberman and Prince develop at the end of their paper in a treatment of rhythmic stress clashes. My goals are to clarify the metrical system of English and to shed light on a current controversy concerning the proper representation of stress.

## 1. Kiparsky's System and Its Drawbacks

I will begin with a brief summary of the proposals of Kiparsky (1977) (hereafter K). Like most metricists, Kiparsky views a metrical system as a set of rules determining when

a given linguistic string constitutes an acceptable instantiation of a particular rhythmic structure, or meter. The meter may usefully be viewed as an abstract template, called a *metrical pattern,* against which linguistic material is evaluated. The rules that carry out this matching are called *correspondence rules,* and lines that pass the test are termed *metrical.* The rules must also include a *metric of complexity,* which measures how far a line deviates from perfect correspondence to the metrical ideal.

The English poetic tradition is remarkable in how much individual poets vary in their correspondence rules—every poet possesses to some degree a "metrical idiolect". The descriptive task posed by the English tradition is accordingly enormous. As compensation, however, the wealth of data can provide numerous tests for any proposed theory.

Kiparsky argues that the metrical patterns for English verse consist of disembodied stress trees of the type proposed by Liberman and Prince. For simplicity, we may assume that each metrical foot is represented by a separate tree, so that iambic pentameter would appear as in (1):

(1)

The metricality and the complexity of a line are determined, roughly, by the degree of congruity between the trees of the meter and the trees of the line's phonological representation. In lines (2)–(4), for example, there is increasing disagreement between the two sets of trees, which accords with the hearer's impression of increasing metrical complexity.

(2)   Of hand, of foot, of lip, of eye, of brow   Shakespeare,
                                                        Son. 106

(3)   To eat the world's due, by the grave and thee   Son. 1
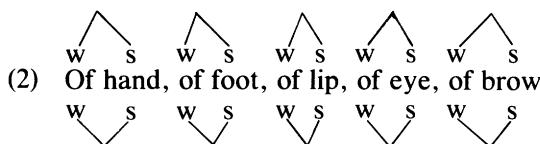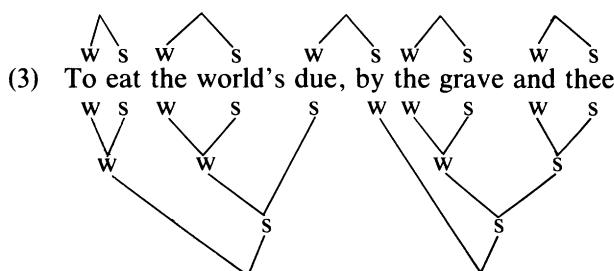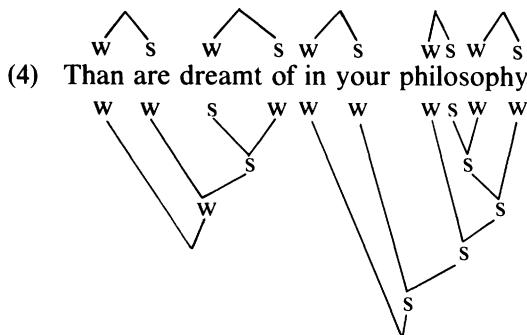
(4)   Than are dreamt of in your philosophy   Ham. 1.5.166

It is at the absolute limits of metricality, however, that the main interest of the theory lies. Kiparsky describes these limits using *metrical filters,* which mark forbidden cadences. All filters have the effect of forbidding linguistic *w* in metrical *w* position. Interestingly, many filters apply only when the linguistic material is *misbracketed* as well as mislabeled—that is, when the linguistic *s* is bracketed to its left, while the metrical *w* with which it is paired is bracketed to its right. An example is the filter below, which I will call *Milton I:*

(5)   *Milton I*

Metrical pattern: *w̸

Phonological representation: s̸

where *s* is the strongest syllable of its phrase.[1]

Lines forbidden by this filter are generally excluded from Milton's mature verse. The missing cadence may be exemplified by a line from Shakespeare, who did not employ filter (5). The point at which the filter applies is marked in boldface.
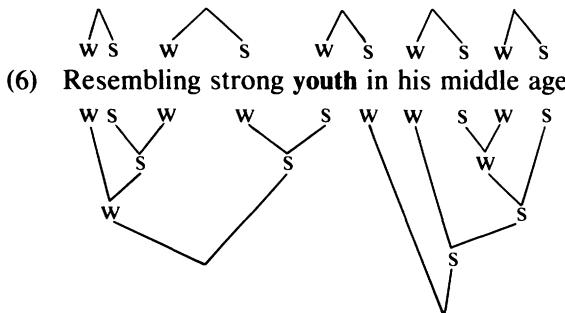
(6)   Resembling strong **youth** in his middle age   Son. 7

In (6), *youth* is mislabeled and misbracketed, and it is the strongest syllable of its phrase.

[1] I have reformulated Kiparsky's filters somewhat in the interest of clarity. The reformulation will have no bearing on the arguments presented.

Notice that if bracketing agrees, the filter does not apply, so that the existence of lines in Milton like (7) is correctly predicted:
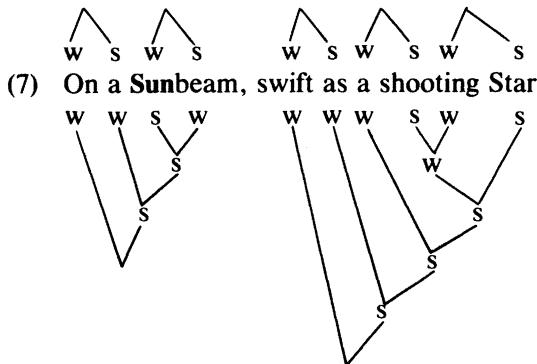
         w   s   w   s   w   s   w   s   w   s
(7)   On a **Sun**beam, swift as a shooting Star   Paradise
         w   w   s   w   w   w   w   s   w   s   Lost 4.556

Lines like (8) similarly show that the filter fails to apply to *s*'s that are not the strongest element of a phrase:
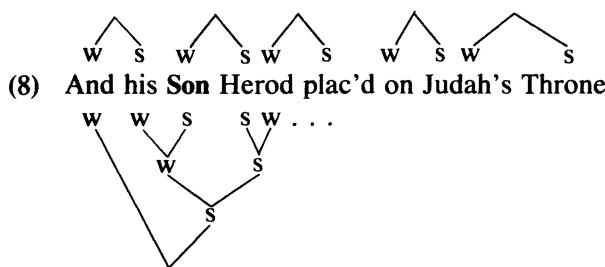
        w   s   w   s   w   s   w   s   w   s
(8)   And his **Son** Herod plac'd on Judah's Throne   Paradise
        w   w   s   s   w . . .   Regained
                                                                  2.424

   There are other filters in Kiparsky's system that refer to bracketing. Most of them make reference to the *level* of the offending *s* syllable, where levels are defined by the boundary system of Chomsky and Halle (1968) and Selkirk (1972). A terminal metrical node is designated as *##-level* if its sister node is separated from it by two word boundaries, *#-level* if its sister is separated from it by one word boundary, and *lexical* if its sister is within the same word. Thus, in (9) *the* is a #-level *w, ti* and *ger's* are lexical *s* and *w*, respectively, and *jaws* is a ##-level *s*.

(9)   the#tiger's##jaws
        w   s w   s
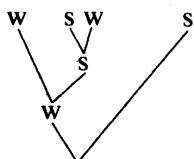
Using this terminology, Kiparsky formulates another filter for Milton's verse, which I will call *Milton II*:

(10) *Milton II*

Meter: *w͗

Line: s͟

where *s* is lexical.

Milton II rules out misbracketed cadences such as the one in (11), from Donne. Where bracketing agrees, however, the filter is blocked, so that lines like (12) are permitted:

(11) Shall behold God, and never taste death's woe   Donne, Holy Sonnets 7
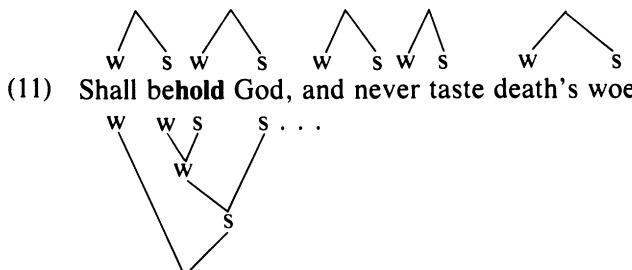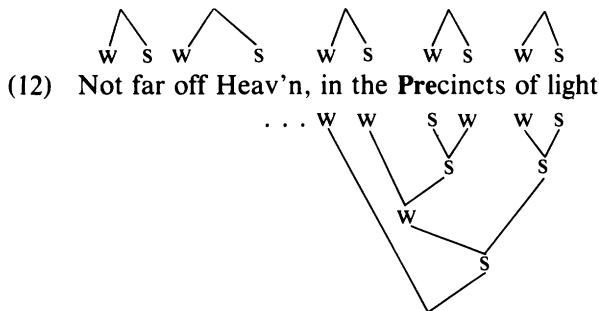
(12) Not far off Heav'n, in the **Precincts** of light   Milton, PL 3.88

The hypothesis that bracketing is relevant to metrical filters provides an elegant and intuitive solution to many problems of meter and handles a far greater range of data than had been previously treated. In what follows, however, I will present some reasons why the approach may need fundamental revisions. The first argument will proceed as follows: I will show that in order to account for certain facts, Kiparsky must introduce an arbitrary disjunction of prosodic configurations into one of his filters. This in itself would not be a serious problem, were it not that the same disjunction crops up in a large number of filters, for several different poets. I will then review Liberman and Prince's theory of grids and show that it allows the arbitrary disjunction to be dispensed with, as the metrically relevant configurations fall into natural classes.

I begin with a filter for Shakespeare that corresponds closely to Milton I. As noted above, Shakespeare's metrical practice is more liberal than Milton's in this area, as he permits lines that Milton would avoid, such as (13)–(15):

(13)   To wag their#high##tops and to make no noise   MV 4.1.75
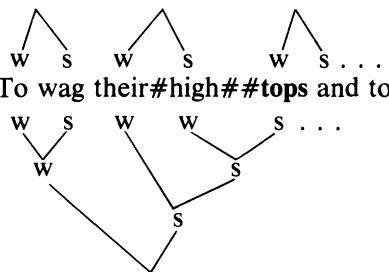
(14)   Or my divine##soul answer it in heaven   R2 1.1.38
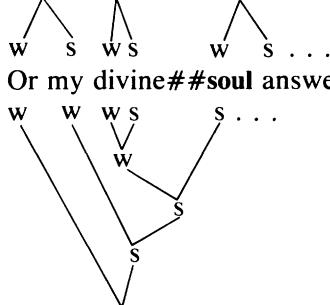
(15)   Why does the#Jew##pause? Take thy forfeiture   MV 4.1.330
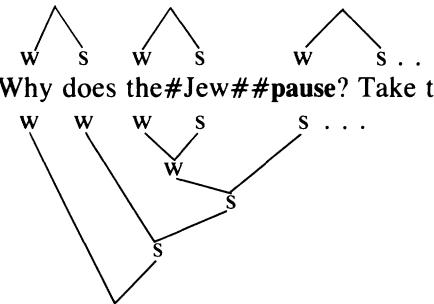
However, there are still some lines of this type that Shakespeare systematically avoids; cf. Thomas Wyatt's (16), (17):

(16)   For good is the#life, ending faithfully   "The longe love . . ."
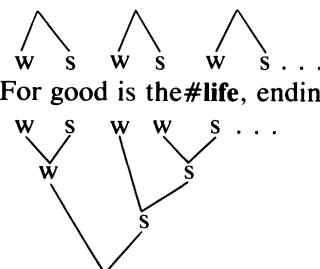
(17)   With innocent##blood to feed myself fat   "Mine own John
                                                          Poynz . . ." 35
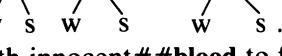
To separate out the various cases requires a fairly complicated filter. The version that Kiparsky formulates, which I will call *Shakespeare I,* is equivalent to Milton I with conditions (b) and (c) added:

(18)   *Shakespeare I*

Meter: *w
Line: s

where (a) s is the strongest element of its phrase.
      (b) s is preceded by w (compare (16), (17) with (14), (15)).
      (c) The preceding w is either #-level or lexical (compare (13) with (16), (17)).

Filter (18) lacks explanatory force, as a separate condition must be added to handle each exceptional case. The significance of this problem will become clearer once we have examined another filter.

I noted above that in general, s's that are mismatched in their labeling may be positioned more freely provided that their bracketing is not also mismatched. However, Kiparsky also formulates some filters that apply to properly bracketed s's. An example is the positioning of mislabeled lexical s in Milton: although lines like (19) and (20) are reasonably well attested in Milton, lines of the type (21) are excluded.

(19)   And with these words his temptation pursu'd   PR 2.405

     w   s   w   s   w   s . . .

(20)   In the#Visions of God: It was a Hill   PL 11.377

     w   w   s   w   w   s . . .

                w   s

                  s

           s
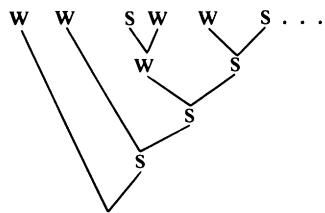
(21) *With dark##visions of God: It was a hill

     w   s   w   s   w   s . . .

     w   w   s   w   w   s . . .

                w   s

                 s

          s
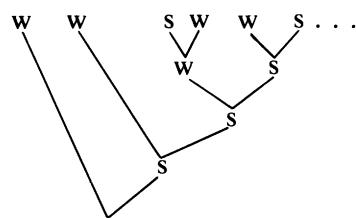
To account for the difference, Kiparsky proposes the filter shown below:

(22)   *Milton III*

Meter: *w

Line: M   s

where s is lexical and M is a ##-level stress.

But this filter is insufficiently general, as it fails to rule out similar cadences like those of (23) (below) and (24) (opposite), which are in fact completely missing in Milton:

     w   s   w   s   w   s . . .

(23) *The#*bard's*##visions of God: It was a hill

     w   s   s   w   w   s . . .

        w   w   s

                 s
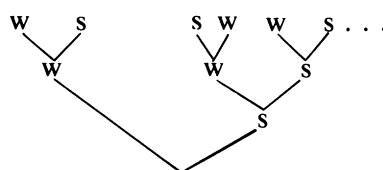
In (23)–(24), the stresses corresponding to M (italicized) are #-level and lexical, so that the filter would not apply, even though the lines are unmetrical.

$$
\begin{array}{ccc}
\wedge & \wedge & \wedge \\
w\ \backslash s & w\ \backslash s & w\ \ \backslash s\ \ldots
\end{array}
$$

(24) *Su*blime*##*visions of God: It was a hill
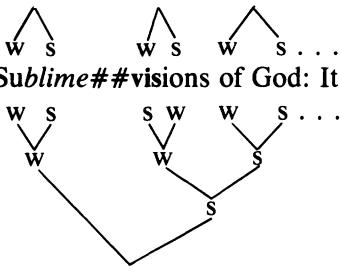
One possible correction would be to allow M in the filter to analyze a nonterminal node in the stress representation—in (23)–(24), M would correspond to the nodes dominating *the bard's* and *sublime,* respectively. This would indeed rule out (23)–(24), but it would also rule out attested lines like (25):[2]

(25)   Spirits*##*odorous breathes: flow'rs and their fruit   PL 5.482
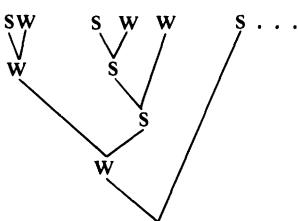
Line (25) intuitively patterns with (19)–(20)—the inverted cadence apparently is metrical only if the inversion is not preceded by a "stressed syllable", in some sense of the term yet to be defined. To account for the facts under Kiparsky's framework requires an arbitrary disjunction in the filter, on the order of (26):

(26)   *Milton III (revised)*

Meter: *w
Line: M   s

where (a) *s* is lexical.
       (b) M is either (i) *##*-level (cf. (21))
                     or (ii) an *s* (cf. (23)–(24)).

What is worse, the arbitrary disjunction is essentially the same one that was posited in

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[2] (25) and PL 3.15 are the only lines in Milton containing this cadence. Their rarity is expected on independent grounds, however. Lexical inversion in Milton is marked, occurring in only about 30 of the 12,600 lines of PL and PR. The stressless syllable preceding the inversion is far more likely to be nonlexical for two reasons: the syntactic contexts in which a nonlexical element would occur are much more common; and a preceding content word must also have its own lexical stress accommodated.

the filter Shakespeare I. The stresses that fit the structural description for M in Shake-speare I form the complement set of those that qualify as M in Milton III: in both cases, *s*'s and *##*-level *w*'s are opposed to *#*-level and lexical *w*'s. That this is no accident is suggested by the existence of filters analogous to Milton III in Shakespeare (K, 212) and Wordsworth (Magen (1980)), as well as a counterpart to Shakespeare I in Spenser (Dunn (1980)). In addition, my own count suggests that Milton adheres to his own filter I much more strictly when the conditions of Shakespeare I are also met. Taken together, the facts suggest that there is a binary distinction pervasive in English metrics that is not perspicuously captured with tree-and-boundary notation.

In what follows I will show that the metrical grids of Liberman and Prince (1977) provide a natural account of this distinction and thus should be preferred to trees as the phonological basis for the metrical rules. To do this will require some background in grid theory, which constitutes the next section.

2. Metrical Grids

Liberman and Prince developed metrical grids as a representation for rhythm in speech. Their article contains two basic arguments in favor of grids. First, grids are essential in the formulation of the *Rhythm Rule,* the rule that retracts stress in phrases like *fòurteen wómen* (< *fourtéen wómen*). Second, the grids capture speaker intuitions about syllable prominence more accurately than either trees or SPE-style numerical representation, without the need for ad hoc readjustment rules. Liberman and Prince conceive grids to be arrays of abstract elements aligned in columns above each syllable, the prominence of a syllable being indicated by the height of its column. The grids are derived from metrical trees using the following rules:

(27)   *Grid Construction*

   a.   As a place marker, assign each syllable a mark on the first level of the grid.

   b.   Assign every lexical (i.e. content word) monosyllable a mark on the second level.

   c.   Assign sufficient additional marks so that the strongest syllable of every strong metrical constituent has more marks than the strongest syllable of its weak sister.

Using the grids created by (27), the Rhythm Rule may be formulated as follows:

(28)   *Rhythm Rule*

   w   s   →   s   w
   1   2   1   2
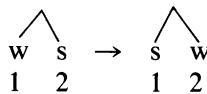
where (a) 2 does not dominate the strongest syllable of its phrase.

(b) The application of the rule alleviates a *stress clash.*

A *stress clash* occurs when two marks are adjacent on their grid level, with no mark intervening on the immediately lower level.

These rules correctly predict stress retraction in a variety of cases; compare (29a,b) with (29c,d,e).[3] In the examples, stress clashes are marked with asterisks and relabeled nodes with boldface type.
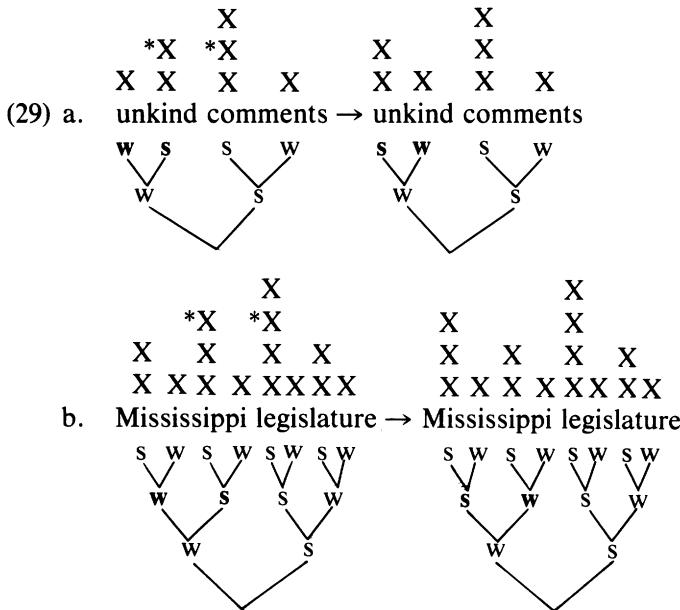
<pre>
                 X   X
        *X *X   X   X
        X X   X X   X X   X   X
(29) a.   unkind comments → unkind comments
        w s   s w   s w   s   w
         \/   \/   \/   \/
          w   s   w   s
           _____/   _____/
</pre>

<pre>
                 X   X
        *X *X   X   X
        X   X   X   X   X   X   X   X
        X X X X XXXX   X X X X XX XX
     b.   Mississippi legislature → Mississippi legislature
        s w s w sw sw   s w s w sw sw
         \/ \/ \/ \/   \/ \/ \/ \/
          w   s s   w   s   w s   w
           \/   \/   \/   \/
            w   s   w   s
             ____/   ____/
</pre>

```
        X                              X
     X     X                        X   X   X
   X X   X X                      X  XX  X   X
c.  unkind remarks   (no      d.  Montana cowboy   (no clash)
    w  s  w  s        clash)       w  s w  s   w
     \/    \/                       \/     \/
     w      s                        s      s
       \      /                  \        /
         \  /                      w
                                     \    /
```

```
            X
        X       X
     X   X   X   X
    X X X  X X X X X
e.  Mississippi legislation   (no clash)
   s  w s  w s w s  w
    \/   \/  \/   \/
    w     s   w    s
      \     /   \    /
        w        s
          \     /
```
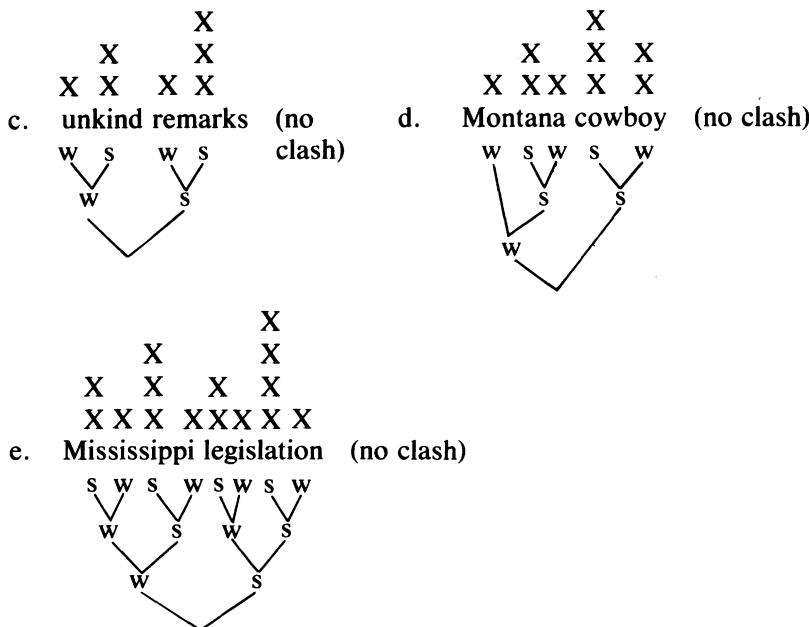
In what follows I will be using a slightly different notation for grids, in which the bottom row is missing and syllable positions lacking grid columns are noted as /./. Under this notation, (29e) comes out as (30):

```
            X
        X       X
     X  .  X  . X  . X  .
(30)  Mississippi legislation
```

Syllables that bear marks on these diminished grids will be referred to as *grid-marked*. The revised grids are a conceptual improvement, in that they express the "natural classes" of rhythmic phonology in a way that the Liberman/Prince grids do not. In particular, it is only the grid-marked syllables that may participate in stress clashes; and rule (27b) can be rephrased so that it refers to a binary distinction, rather than specifying a particular column height:

(31)   Content words must be grid-marked.

With the revised grids, the constraint can be maintained that no linguistic rules refer to the absolute height of grid columns, only to their presence or absence and to their relative height. Finally, the revised grids permit rule (27a) to be eliminated.

In what follows it will be crucial to provide empirical support for rule (27b), now rephrased as (31). Liberman and Prince's argument is based on the fact that compounds like *good-looking* undergo the Rhythm Rule regularly, even though the tree configuration involved is identical to that of *Montàna cówboy*:

```
        X                       X
  *X    *X          X           X
 X  X  . X  X      X   X    .  X   X
(32)  good-looking lifeguard → good-looking lifeguard
     w  s  w  s  w      s   s  w  s   w
           \ /    \ /        \ /    \ /
            s      s          w      s
       \    |               \   |
         w                     w
          \      /              \        /
```
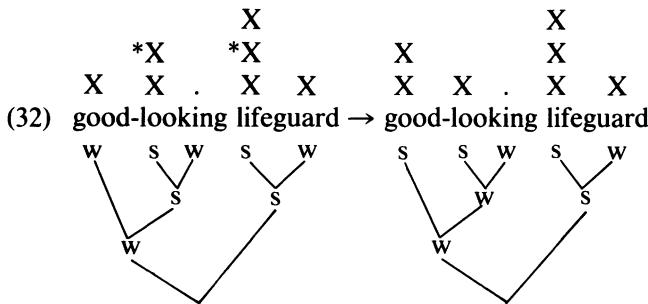
In (32), the grid mark on *good* raises the stress on *look* to a level that clashes with *life,* resulting in an application of the Rhythm Rule. The contrast is in itself not overwhelming evidence for rule (31). But elsewhere in the literature, ample evidence can be found that lexical monosyllables do indeed clash with adjacent stresses. I will review three of these arguments, as the validity of rule (31) is crucial to my analysis.

(a) *Ticonderoga.* The second strongest stress in this word varies freely between the first and second syllables (see Kiparsky (1979) for an explanation). However, in the compound *Fort Ticonderoga* the stress on *con* must dominate over that on *Ti* for most speakers.[4] This may plausibly be attributed to the need to avoid a stress clash between *Ti* and the lexical monosyllable *Fort.* The explanation crucially supposes that *Fort* is grid-marked, so that it will clash with a following stress.

(b) Postnominal Modifiers. In Middle English, a large number of compounds of the form Noun-Adjective were borrowed from French. According to van Draat (1912), the only compounds of this sort that survived into Modern English were those lacking a stress clash. For example, compounds like *bòdy pólitic* and *hèir appárent* have survived, but there are no compounds from Middle English of the form *hèir pólitic.* Clashing N-A compounds do exist today, but they are all modern English innovations, and van Draat shows that even these are more likely to be dropped from the language. Apparently, lack of clash is a factor that contributes to the survival of compounds with marked structure. Notice that the definition of stress clash involved here crucially requires that lexical monosyllables be counted as potentially clashing elements, even if they are labeled *w:*
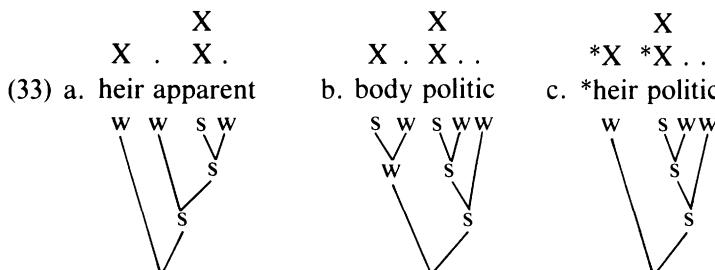
```
        X                 X                  X
   X  .  X .          X  .  X . .        *X  *X . .
(33) a. heir apparent   b. body politic    c. *heir politic
     w  w  s  w          s  w  s w w         w   s w w
            \ /           \ /  \ /              \ /
             s             w    s                s
        \    |               \   |            \   |
           s                   s                s
           \  /                 \  /             \  /
```

Van Draat also observes that Shakespeare uses postnominal *mine* (a relic of Old English usage) only after polysyllables with nonfinal stress: *làdy míne, còusin míne;* but not *lòrd míne, quèen míne.* The argument is the same as before.

(c) Loss of Final Stressless Syllables. Since Middle English, the language has gradually lost the ending *-en* from past participles, as well as the vowel of the ending *-ed.* Van Draat (1912) and Bolinger (1965) observe that in both cases, the loss has occurred more reluctantly in prenominal position, citing the following evidence: (i) With the exception of *fallen* and *risen,* all verbs that have retained *-en* participles are transitive—it is only the transitive participles that can occur as prenominal modifiers. The few newly created participles, such as *proven,* are likewise all transitive. (ii) In some cases, a disyllabic participial form has been retained as an adjective, alongside a monosyllabic verbal participle: for instance, *drunk* but *drunken sailor; shrunk* but *shrunken head; bent* but *on bended knee, I've lit the match* but *lighted match.* (iii) Loss of schwa in *-ed* is inhibited in adjectives, as in *wicked, rugged, dogged, aged, learned*—notice that the participles corresponding to the latter three are monosyllabic. Similar examples exist with *-id: solid, timid, rigid.*

As van Draat and Bolinger point out, the retention of the extra syllable prenominally can be explained by pressure to avoid stress clashes—nouns usually bear initial stress, and there is reason to believe (see Liberman and Prince (1977, 320)) that stress clashes are more severe within close-knit syntactic phrases such as NP. For this explanation to be valid, however, we must assume that lexical monosyllables are grid-marked, so that they will clash with a following stress.

I would conclude from these arguments that rule (31) is indeed valid. Further evidence can be found in Bolinger (1965) and van Draat (1912).

Recall now the arbitrary disjunction that pervades Kiparsky's system of metrical filters: *s*'s and ##-level *w*'s are frequently opposed to #-level and lexical *w*'s. Under the theory of metrical grids, these turn out to represent natural classes, as the former category is grid-marked, the latter not. The metrical categories turn out to be based on a phonological distinction, that of whether or not a syllable may enter into a stress clash. I illustrate this below with the Shakespeare I filter (18). In these examples, the boldface syllable should be taken as occurring in metrical *w* position, and the italicized syllable as the one that can "rescue" the cadence if it is grid-marked.

(34) a.   *Forbidden by Shakespeare I*
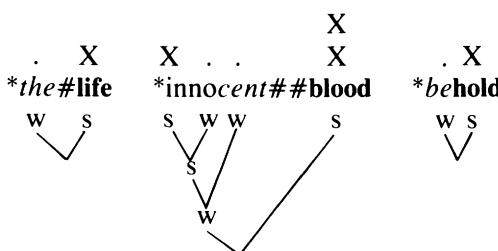
b. *Permitted by Shakespeare I*

```
            X             X               X
  X     X     . X     X       .   X       X
strong##youth  divine##soul   the#Jew##pause
  w      s    w s     s       w   s       s
```
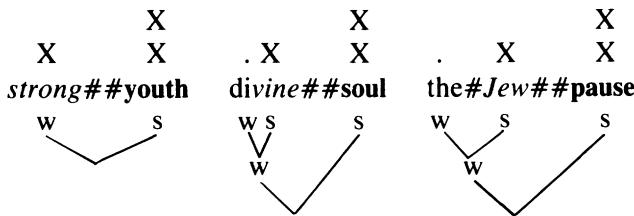
Similar charts could be provided for Milton III and other filters.

These facts strongly suggest that grids may play a role in the English metrical system. An obvious question is then: if grids are necessary to the description of English meter, are they also sufficient, so that trees may be eliminated? I believe the answer is yes, and will argue for this conclusion in three stages. First, I will show that the improvements in descriptive adequacy that Kiparsky's account gains in using tree notation rather than the numbers of SPE carry over as well to grids. I will then formulate an explicit grid-based metrical theory, and will show how the effects that Kiparsky attributes to bracketing congruity can equally well be explained on the basis of a universal principle governing metrical systems. Finally, I will present a number of cases in which the grid theory makes correct empirical predictions where the tree-based theory fails.

3. The Equivalence of Grids and Trees for Secondary Stress

Kiparsky (1977) argued for a tree-based theory in part by demonstrating the metrical relevance of a class of secondary stresses. The class can be characterized very simply under tree theory as the set of syllables dominated by *s*, but requires an extremely complex characterization with SPE stress numbers. The relevant filter applies to the verse of Shakespeare, Pope, Byron (Lindsay (1982)), Coleridge (Hammond (1982)), and many others, though for convenience I will refer to it as *Shakespeare II*:

(35) *Shakespeare II*
    Meter: w
             ↕
    Line: s
    where *s* is lexical and does not begin a phonological phrase.

The filter prohibits the main stress of a polysyllable from occurring in metrical weak position, except after pause or potential pause. In addition, the filter must analyze the boldface secondary stresses of (36a), but not (36b). To make clear the value of the trees, I have added SPE stress numbers to the examples.

(36) a.   Metrically Relevant Secondaries

```
  0  3 01 0      3 00 1 0     3  1 0 3 0    0 1  0 0 3 0
consideration   fortification  unnecessary   interrogatory⁵
```


b.   Metrically Irrelevant Secondaries
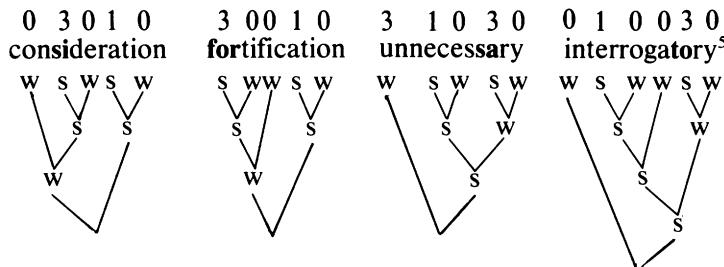
```
  3    1      1   3      1  03
maintain     contact    signifies
```
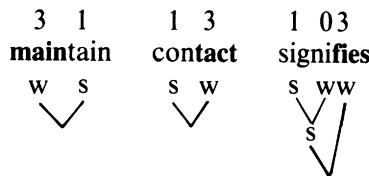

From the above examples it is clear that metrical strong position identifies just the right class of secondaries, and that an equivalent identification with stress numbers would be more or less ad hoc. The difficulties for the numerical theory increase when compounds are considered (see K, 196–199). The relevant point here is that since grids are derived from trees, a set of metrical filters based on grids should in principle make the same distinctions available. This is shown below with the grids for the words of (36):

(37) a.
```
           X                X
    . X . X .         X . . X .
   consideration     fortification
```

b.
```
       X                  X
    . X . X .        . X . . X .
   unnecessary       interrogatory
```

```
    .  X      X .      X . .
   maintain  contact  signifies
```

---

⁵ *Interrogatory* consistently scans in Shakespeare with Resolution (K, 236) of the third and fourth syllables, as in (i):

(i)   in ter roga to ry
      W S W   S W

This rules out the modern pronunciation, which would be scanned SWSWSW.

In (37), the metrically relevant secondary stresses are grid-marked, while the metrically irrelevant secondaries are not. At this point it should be clear that the distinction of grid-marking appears pervasively in the English metrical system. In the next section, I incorporate it into an explicit theory.

4. A Grid-based Analysis

Under Kiparsky's system, three types of linguistic information are relevant to meter: (a) the relative prominence of syllables, as embodied in the tree labeling; (b) the syntactic structure of the utterance, i.e. the division into phrases and the placement of boundary markers; and (c) prosodic constituent structure, i.e. the geometry of the trees themselves. The first two elements are available to a grid-based theory as well, but the effects attributed by Kiparsky to prosodic bracketing must be given another explanation.

To substitute for bracketing, I propose to invoke a well-known and very general principle governing metrical systems:

(38)   Correspondence to a metrical pattern tends to be lax at the beginnings of units; strict at the ends.

The units referred to in (38) can vary; typically they are lines or cola. The validity of (38) appears to be independent of the phonological basis (stress, quantity, or tone) of the metrical system. I cite some confirming examples in the chart below.

(39)

Metrical System	*Phonological Basis*	*Relevant Unit*	*Reference*
French, Italian	stress	line	
Spanish	stress	line, colon	Piera (1980)
Russian	stress	line, colon	Bailey (1971)
Persian	quantity	line	Hayes (forthcoming)
Greek, Sanskrit	quantity	line	
Latin hexameter	stress and quantity	line	Allen (1973)
Finnish *Kalevala*	stress and quantity	line	Kiparsky (1968)
Chinese regulated verse	tone	line	Chen (1979)

My claim is that English meter is also sensitive to the beginnings and ends of units, but that the unit involved is the phonological phrase—a linguistic unit rather than a metrical one. A good deal of prima facie evidence supports this claim. For example, the very widespread filter Shakespeare II is suspended in phrase-initial position, as in (40):

(40)   **Rich**er than wealth, **proud**er than garments' cost   Son. 91

What is more, the frequency of phrase-initial inversion is proportional to the salience of the syntactic break involved: sentence-initial inversion is more frequent than inversion after orthographic comma, which is in turn more frequent than inversion after unpunctuated syntactic breaks such as that of (41):[6]

(41)   And yet dark night [$_{VP}$ **strangl**es the travelling lamp]   Mac. 2.4.7

This is highly plausible under the assumptions made here: if metrical freedom is conferred by the beginnings of phrases, we would expect the more salient phrase beginnings to confer greater metrical freedom.

The converse argument can be made with the filter Milton I. This filter initially appears to have numerous exceptions; my own count of *Paradise Lost* and *Paradise Regained* found roughly 70 lines containing the putatively illegal cadence:

(42)   Draw after him the whole **Race** of mankind   PL 3.161
       As from his Lair the wild **Beast** where he wons   PL 7.457
       By Sin and Death a broad **way** now is pav'd   PL 10.473

However, almost all of these occur before a weak syntactic break—weak enough not to be punctuated. About five cases are found before comma, as in (43):

(43)   First-Fruits, the green **Ear,** and the yellow Sheaf.   PL 11.435

And none at all occurs before a period. The evidence here forms the symmetrical counterpart to the Shakespeare II filter, in that more salient phrase endings imply stricter correspondence possibilities.

I turn now to the cases in which, according to Kiparsky, a bracketing mismatch is necessary in order for a filter to apply. Two of the relevant filters, Milton I and Shakespeare I, are restated below together with cadences showing why bracketing is considered relevant:

---

[6] A typical count is the following, which totals the line-initial inversions in *Julius Caesar*:

(i)	Type of Pause	% of Total Pauses	% of Total Inversions
	Period	28	42
	Weaker punctuation	48	43
	No punctuation	21	7

Similar results were obtained from a sampling of *Paradise Lost*.

(44) a. *Milton I*

Meter: *w

Line: s

where *s* is the strongest syllable of its phrase.

w s w   s   w   s   w s w   s
*Resembling strong##youth   vs.   On a sun##beam

w s w   w   s   w w s   w

s   s   s

w   s
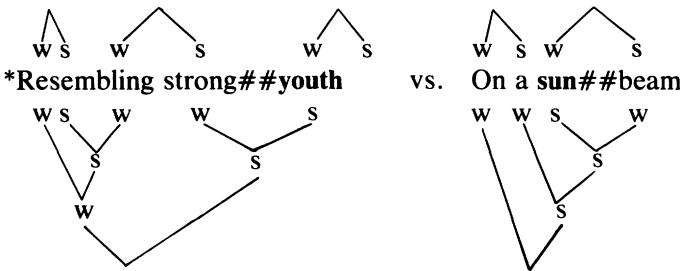
b. *Shakespeare I*

Meter: *w

Line: s

where (a) *s* is the strongest element of its phrase.
      (b) The syllable preceding *s* is not grid-marked.

w   s   w   s   w   s   w   s   w   s
*For good is the#life   vs.   Than are dreamt#of

w   s   w w   s   w w   s   w

w   s   s

s   s
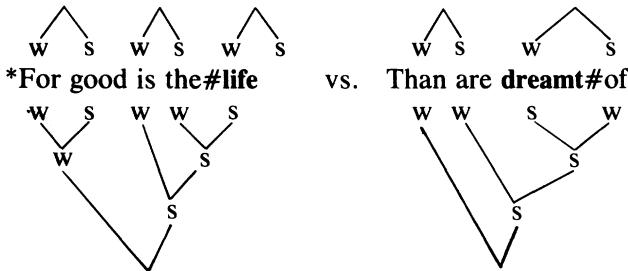
Given the premise that in English, phrase endings are strict while beginnings are lax, an obvious reinterpretation of these facts suggests itself: the starred cadences above are unmetrical because the offending syllable is in phrase-final position. This provides two immediate advantages: it relates the metrical filters to the near-universal principle (38), and it offers hope of dispensing with reference to tree structure in the filters, given that the grids appear to be independently necessary.

In devising an explicit grid-based theory, two principles will be especially useful. The first is a principle of locality, suggested in Jespersen (1933) and in Halle and Keyser (1971): the metrical evaluation of a stressed syllable can be made by comparing its stress level with that of its immediate neighbors. Notice that the grid lends itself to this sort

of locality in a way that trees do not: the arboreal labeling of a syllable may be based on its relation with a stress several syllables away. Later I will present empirical evidence that the locality constraint is correct.

In formulating local filters, it will be useful to introduce some terminology. I define a *stress peak* as a syllable whose grid column is higher than that of at least one of its neighbors. Stress peaks may be termed *rising* or *falling* according to whether a lower neighbor occurs on the left, the right, or both, as shown in (45):

(45) a. *Rising Peaks*

             X   X

   . $\underline{X}$. X $\underline{X}$. $\underline{X}$.   X $\underline{X}$ X

   b. *Falling Peaks*

             X   X

   $\underline{X}$. $\underline{X}$ X .   . $\underline{X}$.   X $\underline{X}$ X

Stress valleys may be defined analogously, as columns having at least one higher neighbor. The notions of stress peak and stress valley allow for a very simple metric of complexity. I assume that the metrical pattern for iambic pentameter is itself a grid, as in (46):

(46) . X . X . X . X . X

Given this pattern, a line can be said to be metrically complex to the extent that its peaks fail to correspond one-to-one with peaks in the meter; its valleys with valleys. The intuition here is that a line is complex when its grid fails to approximate geometrically to an alternating sequence of five rises and four falls.

The other central notion in this system will be the assignment of *domains* to metrical filters: the filters may only analyze material lying within a specified domain, such as the word or the phonological phrase. In this respect they are similar to phonological rules, which obey the same kind of restrictions; see Selkirk (1980b), who argues that phonological representations are organized by labeled bracketing into a hierarchy of rule domains. Selkirk points out that some phonological rules (her "domain juncture" rules) may refer to more than one domain simultaneously. As we will see, such cases are not found among the English metrical filters, so a more powerful "one domain only" constraint may be tenable for metrical systems.

The notions of "locality" and "domain" lead to the following conjectured format for metrical filters:

(47) Meter: Valley

$$\updownarrow$$

Line: $* \left(\begin{Bmatrix} \text{rising} \\ \text{falling} \end{Bmatrix} \right)$ Peak $/ \ [. \ . \ . \ (\psi) \ \underline{\quad\quad} \ (\phi) \ (. \ . \ .)]_\alpha$

where ψ, ϕ may be specified as grid-marked or not, and α is a phonological domain.

The choices (47) makes available are (a) the domain of the filter, (b) whether the offending cadence is phrase-final, and (c) the presence of adjacent grid-marked or non-grid-marked positions.

Under this framework, the filter Milton I can be expressed with quite minimal resources. In stating (48), I have left out the metrical environment (valley position), which is common to all the English filters.

(48) *Milton I (grid version)*
*Peak / [. . . ____]_phrase

The filter obeys principle (38), as it applies at an ending. By convention, it is interpreted as applying more strictly at endings of greater salience (recall the facts of (40)–(43)). The filter handles cases (6)–(8) as shown in (49). Linguistic grids are displayed above the line; the grid of the meter below:

(49) a. *Unmetrical Cadences*

<pre>
(6)   X
          . X   .   X   X
          [Resembling strong youth] in his middle age
          . X   .   X   .   X . X   . X
</pre>

b. *Metrical Cadences (peak is not phrase-final)*

<pre>
(7)   X
          . . X   X
          [On a Sunbeam], swift as a shooting Star
          . X . X   . X . X .   X
</pre>

<pre>
(8)   X
          . . X   X
          [And his Son Herod] plac'd on Judah's Throne
          . X . X . X   . X .   X
</pre>

Notice that examples (7) and (8), while not ruled out by the filter, would be marked as complex by the metric I have proposed.

The filter Shakespeare I is the same as Milton I, with an additional condition:

(50) *Shakespeare I*
*Peak / [. . . ψ ____]_phrase
Condition: ψ is not grid-marked.

The condition correctly prevents the filter from applying to cadences like (49a), which are metrical for Shakespeare. The filter also handles examples like (14)–(17), as shown below.

(51) a. *Metrical Cadences*

  (14)   X
           .   . . X   X
           [Or my divine **soul**] answer it in heaven
           .   X . X   .

  (15)   X
            .   .   . X   X
           [Why does the Jew **pause**?] Take thy forfeiture
            .   X   .   X   .

  b. *Unmetrical Cadences*

  (16)   X
           .   X   . . X
           [For good is the **life**,] ending faithfully
             . X   . X   .

  (17)   X
           . X   .   . X
           [With innocent **blood**] to feed myself fat
             . X   . X   .

Notice that under the grid theory, the various cases that earlier required separate additions to the filter are now subsumed under a single generalization.

The filter Milton II (10) constitutes the remaining case in which bracketing putatively must play a role in the system. It can be reformulated under the grid theory as follows:

(52) *Milton II*

      *Peak / [. . . ——]$_\text{word}$

The claim of (52) is that the *word* can constitute yet another domain in which endings are especially strict. By the nature of the tree shapes found in English, the only lexical stresses that would be misbracketed in iambic verse are word-final ones, so that (52) makes exactly the same predictions as the old Milton II filter:[7]

---

[7] The special salience of word endings provides an alternate explanation for Kiparsky's inventory (K, 224–227) of testimony from naive readers who perceive bracketing effects in poetry: in all the examples cited, the perception of bracketing can be attributed to whether it is iambic or trochaic foot endings with which the word endings principally coincide. Morphological bracketing alone, without prosodic bracketing, is sufficient to explain readers' perceptions. I will address the issue of whether the metrical pattern is itself bracketed below.

(53) a. *Unmetrical Cadences*

    (11)   X
             .   . X X
           Shall [be**hold**] God, and never taste death's woe
           .   X .   X

  b. *Metrical Cadences*

    (12)   X
                    . .   X .   . X
           Not far off Heav'n, in the [**Precincts**] of light
             . X   . X   . X

    (19)   X
                  . .   X .   . X
           And with these words his [temptation] pursu'd
             .   X   . X   . X

The Milton I filter clearly shows the effect of domains. If a filter could consult grid columns outside its domain, we would expect lexical monosyllables to count as stress peaks for purposes of Milton I, whenever they were preceded by stressless clitics. But Milton I must not apply in such cases, as lines like (54) and many others demonstrate:

    (54)   X
                  X X
      .   X   . .   X X
      His knowledge of [**Good**] lost, and Evil got   PL 11.87
      .   X   . X   .   X

Similar arguments hold for most of the other filters.

The filter Milton III (26) forbids lexical inversions after grid-marked syllables. I formulate it as follows:

(55) *Milton III (grid version)*
       *Falling peak / [. . . ψ _____ . .]$_{phrase}$
       where ψ is grid-marked.

Some examples of how the filter applies are as follows:

(56) a. *Metrical Cadences*

(53b), plus

(25)   X
                        X   X
                X . X . .   X
       [Spirits **od**orous breathes:] flow'rs and their fruit
                .X . X .   X

  b. *Unmetrical Cadences*

(21), (23), (24)

                                            X
                              X   X
                        . X   X . .   X
       [⎡ *With dark ⎤ visions of God:] It was a hill
         ⎨ *The bard's ⎬
         ⎣ *Sublime   ⎦
                . X   . X .   X

On inspection, filter (55) appears to be too general, as it forbids *all* falling peaks in the position shown, rather than just lexical stresses. If the filter were to be limited in this way, another pair of brackets would have to be added, as in (57):

(57)   *Falling peak / [$_{phrase}$ . . . ψ [$_{word}$ ——— X]$_{word}$ . . .]$_{phrase}$
       where ψ is grid-marked, and
             X ≠ ∅.

This would violate the proposed filter format (47), which allows for reference to just a single domain. However, my own inspection of the data suggests that Kiparsky's filter is insufficiently general, since with a few doubtful exceptions it appears that *any* falling peak is excluded in the environment given.[8] The hypothesis that metrical filters refer to

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[8] This *includes* cases where the falling peak is a misbracketed *s;* see below.

A further refinement to (55) concerns the tightness of the phrasal domain in which it applies: the filter will work only if its domain is a minor phonological phrase, according to the definition in Kiparsky (1975), rather than a major phonological phrase such as would be flanked by obligatory pauses. This prevents the filter from ruling out the fairly common pattern of (i):

                        X   X
            .   X   .   X   X   . .   X   .   X
(i)   [With Floods and Whirlwinds][of tempestuous fire]   PL 1.77
            W   S   W   S   W   S W   S   S

The distinction between minor and major phonological phrases appears to be independently necessary in English metrics. For example, lexical inversions in Shakespeare may occur after minor phrase breaks, while the Shakespeare I filter applies categorically only before major phrase endings. At minor phrase breaks, it only contributes complexity.

single domains is thus compatible with the known data, although many more cases would have to be found to give it more than tentative status.

Shakespeare uses a somewhat more restricted version of Milton III, which applies only when the offending syllable is followed by an unmarked grid position.

(58) *Shakespeare III*
   *Falling peak / [. . . ψ ____ φ . . .]$_{phrase}$
   where ψ is grid-marked, and
      φ is not.

This has the effect of permitting compounds in *ws* position after a stressed syllable, as in (59a), though clitic-final cadences like (59b) are still forbidden:

(59) a.
```
                        X
      .  X  .   X  X  X
```
   [Upon the wild sea-banks,] and waft her love   MV 5.1.11
```
      .  X  .   X  .  X
```

   b.
```
            X
      X   X       .
```
   *[kings love#thee]
```
      X   .   X
```

Shakespeare III also rules out the cadences of (56b), which are independently excluded by Shakespeare II.

It is instructive to examine the "dialectal" variation found among the falling peak filters. For Spenser (Dunn (1980)) and Wyatt (K, 213), any kind of inversion may occur after a grid-marked position. Milton allows no such inversions, while Shakespeare and Pope (K, 213) allow ##-level inversions but not lexical or #-level. These combinations are in fact the only ones that can be stated using the notation for filters developed here. A filter that forbade lexical inversions but not #-level or ##-level in the relevant environment would have to be stated with extra brackets, as in (57).

The remaining filter to be treated forbids the appearance of lexical stresses in odd position for Shakespeare and many other poets:

(60) *Shakespeare II (grid version)*
   *Peak / [. . . ____ . . .]$_{word}$

The forbidden cadences here are as follows:

(61) a.
```
                    X                b.                    X
         .    .  X  X                   .   .   X  .   .   X
```
   *Shall [behold] God . . .   *In the [Visions] of God . . .
```
         .    X  .   X                      .   X   .  X  .   X
```

c.   X
                        .   .   X .   . X
             *. . . his [temptation] pursu'd
                      .   X   . X   . X

In addition, the filter regulates the appearance of secondary stress in the examples of (37a), forcing the application of Resolution (K, 236) to *fortification* and *intérrogatory* and forbidding it in *consideration* and *unnecessary,* so that the secondary stress peaks will occupy even positions.

An obvious shortcoming of filter (60) is that it fails to allow lexical inversions after pause, as in (40) and (41). To remedy this might appear to require abandoning my claim that all metrical filters refer to a single domain. However, a more general solution is also possible: it appears that *all* metrical filters, as well as the complexity metric, are relaxed in phrase-initial position. For example, although inversion of lexical stress in Milton is metrical in any position (subject to filter (55)), the vast majority (about 98.4%) of lexical inversions are phrase-initial. Claims about the complexity metric are difficult to document statistically, but they can be tested intuitively. Compare the lines of (62), which have identical metrical grids, differing only in the location of pause:

(62) a.   X   X
               .   X   . X .   . X   .   .   X
             He showed no clemency; [all the condemned]
               .   X   . X . X   . X   .   X

     b.   X   X
               .   X   . X .   . X   .   .   X
             He showed no mercy; [and all the condemned]
               .   X   . X . X   . X   .   X

It is fairly clear that (62b) is more metrically complex than (62a). This is not accounted for by any filter proposed so far, but would follow from my proposal, given that the mispositioned stress on *all* is phrase-initial in (62a) but not in (62b). I would accordingly propose the following condition on metrical rule application, common to all English poets:

(63)   All metrical requirements are relaxed for stress peaks in the environment
       / [$_{phrase}$ ———— .

As noted at the beginning of this section, the degree of relaxation is proportional to the salience of the phrase break. By invoking (63), we may retain filter (60) in its simpler form, still adhering to the restrictive filter schema (47).

5. Arguments

The preceding section presented a grid-based alternative to Kiparsky's theory of meter, which handles the same array of data, with greater explanatory power in several areas.

In this section, I will present cases in which the two theories make differing empirical predictions. In each case, the facts will support the grid theory.

Consider first the filter Shakespeare I, formulated as (18) under Kiparsky's system and as (50) under mine. The two versions rule out essentially the same set of stress peaks, the difference being that a peak must be the strongest of its phrase to satisfy Kiparsky's filter, whereas it must be phrase-final to satisfy mine. Because of the rules for English phrasal stress, the two cases normally coincide. However, contrastive stress or the deaccenting of old information sometimes leads to examples that distinguish the two theories, as shown below:

(64) a.   O therefore, love, be of thyself so wary

As I, not for myself,   [but for#**thee** will]   Son. 22

```
                    .    .    X    .
As I, not for myself,  [but for#thee will]
              . . . w  w    s    w
                       \    /
                        \  /
                         s
                          \
                           \
                            s
          W S  W S   W S    W S   W S⁹
```

b.
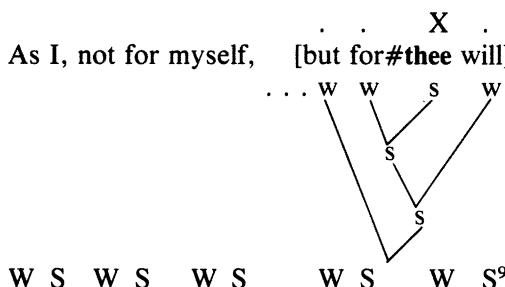
```
                              X
                       .    .  X  X
He said mine eyes were black [and my#hair black]
                      w   w   s   w
                       \  /
                        s
                         \
                          \
                           s
                            \
                             \
                 W    S    W    S
```
AYL 3.5.129
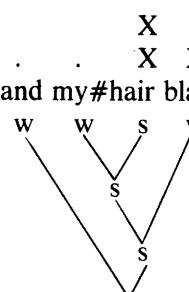
c.   Coral is far more red [than her#**lips'** red][10]   Son. 130
d.   With my love's picture then my eye doth feast
     And to the painted banquet bids my heart.
     Another time mine eye [is my#**heart's** guest]   Son. 47
e.   Did I deserve no more [than a#**fool's** head?]   MV 2.9.59
     (Context: what kind of head is to be expected)
f.   [As my#**trust** was;] which had indeed no limit   Tem. 1.2.96

---

[9] W, S are used as a theory-neutral representation of the metrical pattern.
[10] The reading *hér lips' red* is made unlikely by the appearance of *her breasts, her head, her cheeks* elsewhere in the sonnet, all in WS position.

In each of the examples of (64), the rising stress peak is the strongest of its phrase and is bracketed to the left, but is not phrase-final. These examples are thus ruled out incorrectly by Kiparsky's filter, but not by mine.

It is also possible to construct cadences of the opposite sort: that is, phrase-final rising peaks that fail to fit the conditions for Kiparsky's filter, as in (65).

(65) a.

[He was my father-in-**law**;] all revered him

W S   W S W S W

b.

[And fear Bartholomew-**tide**;] perils lurk
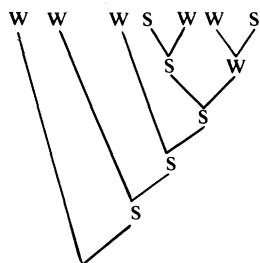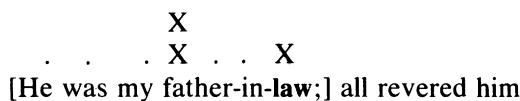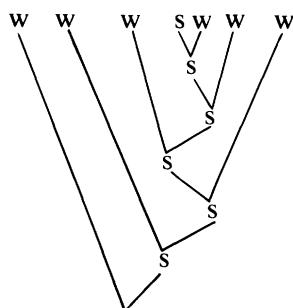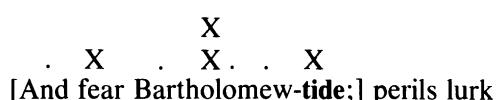
W S   W SW S W

In (65a), *law* is exempt from Kiparsky's filter, as it is weaker than the first syllable of *father*. *Tide* in (65b) is similarly exempt, as it is not even an *s*. Nevertheless, Shakespeare appears to avoid these cadences regularly. Data of this sort are naturally sparse, but what data there are support the proposed filter (50), which rules out phrase-final rising peaks, regardless of their labeling or the presence of a stronger stress earlier in the phrase.

Cadences like *Bartholomew-tide* are also forbidden in Shakespeare if the final syl-

lable occupies the eleventh, extrametrical position. Kiparsky's constraint on extra-metrical syllables (that they must be *w*) fails to account for this, but it follows neatly if extrametrical syllables are required to be stress valleys under the grid theory. Such a constraint would also rule out cadences of the form x̌ x̌ x̌ x̌ (e.g. *hesitantly, visited him*) in positions 8–11. This is again in accord with the facts, but not predicted by Kiparsky's theory. Similar arguments can be made for line-initial extrametrical syllables in trochaic verse: they must be valleys, not just metrically weak. All of these facts provide strong confirmation for the locality principle proposed earlier: in evaluating whether a syllable may occur extrametrically, it must be compared with the *adjacent* syllable. Its metrical labeling, which often reflects its prominence relative to a remote syllable, is irrelevant.

In some cases, the grid theory makes more extensive predictions than the tree theory because it applies to a more impoverished formal representation—not all the information in a tree representation is also available in the corresponding grid. Consider, for example, the bracketed cadences in WSWS position below:

(66) a.

```
                                        X
                            X           X      .
There are more things on earth [than#kings##dreamt#of]
                            w   w        s     w
                             \   \        \   /
                              \   \        \ s
                               \   \      /
                                \   \    /
                                 \   \  /
                                  \   s
                                   \ /
                                    V
                            W   S        W      S
```

b.

```
                                        X
                            X     X     .
There are more things on earth [than#great##kings#have]
                            w   w  s     w
                             \   \ /      \
                              \   s\       \
                               \   \ \     /
                                \   \ \   /
                                 \   \ s /
                                  \   \ /
                                   \   s
                                    \ /
                            W   S    W      S
```
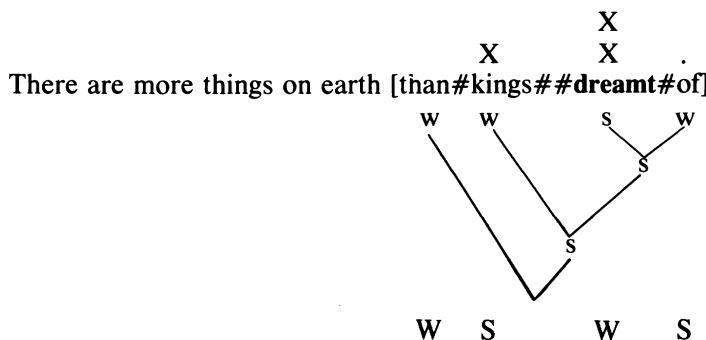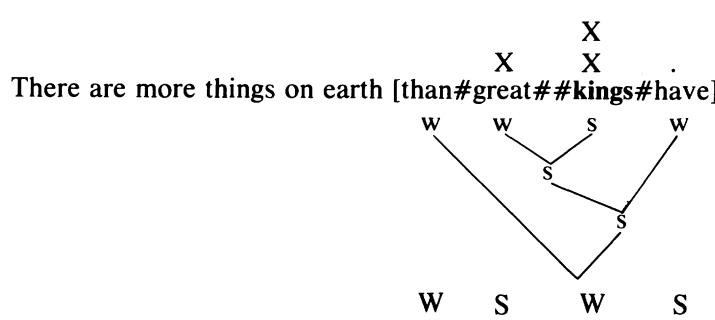
The two examples of (66) differ only in their metrical bracketing: grid shapes and bound-ary placement are identical. Since (66a) is ruled out by filter (58), the grid theory would predict that cadences like (66b) should be unmetrical for Shakespeare as well. My data indicate that this is the case. However, no filter exists in Kiparsky's system that would rule out (66b), as the filter that corresponds to (58) applies only to *s*'s that are bracketed to their right. Although Kiparsky's system could be modified somewhat so as to rule

out (66b), the change would be complex. For this case, the central notion of Kiparsky's system—that metrical bracketing is relevant to meter—serves only to complicate the analysis.

It can also be shown that differences of metrical *labeling* are irrelevant in cases where they are not reflected in the grids. The phrases of (67a) and (67b) all have the same grid shape, but differ in their bracketing and labeling, owing to a difference in syntactic structure.

(67) a.

b.

In Shakespeare's verse, both cadences may occur in either SWS or WSW position, although the former is preferred. This is correctly predicted by both theories. The theories differ, however, in the relative degree of complexity they assign to the two cases. Under Kiparsky's system, complexity results from a weighted sum of the labeling and bracketing mismatches between the linguistic tree and the metrical pattern. This entails that the left-branching examples will be more complex than the right-branching cases in SWS position, and vice versa in WSW position, as shown below:

(68)
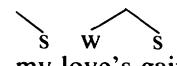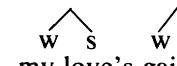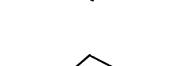
The reason is that the left-branching/SWS and right-branching/WSW combinations contain an extra labeling mismatch (boldface) and an extra bracketing mismatch (dotted). The grid theory predicts no difference between the two types, as the grids and the phrasing are identical. From a count of the relevant cadences in the *Sonnets,* it would appear that these predictions are correct: the ratio of *wsw* to *sws* for the left-branching cadences is essentially identical to that for the right-branching cadences. What minor difference there is goes against the predictions of Kiparsky's theory.

There also exist cases in which the grid theory makes predictions about complexity that are not made by the tree theory. Cadences (69a) and (69b) have identical trees and are thus predicted to be of equal complexity when placed in SWS position.
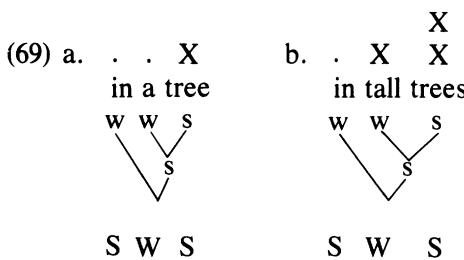
The grid theory, however, predicts that (69b) will be more complex than (69a), since it contains a rising peak on *tall* in W position, as well as a rising valley on *in* in S position. We can test this difference by examining contexts in which metrical complexity is not easily tolerated. One such context is what Kiparsky calls "narrative trochaic" verse, which displays extreme rhythmic fluency. Kiparsky (1975) points out that cadences like (69b) are absent in this verse form, so that while (70a) constitutes a possible line beginning in Poe's "The Raven", (70b) does not:[11]

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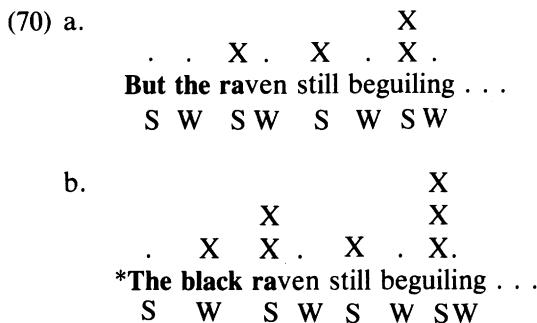
[11] I leave open the question of whether this is due to a low complexity limit in narrative trochaic verse or to a specific metrical filter. If the latter is correct, the filter would be formulated as in (i):

(i)   *Rising peak / [. . . ψ ——— . . .]$_{phrase}$
     where ψ is not grid-marked.

The argument for grids holds true in either case.

The same holds true, according to Bjorklund (1978), for the great bulk of German verse, which in general tolerates complexity far less than English does. A third area in which (69a) can be checked against (69b) is in lines that already contain a sequence that is close to unmetrical. Bjorklund (1978, 181) observes that in Shakespeare, cadence (69b) never occurs before a violation of the filter Milton I (48), so that lines like (71) are not to be found:

(71)   X
                    .   .   X   X   X
          *['Twas the proud full sail] of his greatest verse
                W S   W   S   W

Cadences like (69a) are not constrained in this fashion. I would conclude from these facts that it is the grid theory that makes the right predictions about complexity in this domain. The tree theory could be adjusted to handle the data, but the necessary adjustments would constitute a description more than an explanation.

6. Conclusion

An important aspect of the theory presented here is that very little need be specified in the *metrical* analysis, once the right phonological basis for meter is adopted. The theory of grids, essentially as Liberman and Prince propose it, provides most of the metrically relevant distinctions automatically. First, the grids correctly identify the set of metrically relevant lexical stresses, a task that trees can perform as well. Second, the grids define a binary opposition—grid marking—that appears pervasively in the system of metrical filters. This is a task that cannot be easily carried out with trees. Finally, the grids provide a natural and intuitive representation of the stress contour of a line, allowing for the formulation of a more accurate, but equally straightforward complexity metric.

There are just two basic ingredients of my solution that are specific to the theory of meter: I have assumed that metrical filters are bounded by phonological domains, and that adherence to the metrical pattern within domains is stricter at ends than at beginnings. Both notions are intuitively simple, and the latter is in fact just a specific manifestation of a universal principle.

This situation is, I would claim, just as it should be: given that the poet's feeling for rhythmic patterns is largely unconscious, we would expect the metrical systems poets develop to be straightforward reflections of the linguistic givens, rather than artificial impositions of convention. Individual poets indeed vary in the limits they set on metricality, but all the filters bear a family resemblance, based on the need to preserve an alternating pattern in the grid, along with the general principle of endings being stricter than beginnings. It is reasonable to claim, then, that the analysis presented here constitutes a glimpse through the metrical "window into phonological structure", providing substantial confirming evidence for the Liberman/Prince theory of metrical grids.

Appendix: The Fate of Metrical Trees

The analysis developed here invites an obvious inference: if trees are irrelevant to the patterning of English verse, should they not be dispensed with altogether? This suggestion has been recently advanced by Prince (1983) and Selkirk (forthcoming), who develop well-articulated theories of stress in which grids form the only representation. This line of thought is clearly worth exploring, as it offers hope of constraining the power of prosodic theory. However, I do not take the elimination of trees to be a foregone conclusion, as there are a number of facts about meter that Prince's and Selkirk's theories are unable to handle. The purpose of this appendix is to point out these problems, suggesting a solution to them that, perhaps paradoxically, retains trees.

Word-internal phonology in English is dominated by an opposition between "stressed" and "stressless" syllables, the former being the syllables that bear at least some degree of stress. The empirical support for this distinction is strong. First, the rules of Vowel Reduction, Flapping, and a host of others refer to it (see Kiparsky (1979), Kahn (1976)). In addition, the spacing of stressed syllables from each other and from word edge is subject to severe restrictions based on syllable weight and vowel length. All generative approaches to English phonology have encoded the stressed/stressless distinction: SPE with [n stress] vs. [$-$stress]; Halle (1973) and Liberman and Prince (1977) with [$+/-$stress]; and Selkirk (1980a) and Hayes (1982a) with reference to the (unfortunately named) "metrical foot". In Prince's and Selkirk's recent work, the distinction is encoded in the grid: all "stressed" syllables bear a mark at the second grid level. This means that the Prince/Selkirk grids for certain words differ from the grids that would be assigned under the Liberman/Prince system. In particular, words like *hesitate* would appear as shown in (72b), rather than (72a):[12]

(72) a. *Liberman/Prince*   b. *Prince/Selkirk*

                                              X

              X   X X

              XXX   XXX

            hesitate   hesitate

              s ww

                V/

               s

               V

The extra mark on the final syllable is clearly necessary if grids are to form the sole representation for stress, since the stress pattern of *hesitate* contrasts with that of *hesitant* (cf. Vowel Reduction and optional Flapping in the final syllable). The difference in representation leads to differing predictions about metrical behavior: for Prince and

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[12] The same difference would hold if we followed the practice of this article. leaving out the meaningless bottom row. We could then say that for Prince and Selkirk, grid marking indicates whether a syllable bears stress, rather than whether it may participate in a clash.

Selkirk, the last syllable of *hesitate* is a word-final stress peak and should be excluded from metrical W position for most poets. But as Kiparsky points out (K, 198), words like *hesitate* in Shakespeare are free to occur in this position, provided their initial stress is accommodated by a preceding phrase boundary. The same cadence occurs in Milton as well, as lines like (73a–d) show:

(73) a. **Imitate** when we please? This Desert soil   PL 2.270
     b. **Multitudes** like thyself and thence be called   PL 4.474
     c. **Satisfied** never; that were to extend   PL 10.804
     d. **Purified** to receive him pure, or rather   PR 1.74

These facts lead one to question whether some adjustment can be made, either to the metrical rules or to the Prince/Selkirk system, that will avoid the problem. Note first that the problem cannot be solved by stipulating that the metrical rules ignore grid marks on the second level. The secondary stresses in the words of (36a) would bear second-level grid marks in Prince's and Selkirk's systems and thus must be analyzed by the rules if they are to be properly scanned, both in Shakespeare's verse and in Milton's. Another possibility is to say that words like *hesitate* had stressless final syllables for Shakespeare and Milton and hence lacked final rising peaks. The form *satisfied,* under (73c), makes this unlikely. Shakespeare's and Milton's dialects share with contemporary English the restriction that closed penults before stressless final syllables must bear stress; that is, English lacks words like *Nínòtchkå, bábùshkå.* If *satisfy* could have a stressless final, we would also expect to find words like *ágèndå, pódèctål* in Shakespeare and Milton. These never occur.[13]

Last, an advocate of Prince/Selkirk grids could dismiss the above facts as forming a highly obscure corner of the metrical system. But as Kiparsky (K, 201) points out, this is just the wrong move: in the far reaches of the system, where the poet's practice is unlikely to be motivated by conscious thought, the facts should fall out directly from the system as it stands, without changes in the metrical or linguistic rules.

The argument against a grids-only framework, then, is that when grids are enriched enough to account for the facts of word stress assignment by themselves, they are no longer adequate as a basis for the metrical system. Something else must be added, and my conjecture is that this something else is trees. Specifically, I would advocate a tree theory that incorporates the "metrical foot", as in Selkirk (1980a) and Hayes (1982a). In such a theory, the stressed/stressless distinction is represented arboreally, and the grid reflects only higher-level rhythmic structure. By taking on the stressed/stressless distinction, the "metrical feet" permit the construction of grids that can adequately account for the facts of meter.

In fact, there is a fair amount of independent support for trees. In particular, trees can (a) account for the behavior of segmental rules and infixation processes (Kiparsky

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[13] The restriction involved exempts words derived by Sonorant Syllabification (Hayes (1982a, 260–261)) and words containing "neutral" suffixes. Since *satisfy* fits neither of these categories, the argument holds.

(1979), Hayes (1982b), McCarthy (1982)); (b) explain an otherwise mysterious restriction on the English Rhythm Rule (Hayes (1983)); and (c) explain the migration of stress when stressed vowels are deleted (Halle and Vergnaud (forthcoming)). In addition, there is strong evidence that in many poetic traditions, the metrical pattern is arboreal, since the syntactic bracketing of the phrase must to a greater or lesser extent agree with the bracketing of the metrical pattern (see Piera (1980) for Spanish, Heny (1981) for Persian, Jakobson (1966) for Serbo-Croatian, Kiparsky (1968) for the Finnish *Kalevala,* and especially Chen (1979) for Chinese).

The strategy I am suggesting is that instead of eliminating metrical trees, we should specify more precisely the separate roles that trees and grids play in phonological and metrical systems. My conjecture is that trees are the domain in which prominence relations are assigned, while grids are the means whereby the rhythmic form of trees is computed and evaluated. For example, in Hayes (1983) I argue that the English Rhythm Rule and other rules of rhythmic adjustment must be defined on trees, while the "principles of eurhythmy" that determine when adjustment may take place must refer to the grid. Similarly, Piera (1980) argues cogently that the Spanish hendecasyllable and other Spanish meters have arboreal metrical patterns; but the correspondence rules he formulates clearly must apply to the grid, using notions like "stress peak" and "stress valley".

If this line of reasoning is correct, it is plausible to suppose that the underlying pattern for pentameter in English is arboreal as well, and is essentially as Kiparsky proposed it:

(74)   w   s   w   s   w   s   w   s   w   s
        \ /   \ /   \ /   \ /   \ /
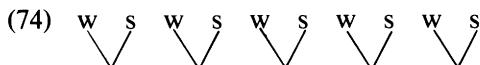
The grid pattern under (46) is merely the grid derived from (74). It is used in evaluating individual lines, through *their* grids. Just as with phonological patterns, the tree of the meter establishes relative prominence, while the grid measures the tree rhythmically.

To summarize: despite their appearance of redundancy, trees are not so easily dispensed with. First, they allow an account of metrical facts that are problematic for grids-only theories. Second, when one views trees in a certain way, the redundancy disappears: trees are the domain of relative prominence assignment; grids the domain of rhythmic evaluation.

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