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mic and tonal), with a strong tendency on the part of the language to encourage the different prosodic systems to line up, and to harmonize with each other.

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Grids and Trees in Metrical Phonology*

Morris Halle

This paper reports on work towards the development of a theory of metrical phonology in which J.-R. Vergnaud and I have been engaged for several years. It is thus to be viewed as a continuation of the line of research begun by M. Liberman in his dissertation of 1975 and advanced in such works as those by Liberman and Prince (1977), Hayes' dissertation of 1980, his papers of 1982 and 1984, the papers by Selkirk (1980) and Prince (1983), and Selkirk's recent book (1984), to name just a few.

In my presentation here I shall focus especially on the notation — i.e., on the abstract symbolism that the theory uses to record the facts and to express the generalizations. It is a distinctive property of a good scientific theory that the notation it provides fits the relevant data as accurately as possible; and, moreover, that the notation is not only capable of recording all of the relevant data and as little as possible of the data that are extraneous, but also that it permits us to discover things about the objects of our study that otherwise might remain hidden from our view. To get some idea of what I have in mind here, consider two of the many ways in which stress has been represented in the linguistic literature. On the one hand, there is a numerical notation of stress such as that illustrated in (1) where the degree of stress is represented by a positive integer so that the greater the stress, the larger the integer.

```
(1)    1  3        2   0  3       1   3  0 2      0 3
       fifteen     Tennessee      formaldehyde    divine
```

As an alternative to the numerical notation Mark Liberman proposed in his dissertation (1975) that stress should be represented by columns of asterisks as illustrated in (2):

```
(2)       *              *          *                *
          *         *    *          *    *           *
        * *         *    *        * *    *           *
       fifteen     Tennessee      formaldehyde    divine
```

Though at first sight it may seem that precisely the same information is contained in the two representations, there is a significant difference between the two. We see this difference when we examine how a process such as the

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* I am grateful to S. Bromberger and J.- R. Vergnaud for their comments on an earlier version of this paper.

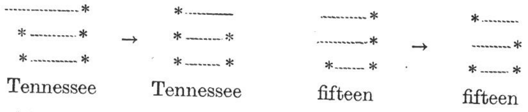
English Rhythm rule would be formulated in the two notations. The Rhythm rule, it will be recalled, accounts for the fact, that words such as *fifteen* and *Tennessee* have two distinct stress patterns: that given in (1)/(2) as well as that in (3) below.

```
(3) a.  *        *           b.
        *  *     *     *
        *  *     *     *      3  2       3    2
       fifteen  Tennessee    fifteen    Tennessee
```

Disregarding for the moment the environments in which the Rhythm rule applies, let us focus here on the structural change of the rule which converts the underlying representations in (1)/(2) into the derived representations in (3). If we utilize the numerical representation of stress we will have to say that the Rhythm rule places a [3 stress] on a syllable with positive stress to the left of the original [3 stress] and *at the same time* reduces the original [3 stress] to [2 stress]. Though a bit involved since it combines in one operation stress enhancement and stress reduction, the rule is perfectly intelligible and there is no reason to question it unless one has an alternative that is clearly superior.

Consider now how the Rhythm rule would be stated in the asterisk column notation. Suppose that we assume with Prince (1983) that the asterisks can move, subject to the constraint that they remain on their respective rows; i.e., that the asterisks behave like beads on an abacus. We can then state the Rhythm rule as an instruction to "slide the topmost asterisk to an asterisk column on its left". Note that we would not have to stipulate, as we had to in case of the numerical notation, that the original [3 stress] reduces to [2 stress], for as illustrated in (4) this reduction would be automatic.

(4)



The only thing that might be needed in addition is the convention that when the landing site of a moved asterisk is not directly above an asterisk (cf. *fifteen*), the gap in the column is filled in. Since stress movement generally does not erase stress on the syllable from which stress has been moved, but leaves a trace there, there is a clear advantage in using the asterisk columns rather than Arabic numerals to notate stress.

Having decided that stress is to be notated by means of asterisk columns we must ask next how such asterisk columns are introduced into the phonological representation. To help us in answering this question it is well to call to mind some general properties of stress contours of words. A sampling of these is given in (5).

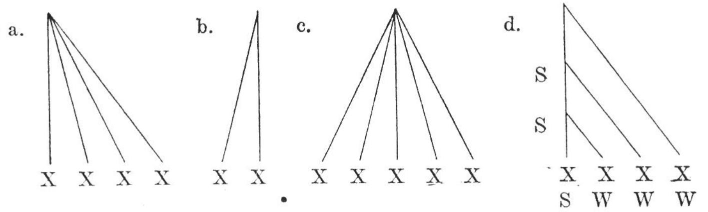
(5) a. In some languages each word has exactly one stressed syllable.
   b. In some languages words may have any number of stressed syllables and there are systematic variations in the degree of stress assigned to these syllables.
   c. There is a preference for locating the main stress of a word at the beginning or at the end of the word.
   d. In languages distinguishing degrees of stress the subsidiary stresses are often located on alternating syllables.

The question that we must answer at this point is how facts such as those in (5) are to be formally reflected in linguistic descriptions. It has been proposed in the literature (cf. Liberman, 1975; Liberman and Prince, 1977; Hayes, 1980) that the basic device available to languages for this purpose is metrical constituent structure. The central point of these proposals is that not only are words and morphemes organized into constituents, but that sequences of phonemes or of syllables may also be organized into constituents where one phoneme or syllable is the head and the rest is the domain. Moreover, phonological constituents are subject to the constraint (6):

(6) Heads of metrical constituents are always located at one end or the other, never in the middle.

There are, therefore, phonological constituents of the types illustrated in (7a) and (7b) but not of the kind illustrated in (7c). (In (7) and elsewhere below, we adopt the graphic convention that entities that are heads are dominated by a vertical line; nonheads, by slanted lines.)

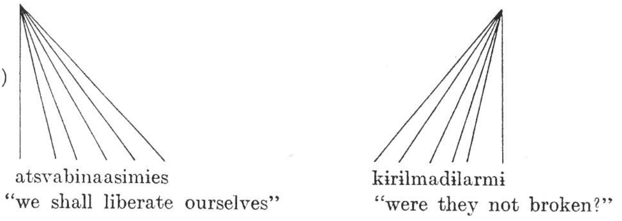
(7)



One of the innovations that Vergnaud and I have been exploring in our work of the last few years is that constituents with the flat unnested structure illustrated in (7a) play a fundamental role in metrical phonology. We deviate in this explicitly from the practice of earlier work in metrical phonology (see, for example, Hayes, 1980 where the only unnested constituents were binary and where, consequently, unlimited nesting of the kind illustrated in (7d) was widely utilized). Prince (1983) has shown that this type of unlimited nesting is nonfunctional in dealing with stress and other phenomena of central interest in metrical phonology and has concluded that *all* constituent structure should be eliminated from metrical phonology and that metrical grids should be constructed *directly* from phonological representations. Vergnaud and I believe this to be too radical a move for various reasons of which perhaps the most striking will be discussed below. We do accept, however, Prince's arguments against nested and labelled tree structure and we respond to these criticisms by replacing trees such as that in (7d) with unlabelled and flat trees of the kind illustrated in (7a, b).

The flat, unnested constituents provide a straightforward means for capturing the fairly trivial stress patterns of languages such as Latvian or Turkish, where words have only a single stressed syllable which is invariably initial (resp. final). In the case of such languages we say that the stress constituents are left-headed (resp. right-headed), and we express this formally by erecting constituent trees such as those illustrated in (8).

(8)



Constraint (6) makes it difficult, if not impossible, to locate the word stress except at the beginning or end of a string, and we shall, therefore, say that (6) accounts formally for the empirical observation (5c). It is, of course, obvious that if we adopt (6) we shall have to say something to account for languages where stress is not initial or final but rather on the penult or antepenult; or where like in English, Latin and numerous other languages, stress alternates between the penult and antepenult. We shall do so below.

It is not obvious that the machinery developed to this point is capable of handling alternating stress patterns referred to in (5d) and illustrated in (9).

(9) Maranungku: langkarateti "prawn" welepenemanta "kind of duck"

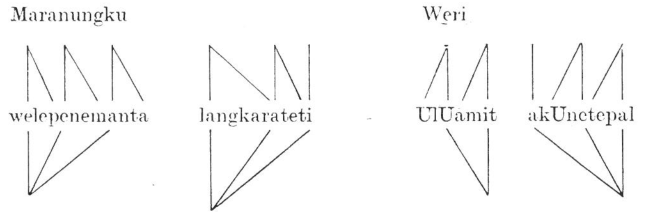
Weri: akunetepal "times" UlUamit "mist"

In the examples in (9) stress goes on odd-numbered syllables counting from left to right in Maranungku, and from right to left in Weri. What we need is a device that will permit us to pair up consecutive syllables and mark one of the pair as head and the other as domain. A straightforward way of obtaining this is by enriching the type of constituents allowed by the theory. Up to this point the only type of constituent that has been considered here is one in which no limitation is imposed on the extent of the domain. We now modify the theory as in (10).

(10) There is a choice between two types of constituent. In *bounded* (i.e. binary) constituents the elements in the domain must directly adjoin the head; in *unbounded* constituents no such restriction obtains.

To capture the facts in (9) we construct bounded constituents as illustrated above the phoneme sequences in (11). We use here the term *feet* to designate the binary constituent trees erected over consecutive syllables of the word. It will be noticed that as before we are imposing constituent structure over the entire string so that *every* syllable in the string is incorporated into some constituent. This is of especial importance in the case where words with an odd number of syllables are organized into bounded — i.e. binary — constituents. As shown in (11) the odd syllable is treated as the head of the (*degenerate*) constituent consisting of a single syllable, for every constituent must have a head (though it need not have a domain). We can tell that the odd syllable is a head because it is stressed, and stress indicates that a unit is the head of some metrical constituent.

(11)



We still need some way of locating the main stress; i.e., of expressing the fact that one of the alternating stresses is more prominent than the rest. To capture this type of stress subordination in our notation we impose constituent structure on the heads of the feet that were constructed in the first step of our procedure. In the examples under discussion here it is the left-most foot that bears main stress in the case of Maranungku, and the right-most foot in the case of Weri. We capture this by constructing a left-headed, resp. right-headed unbounded tree *not* over *all* syllables of the word, but only over those syllables that are heads of a foot, as illustrated in the bottom part of (11). We refer to the single constituent below the phonological string as the *word tree*.

Except for the fact that in order to erect the word tree we need information about the location of the heads of the feet, the trees above the phoneme sequence in (11) and those below are independent of each other. Note in particular that the feet are binary, whereas the word tree is unbounded, and there are numerous languages where feet are left-headed whereas the word tree is right-headed or vice versa. Moreover, languages differ as to the number of independent tree structures that they erect over the words. Languages like Latvian and Turkish (cf. (8)) have only a single tree, namely, the word tree; Weri and Maranungku have two orthogonal sets of metrical trees as shown in (11). And there are languages — e.g., Passamaquoddy (cf. Stowell, 1979) — which have three independent sets of trees.

It has been remarked above repeatedly that heads have greater stress than nonheads, but to this point I have not spelled out how this observation is to be implemented formally in the notation. Since stress will be notated by means of asterisk columns of the sort illustrated in (2) and (3), we need a means for relating tree structures to asterisk columns. The basic device for translating metrical trees into stress contours is the **Grid Construction Convention** (12):

(12) Construct a metrical grid consisting of three horizontal rows and of as many columns as there are stress-bearing syllables in the word. Assign an asterisk to each syllable that is a head of a tree. The top row is reserved for heads of word trees; the bottom row, for heads of feet, and the middle row, for heads of constituents intermediate between the foot and the word tree.

In (13) we have illustrated how the notation developed above captures the patterns of secondary stresses in words with five syllables in Maranungku and Weri, respectively.

(13) a. b.

We note that although the pattern of secondary stresses is the same in both words, the theory developed to this point generates two distinct tree structures: in Maranungku that of (13a) and in Weri that of (13b). At first sight it might well appear that this is a flaw in our notational apparatus, that in the present instance the apparatus has led us to distinguish stress patterns that are, in fact, not distinct. Since a good notation must not allow for nonexistent distinctions, steps would have to be taken to modify the notation so as to

rectify this. In fact, Prince (1983) has shown how this can be done; i.e., how metrical grids can be constructed directly from the phonological string without going through the intermediate step of tree construction. Since Prince's procedure, unlike ours, does not pass through the intermediate step of generating metrical trees, but derives the metrical grid directly from the phonological representation, it produces but a single grid pattern for the two cases under discussion, namely the one illustrated in (14a).

(14) a. b.

1 2 3 4 5   1 2 4 5
* * *   * *

While there is thus no problem about generating the metrical grid required without recourse to tree structure and avoiding what appears to be a useless redundancy in the derivation, there are facts that suggest that the distinct tree structures in (13) are fully functional rather than redundant. One type of phenomenon that has bearing on this issue is the effect of deletion or de-syllabification on the stress contour of words. It is easy to see that the two theories — Prince's tree-less theory and our arboreal alternative — make different predictions as to the effects that the deletion of syllable 3 would have on the stress contour of the words under discussion here. In view of the fact that the tree-less theory generates identical representations for the words in the two languages, this theory predicts that the effect of deletion should be the same in the two languages; i.e., that in both languages syllable 3 and its stress should be eliminated together yielding the representation (14b).

The arboreal theory makes rather different predictions. It will be recalled that an essential property of metrical structure is that every constituent must have a head. Hence when the head of a constituent is deleted the headship is transferred to the next element on the right in a left-headed tree, and to the element on the left in a right-headed tree. If grid construction is ordered *after* deletion we obtain different stress contours (grids) in the two cases as shown in (15).

(15) a. b.

The arboreal theory, therefore, predicts that deletion will preserve the number of stressed syllables in the word and that, moreover, it will effect a stress shift to the right in a language like Maranungku, and a stress shift to the left in a language like Weri.

Unfortunately, I do not have information as to what happens to the stress pattern of words in Weri and Maranungku as the result of deletion. Such information as we have about the effects of deletion on the stress pattern of words seems, however, to bear out the arboreal theory as against Prince's treeless alternative.

As a case in point consider the stress pattern of Tiberian Hebrew, the language of the Masoretic text of the Hebrew bible. In this language, main stress generally goes on the penultimate syllable in words ending with an open syllable. We thus have

(16)				
qámtii	'arose'	kaatábtii	'wrote'	1. sg.
qáamuu		kàatbúu		3. pl.
qáamaa		kàatbáa		3. sg.f.

The stress rule just stated is not obeyed by the last two forms in the right hand column of (16). The two aberrant forms, however, have another peculiarity: they have no vowel before the stem final consonant. As explained by Prince (1975) the absence of the vowel is due to a special rule of Vowel Deletion which applies after stress assignment and deletes short vowels in nonfinal open syllable. Thus prior to the application of Vowel Deletion the last two forms in (16) are trisyllabic, with the penultimate vowel bearing stress. One way of expressing the fact that in a given language words have penultimate stress is by constructing left-headed bounded trees over the last two syllables of the word as shown in (17).[1]

(17) a. b.

As illustrated in (17b) when the penultimate vowel in such forms is deleted we are left with a nonbranching tree dominating the word final syllable. As already noted this means that stress is automatically shifted to the last syllable of the word. Thus, the notation that includes both grids and trees implies that stress movement should be a consequence of syllable deletion.

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[1] The absence of secondary stress on the initial syllable of *kaatabtii* is due to special processes which cannot be discussed here: for details see M. Rappaport (1984).

Rightward stress movement under deletion or desyllabification has been found in several languages, in addition to Tiberian Hebrew. For example, in Sanskrit, glide formation (*kṣaipra sandhi*) causes stress shift to the right (Kiparsky, 1982); in Lithuanian, de Saussure's Law, which has the effect of causing a vowel to lose its ability to bear stress, shifts the stress to the right; in a Palestinian Bedouin dialect, stress shifts to the right under deletion (Kenstowicz, 1983). The theory also predicts that there will be cases where deletion or desyllabification results in stress movement to the left, towards the beginning of the word. For some reason examples of leftward movement have been somewhat hard to find, but there is at least one bona fide case, that of modern Russian. Unfortunately limitations of time do not permit me to discuss this example here (the example is discussed in the book that Vergnaud and I are currently writing). In any event, the connection between deletion and stress movement is well supported by the evidence, which must therefore be taken also as support for the arboreal theory over its treeless competitor.

I might note that the construction of bounded metrical trees over a phonological string is in effect a special counting mechanism which allows us to determine whether the number of elements in a given string is odd or even. This limited type of counting mechanism appears to be required quite independently of the stress facts, for there are well-attested rules in languages that apply to a particular syllable — usually the final or penultimate — only if it is also even-numbered. Examples of this are found in Creek (Haas, 1977), in the Iroquoian languages (Prince, 1983) and in Tiberian Hebrew (Rappaport, 1984). Viewed in this perspective, the grid construction convention is nothing but a means for interpreting the metrical trees in terms of stress, and individual languages may or may not choose to interpret metrical trees in terms of stress. Unbounded trees, by contrast, are the primary mechanism for locating terminal elements in a sequence; they thus play the role that Q variables performed in earlier theories: see, e.g. Halle (1975).

Having illustrated some of the descriptive power of metrical tree structure and provided some motivation for it I turn to the second major component of the theory, the metrical grid. My purpose here is not only to exemplify particular aspects of the grid notation, but also to illustrate the manner in which this aspect of the notation leads to the discovery of things about the objects of our study. The empirical data to be examined are the main rules determining the stress contours of English word sequences: the Nuclear Stress rule, the Compound Stress rule, and the Rhythm rule. Since the major facts are well known illustrative examples will be kept to a minimum.

When words are combined into phrases the main stressed syllable of the last word of the phrase is enhanced so that it has greater prominence than all other stressed syllables in the word. This increased prominence does not otherwise affect the stress contour of the phrase. We illustrate this in (18) where a fourth asterisk is placed over *formaldehyde* and *gas* respectively.

(18)

```
                         *                                   *
       *                 *                 *                 *
       *      *          *     *           *      *          *
       *      *      *   *     *         * *      *          *
they synthesized formaldehyde          formaldehyde is a gas
```

The Nuclear Stress rule, which is responsible for the fact that in a phrase one word has greater prominence than the rest, will be stated as in (19).

(19) Place an asterisk above the topmost asterisk of the right-hand immediate constituent (IC) of the sequence.

In the literature, e.g. in Prince (1983), Hayes (1984) and Selkirk (1984), this kind of process has been referred to as *beat addition.* By formulating the Nuclear Stress rule as a process of asterisk addition we preserve the stress patterns of the individual words intact as required by the facts. Note also that the Nuclear Stress rule cannot be a special case of the Grid Construction convention (12) since that convention assigns asterisks to heads of constituents, whereas the Nuclear Stress rule enhances stress on a word that may not be the head of its constituent. Thus, for example, in the verb phrase *synthesized formaldehyde* cited in (18) stress is enhanced on the nonhead *formaldehyde,* rather than on the word *synthesized,* which is the syntactic head of the VP.

It is well known that the syntactic structure of phrases is to some extent reflected in their stress patterns. We illustrate this in (20).

(20)

```
                                 *
      *                          *
      *               *          *
      *     *         *          *
 *    *     *         *          *
formaldehyde is a colorless gas
```

The Nuclear Stress rule as formulated in (19) will not add an extra asterisk to *formaldehyde* and would, therefore, fail to capture the fact that the stress on *formaldehyde* is greater than that on *colorless.* To obtain the proper results we must impose two conditions. First, we must require that the Nuclear Stress rule apply cyclically on each constituent of the expression in the sequence, starting with the most deeply embedded and ending with the entire expression. Secondly we must impose the Stress Equalization Convention (21):

(21) Stress Equalization Convention
When two IC's are joined into a single higher constituent, the tallest asterisk columns of the respective constituents are equalized by adding asterisks to the lesser column.

It is not difficult to see now that given the normal syntactic structure of the sentence in (20), cyclic application of the Nuclear Stress rule will generate the correct stress contours. In the first cycle we begin with *colorless* and *gas,* each of which has 3 asterisks; Nuclear Stress adds a fourth asterisk to *gas.* In the second cycle we bring in *formaldehyde,* whose tallest column has 3 asterisks (see (20)). The Stress Equalization Convention now raises this [3 stress] to [4 stress]. The Nuclear Stress rule then applies and yields the correct output shown in (20).

A further fundamental fact about English stress is that compound words — compound nouns, compound verbs, compound adjectives — have stress contours that differ from those predicted by the Nuclear Stress rule. In compound words the most prominent stress is not on the last constituent but rather on the penultimate IC. Examples are given in (22), where to save space I have indicated the heights of the different asterisk columns with Arabic numerals. (This space saving move of course does not in any way or form constitute a retraction of the decision motivated above that stress contours must be represented by means of asterisk columns, not by Arabic numerals.)

```
(22) 1 4   2   3          5     3      4
     formaldehyde gas     landing site constraint
        5     3   4           6    3      4    5
     linguistics club journal    movie actors guild president
```

To account for these stress contours I want to propose that, like other syntactic collocations, compounds are subject to the Nuclear Stress rule. What distinguishes compounds from other syntactic collocations is that they are in addition subject to the asterisk movement rule (23), which we shall refer to here as the Compound Stress rule:

(23) Move the top-most asterisk to the left

It is a general fact about stress movement in English — and in some other languages but not in all languages — that it is subject to the Landing Site constraint (24).

(24) When an asterisk is moved it lands on the highest column of asterisks that is in its domain. If there is more than one such column it lands on the nearest of these.

We illustrate in (25) the operation of these rules and conventions with the derivation of the stress contour of the phrase *landing site constraint.*

```
(25)                                              *             *
          *         *             *           *   *    *        *   *     *
                                        NS                 CS                  SE
      [[[landing] [site]]  [constraint]] → [[[l   s]] [c]] → [[[l   s]   [c]]] →
                                *       *
        *       *       *       *       *                     *
        *   *   *       *   *   *       *         *           *
                   NS              CS
      [[l   s] [c]] → [[l   s] [c]] → [[landing  site] [constraint]]
```

We recall that not all compound words undergo the Compound rule. There are, on the one hand, idiosyncratic or nonstructural exceptions like those in (26).

```
(26) 3       4           4       3
     Madison Avenue  vs. Madison Street
       3     4             4     3
     Harvard College vs. Harvard Club
```

Initials: BU MIT USA USSR UCLA

Names: Jean-Roger Mary-Louise Johnson-Laird Fremont-Smith
Christopher Barber Rosamond Thaxter

Such exceptions will be dealt with by special markings blocking the Compound rule from applying. On the other hand, there is the systematic exception noted already in Chomsky and Halle (1968) and illustrated in (27) that the Compound Rule does not apply if the asterisk to be moved is located anywhere but on the last word of the right hand constituent.

```
(27) 4       5     3      4     3     1 5      3
     kitchen towel rack   labor union vacation colony
```

In the compound noun *kitchen towel rack* in the sense of "towel rack foun in a kitchen" the main stress remains on *towel* because the Compound Stress rule cannot move the top-most asterisk to the left since it is not located on the last word. And as the same restriction applies when *labor union* is compounded with *vacation colony*, the main stress in the second compound of (27) remains on the word *vacation*. We reformulate the Compound Stress rule, therefore, as in (28).

ʌd

(28) Move leftward the top-most asterisk in the right-hand constituent of a compound word, provided the asterisk is located on the final word of the constituent.

As noted in connection with (26), names are not subject to the Compound rule, only to the Nuclear Stress rule. Nothing further needs to be said about the names in (29a), all of which have right branching constituent structure. This, however, is not the case for the names in (29b), which have left branching constituent structure, yet surface with the same stress contours as the right branching names in (29a).

```
(29) a.  4      3       5          4     3        5
         Philip Johnson-Laird      John  Fremont-Smith
         4     3    5              4     3      5
     b.  Jean-Roger Vergnaud       Mary-Louise  Kean
```

Given the rules developed to this point we should have expected the derivation and stress contour shown in (30). (To save space we have omitted the two bottom rows of asterisks.)

```
(30)                                                              *
                                   *             *  *          *  *
      *    *        *          *   *  *      *   *  *      *   *  *
                          NS            SE            NS
   [[Jean-Roger] Vergnaud] → [[J – R] V] → [[J – R] V] → [[J – R] V]
```

It is obvious that the correct stress contour will be obtained if the stress contour on the first name is changed from rising to falling by application of the Rhythm rule, which moves the topmost asterisk of the prefinal constituent to the left. (The Rhythm rule is stated in (33) below.)

It is a fact of some interest that the Rhythm rule *is disjunctive* with the Compound Stress rule; i.e., a compound word that is subject to asterisk movement by the Compound rule does not also undergo the Rhythm rule as shown in (31a), whereas compounds that are not subject to the Compound rule do undergo the Rhythm rule, as illustrated in (31b).[2]

```
(31) a.
       3   5     4         1 4     3         2   4     3
       Tom Paine Brigade   antique dealer    Tennessee Street
     b.
       4   3     5         3 2     4         3   2     4
       Tom Paine Avenue    antique furniture Tennessee Avenue
```

The fact that these two rules of leftward asterisk movement are disjunctive suggests that we may in fact be dealing with a single rule operating in several environments subject to some version of Kiparsky's *elsewhere* condition. The facts in (32), first noted by Prince (1983), appear to provide significant evidence in support of this guess.

```
(32) a.                          b.
       5   3     4      6          3   5     4      6
       Tom Paine Avenue Blues      Tom Paine Street Blues
```

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[2] Constituents that are not compounds generally undergo the Rhythm rule although this is subject to various restrictions detailed in Prince (1983), Hayes (1984) and elsewhere.

As shown in (32b) when the top-most asterisk is not located on the last word of the left constituent, the Rhythm rule does not apply and the addition of the word *Blues* has no effect on the stress contour of *Tom Paine Street.* By contrast, as shown in (32a), when the top-most asterisk in the prefinal constituent is located on the last word — as e.g. in *Tom Paine Avenue* quoted in (31b) — the Rhythm rule does apply and moves the asterisk from *Avenue* to *Tom*. The Rhythm rule must therefore be formulated as in (33).

(33) Move leftward the top-most asterisk in the IC preceding the right-hand constituent, provided the asterisk is located on the final word of the constituent.

To bring out the essential similarity between the Rhythm rule and the Compound rule we combine the two rules as shown in (34):

(34) Move leftward the top-most asterisk in [the IC preceding]$_a$ the right-hand constituent [of a compound word]$_b$ provided the asterisk is located on the final word of the constituent.
Cond.: a iff not b

I have sketched here a notation and theory of stress in which stress is viewed as the phonetic manifestation of metrical constituent structures. I have illustrated salient properties of the two major components of the theory: the metrical constituent trees and the metrical grids which are derived from the trees by means of convention (12). Finally I have attempted to motivate and defend the theory by showing that it provides some insight into simple and straightforward facts such as those in (5) as well as into much less transparent facts such as the effects of deletion on the stress contours of words and the relationship between Nuclear Stress, Compound Stress and the Rhythm rule of English.

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