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1984

"It don't mean a thing if it ain't got that swing."

Duke Ellington

Bruce Hayes

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Constraining Metrical Theory:
A Modular Theory of Rhythm and Destressing

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Linguistics

by

Michael Theodore Hammond

1984

Contents

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This thesis would not have been possible without the guidance and support of my advisor Bruce Hayes. Though I took careful pains never to admit it to him, I believe his every action with regard to my thesis work was for my own good . . . ultimately. The rest of my committee were also generous with their advice and support: George Bedell, Sandy Chung, Pat Keating, Will Leben, and Alan Timberlake.

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Lastly, none of this would have been possible without the love and understanding of my family: the eccentric brother and son couldn't have done it without you.

* * *

In July 1983, I met a fourteen year old boy on Greyback. He had scars on his hands from knifefights. He liked hiking. He looked a lot like a 'cholito'. We hiked a lot together. He said he stole cars. I like hiking too.

Ten days later I went back to work on my thesis. A month later he went to jail. I dedicate this thesis to the boys in "Primera Flats".

ABSTRACT OF THE DISSERTATION

Constraining Metrical Theory:
A Modular Theory of Rhythm and Destressing

by

Michael Theodore Hammond
Doctor of Philosophy in Linguistics
University of California, Los Angeles, 1984
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This dissertation inquires into the possibility of constraining rules of rhythmic adjustment and destressing -- metrical transformations. The Clash Resolution Hypothesis is advanced as a central constraint on the operation of such rules: they must operate so as to minimize clashes in the prosodic hierarchy.

Chapter One of the thesis demonstrates how metrical transformations are seriously unconstrained in metrical theory as it stands. This unconstrainedness allows nearly every possible metrical configuration to be generated through the intervention of rhythm and destressing rules.

Chapter Two of the thesis proposes the Clash Resolution Hypothesis and tests it in English. It is shown that the hypothesis makes substantial empirical gains. It allows one to collapse together Prestress Destressing, Poststress Destressing, and word-internal Rhythm into one general rule: Prune Alpha.

Chapter three of the thesis develops this theory to account for phrasal rhythm in English. It is argued that the Clash Resolution Hypothesis and Prune Alpha can be extended fruitfully to account for phrasal rhythmic adjustment. In addition, several auxiliary principles are developed: Metrical Locality, the Syllable-Adjunction Prohibition, and Prosodic Rooting. These principles receive independent motivation, and provide for a modular theory of metrical transformations.

Chapter four of the dissertation attempts to confirm the theory proposed in the preceding chapters by extending it to account for rhythm and destressing in Tunica. It is demonstrated that the theory is crucial to a proper analysis of the Tunica facts.

Symbols

In this thesis, an acute accent indicates primary stress. Circumflex and grave accents indicate weaker and weakest stresses respectively. When there are more than one nonprimary stresses that are unrankable, they are all notated with graves. Schwa is transcribed as [@]. Other symbols are explained where introduced in the text.

Chapter One

The Unconstrainedness of Metrical Transformations

This dissertation is concerned with the constrainability of the processes that manipulate metrical structures once they have been constructed: rhythm and destressing rules. The current literature abounds in such rules, yet there is no real consensus about what they are, leaving present-day metrical theory seriously weakened by the lack of a constrained subtheory of metrical transformations. In this dissertation, I propose a set of constraints on the form, function, and operation of these rules such that metrical theory no longer "leaks" through metrical transformations.

The implications of this proposal are far-reaching. First of all, some of the constraining principles can be extended to cover phonological rules of other types, thus obtaining deeper explanation in unexpected empirical domains. In addition, a substantial theoretical advance can be realized. In Hayes (1981), metrical transformations are apparently constrained in the SPE fashion.[1] A notation for rules is provided and any rule writable in the notation is permitted (though not necessarily highly-valued). In the theory proposed here, rule notation as an evaluation metric is abandoned in favor of a set of principles and

[1]Chomsky & Halle (1968).

parameters interacting to provide for fewer possible grammars.

In the chapters that follow, these results will be sketched out in detail. In Chapter One, previous proposals are shown to be untenable, and the present proposal is presented and fleshed out. The exact sense in which metrical transformations are left unconstrained in Hayes' dissertation is discussed. Prince's (1983a) attempt to constrain the theory and recast it in terms of grids is also discussed and criticized. Lastly, the particular component principles of the theory to be defended are unveiled.

In Chapter Two, the sole mechanism of metrical manipulation is presented: Pruning. It is argued that the metrical transformational component contains a single rule, Prune Alpha, which affects metrical trees. Relabelling rules and adjunction rules are not permitted in this framework. Employing this mechanism yields some nice results in English, in that a number of previously unrelated rules can now be collapsed. The hypothesis is advanced that prune alpha must be "clash-reducing" in a specific sense; each application must reduce the number of clashes present in the span.

In chapter three, the mechanism of pruning is extended to deal with phrasal rhythm in English. The analysis of chapter two is confirmed as it neatly accounts for the phrasal data. In addition, the constraints of Metrical Locality and Prosodic Rooting are advanced. Metrical Locality mediates what can constitute a clash. Rooting, on the other hand, describes under what circumstances pruning can take place. In particular, it prevents prune alpha from completely destressing lexical items.

Finally, in chapter four, the stress system of Tunica is described. Tunica appears to have a complex barrage of metrical transformations. Chapter four focuses on these processes in order to exemplify again the mechanisms and principles presented earlier. It turns out that the destressing component in Tunica can also be reduced to prune alpha.

1.1 Background

Much has been done in the literature toward the goal of a constrained theory of metrical structure -- one admitting only a limited number of tree and/or grid geometries. Among this work, one can single out Hayes (1981) and Prince (1983a) as deserving special mention. Hayes makes a number of specific proposals for an explanatory theory of stress based on tree geometry, simultaneously providing a typology of stress systems for future research. Prince, on the other hand, argues that a more constrained theory can be formulated in terms of the metrical grid, allowing certain stress configurations describable only in terms of the grid. He attempts to eliminate destressing rules from the vocabulary of the theory by showing that they are artifacts of grid construction miscast in arboreal terms. In the following two sections, these two theories will be outlined.[2]

Both of these proposals must be considered against the backdrop of SPE and Liberman & Prince (1977). They serve as points of comparison, and as useful entry points into the data these theories account for. The crucial difference between SPE and subsequent theories of stress is the numerological, as opposed to relational, representations of stress

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[2]In recent manuscripts, Halle & Vergnaud have argued for a melded representation including tree and grid, suggesting that Prince has eliminated the tree prematurely, yet accepting some of his arguments

adopted by SPE. There it was maintained that "stress" is a segmental feature exactly like [±high] or [±coronal]. As a segmental feature, it undergoes a translation into n-nary values on the way to phonetic implementation. Consider a feature like [±back]. Obviously, in order to insure correct positioning of the tongue body, this feature would have to undergo a translation into integer values to account for the continuously variable backness of segments specified [±back] phonologically. However, unlike a feature like [±back], stress shows more than two values while still in the deeper parts of the phonology. In other words, more than two degrees of stress are contrastive on the surface. For example, (1) is said to involve a contrast between [3stress] and [4stress].

(1)
    4 1 3
    [[American history]$_{NP}$ teacher]$_{N}$

    3 1 4
    [American [history teacher]$_{N}$]$_{NP}$

For some speakers, tertiary and quaternary stresses contrast to mark different syntactic bracketings. The following cases also illustrate contrasts between more than two degrees of stress.

(2)
    1 3 Hanover   1 2 pushover

    1 3 gymnast   1 2 hip flask

Here boundary strength is reflected in degrees of stress.

To account for this, SPE posits an algorithm translating [±stress]

---

for grid-based phenomena. I will not undertake a complete discussion of Halle & Vergnaud's proposal here as the work is still in manuscript form.

into n-nary values. This algorithm makes use of the Stress Subordination Convention and the Cycle. The Stress Subordination Convention states that whenever a stress is promoted to primary stress, all other stresses in the domain are demoted by one. The Cycle, on the other hand, allows one to apply rules to a span repeatedly in successively larger syntactically-defined domains. Consider again the example of [[American history]$_{NP}$ teacher]$_{N}$. All the words are assigned primary stress. Then a rule (vacuously) promotes the second word of the inner cycle to primary demoting the second word. On the outer cycle, [American history teacher]$_{N}$, the second word is promoted again, and the first and third demoted. This derivation is given in (3).

(3)
```
                American history teacher      ->

                  1       1       1
->              American history teacher      ->

                    2       1           1
->              [American history]NP teacher  ->

                    3       1       2
->              [American history teacher]N   ->

                    4       1       3
->              [American history teacher]
```

Although this move is ad hoc for stress, this exceptionality is minimal in the light of the general translation of binary into n-nary features in the phonetics. Moreover, as we have seen, this special property of stress seems justified given the constrastiveness of different stress values on the surface. In retrospect, this procedure may seem somewhat baroque, but in the light of then current assumptions, it was quite impressive. By positing n-ary stress values in the deeper phonology, SPE could account for a variety of other processes that would have been undescribable otherwise. Though the intricacies of the data required quite complicated formulations, SPE bit the bullet. The Stress Subordination Convention must be viewed as an ad hoc device enabling stress to be treated as a segmental feature, but the Cycle had panphonological appeal, since Chomsky and Halle argued that all phonological rules apply cyclically.

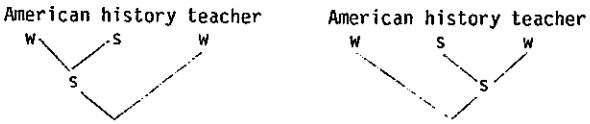
Against the backdrop of structuralist methodology, the SPE attempt to treat all features segmentally made sense. Under the behaviorist assumptions adopted by the structuralists,[3] where the only input to acquisition is the phonetic string, a multitiered representation without direct phonetic correlates is senseless. Given an innate endowment though, why should a mental representation of the phonetics be linear? On this view, linearity must be seen as a consequence of an a priori simplicity metric, rather than empirical investigation. When innateness began to be taken seriously, the segmentability of speech could be questioned seriously: first in tone by Williams (1976), Leben (1973), and Goldsmith (1976); and then in stress in the work of Liberman (1975), Prince (1975), and Liberman & Prince (1977).

Following this trend toward desegmentalization and enriched structures, Liberman & Prince (1977) proposed that stress is not a segmental feature, but a property of tree structures over the segmental string. These tree structures contain embedded constituents with nodes in the tree given an index of strength relative to sister nodes. The following

[3] Cf. Bloomfield (1933).

examples in (4) are the arborealizations of the two examples considered above.

(4)



Let us look at the claims of the notation in the first example. First, American history is defined as a constituent. Second, relative strength is indicated with s(trong) w(eak) labelling. Thus history is stronger than American; and American history is stronger than teacher. In the second example, a different branching gives a different interpretation. History teacher is a constituent; history is stronger than teacher; and history teacher is stronger than American. Notice that this notation therefore makes no (necessary) prediction about the relative strengths of American and teacher in the two examples. According to Liberman & Prince, this is in better accord with the facts: the two phrases differ in their timing, not in terms of relative prominence. The first phrase allows a pause after the second word, while the second phrase allows a pause after the first word, suggesting that metrical structure better captures the differences between these two phrases.

Liberman & Prince advance other arguments in favor of their theory that I will not discuss here. What should be emphasized with respect to the victory of metrical theory over the segmental account is the number of new questions it allowed linguists to raise about stress. The new framework sets problems in a different way which is more conducive to explanatory conclusions. For example, the new framework suggests that stress subordination should be considered in terms of trees and tree-

labelling algorithms. In contrast, the SPE theory framed stress subordination in terms of the Stress Subordination Convention, and the kind of retraction rules a language has. The idea of labelling algorithms offers a framework within which to consider possible retraction systems. The SPE theory could not address this question in as direct a fashion.

While much research has been conducted toward a theory of well-formed tree structures, not much research has been done on the subject of permissable manipulations of these structures. This is the task to be undertaken in this thesis.

1.2 Arboreal Theories

Liberman & Prince did not discuss stress systems other than English, but there are a number of early attempts to extend the framework to other languages. Among this work one can cite Prince (1975), McCarthy (1979), and Halle & Vergnaud (1979). This work culminated in the theory developed by Hayes (1981) in his dissertation. Hayes' thesis offers an in depth treatment of English, and a number of other languages. On the basis of comparative work, Hayes proposed a restrictive theory of tree geometries admitting of only certain kinds of tree structures.

Hayes' theory of stress is an improvement over Liberman & Prince's in three crucial respects: incorporation of syllable structure, feet, and extrametricality.

Syllable structure: Hayes adopts a geometric conception of syllable structure, one where it is possible to distinguish light syllables from heavy syllables in terms of geometry, rather than segmental strings. This kind of proposal was originally made by McCarthy (1979), and allowed him to simplify the statement of stress assignment rules,

leaving out cumbersome parentheses, subscripting, and superscripting, the prediction of this kind of notational change being that syllable structure is a determining factor in stress assignment. The version of syllable structure Hayes assumes is one where the metrical branching versus nonbranching dichotomy is extended to distinguish heavy versus light syllables in languages with quantity-sensitive stress assignment. Thus closed syllables are represented with branching rhymes and light syllables with nonbranching rhymes.

Extrametricality: This subtheory maintains that single elements such as rhymes or feet at the margins of words can be excluded from consideration by stress rules. For example, English excludes final syllables with short vowels from consideration in determining stress in nouns and suffixed adjectives. This predicts the availability of antepenultimate stress for nouns and suffixed adjectives, but only penultimate stress in other syntactic categories. This allows Hayes to simplify greatly the typology of foot types, by eliminating ternary feet altogether.

Feet: Finally, Hayes develops a typology of feet. Feet are metrical trees embedded in larger trees (word trees) and labelled with 'strong weak' labelling. They supplant the feature [±stress] in Liberman & Prince's system. The designated terminal element (DTE) of a foot, that constituent dominated exclusively by nonweak nodes within the foot, is interpreted as stressed. Feet are parametrized as follows.

1. Number of stressless syllables in the foot: at most one or as many as possible. These foot types will be referred to as binary or unbounded.

2. Direction of foot construction: feet can be constructed left to right or right to left across a domain.

3. Polarity of the foot: they can be right-strong (iambic) or left-strong (trochaic).

4. Quantity-sensitivity: heavy syllables can be confined to strong position within feet or they can be treated on a par with light syllables. Also syllable weight can be determined on the basis of branching rhymes (i.e. $C_0\bar{V}C_1$ and $C_0\bar{V}C_0$ vs. C_0V) or nuclei (i.e. $C_0\bar{V}C_0$ vs. C_0VC_0)

This is in contrast to the foot typologies proposed by earlier investigators, e.g., McCarthy (1979) and Halle & Vernaud (1978).

Just considering binary quantity-insensitive feet, and hypothetical five- and six-syllabled words, this theory defines the following possibilities. (Each 'o' stands for a syllable.)

(5)	left to right iambic	(S. Paiute)	o ó o ó ó	o ó o ó o ó
	left to right trochaic	(Maranungku)	ó o ó o ó	ó o ó o ó o
	right to left iambic	(Weri)	ó o ó o ó	o ó o ó o ó
	right to left trochaic	(Warao)	ó ó o ó o	ó o ó o ó o

As Hayes points out, all these foot types are attested in languages -- as the names in parentheses are languages illustrating these possibilities. Nonetheless, one can question the excessive power of his system.[4] To derive the stress patterns of natural language, Hayes is forced to supplement his basic geometries with special destressing or stress movement rules.

Let us consider Warao. Hayes cites the examples in (6).

[4]Cf. Magnus (1983) and Prince (1983a).

(6) yápurúkitánehâse 'verily to climb'

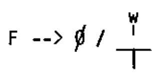
náhoróahákutái 'the one who ate'

yiwáranáe 'he finished it'

enáhoróahákutái 'the one who caused him to eat'

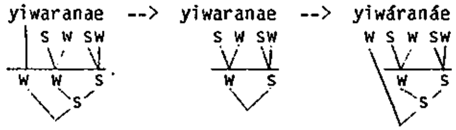
To account for these, left-dominant feet are built right to left. This, however, leads one to expect clashing stresses in the odd-syllabled cases: *yíwáranáe or *énáhoróahákutái. This is not what one gets, so Hayes sets up the following rule readjusting the output of the tree construction rules. This rule removes a foot that is weak and monosyllabic.

(7)



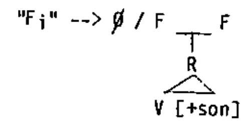
This rule incurs Hayes' Stray Syllable Adjunction convention which gives the following derivation for yiwáranáe.

(8) yiwaranae --> yiwaranae --> yiwaranae --> yiwáranáe



If such rules are of a limited type, then they are acceptable, since they localize and make precise the kind of exceptions one observes with regard to the basic theory. This is not so though. Hayes proposes a variety of destressing rules and stress shift rules for different languages. Below I give two more rules from Hayes' discussion of English.

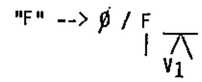
(9)



Condition: F_i is not dominated by s.

This rule destresses a monosyllabic foot dominating a rhyme containing a sonorant when it is followed by a foot, and preceded by a monosyllabic foot.

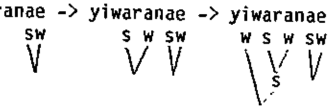
(10)



This rule defoots a binary foot whose first syllable may contain a long vowel.

A conceivable alternative to the destressing rules above is introducing a new parameter [±Obligatory Branching]. This parameter, when in force, would disallow degenerate -- monosyllabic -- feet. The initial syllable of yiwáranáe would simply never get stressed. Thus as feet are constructed right to left, the third foot would simply not get constructed. Rather, the initial syllable would get adjoined to the following foot by Stray Syllable Adjunction, as in (11).

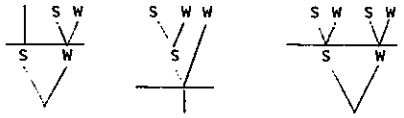
(11) yiwaranae -> yiwaranae -> yiwaranae -> yiwaranae



There are several problems with this proposal though. First, what about monosyllables? If all feet must branch, monosyllables cannot receive stress. Also, in languages like English, rules of allomorphy require syllables undergoing destressing to have been stressed earlier

in the derivation. Finally, there are cases of destressing -- English again --where the foot destressed is branching. One such case is exemplified in the partial derivation in (12) below.

(12) cursory --> cursory (cf. promissory)



Hayes proposes no constraints on these rules. We can only assume that they are limited by the usual kind of simplicity metric implicit in most work since SPE. Given these at best vague constraints, the general theory is left with little content.

Consider the possible distribution of stresses over a disyllabic domain, ignoring the different degrees of stress that may be imposed by the word tree. Following I give the four logical possibilities.

(13) ó ó ó o o ó o o

Assuming quantity-insensitive feet, the first option is impossible. All permitted foot types require at least one unstressed syllable, and none of the patch-up rules add a stress, although nothing in principle excludes that possibility. The second and third patterns can be generated straightforwardly using iambic and trochaic feet.

Let us consider the fourth case. As far as I know, no language systematically excludes disyllables as stress-bearing units. However, this is entirely possible in a theory where metrical transformations are unconstrained. The following rule in (14) seems just as simple as the poststress destressing rule in (15) responsible for (12).

(14) "F" --> ∅ / ___ #

(15) F --> ∅ / F
|
V_1

Contrast this with the case of trisyllabic spans in (16). I list all the logically possible stress configurations.

(16) ó ó ó ó o o o ó o o o ó
ó ó o ó o ó o ó ó o o o

Again, as with the disyllabic cases, all these possibilities are generable except the first. The same arguments could be repeated for larger spans too.

One can also make the same kind of argument with respect to possible languages. Consider the following hypothetical data in (17). Each column represents a possible language.

(17)

A	A'	B	B'
ó	ó	ó	ó
ó o	ó o	o ó	o ó
ó o ó	ó o ó	ó o ó	ó o ó
ó o ó o	ó o o o	o ó o ó	o o o ó
ó o ó o ó	ó o ó o ó	ó o ó o ó	ó o ó o ó
ó o ó o ó o	ó o ó o o o	o ó o ó o ó	o o o ó o ó

Type A and B are readily accountable for. Type A is trochaic feet built from left to right, while type B is iambic feet built from right to left. The primed columns are not so readily handled. To account for these, we must assume the operation of metrical transformations. For

A', trochaic feet are built from left-to-right just like type A, but the output is subject to the following rule. This rule eliminates a branching foot in final position after another foot.

(18) "F" --> $\emptyset$ / F ___ #
(with a branching foot, /\, under the blank)

Type B' is the mirror image: iambic feet built from right-to-left, with the output filtered through the following rule.

(19) "F" --> $\emptyset$ / # ___ F
(with a branching foot, /\, under the blank)

All the languages listed can be handled straightforwardly using metrical transformations, but there is a problem here. Languages A and B are attested -- Maranungku and Warao -- but the other types do not appear to exist. Since the basic metrical pattern is attested, we would expect the only limiting factor on such analyses to be the simplicity metric applied to formulations of possible transformations. These candidates can be compared to the cases listed above, and found to come out the same or even better in terms of any metric imaginable. Thus the metrical theory of stress as it now stands has some serious dancing to do, as nearly all conceivable stress patterns are generable.

Thus we see that although Hayes' basic theory of tree geometries makes claims about possible stress systems, these predictions are vitiated by the absence of any serious constraint on metrical transformations. In what follows, I will argue that Hayes was basically on the right track. His theory of tree geometry and labelling seems to be of the right sort, and with small modifications, can account for all the objections the competitors have raised. However, a serious theory of metrical transformations must be advanced. I will argue that these

operations must and can be tightly constrained in form and function.

1.3 Grid Theory

Prince (1983a) argues that the model should be derived from clash avoidance -- the principle that stresses be nonadjacent. To this end, Prince proposes that metrical trees are superfluous, and that stress should be represented solely in terms of the metrical grid -- a representation that is claimed to most perspicuously represent clash.

Prince's proposal is to eliminate the degree of freedom Liberman and Prince allow in grid-to-tree alignment. Rather than building a tree and then constructing a grid in conformity with it, Prince builds the grid directly. This eliminates any kind of constituency that is not mimicked in the morphology or syntax. Thus feet, since they have no grammatical analog, are epiphenomenal on Prince's view.

Prince suggests the device of the Perfect Grid.

(20)
```
        x   x   x   x   x   x   x
  . . . x x x x x x x x x x x x x x . . .
```

This simple alternating pattern captures the remaining properties of feet. It is aligned with a string from left to right (LR), or from right to left (RL), and can start the alignment from a peak (pk) or trough (tr). Below, these four properties define the same four cases that were considered above.

```
(21)                x   x
                  x x x x x
    PG(LR;tr)     o o o o o . . .          S. Paiute

                  x   x   x
                  x x x x x
    PG(LR;pk)     o o o o o . . .          Maranungku

                        x   x   x
                        x x x x x
    PG(RL;pk)     . . . o o o o o          Warao

                          x   x
                        x x x x x
    PG(RL;tr)     . . . o o o o o          Weri
```

Prince supplements his rule of perfect grid alignment with the <u>End Rule</u> (ER). This rule operates to add a tick at the beginning (I) or end (F) of a span, provided it does not occasion a clash. It can operate on different levels too. Thus it can augment either of the following grids.

```
(22)                                          x
                  x   x   x                   x   x   x
        ER(I;Wd)  x x x x x x      ===>       x x x x x x

                                              x
        ER(I;Σ)   x x x x x x      ===>       x x x x x x
```

In the first case, ER(I;Wd) adds a tick to the initial tick on the second layer. In the second case, ER(I;Σ) adds a tick to the first tick on the first layer. In general, the rule can only add ticks to the highest layer present in the grid already. Thus ER(I) could <u>not</u> apply in the following fashion.

```
(23)              x   x   x            x x   x   x
      ER(I;Σ)   x x x x x x    =/=>    x x x x x x
```

However, as we will see, this constraint on ER must be relaxed.

ER thus performs the function of a word tree -- signalling out a marginal constituent to elevate to word stress status. However, ER can

also apply before PG, and in such a capacity, it gives the effect of other destressing rules in Hayes' framework. Consider Prince's discussion of hypothetical simplified Hawaiian (no heavy syllables). In this language, one gets penultimate main stress, with alternating stresses preceding it, except for words with five syllables, where one gets initial secondary instead of preantepenultimate secondary.

(24) ó o   o ó o   ò o ó o   ò o o ó o   ò o ò o ó o

To account for these facts, Prince proposes the following derivation: final extrametricality, ER(F), ER(I), PG(RL;tr), and ER(F;wd). This gives him derivations as follows.

```
(25)            x x x     x x x x     x x x x x     x x x x x x
                o o o     o o o o     o o o o o     o o o o o o

        EM      x x(x)    x x x(x)    x x x x(x)    x x x x x(x)

                  x         x           x                 x
        ER(F)   x x(x)    x x x(x)    x x x x(x)    x x x x x(x)

                  x       x   x       x     x       x       x
        ER(I)   x x(x)    x x x(x)    x x x x(x)    x x x x x(x)

                  x       x   x       x     x       x   x   x
        PG      x x(x)    x x x(x)    x x x x(x)    x x x x x(x)

                  x           x             x               x
                  x       x   x       x     x       x   x   x
        ER(F;Wd) x x(x)   x x x(x)    x x x x(x)    x x x x x(x)
```

Clash avoidance gives the destressing effects. Hayes' theory, on the other hand, would need two destressing rules.

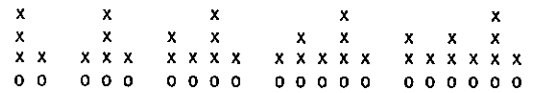
(26) F --> ∅ / F __   F --> ∅ / __ F

Prince's theory needs no destressing rules at all.

Notice that PG alone can account for stress assignment in certain cases without appeal to destressing rules. As we saw, Hayes' theory

required him to set up a destressing rule to prevent stress from falling on the initial syllables of odd-syllabled words in Warao. Under Prince's theory, no rule is required. He need only apply PG in its trough-first right-to-left mode. Then apply the final form of ER.

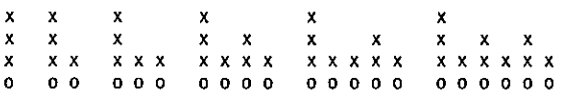
(27)



ER functions in its normal capacity. It picks out a marginal syllable to elevate by adding a tick. The initial syllable of odd-syllabled words simply never gets stressed. However, as we saw above, Hayes' system requires a special destressing rule to prevent stressing of initial syllables in odd-syllabled words. This destressing function is performed by PG here.

In Garawa, this function is performed in a slightly different way by ER. Prince describes the stress pattern as follows: "main stress falls on the initial syllable, secondary stress on the penultimate, and tertiary stress on alternating syllables preceding the penult." In addition, "non-primary stress may never occur on syllables directly following the main stress." The system is basically the following: first ER(I;Σ) applies putting down a tick on the initial syllable. Then PG(RL;tr) applies applying the perfect grid right to left trough first. Lastly ER(I;Wd) places word stress.

(28)

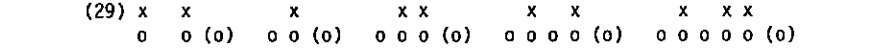


This combination of PG and ER(I;Σ) derives the result that in odd-syllabled words one gets two unstressed syllables in a row to protect

the initial stress from adjacent stresses.

Contrast this with Southern Paiute though. Here stress iterates toward a stress placed by ER, but adjacent stresses result in even-syllabled words. To get this, the final syllable is made extrametrical and thereby ignored by ER and PG. Then ER(F;Σ) applies feeding PG(LR;tr).

(29)



To account for the adjacent stresses, Prince invokes something he calls "Forward Clash Override" ([$\pm$FCO]). This allows PG to place a tick peak even when the syllable just beyond the peak is stressed.

This is a serious weakening of Prince's claim that stress assignment avoids clash. The positive claim is now reduced to a parameter whose values exhaust all the logical possibilities. We will see below, once the machinery has been developed, that Southern Paiute is not alone in having this property -- English has it too. Moreover, English cannot be accomodated at all under Prince's assumptions,[5] since, as was noted above, there are phonological rules of English, like vowel reduction, that are sensitive to the difference between unstressed and destressed vowels.

Prince argues for his theory in two ways. First, he argues that many of the theoretical constructs of the arboreal version of metrical theory are unnecessary, and that when this padding is pared away, one arrives at grid theory. Second, he argues that a better typology of stress systems is available within grid theory. Below I will outline

[5]To account for English, Prince (1983b) has argued for something he calls "grid repair". This seems to be a notational equivalent of destressing rules.

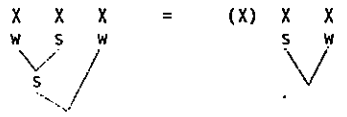
these arguments.

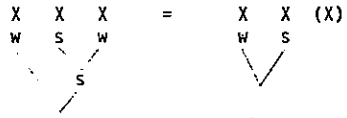
Prince's argument that trees are superfluous focuses on the Lexical Category Prominence Rule and the Rhythm Rule. The Lexical Category Prominence Rule (LCPR) is the tree-labelling convention that says "right/left node is strong iff it branches" (R/LSIB). This labelling algorithm can be applied to left-branching or right-branching structures in either its 'right' or 'left' mode, yielding the following four possibilities.

(30) LSIB  LSIB 

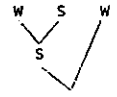
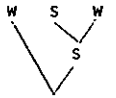
RSIB  RSIB 

When the mode of the LCPR is opposite the branchingness of the tree constructed, one gets a uniform left-dominant or right-dominant tree. Otherwise, the LCPR effectively allows one to place a peripheral stress excluding a nonbranching marginal constituent. However, Prince points out that this exclusion of a marginal constituent can also be performed by extrametricality.

(31)  =

 =

Thus one might expect languages to exhibit both properties simultaneously. This apparently does not occur.

(32) * # (X)  *  (X) #

Prince therefore concludes that one does not need the LCPR, and that it is not an argument for trees.

Prince's next argument concerns the rhythm rule. The structural description of Liberman & Prince's version of the rhythm rule was cast in terms of a grid, but the structural change in terms of a tree. If it really is more appropriately stated as an operation on trees, then this would argue that trees cannot be done away with. Prince therefore argues that the structural change of the rule can be recast in terms of the grid. Prince argues that a grid-based structural change is to be preferred, and devotes some space to this. His proposal will be considered in depth in chapter three, but for now we will see how the proposal works in simple cases.[6]

Prince assumes that the structural description for the rhythm rule is the same as for Liberman & Prince's version -- stress clash. The structural change is by a rule move X. "An entry at a certain level . . . is moved within its level away from a position of clash. Where does it move to? Evidently, to the first position it can legitimately occupy." (p.33) Thus the following representations undergo the movements indicated.

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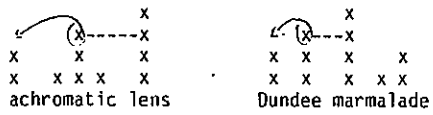
[6]Prince does not explain how stress is assigned in English, and it is not clear how he could account for bidirectional clash resolution of the sort discussed in chapter two below. I will follow his practice

(33)



Having argued that tree theory posits constructs that are unnecessary, Prince goes on to show that grid theory can provide a much more constrained typology of stress systems than Hayes' arboreal theory. Part of his argument is that destressing facts of the sort considered above can be dealt with in his basic typology, rather than in terms of tack-on destressing rules. An additional argument though is his treatment of languages like Aguacatec Mayan, Khalkha Mongolian, Eastern Cheremis, and Komi. These languages exhibit the following four stress systems.

(34) Aguacatec Mayan

Stress the rightmost syllable with a long vowel, otherwise the final syllable. (p.65)

Khalkha Mongolian

Stress the leftmost syllable with a long vowel, otherwise the initial syllable. (p.63)

Eastern Cheremis

Stress the rightmost syllable with a full vowel, otherwise the initial syllable. (p.57)

Komi

Stress the leftmost syllable with a heavy vowel, otherwise the final syllable. (p.58)

Prince accounts for the Eastern Cheremis pattern as follows.[7]

---

of giving input grids to rhythm without earlier derivations.

[7] I will continue to use his hypothetical words for examples. In this example, QS stands for Quantity Sensitivity, the rule that adds a tick to a heavy syllable. Small 'o's stand for light syllables;

(35)

In these derivations, ER(I) applies on level 2, and ER(F) on level 3 of the grid. Komi is the mirror image. Contrast this with his treatment of the switch polarity cases: Aguacatec Mayan and Khalkha Mongolian. Following are Prince's derivations for Khalkha.

(36)

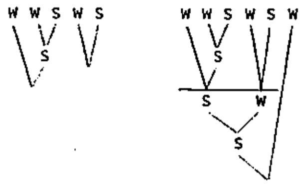
These derivations require a new interpretation for the End Rule. It is indexed for the level it applies on, but can default to the next lower level if there is nothing to apply to. Prince claims that "conceptually, this solution is similar to that of Halle & Vergnaud, but it fits rather more snugly into the present theory, since it requires neither special parameters, nor dubious assumptions about constituency." (p.74) The special parameter Prince refers to is the one adopted by Hayes. One can stipulate -- as a parameter -- that dominant nodes must branch. Hayes needs this parameter to account for stress in the Khalkha type cases. This is exemplified in the derivations in (37) parallel to

---

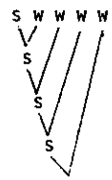
large ones for heavy syllables.

(36). First, right-dominant feet where strong nodes must branch are constructed. Then a left-dominant word tree is added.

(37) o o O o O o --> o o O o O o --> o o O o O o



o o o o o ---> inapplicable --> o o o o o



Prince eliminates this excess power in grid theory by tying the End Rule to the applicability of Q(uantity) S(ensitivity). When the End Rule applies in the Khalkha and Aguacatec type cases, it applies to the highest level of the grid present. When ER applies in the E/$\bar{E}$ cases though (Eastern Cheremis and Komi), then ER applies at the lowest level it can, feeding later applications of ER of a different polarity.[8] Compare the following derivations repeated from above.

---

[8]I adopt Prince's notation E/$\bar{E}$ to abbreviate the stress patterns of Eastern Cheremis and Komi; E/E to abbreviate the stress patterns of Aguacatec and Khalkha.

(38)

```
                                                                  x
                    x                 x  x                  x  x
x x x x x   QS    x x x x x  ER(I)  x x x x x  ER(F)  x x x x x
o o O o o   -->   o o O o o   -->   o o O o o   -->   o o O o o

                                     x
                    x                x
x x x x x   QS    x x x x x ER(F;Wd) x x x x x
o o O o o   -->   o o O o o   -->    o o O o o
```

In the first case, the effect of ER(I) for primary stress is felt only when the word contains no heavy syllable. Contrast:

(39)

```
                                               x
                                  x            x
x x x   QS             ER(I)      x x x  ER(F) x x x
o o o   -->  vacuous    -->       o o o  -->   o o o

                                    x
                                   (x)
x x x   QS            ER(F;Wd)    x x x
o o o   -->  vacuous    -->       o o o
```

The operation of ER(I) in the first case conditions application of the following rule ER(F). As noted above, Prince suggests that this solution fits better into his overall system than does the Halle & Vergnaud obligatory branching parameter. Since Prince does not make clear in what sense this fits better, one must assume that the issue is the constrainedness of the theories under consideration. In fact this argument does not go through. While it is true that the Hayes/Halle/Vergnaud theory gives too many possibilities, so does the Prince theory.

The problem for the Hayes/Halle/Vergnaud theory is that one cannot freely apply the obligatory branching parameter to all the other configurations permitted by Hayes.[9]

---

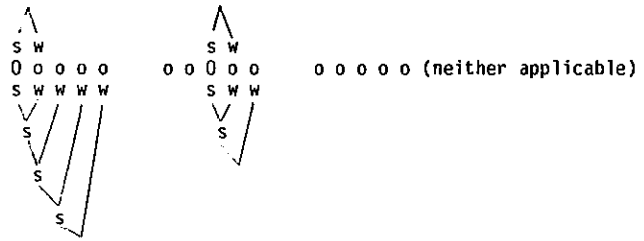
[9]This is adapted from Magnus (1983).

(40)

		[-oblig]	[+oblig]
troachaic	left to right	Maranungku	?
iambic	left to right	S. Paiute	Malayalam
trochaic	right to left	Warao	?
iambic	right to left	Weri	Yapese
left-dominant unbounded		Czech	Aguacatec
right-dominant unbounded		Quebecois	Khalkha

There are no cases of obligatory-branching trochees built left to right, or obligatory-branching iambs built right to left. These hypothetical systems produce results identical to their unbounded analogs. In the hypothetical cases below, the left-dominant examples are compared.

(41)



Prince's argument here does not go through though, because it is premised on several questionable assumptions. First, he assumes that the Halle & Vergnaud parameter is the only modus available to arboreal theory to account for the E/E cases. Second, he assumes that grid theory generates no redundancies, but an account of these facts analogous to Prince's account is available.

The crucial notion at play here is the relationship of heavy syllable stressing to default stressing. In the E/E cases, Prince makes

the default stressing a consequence of the ER's application. If there are heavy syllables, the last/first one gets main stress; otherwise, the last/first syllable gets main stress. In the case of E/$\bar{E}$ examples, Prince must lay the seeds of his default cases. In the example above, repeated below, ER(I) must be added so as to create the proper environment for later applicatin of ER(F).

(42)

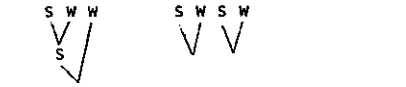
Under tree theory, ER(I)'s effect is a simple consequence of exhaustive footing. Thus one should conclude from these facts that though tree theory does create redundancies in order to describe the E/E types, it describes the E/$\bar{E}$ examples directly.

Can these redundancies be eliminated from tree theory? The simplest escape hatch is to rephrase Prince's solution in tree-theoretic terms. One way of doing this would be to eliminate the parameter of obligatory branching in favor of footing rules that only foot heavy syllables.[10] Consider Khalkha.

(43) o o Ó o o o Ó o O o ó o o o o

First comes a rule that builds left-dominant feet with heavy heads.

(44)

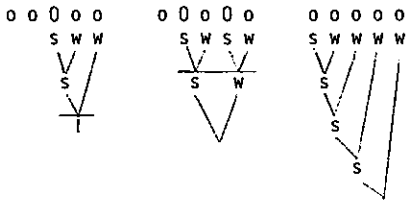


Then word tree construction applies to the highest level of structure

[10]Bruce Hayes (personal communication).

available.

(45)



This exactly recapitulates Prince's analysis in tree terms, and suggests that the analysis contains no argument for grids, since the analysis can carry over to trees.

Prince's argument fails in another respect as well. His observation that tree theory is excessively powerful only makes sense if, ceteris paribus, grid theory is more constrained. This is not so clear though, since grid theory contains its own excesses. Consider the device of indexing the End Rule for the level it applies on. This proved useful in the account of several recalcitrant examples. However, in simple cases, it is too powerful. Consider a language like Czech that stresses the first syllable of the word. The obvious analysis is ER(I).

(46)
```
x     x      x       x         x
x     x x    x x x   x x x x   x x x x x
o     o o    o o o   o o o o   o o o o o
```

However, given that the rule can be indexed for the level it applies on, there are three possible analyses of this simple system. First, ER(I;Σ) could be the only rule.

(47)
```
            x
x x x ER(I;Σ) x x x
o o o   -->   o o o
```

Second, ER(I;Wd) could be the only rule.

(48)
```
            x
            x
x x x ER(I;Wd) x x x
o o o   -->    o o o
```

Third, ER(I;Σ) could feed ER(I;Wd).

(49)
```
                          x
              x           x
x x x ER(I;Σ) x x x ER(I;Wd) x x x
o o o   -->   o o o   -->    o o o
```

The same argument could be made on the basis of Perfect Grid too. The point here is that Prince's system also generates too many possible grammars. Moreover, his system overgenerates in core cases. Thus the argument about constrainedness of the overall theory does not go through in favor of grid theory. At best the E/E and E/$\bar{E}$ languages do not motivate an argument either way. These languages seem to permit a variety of solutions, and there is no reason as yet for choosing between any of the competitors.

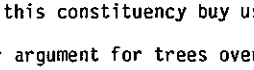
1.4 Conclusion and Introduction

In the final comparison between grids and trees, the real test has to be whether the constituency defined in trees captures linguistically significant generalizations. Consider the following grid.

(50)
```
  x   x
x x x
o o o
```

This grid has two translations into tree notation.

(51)



Does this constituency buy us anything? If it does, then there is a clear argument for trees over grids. If not, then trees contain

superfluous structure and should be abandoned in favor of grids.

It has been argued by Kiparsky (1979) that the foot can function as the domain of application of certain phonological rules. It has been argued in subsequent work that this claim is incorrect (Hammond, 1982),[11] because an important principle to be discussed in chapter three -- Metrical Locality -- indirectly limits the kind of evidence that can be observed for prosodic constituency. As a consequence of this principle, segmental rules cannot refer to foot boundaries. However, morphological rules still can. Consider reduplication in Yidiny as discussed by Hayes (1982b). In Yidiny, the first two syllables of a word can be reduplicated to form plurals.

(52)

mulari	mulamulari
'man'	'men'
gindalba	gindalgindalba
'lizard'	'lizards'

The stress system of this language, also discussed by Hayes, is quite bizarre, and recapitulating it would take us far afield, but it is plausible that the first two syllables of all words form a foot together, thus suggesting that the rule of reduplication copies the first foot of the word. A diehard grid theorist might counter that the rule of reduplication copies the first two syllables. Both statements of the rule can capture the facts, but the first fits much better into reduplication theory. Levin (1983), in a discussion of reduplication and syllable structure, argues that reduplication rules can only result in reduplication of possible constituents. If this proposal is to

[11]Another argument yet to appear in the literature is Halle & Vergnaud's. They argue that foot constituency is relevant for stress shifting when a stressed vowel is deleted. This line of argumentation seems promising, but I will have nothing further to say about it here.

extend to higher level reduplication, then the Yidiny case must be analyzed as foot reduplication rather than disyllabic reduplication.

Prince thus goes a long way toward solving some of the problems with Hayes' framework. Hayes proposed a system that is at once too restrictive and too powerful. Hayes' basic rules do not generate all the attested stress patterns of natural language. But provided such an elegant system, Hayes supplemented it with destressing rules, rather than mar its explanatory force. While such rules were well-intentioned, they made the whole theory too powerful. Prince picked up on that and made a crucial observation in adopting his framework. He observed that the basis of stress systems was clash avoidance. This observation, coupled with the grid-based nature of clash, forced him to drop trees and represent stress solely in terms of grids. There the operative idea had to be clash.

We see now that Prince's position was too strong: clash avoidance, while part of the system, does not provide its only basis, as evinced by Southern Paiute above and English below. Prince suggests that PG is maximally organized stress, organized up to clash. The end rule, on the other hand, cannot be seen as an instance of clash avoidance. It places a prominence independent of clash or organization. Thus, given FCO and ER, we see little hope for the idea that clash avoidance is the central force of stress assignment. How could it be if a language can effortlessly opt for [+Forward Clash Override]?

Looking over the treatment of stress since SPE, we can see a general trend. SPE proposed that certain conventions mediated the operation and interpretation of stess rules. Subsequently, those general principles were rationalized in the metrical theory of stress. However, in both SPE and Liberman & Prince, stress rules were constrained only by the general simplicity metric.

Hayes began to eliminate this problem. His theory attempted to limit possible stress rules by a theory specific to stress. His theory was weakened, though, by the unconstrainedness of metrical transformations. Yet he has paved the way by proposing a constrained theory of tree geometry.

Prince eliminated destressing rules, and attempted to constrain the whole theory with clash avoidance, which proved too strong. Nonetheless his proposal was crucial in the development of current ideas. It raised the question of how far we can go with clash avoidance.

In what follows, I will focus on the theory of metrical transformations, showing how they can be constrained in form, application, and function.

I will argue that the rules can be constrained by a condition called Metrical Locality. This locality condition on the kind of information rules have access to and the kind of changes they can perform entails that clashes can only be resolved when the DTEs (designated terminal elements) are adjacent on some level, where level includes foot, word, phrase, etc. It will be argued that any rule manipulating prosodic structure must be sensitive to Metrical Locality. Rather than defooting and relabelling, I argue that metrical transformations can only perform

one operation: Pruning. Elements can be pruned from the tree, but that is all. There is no relabelling or adjoining constituents via metrical transformations.

I will impose a constraint on the structural description of all metrical transformations. They must apply so as to remove clashes.

Finally, this theory of metrical transformations causes us to reevaluate the utility of strong/weak labelling. It is argued that DTE is the basic notion, and strong/weak labelling derivative.

This battery of constraints, and others to be discussed below, form a strong claim as to possible metrical systems. Taken in conjunction with a constrained theory of basic stress assignment, a serious proposal of about theory in natural language emerges.

Chapter Two

The Clash Resolution Hypothesis

2.0 Introduction

English stress assignment is quite complicated. To capture its regularities, Hayes (1981) supplements his basic stress assignment procedure with several destressing rules, including Prestress and Poststress Destressing.[1] In this chapter, I argue that these rules exhibit an important functional similarity: they both relieve stress clashes. That is, they destress a foot when its stressed syllable (Designated Terminal Element or DTE) is adjacent to another stressed syllable.

This property of the rules is not expressable in the usual metrical notation where nodes are labelled strong 's' and weak 'w'. To fix this, an alternative notation is proposed that allows one to capture the notion "stress clash" more easily. The alternative notation marks Designated Terminal Elements directly.

Once this is done, the functional similarity of the two rules can be extracted and formulated as a condition on destressing rules: the Clash Resolution Hypothesis. This constraint requires that all destressing rules eliminate clashes. As a consequence, Prestress Destressing and Poststress Destressing can be formulated as a single rule: Bidirectional Destressing.

[1]There are other destressing rules that are beyond the scope of the current work, notably the Arab Rule and Sonorant Destressing.

We will then turn to word-internal applications of the Rhythm Rule. This rule accounts for certain leftward stress shifts in cyclically-derived items. For example, from expéct, [êxpèct]átion instead of [èxpêct]átion, or from àrtifícial, [àrtifîciál]ity rather than [àrtifîciál]ity.[2]

There are certain well-known anomalies in the application of the rule. For example, it does not apply in certain trisyllabic spans: from sènsátion, we get [sènsâtion]álity, not *[sênsàtion]álity. This can be accounted for by the Clash-Resolution Hypothesis, if we extend it to cover the Rhythm Rule too. The Rhythm Rule relieves a clash in expectation, but not in sensationality.

To capture this generalization, the Rhythm Rule is taken as a subcase of Bidirectional Destressing. This move leads one to expect vowel reduction whenever the rhythm rule applies since the destressing rules always feed reduction. To avoid this consequence, the reduction rule of English is split: Early Reduction and Late Reduction. This revision makes it possible to collapse the Bidirectional Destressing rule and the Rhythm Rule. It also accounts for the different degrees of exceptionality exhibited by the two reduction rules.

Once Late Reduction has been extracted, no segmental conditions remain on the rule of Bidirectional Destressing, and the only constraint on its application is the Clash-Resolution Hypothesis. This allows us to see metrical transformations not as a barrage of different rule types, but as a single rule operating in a restricted environment.

[2]See introductory note on symbols.

2.1. Destressing as Clash Resolution

In the following section, the rules of Prestress and Poststress Destressing from English will be reviewed, and it will be argued that they are both instances of Clash Resolution, though this is not evident from traditional tree notation.

2.1.1 Motivations for Destressing

Following are the rules of Prestress and Poststress Destressing as formulated by Hayes (1981). The first rule removes a foot from a tree when it is monosyllabic, weak, and followed by another foot. The second rule removes a disyllabic foot when it follows a monosyllabic foot, and its first syllable is open.

(1)

Prestress Destressing	Poststress Destressing
"F" --> ∅ / ⊤ F	"F" --> ∅ / F (R, V_1)

2.1.1.1 Motivation for Prestress Destressing

Hayes argues that the rule of Prestress Destressing is necessary to account for two classes of examples: initial secondary stresses and cyclic stresses. I illustrate these below.

2.1.1.1.1 Initial Secondary Stresses

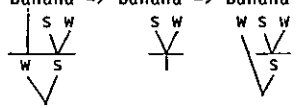
It is necessary to account for the lack of an initial secondary in examples like those in the first column below. Because footing covers the entire span in English, we would expect forms analogous to those in the second column for the items in the first column. These hypothetical forms are given in the third column.

(2)

banána	bàndánna	*bànána
cavórt	càntánkerous	*càvórt
abóut	àmbívalent	*àbóut
eléctric	ècstátic	*èléctric
capácity	càptívity	*càpácity
demónic	dàctýlic	*dèmónic

Following I give the derivations of banana and bandana. In the first derivation, footing and word tree construction proceed as normal, feeding Prestress Destressing. Prestress Destressing is applicable because the initial syllable is light, weak, and followed by another foot. This is followed by the convention of Stray Syllable Adjunction (SSA), which readjoins the footless syllable as a weak sister to the word tree.

(3) banana -> bànána -> banana -> banána



In the second derivation below, footing and word tree construction proceed as normal, but not feeding Prestress Destressing. Prestress Destressing is inapplicable because though the initial foot is weak and followed by another foot, it dominates a heavy syllable.

(4) bandana -> bàndána -> Prestress Destressing inapplicable

2.1.1.2 Cyclically Assigned Stresses

Prestress Destressing also accounts for the apparent absence of cyclically assigned stresses in the column II forms below. These forms

are derived from their column I counterparts, and these relationships can be compared with those between the column III and IV forms. Column IV forms preserve, to some degree, the stress assigned in the column III forms from which they are derived, while the column II forms do not preserve the stress assigned in column I.

In column V we see forms with no possible cyclic derivation. These forms all have stressless medial heavy syllables. This suggests that the forms in column IV are indeed a consequence of cyclic stress assignment (to account for the contrast between IV and V) and that the facts to be explained are in column II. Namely, why do these words not have the pronunciations given in column VI?

(5)

column I	column II	column III	column IV
rétrogràde	[rètrograd]átion	órient	[ôrient]átion
ecónomize	[ecònomiz]átion	cómplimènt	[cômplimènt]átion
dígitize	[dìgitiz]átion	expérimènt	[expêrimènt]átion
ànticipàte	[ànticipat]ory	índex	[índex]átion
díagràm	[dìagramm]átic		

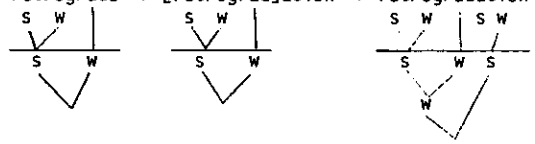
column V	column VI
ánecdote	*[rêtrogràd]átion
sèrendípity	*[ecônomiz]átion
sùrreptítious	*[dígitiz]átion
nèurasthénia	*[ànticipàt]ory
diagnósis	*[diagràmm]átic

The answer is that the rule of Prestress Destressing is applicable to the words in column II, but not to the words in column IV. This is because all the column II words have a medial syllable with a long

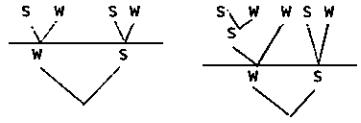
vowel in an open syllable, while the column IV words have short vowels in closed syllables, and Prestress Destressing does not apply to closed syllables.

Following are derivations of items from columns I through V. Retrograde undergoes stress hitchlessly, but when it undergoes morphological derivation to become retrogradation, it falls victim to Prestress Destressing.

(6) retrograde -> rétrogràde -> [rétrogràd]ation -> rêtrogràdátion

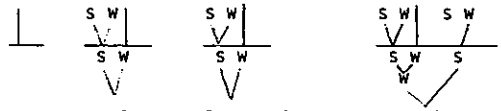


-> rètrogradátion -> rètrogradátion



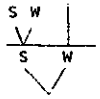
This can be contrasted with the derivation of orient and orientation below. Again, stress is assigned straightforwardly to orient, but the form then undergoes morphological derivation to orientation making it potentially susceptible to Prestress Destressing. Since the medial syllable is not light, it does not undergo Prestress Destressing, and the medial syllable surfaces stressed.

(7) orient -> órient -> [órient]ation -> ôrientátion -> Prestress Destressing inapplicable



In the case of the column V forms, the medial syllable is never stressed, and thus never has a chance to undergo Prestress Destressing.

(8) anecdote -> ánecdòte



2.1.1.3 Prestress Destressing Fed by the Rhythm Rule

Prestress Destressing also accounts for the absence of cyclic stresses in the following forms. These are cases where one might expect a secondary stress as opposed to a tertiary in medial position, but where one gets a stressless syllable in some cases, and a tertiary stress in other cases. The first type is illustrated in column II, and the second in column IV. Columns I and III give the derivational bases for columns II and IV respectively.

(9)

column I	column II	column III	column IV
allége	àllegátion	expéct	êxpèctátion
oblíge	òbligátion	condénse	côndènsátion
defér	dèferéntial	annéx	ânnèxátion
instáll	ìnstallátion	àuthéntìc	âuthèntìcity
derîve	dèrivátion	ellîpsòid	êllîpsóidal
		elástic	êlàstìcity

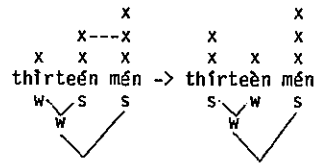
The absence of patterns with a medial secondary as in (10) is accounted for by the rule of Iambic Reversal (the Rhythm Rule), which Hayes adopts from Liberman & Prince (1977).

(10)

*[condênsˌ]átion	*[expêctˌ]átion
*[annêxˌ]átion	*[àuthêntìcˌ]ity
*[ellîpsóidˌ]al	*[elâstìcˌ]ity

This rule operates to relieve clashes in the metrical grid by reversing the labelling of iambs in the tree. This is exemplified in the derivation of thirteen men in (11). The clash is indicated with hyphens. Relabelling permits a new grid alignment without a clash.

(11)



This rule will be considered in depth in section 2.3 of this chapter and in the following chapter. For now, it is sufficient to note that it provides input to the rule of Prestress Destressing. Thus the output of this rule for columns II and IV above is given below.

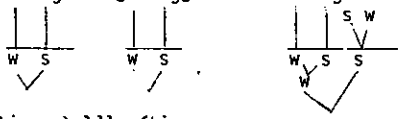
(12)

column II	column IV
*àllègátion	êxpèctátion
*ôbligátion	côndènsátion
*dêfèréntial	ânnèxátion
*ìnstàllátion	âuthèntìcity
*dêrîvátion	êllîpsóidal
	êlàstìcity

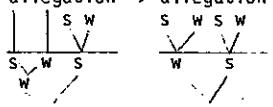
This only gets us partway to the actual data. Prestress Destressing must now apply to the output of Iambic Reversal in the column II forms in (12).

A complete derivation is given below. First, stress is assigned in the usual fashion to allege. Then àllége undergoes morphological derivation to become àllégation, which in turn feeds the stress rules to become àllêgátion. The Rhythm Rule then applies, which feeds Prestress Destressing and Stray Syllable Adjunction.

(13) allege -> àllége -> [àllég]ation -> àllêgátion ->

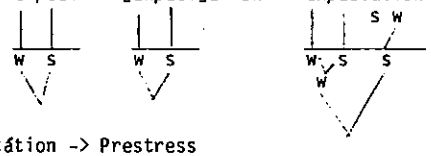


-> âllègátion -> àllegátion

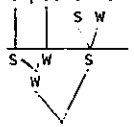


This derivation can be contrasted with that for expectation in (14). In this derivation, stress assignment applies before morphological derivation as before, but the Rhythm Rule applies to the output of the second round of stress assignment without feeding Prestress Destressing. This is because the syllable pec is heavy, and thus ineligible for destressing via Prestress Destressing.

(14) expect -> èxpéct -> [èxpéct]ation -> èxpêctátion ->



-> êxpèctátion -> Prestress Destressing inapplicable



The rule of Prestress Destressing thus seems to have adequate motivation. It accounts for a range of cases that would require a great complication of the basic stress assignment procedure to handle.

2.1.1.2 Motivations for Poststress Destressing

Hayes intends for his rule of Poststress Destressing to account for two classes of data: medial ternary feet and suffixes like -ory.

2.1.1.2.1 Medial Ternary Feet

Columns I and III below exhibit medial ternary feet. In Hayes' theory of tree geometry, these cannot be generated directly, and so an alternative mechanism must be found to account for them. Hayes chooses the rule of Poststress Destressing.

(15)

column I	column II	column III
àbracadábra	Mamáronèck	Kàlamazóo
Lùxipalílla	Escúminàc	Hàrdecanúte
Pèmigewássett	Saskátchewàn	Àllamakée
òkefenókee	Assinibòine	Ìlliloué̱tte
Nèbuchadnézzar	Oktíbbehà	Màttamuskéet
pàraphernália	àshurbánipàl	Àntigonísh
Kìlimanjáro	Genádenhütten	Gàllipolís

The rationale behind this move is that there is a gap in the paradigm. There do not appear to be any words of the sort illustrated below. These are hypothetical cases of weak binary feet with light DTEs following monosyllabic feet.

(16)

column IV	column V
*àbràcadábra	*Kàlàmazóo
*Lùxìpalílla	Hàrdècanúte
*Pèmìgewássett	*Allàmakée
*òkèfenókee	*Ìlliloué̱tte
*Nèbùchadnézzar	*Màttàmuskéet
*pàràphernália	*Àntìgonísh
*Kìlìmanjáro	*Gàllìpolís

In contrast, there are plenty of medial binary feet with heavy DTEs.

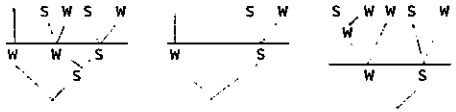
(17)

Tìcònderóga	Srìràngapátnam
decàlcománia	Valènciénnes
Balùchistán	Agèsiláus
appèndicítis	conjùnctivítis
encỳclopédia	litùrgiólogy
èxtèmporáneous	

Binary feet cannot account for the forms in (15). The conclusion that Hayes draws from this gap is that it is the result of the application of the rule of Poststress Destressing.

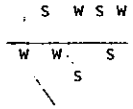
The rule applies in the following fashion, as exemplified in the derivation of abracadabra below. First, normal stress assignment applies producing a medial binary foot with a light designated terminal element. This then undergoes Poststress Destressing and Stray Syllable Adjunction.

(18) abracadabra -> àbràcadábra -> àbracadábra -> àbracadábra



This derivation can be contrasted with that of Ticonderoga below. In the derivation (19), Poststress Destressing is inapplicable because con is heavy.

(19)Ticonderoga -> Tìcònderóga -> Poststress Destressing inapplicable



2.1.1.2.2 Adjectives in -ory, -ary, and -ative.

The rule of Poststress Destressing is also intended to account for the destressing behavior of the suffixes -ory, -ary, and -ative. The relevant data are given below in nine columns. Columns I, IV, and VII give the suffixes in their stressed forms, while columns II, V, and VIII show that the very same suffixes occur stresslessly. To account for these alternations, Hayes suggests that the same rule of Poststress Destressing is operative. This predicts the absence of forms like those in columns III, VI, and IX corresponding to columns II, V, and VIII.

(20)

column I	column II	column III
àdmónitòry	àdvísory	*àdvísòry
premónitòry	òlfáctory	*òlfáctòry
explánatòry	perfúnctory	*perfúnctòry
prómissòry	trajéctory	*trajéctòry
áuditòry	vàledíctory	*vàledíctòry
column IV	**column V**	**column VI**
córollàry	infírmary	*infírmàry
prelíminàry	èleméntary	*èleméntàry
líteràry	ànnivérsary	*ànnivérsàry
apóthecàry	dispénsary	*dispénsàry
sùbsídiàry	exémplary	*exémplàry
áncillàry	placéntary	*placéntàry
órdinàry	còmpliméntary	*còmpliméntàry
	dòcuméntary	*dòcuméntàry
column VII	**column VIII**	**column IX**
ímitàtive	àltérnative	*àltérnàtive
invéstigàtive	illústrative	*illústràtive
límitàtive	demónstrative	*demónstràtive
	contémplative	*contémplàtive
	appréciative	*appréciàtive

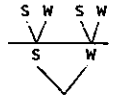
Following is a derivation exemplifying how Poststress Destressing operates here. First, stress assignment applies in the expected way.[3] This feeds Poststress Destressing and Stray Syllable Adjunction.

[3]There is a slight hitch in that all these suffixes are initially extrametrical, entailing that they are weak in the tree, but that does not affect the operation of Poststress Destressing.

(21) cursory -> cúrsòry -> cúrsory -> cúrsory

This derivation can be contrasted with that for corollary, where Poststress Destressing is inapplicable because the preceding foot is not monosyllabic.

(22) corollary -> córollàry -> Poststress Destressing inapplicable



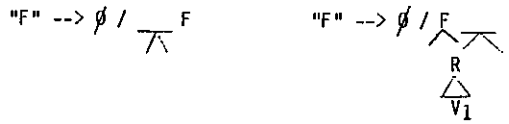
Thus Poststress Destressing is also well motivated. Like Prestress Destressing, its absence would require that we greatly complicate the basic stress assignment procedure.[4]

2.1.2 The Clash Resolving Nature of Prestress and Poststress Destressing

Despite the well-motivated status of these rules, it is rather apparent in the light of the research program outlined in Chapter One that there is a generalization being missed in the formulation of both rules. That is, under Hayes' theory, one would just as easily expect the rules in (23) as the rules in (1), repeated as (24) below.

[4]The facts may be more complicated than this. See Nanni (1977) and Travis (1983) for discussion.

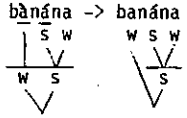
(23) Fake Prestress Destressing Fake Poststress Destressing



(24) Prestress Destressing Poststress Destressing

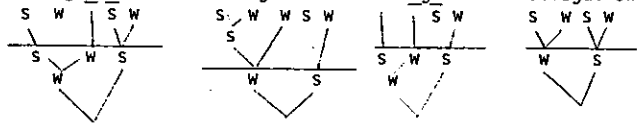
The generalization that seems to separate the occurring destressing rules from the nonoccurring ones is that the actually occurring destressing rules eliminate clashes, where clashes refer to adjacent stressed syllables or DTEs. Let us briefly reconsider the instances that motivated the two rules in the first place to demonstrate that this is so. Consider first the case of initial secondary stresses which provided the basic motivation for Prestress Destressing. The initial secondary stress is removed when it is adjacent to another stress. The clashing stresses are underlined in the example below.

(25) bànána -> banána



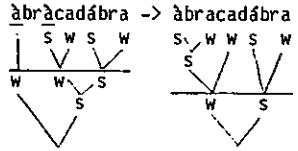
The destressing of cyclic stresses, whether as a result of the Rhythm Rule or not, can also be seen as instances of clash resolution. The clashing stresses are underlined in the following partial derivations involving cyclically placed secondaries.

(26) rêtrogràdátion -> rètrogradátion âllègátion -> àllegátion



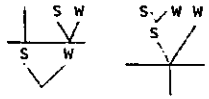
Thus all the Prestress Destressing cases can be seen as instances of clash resolution; the Poststress Destressing cases can also be seen as instances of clash resolution. Following is a medial ternary example, where the clashing stresses have been underlined.

(27) àbràcadábra -> àbracadábra



Adjectival suffixes like -ory can also be seen as instances of clash resolution.

(28) cúrsòry -> cúrsory



2.1.2.1 Other Languages

This generalization about English destressing rules seems to extend to other languages as well: Warao (as discussed in chapter one), Hawaiian (also as discussed in Chapter One), Icelandic (Arnason, ms), etc. The apparent crosslinguistic nature of this generalization suggests that it is not a spurious one.

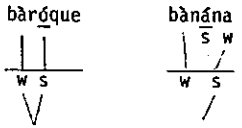
2.1.3 Does the 's w' theory capture the generalization?

If this is a real generalization, and it certainly seems to be, then one would like to find some formal reflection of it in the theory. This does not seem to be possible in the version of metrical theory

under consideration here.

This is because stressed syllables are not marked in trees uniformly. Some stressed syllables, those with no sisters, get no marking. Other stressed syllables, those with weak sisters, get marked 'strong'.

(29)



This difference in marking is based on the relativity of 's w' labelling. An element is marked 'strong' only if it is strong in relation to its sister node. Since the stressed syllable of a monosyllabic foot has no sister node, it cannot get marked 'strong'. To do so would wreak havoc with the relative nature of the labelling system.

It is, however, possible in classical metrical theory to state the generalization. Liberman & Prince's version of metrical theory used the feature [stress] to indicate that a syllable was stressed (a DTE). In that theory, it is possible to recognize just the sort of stress configurations needed to express the clash resolution generalization above. Namely, destressing rules eliminate adjacent [+stress] syllables.

Hayes' theory differs from the classical Liberman & Prince theory in rejecting the feature [stress], substituting in its stead the constituent foot. This move seems justified in the light of the constrained theory of foot geometry it permits, and we are therefore left out in the cold. Need we return to the Liberman & Prince theory to capture the notion stress clash or are we obliged to maintain foot theory leaving the clash-based nature of destressing unexpressed? Rather than taking

either of these steps, I propose a third alternative that lets us maintain both generalizations.

2.1.4 The DTE Theory

In both the Liberman & Prince theory, and the Hayes theory, the derivative notion of Designated Terminal Element (DTE) is exploited to account for grid alignment. The notion is explicitly referred to in Liberman & Prince's Relative Prominence Projection Rule:

(30) Relative Prominence Projection Rule

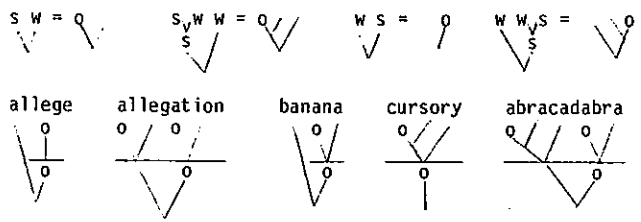
> In any constituent on which the strong-weak relation is defined, the designated terminal element of its strong constituent is metrically stronger than the designated terminal element of its weak constituent.

Liberman & Prince define designated terminal element as follows: "we will call the most prominent terminal element of a given constituent, its 'main stress', by the name designated terminal element". (p.259) This notion groups together strong nodes and unlabelled nodes. A strong node is a DTE in virtue of its being stronger than its sisters, while an unlabelled node is a DTE in virtue of its having no sisters at all, ipso facto the strongest node of its constituent.

In both frameworks, this notion is left unexpressed in the notation. It it were in the notation explicitly, then there would be no problem in formally capturing the idea that destressing rules relieve clashes. The generalization could refer to DTEs directly.

I propose that, rather than marking relative strength of nodes, and letting DTEs be a derivative notion, that DTEs are marked directly, indicated by a small circle in the tree. The following trees have the translations given.

(31)



In these trees, the interpretation of the 'little o' is straightforward. If a node is marked with an 'o', then it is to be taken as the designated terminal element of the constituent. If the node has sisters, then it can translate into strong-weak labelling as a strong node with its sisters labelled weak. If it has no sisters, it will translate into strong-weak labelling as an unlabelled node.

In the cases of unmarked trees, where recessive (or weak) nodes dominate only terminal material of that level, the translation algorithm is as given. In a marked tree, where recessive nodes can dominate non-terminal material, the interpretation would have to be somewhat different. It will therefore be assumed, following a suggestion in Hayes (1981), that marked trees are permitted only in derived vocabulary.[5]

2.1.4.1 Prestress and Poststress Destressing

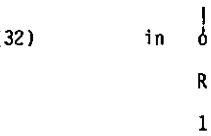
When this formalism is adopted, a formulation of the rules that reflects the clash-based nature of destressing is possible.

2.1.4.1.1 Prestress Destressing

Following is the revision of Prestress Destressing required by the new formalism. This rule says that the foot containing the rhyme (R) labelled '1' is deleted from the tree when that rhyme is a DTE and adjacent to another DTE. Other details of the rule will emerge later.

[5]The particular diacritic used to mark DTEs is adopted from Halle and Vergnaud (ms.). However, their representations are rather different, as the exposition will gradually make clear.

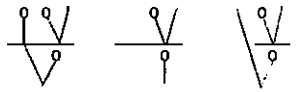
(32)



delete foot containing 1

The following derivation exemplifies the operation of this rule. As in Hayes' system, the rule is fed by the same basic stress assignment procedure, and feeds the same convention of Stray Syllable Adjunction.

(33) banana -> bànána -> banána -> banána

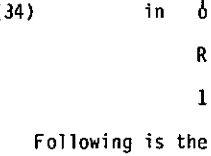


The only difference -- a significant one -- is that now the clash-based nature of the rule is evident in its formulation

2.1.4.1.2 Poststress Destressing

Following is the revision of Poststress Destressing required by the new formalism. This rule is just like the first one, except it is slightly more complicated. First, as indicated in the formalism, the second foot must be branching. Second, though not indicated in the formalism yet, the rhyme labelled '2' may dominate a tense vowel.

(34)



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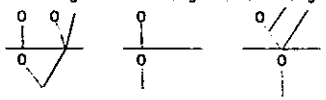
Following is the derivation of cursory, exemplifying the operation of the revised rule of Poststress Destressing. As with its strong-weak counterpart, it is fed by the stress assignment procedure, and itself

feeds the convention of Stray Syllable Adjunction.

(35) cursory -> cúrsȍry -> cúrsory -> cúrsory



Like (32), this rule is minimally different from its strong-weak counterpart, except for the perspicuity with which the clash resolution generalization can be stated. This generalization can be rephrased as a strong constraint on possible grammars, and its statability in formal terms seems easily worth the revision proposed. Below the generalization is stated explicitly as a hypothesis about possible grammars.

(36) Clash Resolution Hypothesis

All destressing rules must operate so as to eliminate adjacent DTEs.

The hypothesis requires that all destressing rules resolve clashes. It does not require that all languages resolve clashes.

2.2 Collapsing the Destressing Rules

The following section will demonstrate that once the Clash Resolution Hypothesis has been extracted as a generalization over all destressing rules, it is possible to collapse Prestress and Poststress Destressing as one rule: Bidirectional Destressing.

2.2.1 Liberman & Prince

Interestingly, Liberman & Prince's version of metrical theory allowed them to collapse the two destressing rules as one. This is because their theory had the feature [stress] to mark the opposition between designated terminal elements (DTEs) and non DTEs. However, their rule is somewhat problematic, and it seems to have been excluded

from Hayes' version of metrical theory for good reason. The rule is given in (37).

(37) English Destressing Rule

$$\begin{matrix} V \\ [<+long>_a] \end{matrix} \text{ --> } \begin{bmatrix} \text{-stress} \\ \text{-long} \end{bmatrix} \text{ / } \# <X\ V>_b\ C_0 \_\_ <C_0 =>_c\ (C)\ V$$

condition: $a \supset (b \vee c)$

The rule is very complicated, and abbreviates four subcases. The first subcase is given as (38) below.[6]

(38) $$\begin{matrix} V \\ [+long] \end{matrix} \text{ --> } \begin{bmatrix} \text{-stress} \\ \text{-long} \end{bmatrix} \text{ / } \# \ X\ V\ C_0 \_\_ C_0 = (C)\ V$$

This case of the rule apparently does not account for any data, and seems to be an artifact of the abbreviatory conventions. It says that a long vowel is destressed and shortened when it occurs in a noninitial syllable of a Latinate prefix. The reason this case of the rule accounts for no data is that there are no polysyllabic Latinate prefixes with long vowels in noninitial syllables.

The second subcase is given as (39) below. This clause of the rule makes a long vowel stressless and short when it is in an open syllable and between two other vowels.

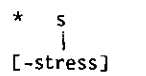
(39) $$\begin{matrix} V \\ [+long] \end{matrix} \text{ --> } \begin{bmatrix} \text{-stress} \\ \text{-long} \end{bmatrix} \text{ / } \# \ X\ V\ C_0 \_\_ (C)\ V$$

In addition, though not indicated in the formalism, the vowel must be metrically weak. This is because of the general prohibition in Liberman & Prince which excludes the following configuration:

---

[6]The boundary symbol '=' separates a Latinate prefix from a stem.

(40)



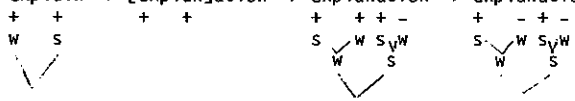
Prohibition (40) guarantees that clause (39) of the rule will only apply to vowels that are weak in the tree. Liberman and Prince intend (39) to account for the oppositions in (41). In the first column are forms where the vowel does not undergo the rule because the vowel is either strong component, in a nonmedial syllable parasite, or both explain. The forms in column b all undergo the rule because they are long, weak, and medial. The forms in column c do not undergo the rule because the vowel is followed by more than one consonant, i.e. it is in a closed syllable.

(41)

a. unreduced	b. reduced	c. unreduced
explain	èxplanation	ôdòntology
rótàte	ròtatory	êvàngélical
compónent	còmponéntial	âdvèntítious
párasìte	pàrasitology	Hàlicàrnássus
defíne	dèfinition	rêlàxátion

Following is an illustrative derivation. First, stress is assigned, then morphological derivation and deforestation take place. Stress assignment reapplies feeding the English Destressing Rule.

(42) explain -> èxpláin -> [explan]ation -> èxplanátion -> èxplanátion



This subcase of the rule is also intended to account for the destressing behavior of the suffixes -ory, -ary, and -ative, as in cur-

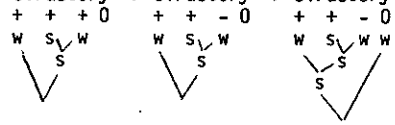
sory, infirmary, and alternative. These are also cases of a long vowel in an open syllable which destresses in metrically weak position between two other vowels. The relevant data are repeated below. Columns I, III, and V show the suffixes in their stressed guises. Columns II, IV, and VI give the same suffixes in stressless form.

(43)

column I	column II
àdmónitòry	àdvísory
premónitòry	òlfáctory
explánatòry	perfúnctory
prómissòry	trajéctory
áuditòry	vàledíctory
column III	**column IV**
córollàry	infírmary
prelíminàry	èleméntary
líteràry	ànnivérsary
apóthecàry	dispénsary
sùbsidiàry	exémplary
áncillàry	placéntary
órdinàry	còmpliméntary
	dòcuméntary
column V	**column VI**
ímitàtive	àltérnative
invéstigàtive	illústrative
límitàtive	demónstrative
	contémplative
	appréciative

The rule is exemplified in (44). First, stress assignment applies, feeding the English Destressing Rule.

(44) olfactory -> òlfáctòry -> òlfáctory -> òlfáctory



Notice that the <y> is not scanned by the stress assignment rule since Liberman & Prince assume the rule of y-vocalization proposed in SPE. At the point at which stress assignment takes place, the /y/ is still a [y]. Only after Destressing has applied can the [y] be adjoined to the tree. The rule cannot apply in columns II, IV, and VI because the medial syllable that would destress is specified 'strong'.

Following is the third subcase of the rule.

(45) $$V \underset{[+long]}{\text{ --> }} \begin{bmatrix}\text{-stress}\\ \text{-long}\end{bmatrix} \;/\; \#\, C_0 \_\_ C_0 = (C)\, V$$

Liberman and Prince intend it to account for the data in (46). This subcase of the rule destresses and shortens a long vowel when it is in a Latinate prefix. Column a and b forms are those that do not undergo the rule because they are metrically strong.

(46)

a. full	b. reduced	c. full
côndènsátion	condénse	cóntemplàte
âdvàntágeous	advánce	ádulàte
âbnòrmálity	absúrd	àbnegátion
ádèpt$_N$	adépt$_A$	
âdàptátion	adjácent	àdjurátion
cònformátion	confórm	cònfirmátion
prôlòngátion	prolóng	próduct
rélày$_N$	reláy$_V$	rélative
rêlàxátion	reláx	réplicàte
prétènse	preténd	prédicate

The derivation in (47) shows how the rule applies to column b. forms. First stress assignment applies feeding destressing. Destressing is applicable because, as indicated in the derivation, the prefix is separated from the stem by a '=' boundary.

```
(47)    con=dense -> còn=dénse -> con=dénse
                      +    +       -    +
                      w    s       w    s
                       \  /         \  /
```

The last subcase of the rule is given below as (48). It is intended to account for the data in (49). What the rule does is destress a short vowel when it is in an initial light syllable.

(48) $$\underset{[-\text{long}]}{V} \longrightarrow \begin{bmatrix}-\text{stress}\\-\text{long}\end{bmatrix} \;/\; \#\, C_0 \_\_\_ \,(C)\, V$$

In the column a. forms we see that the rule has applied.[7] In the column b. and c. forms the rule does not apply because the initial syllable is

[7]Notice that the rule applies before consonant clusters if those clusters form a complex onset: <a.spa.ra.gus>, <a.stro.no.my>. Liberman & Prince's use of standard SPE notation does not reflect

either long or closed (b. and c. respectively).

(49)

a. light	b. long	c. closed
políce	psỳchólogy	bàndána
Monòngahéla	tòtálity	làctátion
ballóon	Dàytóna	pòntóon
aspáragus	nèutrálity	sèctárian
mosquíto	tìsáne	Càrtésian
astrónomy	màintáin	tèchníque

The following derivation illustrates how the rule applies in the column a forms.

```
(50)    police -> pòlíce -> políce
                   + +       - +
                   w s       w s
                    V         V
```

Thus Liberman and Prince's version of metrical theory permitted a collapse of the rules of Prestress and Poststress Destressing that seems to capture the facts. It is somewhat inelegant in several respects though. First, as observed above, the first subcase of the rule (38), though apparently necessary in order to abbreviate the other rules properly, does not account for any data. Second, the last subcase of the rule, (45), though it does account for the data, does so by redundantly specifying that [+short] vowels become [+short]. These inelegancies of the rule, though suspicious, do not damn the effort. The generalizations captured here are unfortunately lost under the revision of metri-

this, and we must assume that this part of the rule is not intended as a claim about the actual rule, but is rather a nontheoretical notational convenience.

cal theory proposed by Hayes.

2.2.2 What Price Feet?

McCarthy's, Halle & Vergnaud's, and Hayes' versions of metrical theory eliminate the feature [stress] in favor of a typology of feet. As will be shown below, this move seems to deny foot theory the possibility of a single rule to account for the Prestress and Poststress Destressing rules.

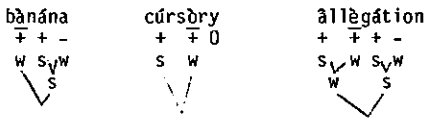
Feet force a revision of the constraint (40) above, repeated as (51) below, that is not as powerful as the original. Hayes' version of the constraint is given below as (52). Hayes' constraint prevents him from destressing strong feet; Liberman & Prince's constraint prevents them from destressing strong syllables.

(51)
```
   * s
   |
[-stress]
```

(52) "No foot in strong metrical position may be deleted."

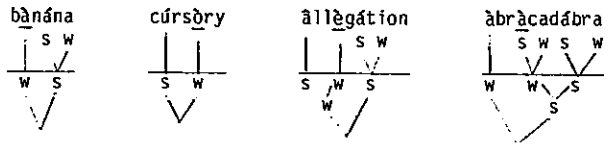
The difference is that Liberman & Prince's theory precludes destressing binary feet even if they are weak. Their constraint, in conjunction with the feature [stress], allows them to single out all weak stressed syllables. These are underlined in (53).

(53)



Hayes' theory can also group these syllables together as monosyllabic weak feet, but his foot typology forces him to treat medial ternary feet, as in abracadabra, as instances of destressing. This case cannot be grouped with the other three as a monosyllabic weak foot, and therefore forces Hayes to posit two separate rules of destressing. The representations Hayes assigns to the relevant forms are given in (54).

(54)



Notice that Liberman & Prince's version of the constraint would not allow them to use a destressing analysis to account for abracadabra.

Is foot theory worth the obfuscation and complexity? Are the restrictions in stress assignment on adoption of a restrictive theory of foot geometry worth the loss of the generalization of the English Destressing Rule? Probably so, as formulated here. In Liberman & Prince, the generalization realized by the English Destressing Rule was confined to the English Destressing Rule. On their view, it did not necessarily follow that all languages would have only one destressing rule. In contrast, Hayes' theory of tree geometry is explicitly universal, and makes claims about stress assignment in all languages. In this light, one would surely opt for the universal, rather than the language-specific generalization.

However, it is possible to have our cake and eat it too. In the following section it will be demonstrated that: 1) it is possible to maintain a generalized rule analogous to Liberman & Prince's English Destressing Rule within a theory like Hayes' with a restrictive inventory of tree geometries and 2) the generalization of the destressing rules as a single rule of Bidirectional Destressing can be formulated as a universal constraint on stress manipulation. In this way, the

language-particular generalization can be maintained, and made to follow as a consequence of Universal Grammar.

2.2.3 Medial Laxing

The organization of the following section is as follows. First, I will demonstrate that there is a generalization being missed in the treatment of long vowels in the rules of Prestress and Poststress Destressing as formulated by Hayes. Namely, both rules apply to long vowels only in medial position only. This generalization is extracted and formulated as an independent rule: Medial Laxing. This rule captures the generalization about long vowels, and allows us to collapse the rules of Prestress and Poststress Destressing.

There are two problems for collapsing Prestress and Poststress Destressing in a foot-based metrical theory. The first problem is that there are different segmental conditions on the rules. Poststress Destressing can defoot a long vowel, but Prestress Destressing can defoot a long vowel only in the medial cases.

The following data, in (55), illustrate that Prestress destressing, when it applies in initial position, cannot destress a long vowel. Thus column I below contains disyllables with initially-stressed long vowels. When these forms undergo morphological derivations which demote that primary to a secondary and follow it with a primary, there is no destressing.

(55)

column I	column II
néutral	nèutrálity
cúpid	cùpídity
Cháucer	Chàucérian
nómàd	nòmádic
dónàte	dònátion
írony	íronic
dýnasty	dỳnástic

These forms can be compared with the following data demonstrating the applicability of Prestress Destressing to light syllables in initial position. Column I gives disyllables where an initial light syllable has received primary stress. The column II forms show what happens to such stresses in the environment for Prestress Destressing - they destress.

(56)

column I	column II
mánor	manórial
sátire	satírical
móral	morálity
stérile	stérility
vírile	virílity

Both sets of data can be compared with the internal cases of Prestress Destressing. In internal position, Prestress Destressing can destress a long vowel. The following forms illustrate this. Columns I and III give forms where the final vowel receives some degree of stress. In column I, these are tense vowels, while in column II, they are lax. In columns II and IV, these forms undergo morphological derivation

putting the stressed vowels in the environment for Prestress Destressing. Prestress Destressing applies whether the vowel is long (column II) or short (column IV).

(57)

column I	column II	column III	column IV
rétrogràde	rètrogradátion	allége	àllegátion
ecónomize	ecònomizátion	defér	dèferéntial
dígitize	dìgitizátion	exíst	èxisténtial
àntícipàte	àntícipatòry		

Compare this state of affairs with Poststress Destressing. Poststress Destressing can destress long or short vowels. When it applies to the adjectival suffixes -ory, -ary, or -ative, which all contain long vowels, it destresses long vowels. When it applies to medial ternary feet cases like abracadabra, it applies to light syllables.

This division of labor for Poststress Destressing is a consequence of the stress assignment procedure. The only position where a light syllable will get stress immediately after another stressed syllable is when iterating foot construction is running up against the left edge of the span. At the right edge of the span, the rules conspire such that a light stressed syllable will never end up to the immediate right of a stronger stressed syllable.

Following I repeat the data exemplifying how Poststress Destressing can apply to long or short vowels. The data in (58), repeated from (43), are the adjectival suffixes that can undergo the rule. As indicated above, these are all long vowels.

(58)

àdmónitòry	àdvísory
premónitòry	òlfáctory
explánatòry	perfúnctory
prómissòry	trajéctory
áuditòry	vàledíctory
córollàry	infírmary
prelíminàry	èleméntary
líteràry	ànnivérsary
apóthecàry	dispénsary
sùbsídiàry	exémplary
áncillàry	placéntary
órdinàry	còmpliméntary
	dòcuméntary
ímitàtive	àltérnative
invéstigàtive	illústrative
límitàtive	demónstrative
	contémplative
	appréciative

In (59) are the medial ternary feet cases. These all appear to be short vowels, but, in fact, there is no way to tell, since none of these forms are alternating. They could be either long or short vowels underlyingly.

(59)

àbracadábra	Kàlamazóo
Lùxipalílla	Hàrdecanúte
Pèmigewássett	Àllamakée
òkefenókee	Ìlliloúette
Nèbuchadnézzar	Màttamuskéet
pàraphernália	Àntigonísh
Kìlimanjáro	Gàllipolís (?)

Notice that Hayes' formalism does not capture this distribution of the data. Looking back at the rules in (1), it is not clear whether Prestress Destressing applies to long and short vowels, or just to long vowels. Whichever class it does apply to, different applicability of the rule to long vowels depending on where in the word it applies is certainly not part of the formalism. Thus, just to account for the facts, some revision of the rules is required.

The generalization seems to be that Prestress Destressing applies to long vowels just in case there is a syllable preceding the syllable to be defooted. This generalization allows us to separate the initial destressing cases from the cyclic medial cases. It also allows us to group the Poststress Destressing cases in with the latter class, because all the Poststress Destressing cases obviously require a syllable to precede the syllable to be defooted. The following table illustrates the environmental generalization.

(60) Effect of a Preceding Syllable

# ___	syllable ___
a. Prestress Destressing when it applies in initial position. (e.g. banana)	a. Prestress Destressing when it applies in medial position (e.g. allegation and explanation)
	b. Poststress Destressing in all positions (e.g. cursory and abracadabra)

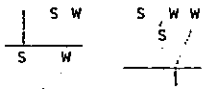
There is another side to the problem. As indicated in Hayes' formalism, the rule of Poststress Destressing only applies to disyllabic feet. The data in (61) show this. Column I contains forms with a secondary stress immediately following the primary, but it is not defooted, since Poststress Destressing is inapplicable because the second foot is monosyllabic. These can be contrasted with the column II forms where Poststress Destressing is applicable because the defooted stress was a disyllabic foot. Column III gives the derivational source of the column II forms demonstrating that they are in fact the result of Poststress Destressing.

(61)

column I	column II	column III
cóntòur	placéntary	áncillàry
rádàr	advísory	admónitòry
méntòr	cúrsory	prómissòry

A derivation of cursory is given in (62) below. Stress assignment applies in the usual fashion feeding Poststress Destressing.

(62) cursory -> cursory -> cursory



In contrast, as we have seen, Prestress Destressing can only apply when the foot to be destressed is monosyllabic. The difference can be incorporated into the chart above by dividing the chart into three columns: initial, medial, and final. These indicate all the possible positions in which a syllable could be destressed by either of the two rules.

(63)

		initial	medial	final
short <	Prestress:	yes	yes	no
	Poststress:	no	yes	?
long <	Prestress:	no	yes	no
	Poststress:	no	yes	no

The question mark has been placed in the final column for short vowels destressed by Poststress Destressing because there really is no way of knowing whether Poststress Destressing applies to short vowels in that position, as no short vowel (in an open syllable) would ever be in a position to be destressed there, as will be seen below.

The crucial generalization is now clearly evident. Both Prestress and Poststress Destressing destress a long vowel when that vowel is flanked by other syllables. In initial and final position, only short vowels can be destressed. Although, this latter claim is so far untestable in final position.

2.2.3.1 An Analysis

To account for this, I propose that the reduction of long vowels be factored out of the destressing rules in medial position. This proposal has two parts: First, both Prestress and Poststress Destressing as formulated above are to be reformulated so that they only apply to short vowels in open syllables, i.e. to light syllables. Second, there is to be an independent shortening rule that applies in medial position feeding the medial cases of Prestress and Poststress Destressing. Let us refer to this shortening rule as Medial Laxing.

A prose formulation of the rule follows.

(64) Medial Laxing

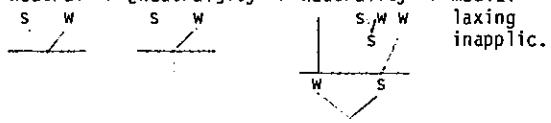
A long vowel shortens under the following circumstances:

1. it is medial, and
2. it does not bear main stress, and
3. it is adjacent to another stress.

2.2.3.2 Derivations

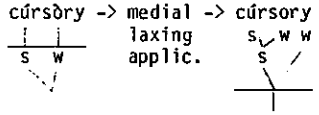
Medial Laxing feeds the rules of Prestress and Poststress Destressing and is exemplified in (65) and (66). First, we see the derivation of neutrality. Stress is assigned, then the form undergoes morphological derivation, potentially feeding Medial Laxing and Prestress Destressing. Medial Laxing cannot apply though because the vowel to be laxed is in a nonmedial syllable, and thus ineligible for laxing. Since that vowel is long, Prestress Destressing cannot apply, and the form surfaces with the clash unresolved.

(65) neutral -> néutral -> [néutral]ity -> nèutrálity -> medial laxing inapplic.



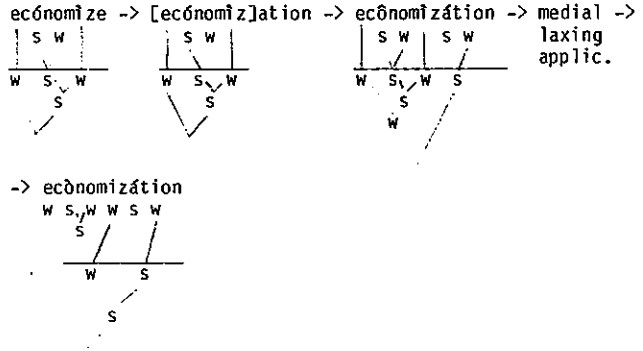
This can be contrasted with the following derivation of cursory. In this case, stress assignment does feed Medial Laxing, which in turn makes Poststress Destressing applicable.

(66) cursòry -> cúrsòry -> medial laxing applic. -> cúrsory



Finally, let us consider a case where Prestress Destressing applies to a long vowel in medial position. The first stage of this derivation shows the application of the stress assignment rules to the base economize. Next this form undergoes morphological derivation, and becomes eligible for Medial Laxing, which feeds the rule of Prestress Destressing.

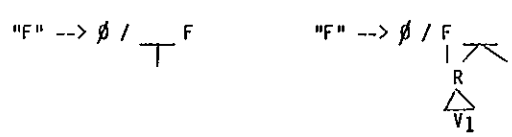
(67) ecónomìze -> [ecónomìz]ation -> ecônomìzátion -> medial laxing applic. -> ecònomizátion



2.2.3.3 Bidirectional Destressing

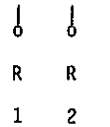
The rule of Medial Laxing can be motivated in terms of the simplification it permits of the rules of Prestress and Poststress Destressing. However, it also permits a greater simplification of the grammar. Namely, it allows us to reformulate the rules of Prestress and Poststress Destressing as a single rule. Below I repeat Hayes' rules from (1) above.

(68) Prestress Destressing Poststress Destressing

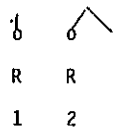


We reformalized these as (32) and (34) in the light of the Clash Resolution Hypothesis. These are repeated as (69) and (70) below.

(69) in delete foot containing 1



(70) in delete foot containing 2



Although not indicated in the formalism here, (69) and (70) differed originally in their segmental conditioning. Prestress Destressing only applied to short vowels in initial position, but to long and short vowels in medial position, while Poststress Destressing applied to long or short vowels in medial position.

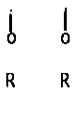
This difference between the two rules was factored out into the rule

of medial laxing: (64). This rule enables us to do two things. First, the different segmental conditions on the destressing rules are eliminated and the rules can stand as above with identical segmental conditions: the DTE of the deleted foot must be a light syllable. Second, the requirement that the foot to be destressed be binary in the case of Poststress Destressing can be eliminated.

Why can this requirement be eliminated? Let us consider all the possible cases where Poststress Destressing might apply to a monosyllabic foot. In medial position, there is no problem. If a foot is medial and monosyllabic, then it will either be followed by a stress, and destressed by Prestress Destressing, or be followed by a derived syllable (in y-vocalization cases such as cursory) and therefore liable to the rule of medial laxing and subsequent Poststress Destressing. If a foot is final and monosyllabic, then the rule of medial laxing will not apply because the foot is not medial. Notice that there is no way to generate a weak monosyllabic light foot in final position.

This seems to exhaust all the possibilities. Given such empirical coverage, the restriction that Poststress Destressing apply only to disyllabic feet becomes epiphenomenal and need not be stipulated in the rule. That being the case, the rule of Poststress Destressing can be reformulated as follows. (71) states that a foot deletes when its DTE is adjacent to a previous DTE.

(71) in



delete foot containing 2

Again, although not in the formalism, the rule only applies when '2' dominates a light syllable.

It is now a trivial matter to collapse these rules since they are mirror-images of each other. All apparent assymmetries have been factored out into the rule of Medial Laxing or follow from the directional assymmetry of stress assignment (right-to-left). I give the rule below in prose form.

(72) Bidirectional Destressing

A foot is deleted under the following conditions:

1. its DTE is light, and
2. its DTE is adjacent to another DTE.

Notice that clause two does not have to be part of the language-specific rule since it follows from the Clash Resolution Hypothesis. This rule is further subject to Hayes' condition, the successor to Liberman & Prince's filter (40).[8]

(73) No foot in strong metrical position may be deleted.

2.2.4 Summary

In the preceding section it has been argued that it is possible to collapse the rules of Prestress and Poststress Destressing. This generalization depended crucially on the Clash Resolution Hypothesis presented in 2.1, and on making DTE primitive. In addition, this generalization was made possible by extracting out the rule of Medial Laxing. This rule accounts for the fact that long vowels can only destress - by either rule - in medial position. The other asymmetries

[8]We will see below that this needs to be revised as well.

in Hayes' formulation of the rules were seen to follow from the asymmetric nature of stress assignment in English - it proceeds from right to left.

An additional argument for the system presented is that while there is variation across languages in whether they exhibit destressing rules, there appears to be something that we might call "core destressing". What this means is that if a language exhibits any kind of destressing rules, then rule (72) above seems to be at least part of the destressing system. Thus, some languages destress syllables of any weight (Warao & Hawaiian), while others (English) destress only light syllables. One can add languages like German (Kiparsky, 1966) or Icelandic (Arnason, ms) to this picture. German seems to care about syllable weight, but Icelandic does not. As far as I know, there do not appear to be any languages that operate the other way around, destressing only heavy syllables, and leaving clashes involving light syllables unresolved.

2.3 The Rhythm Rule within Words

In the following section, I would like to argue that the generalization attained above in collapsing Prestress and Poststress Destressing can be extended fruitfully to include word-internal instances of the Rhythm Rule as well. I will argue that rather than having a Rhythm Rule feeding Bidirectional Destressing, the Rhythm Rule should be seen as just one more instantiation of the Clash Resolution Hypothesis, and that it too can be subsumed by the rule of Bidirectional Destressing.

The organization of this section will be as follows. First, I will sketch out the traditional analysis of the rhythm rule facts. This

account has some well-known problems, namely forms like sensationality where the Rhythm Rule does not apply, and the sandwiching of the destressing rule between two applications of the Rhythm Rule to account for the inapplicability of phrasal rhythm to examples like exact change. These problems seem unsolvable given standard assumptions about metrical representatons, but they evaporate once one recognizes the Rhythm Rule as a subcase of Bidirectional Destressing. In order to reformulate the Rhythm Rule as a subcase of Bidirectional Destressing, we have to revise somewhat the mode of application of Bidirectional Destressing. The remainder of the section is devoted to demonstrating how this reformulation works.

2.3.1 A puzzle

Following I give a synopsis of the traditional account of the "rhythm facts". By rhythm facts, I mean the cases where there is an apparent leftward shift of stress within words when they undergo derivation. This is exemplified in (74). Column one gives the non-derived forms. The bracketed spans in column two have apparently undergone some kind of leftward retraction of stress. The column three forms illustrate what one might expect.

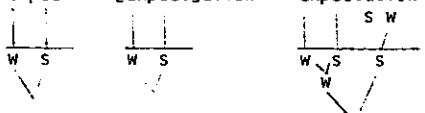
(74)	expéct	[êxpèct]átion	*[èxpêct]átion
	rèpresént	[rêpresènt]átion	*[rèpresênt]átion
	àrtificial	[ârtificiál]ity	*[àrtifîciál]ity

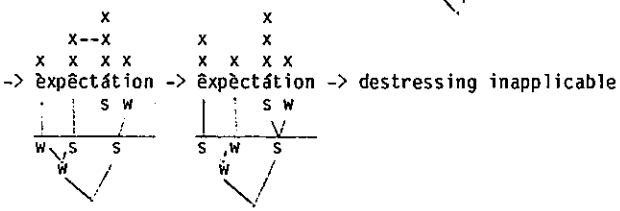
2.3.1.1 Tradition

Hayes (1981) provides the following account of forms like these. First, they can undergo the Rhythm Rule, which as we have seen operates to remove a stress clash on the metrical grid. Then, after that, they

can undergo destressing rules. Following is the derivation of expectation. Notice that destressing is inapplicable because the syllable to be destressed is heavy. The clash in the input grid is indicated with hyphens.

(75) expect -> èxpéct -> [èxpéct]ation -> èxpêctátion ->



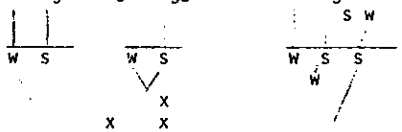


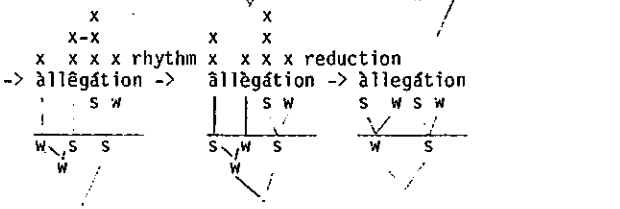
-> èxpêctátion -> êxpèctátion -> destressing inapplicable

This derivation can be contrasted with that for allegation. In allegation, the difference is that the syllable to be destressed is light, and thereby eligible for destressing. The derivation is given as (76). In this case, Rhythm feeds destressing.

(76) affixation stress grid

allege -> àllége -> [àllég]ation -> àllêgátion ->





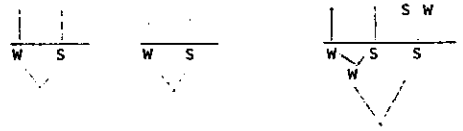
-> àllêgátion -> âllègátion -> àllegátion

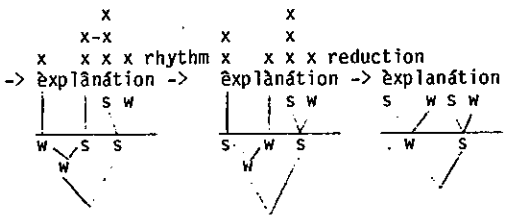
Since Prestress Destressing in Hayes' formulation also applies to long vowels, this relationship between the Rhythm Rule and Destressing

can also be observed when the vowel to be destressed is long, as in explanation. The derivation is given below.

(77) stress affixation stress grid

explain -> èxpláin -> [èxpláin]ation -> èxplâinátion ->





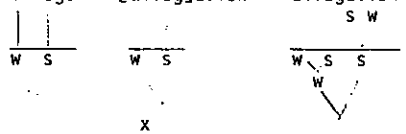
-> èxplânátion -> êxplànátion -> èxplanátion

2.3.1.2.1 A problem

Notice that it is crucial for the Rhythm Rule to apply to these forms before the rule of Prestress Destressing has a chance to apply, so that destressing will not bleed the Rhythm Rule. If they applied in reverse order, unattested forms would result. The following derivation exemplifies what would happen if Prestress Destressing were to apply before the Rhythm Rule.

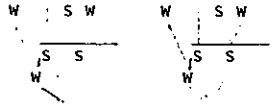
(78) stress affixation stress destressing

allege -> àllége -> [àllég]ation -> àllêgátion ->



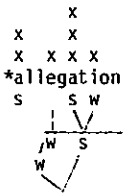
grid x x x x

-> allègátion -> allègátion -> Rhythm inapplicable



The Rhythm Rule is blocked because it would produce a structure where a 'strong' node dominated a unstressable syllable, namely the initial syllable weak-adjoined to the word tree by Stray Syllable Adjunction.

(79)



*allegation

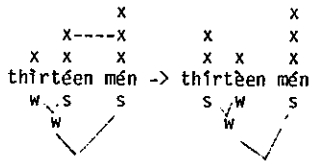
The Rhythm Rule also applies phrasally. Liberman & Prince show that the same rule is involved in alternations like those in (80). In each of these cases, stress retraction seems to be induced to avoid a stress clash on the metrical grid.

(80)	thírtéen	thîrtèen mén
	àchromátic	âchromàtic léns
	Tènnessée	Tênnessèe áir
	gòod-lóoking	gôod-lòoking lífeguard
	èmpty béd	êmpty bèd blúes

This is exemplified in the derivation of thírtèen mén below. Here the

operation of the Rhythm Rule relieves the grid clash between teen and men.

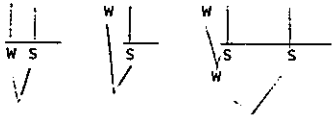
(81)



thîrtéen mén -> thîrtèen mén

Notice that the Rhythm Rule is blocked on the phrasal level by syllables that have undergone destressing.

(82) èxáct -> exáct -> exáct chánge -> Rhythm Rule inapplicable



Given these relationships between the Rhythm Rule and the destressing rule, there is no way to order them linearly without wrong results. Prestress Destressing bleeds the Rhythm Rule in exact change, but counterbleeds it in allegation. Thus, the traditional account (Cf. Hayes, 1981 and Kiparsky, 1979) adopts a nonlinear ordering, as in (83).

(83) Rhythm -> Destressing -> Rhythm

This system has the virtue of observational adequacy, but it is not at all what one would hope to find given the predictions of SPE-type linear ordering. Of course, one could give up the linear ordering theory, and this situation may provide an argument for doing so.

A preferable tack would be to take a closer look and see whether in fact there is some way to revise the rules such that this ordering dilemma ceases to exist. It will be seen below that this is a consequence of collapsing the rules of Bidirectional Destressing and

Rhythm.

2.3.1.2.2 The Montana Cowboy Effect

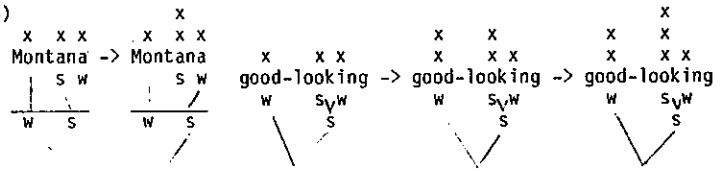
Another problem for the traditional theory is the treatment of certain trisyllabic modifiers. Contrast the possibility of rhythm in utterances like those in (84). Rhythmic adjustment is more likely in the first case than the second.

(84) gòod-lóoking góod-lòoking lífeguard

Mòntána *Móntàna cówboy

To account for this difference, Liberman & Prince propose to revise the grid alignment procedure. They suggest that the Designated Terminal Element of a lexical item gets an extra tick on the grid before the Relative Prominence Projection Rule (30) goes into effect. This gives the following grid alignment derivations for Montana and good-looking.

(85)



Liberman & Prince say the following in justification of this move. "The difficulty seems to be that the initial monosyllabic word (or # prefix) in cases like good-looking is not being given its proper 'weight'. It seems wrong to give a lexical entry (albeit monosyllabic) no greater representation in the metrical grid than a pretonic initial syllable would receive." (p.322) However, since no other motivation for this move is presented other than the intuition of the authors, it must be seen as ad hoc. In fact, an alternative explanation for these facts is possible if one looks first at analogous facts word-internally.

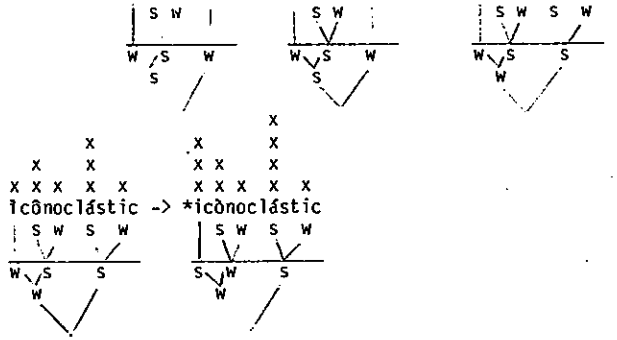
The examples alluded to are given in (86) below. These are polysyllabic words prosodically identical to Montana that undergo morphological derivation. Interestingly, they too do not undergo the Rhythm Rule. Column I gives the derivational sources for the column II forms. Column III gives the output of the Rhythm Rule, if it applied.

(86)

column I	column II	column III
ìcónoclàst	ìcônoclástic	*îcònoclástic
diréctional	dirèctionálity	*dîrèctionálity
àntícipàte	àntícipátion	*ântícipátion
demónstrable	demònstrabílity	*dêmònstrabílity
invéstigàte	invèstigátion	*învèstigátion
confúse	confùsabílity	*cônfùsabílity
confígure	confìgurátion	*cônfìgurátion
abóminàte	abòminátion	*âbòminátion

In (87) I give an incorrect derivation of iconoclastic to show how Rhythm might apply.

(87) iconoclast -> ìcónoclàst -> [ìcónoclàst]ic -> ìcônoclástic ->



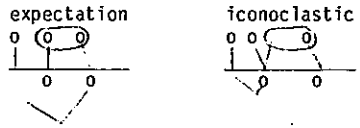
Liberman & Prince's theory correctly predicts absence of rhythm in these forms: Rhythm does not apply because there is no clash in the input grid.

However, there is an alternative account of these facts that will also allow us to reformulate the Rhythm Rule and Bidirectional Destressing as a single rule. This single rule can also explain the Montana - good-looking problem, where the earlier analysis only accounted for it in an ad hoc manner.

2.3.1.3 The generalization

The question to reconsider is why the Rhythm Rule applies in words like expectation, but not in words like iconoclastic. Let's look at these forms in terms of the DTE theory proposed in section 2.2. The representations are given in (88) below.

(88)



In light of the Clash Resolution Hypothesis, the generalization is readily apparent. The Rhythm Rule applies in the former because there is a syllable-level clash in the input tree. It does not apply in the latter because an analogous clash does not exist. The relevant nodes are circled above.

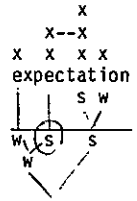
Intuitively, Rhythm does the same thing that Bidirectional Destressing does: it removes a foot when the DTE of that foot is in a clash. This shared part of the structural description of Bidirectional Destressing and the Rhythm Rule strongly suggests that the two rules should be reformulated as a single rule.

2.3.1.4 Why Hayes did not collapse the rules

Although the intuition that the Rhythm Rule prunes feet to avoid clashes is most perspicuously evident when one assumes the Clash Resolution Hypothesis, it is also visible within an orthodox 's w' tree, since DTE-status is derivable from 's w' labelling. One can then ask whether it is possible to collapse Rhythm and destressing in a standard account.

A major problem for such a move is that Hayes' theory contains a prohibition against defooting feet labelled strong (73). If the Rhythm Rule is to be subsumed as a subcase of the rule of Bidirectional Destressing, then this constraint would have to be relaxed, because the foot to be "defooted" is labelled strong. This is apparent in the (89). The circled node is the node that would have to be defooted. Since it is labelled 's', it could not be defooted in Hayes' theory because of condition (73).

(89)



A second problem for the Hayesian theory is that the structural description of the Rhythm Rule refers to the metrical grid. That is, the Rhythm Rule relieves clashes of a certain sort - those defined in terms of a grid. The destressing rules, on the other hand, remove feet in terms of certain tree geometries. To collapse the two rules, either destressing would have to be reformulated in terms of the grid, or

Rhythm reformulated in terms of the tree.

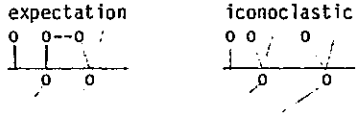
2.3.2 Summary

It has been suggested above that the problems for Hayes' version of destressing and the Rhythm Rule can be solved by reformulating the Rhythm Rule as a subcase of Bidirectional Destressing. Moreover, it was argued that this move is unavailable to Hayes because of his condition (73) and the grid-based nature of the Rhythm Rule. In the following section, a generalized rule of destressing and rhythm will be developed based on the DTE-theory and the Clash Resolution Hypothesis.

2.3.3 The DTE solution

As was observed above, the crucial generalization seems to be that the Rhythm Rule applies just in case it eliminates a clash in the sense of the Clash Resolution Hypothesis. In êxpèctátion, the Rhythm Rule relieves a clash between the syllables <pec> and <ta>. In an example like îcônoclástic, there is no such clash between the syllables <no> and <clas>. The representations of these words are repeated from (88) in (90). A clash is indicated with hyphens.[9]

(90) expectation iconoclastic



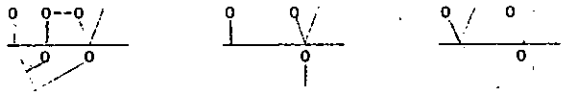
2.3.3.1 Why not apply destressing first?

The simplest approach to these facts would be to allow Bidirectional Destressing to apply before the Rhythm Rule in these forms, and to

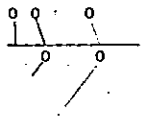
[9]Notice that these forms contain additional clashes not marked with hyphens. These clashes will be dealt with below.

allow the destressing rule to apply to a node labelled 'strong'. This in essence makes subsequent application of the Rhythm Rule unnecessary, deriving its word-internal effects from Bidirectional Destressing instead. This would produce partial derivations as below. In expectation, Bidirectional Destressing prunes the medial foot. The unmoored syllable is then eligible for Stray Syllable Adjunction. In iconoclastic, Bidirectional Destressing is inapplicable.

(91) expectation --> expectation --> expectation



(92) iconoclastic --> destressing inapplicable

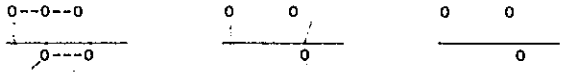


This naturally forces one to revise Hayes' condition (73). We will see below exactly how much of a revision is necessary.

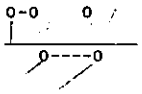
2.3.3.2 How does this work?

To get this to come out right, certain assumptions have to be made about how Bidirectional Destressing applies. One necessary move is that the rule must apply so as to remove clashes from bottom to top. That is, the rule must first remove syllable-level clashes, and then, after all syllable-level clashes have been removed, go on to remove higher level clashes. This is necessary because, in a more general sense, there are more clashes in (91) and (92). In (93) and (94) below, the derivations are repeated, and all clashes have been indicated with hyphens.

(93) expectation --> expectation --> expectation



(94) iconoclastic --> destressing inapplicable



Just what happens to these is discussed in the following section.

2.3.3.2.1 A Digression

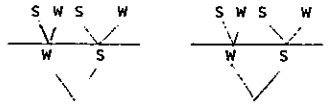
Let us consider the case of higher level clashes in their own right, and then return to how they interact with lower level clashes. In (95) we see cases of higher level rhythm. In column one are the morphological sources for the column two forms. The column two forms show the results of higher level rhythm.

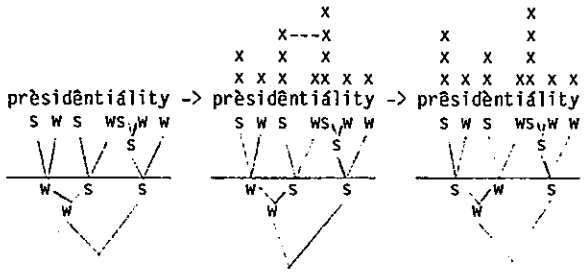
(95)

column I	column II
prèsidéntial	prêsidèntiálity
àrtifícial	ârtifíciálity

To capture these alternations, the traditional theory allowed the Rhythm Rule to apply as shown in (96) for presidentiality. The last stage of the derivation shows how the Rhythm Rule applies to relieve a higher level clash.

(96) presidential -> prèsidéntial -> [prèsidéntial]ity ->





-> prèsidêntiálity -> prèsidêntiálity -> prêsidèntiálity

In fact, the same kind of derivation is available under the Clash Resolution Hypothesis if we extend it to include higher level clashes. The revised version of the Clash Resolution Hypothesis is given below.

(97) Revised Clash Resolution Hypothesis (CRH)

If a language has one or more destressing rules, then those rules must operate so as to remove clashes, where clashes are of two sorts:

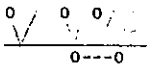
a. syllable-level clashes where the Designated Terminal Elements of two feet are adjacent.

b. higher-level clashes where the Designated Terminal Elements of two higher-level constituents are adjacent at some level.

Clause a. of (97) covers the Prestress and Poststress Destressing cases, and instances of the Rhythm Rule analogous to those considered above, that is lower-level rhythm. Clause b. is meant to account for higher-level rhythm as in artificiality. The DTE-theory representation of the input to the generalized rule for rhythm and destressing for artificiality is shown in (98). The higher level clash is indicated with

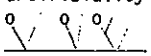
hyphens.

(98) artificiality

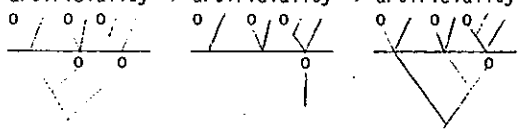


The kind of output one needs here is that given in (99) below. This shows that for higher-level rhythm, one needs a higher-level pruning rule. In this case, if higher-level rhythm prunes the constituent fici, and then adjoins the output to the word tree via Stray Syllable Adjunction, we get the desired results in (100).

(99) artificiality



(100) artificiality -> artificiality -> artificiality



Higher level Rhythm is parallel to lower level rhythm. They both resolve clashes by pruning the constituent of which one of the clashing DTEs is DTE. This is made explicit in (101). Compare (101) with (72).

(101) Bidirectional Destressing

A constituent is deleted under the following conditions:

1. its DTE is light, and
2. its DTE is adjacent to another DTE.

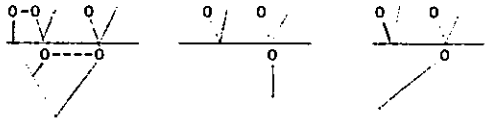
Higher-level rhythm, as an instance of generalized Bidirectional

Destressing will have to be ordered with respect to lower level rhythm. This ordering is bottom to top; lower level clashes are resolved before higher level ones.

2.3.3.2.2 Sensationality

Returning now to the properties of generalized Bidirectional Destressing, as the rule goes about resolving clashes in accord with the Clash Resolution Hypothesis, it resolves the lower level ones first. After it has resolved lower level clashes, it then goes on to resolve any higher level clashes. This ordering constraint can account directly for the lack of a leftward stress shift in examples like iconoclastic. These forms actually undergo lower level rhythm, which bleeds higher level rhythm. This is exemplified in the following derivation. The input tree has clashes marked with hyphens. Notice that the output of lower level rhythm indirectly eliminates the upper level clash.

(102) iconoclastic -> iconoclastic -> iconoclastic

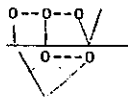


When the syllable-level clash is eliminated by pruning the initial foot, the higher-level clash is removed too because it involves a DTE built over a span crucially including the defooted syllable.

In this way, the inapplicability of the traditional formulation of the rhythm rule to forms like iconoclastic and Montana cowboy is explained by a "traffic principle". This principle comes at nearly no cost as well, since in any case we need to know how such situations involving multiple clashes are resolved.

Another traffic principle is necessary as well. Consider a form like expectation. Bidirectional Destressing applies in this form to eliminate the clash between pec and ta, but what about the clash between ex and pec? The input structure contains three clashes. This is shown in example (103): one between ex and pec, one between pec and ta, and a higher level clash between pec and tation.

(103) expectation



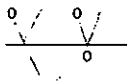
In a case like this, we need to guarantee that the clash involving pec and ta is resolved first. I propose the following traffic principle to account for this observation.

(104) Trigger Prominence Principle

> When resolving clashes on any level, prune the constituent first whose DTE clashes with the DTE of the domain. Only after such clashes are resolved, can other clashes be resolved.

This principle seems appropriate and adequate. In an example like expectation, the DTE of the domain is ta, and clashes involving it are resolved before any other clashes on that level. In this example, the other clashes are also eliminated indirectly since the following output results from eliminating this clash.

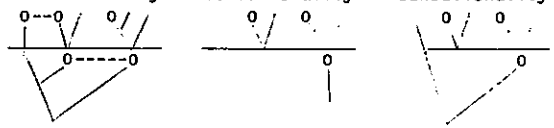
(105) expectation



It's not clear whether the Trigger Prominence Principle applies only within a level, or across levels. The derivation above demonstrates

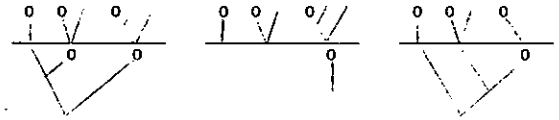
that it must apply at least within the lower level, but it may also apply across levels too. For example, the derivation of sensationality may be as follows.

(106) sensationality -> sensationality -> sensationality

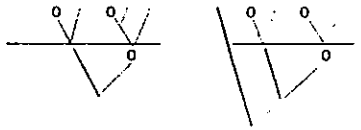


If the derivation proceeded in this manner, the principle would have to be inapplicable across levels, because there are two clashes: one on the lower level, and one on the higher level involving the DTE of the domain, but the lower level clash is resolved first. If the principle applied across levels, then we might expect a derivation like that in (107) to result. Here the higher level clash is resolved first because it involves the DTE of the domain.

(107) sensationality -> sensationality -> sensationality ->



-> sensationality -> sensationality



Since the output in both derivations is identical[10], there is no way to decide how the principles interact at this point.

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[10]Actually, it is not clear why either derivation would not produce sènsationálity. I will return to this below.

A further advantage of the Trigger Prominence Principle is that it allows us to dispense with (73) which said that no foot in strong position may be deleted. The two principles are not the same, and the Trigger Prominence Principle seems to work better.

Notice that the Trigger Prominence Principle is in part a translation of the ordering relationship between Hayes' rules of Prestress Destressing and the Rhythm Rule. However, the Trigger Prominence Principle is more general in that it is not intended as a language-particular ordering statement, but a principle of Universal Grammar. As such, it does not "add to the cost" of particular grammars. In contrast, the ordering statement that Rhythm precedes Prestress Destressing must be seen as something for the language learner to acquire and thus increases the cost of a particular grammar.

This leads to an obvious question. Is the Trigger Prominence Principle universal? As far as I can tell, it seems to be so. It predicts that if a language has <u>apparent</u> word-internal rhythm and destressing, then the destressing rules will always follow the rhythm rules. German is a language which seems to have both destressing and word-internal rhythm. The destressing rules follow the word-internal rhythm rule.[11] Icelandic also appears to have rhythm and destressing rules, and as expected, rhythm feeds destressing.[12] This suggests that the ordering is probably more properly seen as a consequence of a universal constraint on grammars rather than a language-particular statement.

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[11] Cf. Kiparsky (1966).

[12] Cf. Arnason (ms).

2.4 Rhythm and Destressing as Pruning

One problem remaining with the analysis is that it seems to predict reduction whenever generalized Bidirectional Destressing applies.

(108) *sənsèysənǽləti *ɛ̀kspəktéysən

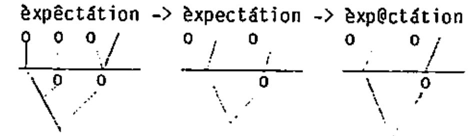
This is because the reduction rule, as assumed by Hayes, reduces anything that is weak within a foot. An examination of the outputs of the derivations of <u>sensationality</u> and <u>expectation</u> show that the syllables <u>sen</u> and <u>pec</u> are weak in their respective feet, and would thereby undergo reduction.

In this section, I will argue that the reduction rule of English should be revised. This revision has the consequence that the forms in (108) are not produced. In addition, the revision finds independent support in the treatment of exceptions to reduction.

2.4.1 Why is there a problem?

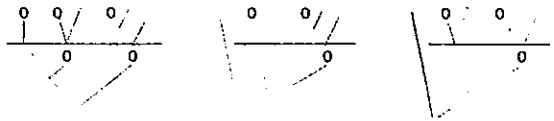
The problem is that for the rule of Bidirectional Destressing to account for rhythmic adjustment in forms like <u>expectation</u>, it must be allowed to apply to heavy syllables. If it applies to heavy syllables, then we would expect these syllables to reduce, but they do not. The following derivation exemplifies the problem. The output of Bidirectional Destressing feeds reduction, and the medial syllable reduces here.

(109) èxpêctátion -> èxpectátion -> èxp@ctátion



The same kind of derivation results for sensationality if low level Bidirectional Destressing is to bleed higher level destressing. What happens is that the initial syllable is made vulnerable to reduction if it is pruned as a consequence of Bidirectional Destressing.

(110) sènsâtionálity -> sensàtionálity -> s@nsàtionálity



2.4.2 A Solution: Spliting up Vowel Reduction

The most straightforward solution to this dilemma is to revise the reduction rule. In the following section, it will be shown that the reduction rule should be split into two separate rules. These rules differ in their structural descriptions, and in degree of exceptionality. Moreover, splitting up the reduction rule in this way has desirable consequences for the rule of Medial Laxing, allowing for simplification of that rule.

2.4.2.1 The Rules

The data in (111) exemplify the range of reduction environments in English. Column I gives forms that undergo reduction regardless of syllable weight, if the syllable has never been stressed. Column II gives forms that are reduced when the syllable has undergone some destressing rule. Column III gives the derivational sources for the column II forms.

(111)

column I	column II	column III
trîdent	àllegátion	allége
sèrendípity	stabîlity	stáble
ánecdòte	phonémic	phóneme
Sìascónset	mammálian	mámmal
dîagnósis	clinîcian	clînic
sùrreptîtious	atómic	átom
àtascósa	fragîlity	frágile
Flóresbòro	cónference	confér
înadvértant	réference	refér
hélix		

Previously, the difference between the applicability of reduction to light and heavy syllables was stated as a condition on the applicability of the destressing rules. Namely, the destressing rules could not apply to heavy syllables. That avenue is no longer open to us. The obvious approach is to state directly that the reduction rule is inapplicable to heavy syllables. Since this is not compatible with the column I forms above, one is led to posit two reduction rules. One reduction rule will apply before the rule of Bidirectional Destressing and will reduce any syllable that is weak in a foot. The other reduction rule will apply after Bidirectional Destressing and reduces any syllable that is weak in a foot and is light. This allows us to capture the generalizations exhibited in the columns in (111). Vowels without a derivational source can reduce whether they are in an open or a closed syllable, but vowels with a derivational source can reduce ónly if they are in a light syllable. These rules are given below in (112).

(112) Early Reduction: reduce all vowels in non-DTEs.

Late Reduction: reduce all non-DTEs in light syllables.

These rules are ordered with respect to Bidirectional Destressing in the following manner.

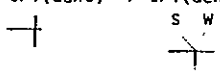
(113) Early Reduction > Bidirectional Destressing > Late Reduction

By splitting the reduction rule like this, the fact that the medial syllable that undergoes Bidirectional Destressing in expectation does not undergo reduction is explained as a consequence of the inapplicability of Late Reduction to vowels in closed syllables. The syllable <pec> is closed hence rendering Late Reduction inapplicable. Early Reduction is inapplicable because the vowel is still a DTE when Early Reduction applies.

The same type of story can be told for sensationality. The initial syllable is pruned and made a weak sister by Bidirectional Destressing and Stray Syllable Adjunction. At that point, Late Reduction is able to apply, but cannot since the vowel is in a closed syllable: <sen>. As above, Early Reduction cannot apply because at the point at which it is applicable, the syllable is still a DTE.

These two cases can be contrasted with that of trident. In this case, the final syllable starts out extrametrical, and is adjoined to the word tree by Stray Syllable Adjunction. Since it is never a DTE, it can readily undergo Early Reduction when it applies.

(114) trident -> tri(dent) -> tri(dent) -> tri(dent)



A positive result of this change is that we can make the rule of

Bidirectional Destressing even simpler, eliminating reference to syllable weight.

(115) Bidirectional Destressing (Revised)

A foot is deleted under the following conditions:

1. Its DTE is adjacent to another DTE.

This move has additional consequences. For example, it predicts that the reduction rules may differ in the kind and number of exceptions they allow. This seems to be the case. Early reduction seems to be exceptionless, while Late Reduction has many exceptions. Following are some exceptions to Late Reduction.

(116)

îns̲ípídity	hè̲llénic
dîstî̲llátion	sè̲ttée
înhî̲bítion	Nà̲nétte
phrè̲nólogy	Hè̲bráic
Dù̲néllen	czà̲rína
quà̲drátic	à̲cídity
dõdè̲canésian	à̲udácious
	blõ̲ckade
	sù̲mmátion
hî̲stórian	mỳ̀thólogy
tà̲chómeter	Fà̲scístic
hỳ̀pócracy	gè̲lídity

Many more examples could be added to this list. Notice that, as one would expect, this list is subject to dialect variation. In contrast, there are no exceptions to the rule of Early Reduction. A solution that had only one rule could not account for these facts.

A second consequence of the split is that it allows us to simplify the rule of Medial Laxing. The rule is repeated below as (117) from (64) above.

(117) Medial Laxing

A long vowel shortens under the following circumstances:

1. it is medial, and
2. it does not bear main stress, and
3. it is adjacent to another stress.

In the analysis above, this rule fed the unmodified rule of Bidirectional Destressing. This was because that version of Bidirectional Destressing could only apply to short vowels in open syllables. Now that Bidirectional Destressing has been revised so that it applies to heavy syllables as well, Medial Laxing can be greatly simplified.

Since Bidirectional Destressing applies to syllables, Medial Laxing does not have to feed it, which means that Medial Laxing can be ordered after Bidirectional Destressing. Once that has been done, the restriction on Medial Laxing that the syllable to be laxed not bear main stress and be adjacent to another stress can be traded for the stipulation that the syllable be weak in a foot. The revised rule of Medial Laxing can then be formulated as in (118). This rule shortens a stressless vowel between two syllables.

(118) Medial Laxing (Revised)

$$V: \rightarrow \breve{V} \;/\; \sigma \_\_\_ \sigma$$

Its ordering with respect to the other rules is given in (119) below.

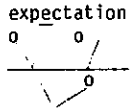
(119) Early Reduction > Bidirectional Destressing >
> Medial Laxing > Late Reduction

This is a significant savings over the previous analysis, and must be reckoned in favor of the split reduction analysis.

Another virtue of the current analysis is that it allows us to factor out completely any segmental conditioning on the rule of Bidirectional Destressing. The sole conditioning environment of that rule is clash. This is quite promising for a universal theory of clash resolution, and must also be reckoned in favor of the current analysis.

One might object that we are now saying that syllables like pec and sen in expectation and sensationality are unstressed unreduced, when they are in fact stressed. Actually, in this respect, the current analysis is in better accord with at least one descriptive treatment of English. Kenyon & Knott (1953), the descriptive source for SPE, actually use a four-way transcription system. (120) below shows this in the form of a chart comparing SPE values, Kenyon & Knott transcriptions, and the categories assigned by the current theory. (120) gives the cases where the distinctions in SPE are paralleled in Kenyon & Knott. The four examples in the columns correspond to categories Kenyon & Knott term as follows: primary stress, secondary stress, unstressed unreduced, and unstressed reduced.

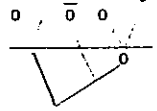
(120)

	Kenyon & Knott	SPE	DTE-theory
primary stress	'apple	1 0 apple	apple 
secondary stress	,Al@'bam@	3 0 1 0 Alabama	Alabama 
unreduced	,expec'tati@n	3 4 1 0 expectation	expectation 
reduced	b@'nan@	0 1 0 banana	banana 

However, there are a number of cases where the theories do not line up exactly. These mismatches are represented in (121) below.

These examples can be categorized into two classes. The first class is cases where Kenyon & Knott posit an unstressed unreduced vowel adjacent to a another stress and SPE gives it as a tertiary. Also, there are the higher level rhythm cases where SPE gives a quarternary stress for the position from which stress was retracted, but Kenyon & Knott record it as a secondary.

(121)

	Kenyon & Knott	SPE	DTE-theory
	ban'dan@	3 1 bandana	bandana 
	,arti,fici'ality	3 0 4 01 0 0 artificiality	artificiality 

Notice that the DTE-theory consistently agrees with Kenyon & Knott's description of the facts even where SPE diverges. Thus the fact that the DTE-theory diverges from the SPE theory should not be seen as a fault for the DTE-theory, but a virtue of the theory.

2.5 Conclusion

In the beginning of this chapter, we started out by looking at the rules of Prestress and Poststress Destressing in English. It was argued that there was a crucial generalization being lost in the formulation of these rules. They both resolved clashes, but that was not expressed in the notation. To capture this fact, the notation was revised, and the Clash Resolution Hypothesis proposed.

Once the similarity between the two rules was brought out into the open, it became apparent that it was possible to collapse the two rules into a single rule: Bidirectional Destressing. This rule captures the fact that both rules resolve clashes in the same way, and no rule is ordered between the two rules. These generalizations were unstated in the previous analysis. This revision required that we posit a rule of

Medial Laxing, but, in the light of discussion above, this seemed to be independently motivated to account for the different possibilities of Prestress Destressing in initial and medial positions.

The word-internal instances of the Rhythm Rule were considered next, and it was determined that this rule could also be profitably seen as an instance of Bidirectional Destressing.

Collapsing Rhythm in with the other two rules enables one to make sense of the apparent nonapplicability of the Rhythm Rule to cases like sensationality, and the apparent sandwiching of Destressing between two applications of the Rhythm Rule. Both of these fall out from the traffic principles necessary to mediate the application of the rule.[13]

Generalizing the rule of Bidirectional Destressing to include word-internal Rhythm had one apparently bad consequence. It predicted that vowel reduction should apply to heavy syllables when these syllables were the loci of rhythmic adjustment. Thus, complexity seemed unavoidable, where the previous analysis had a single reduction rule that reduced anything in a foot. This problem was solved by setting up two reduction rules ordered before and after Bidirectional Destressing respectively. This accounted for the nonreduction in Rhythm contexts, and had desirable consequences for the treatment of exceptions to reduction. In addition, splitting the rule in this manner also allowed us to simplify the rule of Medial Laxing.

The final rule of Bidirectional Destressing emerges without any segmental conditions on its application, and with no geometric stipulations about foot shape. In essence, the only restriction on its application is that it resolve clashes. Thus it seems to be as general as the syntactic transformation Move Alpha, and could be rightly referred to as Prune Alpha.

[13]The Trigger Prominence Principle seems to give the wrong results for phrasal examples like divine guidance. These will be dealt with in chapter three.

This revision in nomenclature should not be taken lightly. If in fact, this rule can be seen as a "principle of grammar" analogous to move alpha, then the revisions proposed here have led to a significant metatheoretical advance. While previously, metrical transformations were only constrained in the SPE fashion, they are now statable in terms of global parameters: does a language have prune alpha?

Notice that elevating the existence of rhythm and destressing rules to the level of a linguistic parameter does not excuse the rest of the phonology from containing rules, as we at least must countenance reduction rules.

The difference is empirical as well. The DTE-theory predicts that the locus of variation in the metrical transformational component in languages can be the presence or absence of prune alpha, but not in how it applies.

Furthermore, there may be parametric variation in the principles governing the application of prune alpha. We have already seen the traffic principle that causes the rule to apply bottom-to-top. We also examined the Trigger Prominence Principle which required that clashes involving DTEs be resolved before clashes involving non-DTEs. These principles do not appear to exhibit any variation, but it is obviously too early to tell.

Lastly, we have seen justification for the Clash Resolution

Hypothesis, the cornerstone of the theory. This principle requires that all destressing rules (and by extension Rhythm Rules) resolve clashes. This principle is a strong constraint on theoretical power, but in addition, also provides for gains in other domains. It allows us to first collapse the rules of Prestress and Poststress Destressing, and provide for the subsequent collapse of Bidirectional Destressing and Rhythm. Both of these moves result in significant gains in empirical coverage and theoretical economy, and are only possible under the Clash Resolution Hypothesis.

We must now look at other data and see if the principles stand up to further empirical investigation. This will be undertaken in the following chapters. Chapter Three focuses on phrasal rhythm in English, and Chapter Four deals with the rhythmic phonology of Tunica, a Native American language.

Chapter Three

Phrasal Rhythm and the Arboreal Grid

3.0 Introduction

The present chapter describes how the theory developed in Chapter Two can be extended fruitfully to the phrasal data covered by the Rhythm Rule. Rather than formulating the Rhythm Rule in terms of stress clash on the metrical grid, as Liberman & Prince do, it will be argued that it is more profitable to reformulate it in terms of DTE-trees. The immediate gains from this approach are that phrasal rhythm can be seen as one more aspect of Prune Alpha, and that the grid becomes unnecessary.

Next, the applicability of the Clash Resolution Hypothesis to phrasal rhythm is considered. In particular, the Clash Resolution Hypothesis is compared to theories of phrasal rhythm positing notions like "eurhythmy".[1] The relevant claim of such a theory is that Rhythm is not a consequence of clash avoidance as Liberman & Prince (1977) claim, and as claimed here, but rather that it is an effect of the stress system aspiring toward "eurhythmic targets". I argue that this approach, while adding to our understanding of Rhythm, does not contradict the spirit of the Clash Resolution Hypothesis. Rather, eurhythmic targets are actually eurhythmic constraints on Clash Resolution, and only when the Clash Resolution Hypothesis is taken into consideration can a truly adequate account of eurhythmic targets be possible.

Lastly, I show that the rule prune alpha is the mechanism of phrasal

[1] Cf. Hayes (forthcoming) and Dell (forthcoming).

rhythm. In this capacity, the rule is constrained by several interdependent principles. The first of these is the principle of Metrical Locality. This principle restricts the levels of the metrical hierarchy that a prosodic rule may have access to. A second constraint is the Prosodic Rooting Condition. This principle prevents prune alpha from totally destressing lexical items phrasally.

The view of rhythmic restructuring that eventually emerges is a modular one, with discrete subcomponents like prune alpha, Beat Addition, Metrical Locality, and Prosodic Rooting. This is an improvement over previous theories which are forced to posit distinct sets of rules or principles to account for rhythm and destressing. The new theory admits only one set of principles for both domains.

3.1 The Arboreal Grid

The following section will illustrate the argument for the metrical grid. It will then be demonstrated that the virtues of the grid are also available in an analysis making use of the tree notation developed in chapter two. We will refer to these structures as DTE-trees. Since DTE-trees can therefore represent both stress and rhythmic structure, and Liberman & Prince require two representations, the simpler theory is preferrable. The simpler theory is also preferrable on empirical grounds in that it can readily account for facts which require ad hoc stipulation in the grid theory.

3.1.1 The Metrical Grid

Liberman & Prince (1977) argued that metrical grids were necessary to account for certain phrasal stress shifts: thîrtéen, but thîrtèen mén. The primary stress on the ultima in the first word is retracted

to the penult in the phrasal collocation. Liberman & Prince argue that this happens in the environment of a "stress clash", but that clashes must be determined on the basis of some representation other than a tree. To this purpose, they propose the metrical grid.

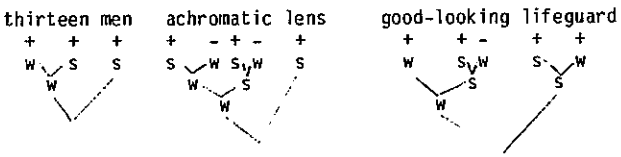
3.1.1.1 Examples supporting Grids

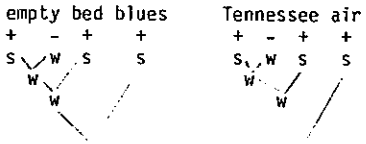
The examples in (1) below are instances of the "Rhythm Rule" and were adduced by Liberman & Prince as an argument for the metrical grid. The words in the first column exhibit primary stress either on the ultima or penult, but in the phrasal collocations in the second column, these stresses are retracted to the penult, antepenult, or preantepenult.

(1)		
	thîrtéen	thîrtèen mén
	àchromátic	âchromàtic léns
	gòod-lóoking	gôod-lòoking lífeguard
	èmpty béd	êmpty bèd blúes
	Tènnessée	Tênnessèe ír

Liberman & Prince argue that the stress shift is best expressed as a relabelling operation on trees, but that the impetus for the shift is best expressed in terms of a different representation: grids. The forms in (2) below show the arboreal inputs to the relabelling process.

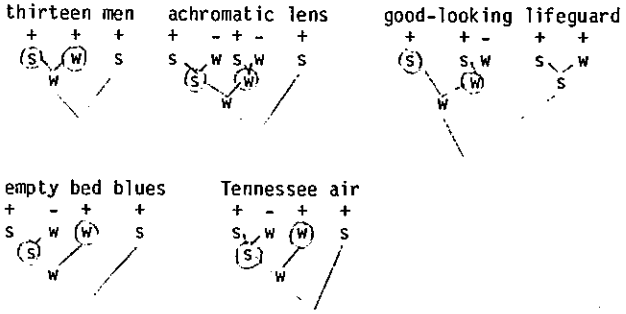
(2)





The outputs of the process are given below in (3). In each of these, the circled nodes are the relabelled ones.

(3)



As noted above, Liberman & Prince observe that the conditioning environment for the stress shift has something to do with adjacent stresses or stress clash. Yet, though there are adjacent stresses in thirteen men, there are not analogous clashes in examples like achromatic lens or good-looking lifeguard. For this reason, they decide that trees are an inadequate representation for determining adjacency of the sort that conditions the stress shift.

The kind of representation that is needed is one that can represent stress clash hierarchically, where adjacent stresses occur on different levels. To capture this intuition, Liberman & Prince propose metrical grids. These representations are mapped from trees by means of the following algorithm.[2]

[2]Paraphrased from Hayes (forthcoming).

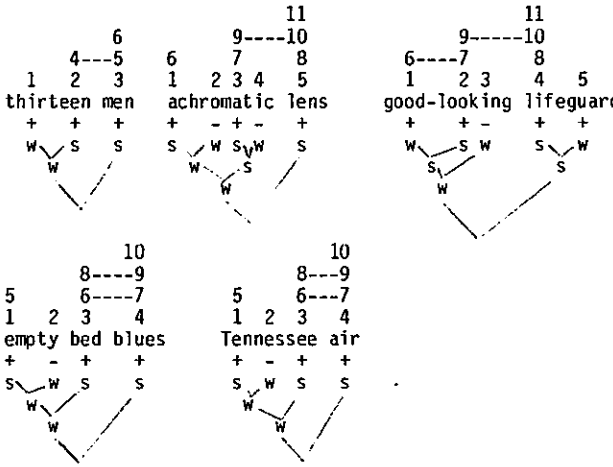
(4) a. As a place marker, assign every syllable a mark on the lowest level of the grid.

b. Assign a mark at level two to the strongest syllable of every phonological word.

c. Assign sufficient additional marks so that the strongest syllable of every constituent labelled S has a higher grid column than the strongest syllable of its weak sister.

This algorithm gives the following grid alignments for the inputs to rhythm given in (2) above. The ticks are numbered for easy reference.

(5)

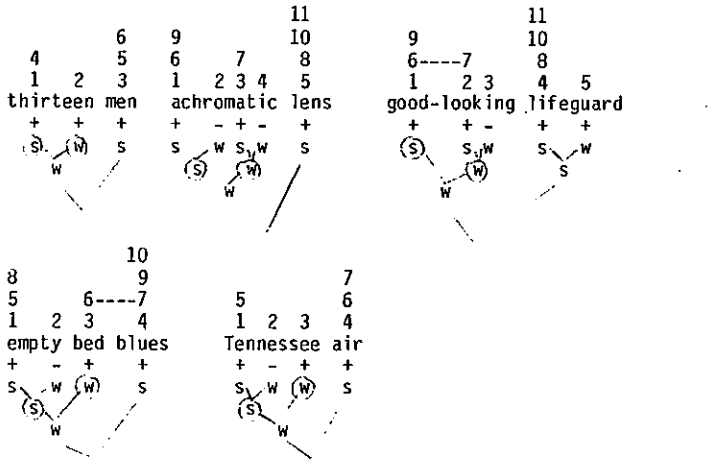


It is now possible to identify the input to the Rhythm Rule in terms of clash. Clashes can be defined as two adjacent placeholders on a level n with no intervening elements on level n-1. For example, ticks #4 and #5 clash in thirteen men because, on the next level down, no tick intervenes between #2 and #3. In achromatic lens, #9 and #10 clash because no tick intervenes between #7 and #8. Such configurations are indicated in the grids above with hyphens.

However the rule is formalized, the outputs clearly contain fewer

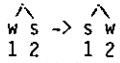
stress clashes when seen in terms of the grid procedure above. Following, in (6), are given the output grids for (5). Again, relabelled nodes are circled, and clashes are indicated with hyphens.

(6)



Notice that some clashes remain in the outputs to the Rhythm Rule since these cannot be eliminated by relabelling 'w s' as 's w'. The rule that effects this relabelling is given below as (7). I will have more to say about the conditions on this rule below.

(7) Iambic Reversal (optional)



Conditions: 1. Constituent 2 does not contain the designated terminal element of an intonational phrase.
2. Constituent 1 is not an unstressed syllable.

3.1.2 DTE-theory: "The Arboreal Grid"

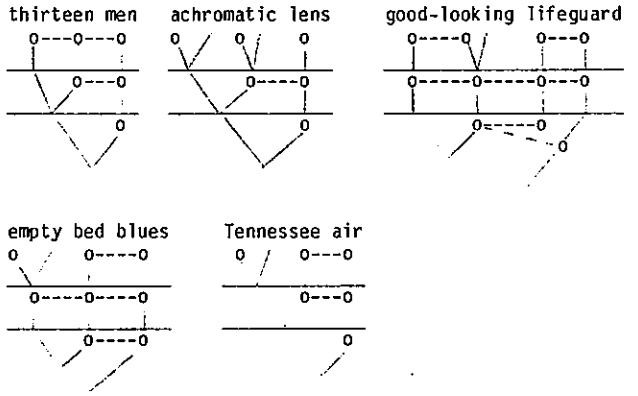
In the following section, I will develop an alternative conception of rhythm that operates not on the grid as Liberman & Prince propose,

but in terms of the DTE-trees proposed in Chapter Two. This proposal will have two principal consequences. First, it will constrain metrical theory by eliminating unnecessary representations; all metrical rules and interpretations will be made from the tree. Second, the DTE-theory extends the empirical coverage of the theory to account for facts that the grid theory couldn't account for without ad hoc stipulation.

The core of the proposal is the following: determination of stress clash for phrasal rhythm is identical to that of stress clash for prune alpha: adjacent DTEs of the same rank. This is just what we would expect inasmuch as word-internal rhythm is already rephrased in terms of arboreal clash.

The examples in (8) below illustrate how clashes can be determined in a DTE tree. Any pair of adjacent DTEs constitute a clash. These representations should be compared to those in (5) above. As above, the clashes are indicated with hyphens.

(8)



3.1.2.1 Temporal Alignment

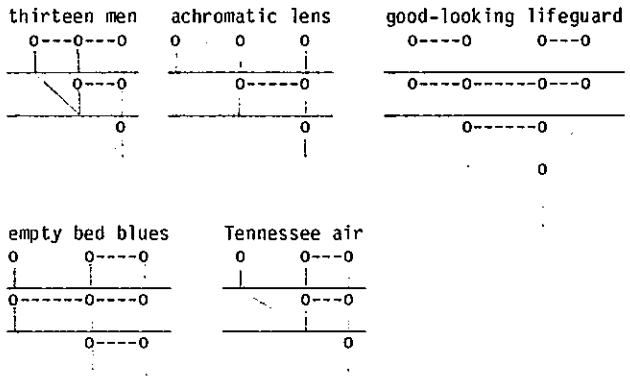
If these trees are to express rhythmic structure, then an additional change has to be made in the DTE-trees. The trees must also be able to characterize the temporal alignment of beats with a string. So far, though the DTE-trees are sufficient for calculating stress and rhythmic adjustment, they do not provide a representation from which one can easily determine the temporal positioning of beats associated with rhythmic structure.

To meet this problem, I propose the following revision of the DTE-tree notation:

(9) Temporally align DTEs with their daughter-DTEs.

This requirement gives the following representations for the examples in (8) above.

(10)



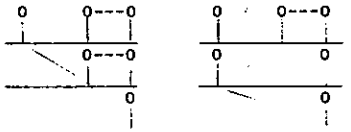
This simple revision allows us to represent stress and rhythmic structure in a single representation.

3.1.2.2 Pruning vs. Relabelling

Let us consider now the formulation of the structural change of the Rhythm Rule. In Liberman & Prince the rule was formulated as a relabelling operation on trees, and in the theory sketched above, this formulation is still possible. The derivation in (11) below illustrates how a relabelling analysis could be maintained in terms of the arboreal grid.

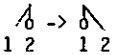
The identification of clashes would be as above: locate adjacent Designated Terminal Elements. Once the clashes have been identified, one would then apply the DTE-theoretic version of Liberman & Prince's rule of Iambic Reversal, which would then scan the tree to determine where legal relabelling could relieve clashes. In the derivation below, this would give the right result.

(11) Tennessee air --> Tennessee air



The suggested form of Iambic reversal is given below as (12)

(12) Iambic Reversal (optional) [DTE-theoretic version]



1 2 1 2

Conditions: 1. Constituent 2 does not contain the designated terminal element of an intonational phrase.
2. Constituent 1 is not an unstressed syllable.

A more interesting alternative presents itself though. Why not use the same rule of prune alpha phrasally? This would enable us to completely do away with any apparently arbitrary division of labor

involving rhythmic adjustment, as all instances of rhythmic adjustment would be instances of <u>prune alpha</u>. This approach will be explored in 3.3 below.

3.1.3 Choosing between the Alternatives

It is not sufficient to show that a DTE-account is possible. It must also be demonstrated that the DTE-account is preferred. There are arguments of several sorts for the DTE-theoretic account. First, DTE-theory is independently motivated by the word-internal destressing facts, while the grid account receives no such independent motivation in the linguistic system.[3]

Second, the DTE-theory has the virtue of only one relatively simple (albeit hybridized) representation, while the grid theory must employ two parallel representations with a fairly complicated translation procedure mediating their relationship (cf. 4).[4]

Lastly, the DTE-theory has greater empirical coverage than the grid theory. Consider the following contrasting sets of data originally due to Prince (1983a). The first set of data in (13) does not exhibit rhythm. The second set of data in (14) does exhibit rhythm.

---

[3]Grids do receive some independent motivation from the theory of metrics though. Hayes (1983) argues in favor of a grid-based theory of poetic meter. However, the facts that would distinguish a grid-based theory from a DTE-based one are quite subtle and fail to form an overwhelming argument.

[4]Halle & Vergnaud's (ms.) version of the metrical grid is also susceptable to this objection. They must posit two (simultaneous in some sense) representations where the DTE-theory has only one.

(13)
a. [[àntîque] shop] zóning board
b. [[Thìrtêen] Club] festívities
c. [[Thìrtêenth] Street] Bar and Gríll
d. [[Tòm Pâine] Street] blúes
e. [[frèe vêrse] club] árt festival
f. [[Hundred and thìrtêenth] Street] blúes
g. [[kàngarôo] rider's] sáddle

(14)
a. [Ù. Mâss.][free vérse club]
b. [Ù. Mâss.][department of linguístics]
c. [véry spêcial][old pórt]
d. [véry fât][old mén]
e. [thìrtêen][pontóons]

Thus a form like <u>kangaroo rider's saddle</u> emerges with a grid like the following.

(15)
```
                      x
          x           x
     x    x  x        x
     x  x x  x x      x  x
     kangaroo rider's saddle
```

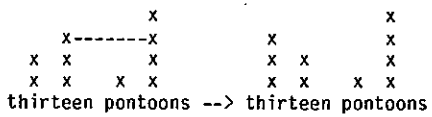
In contrast, a form like <u>thirteen pontoons</u> undergoes the following derivation.

(16)
```
              x                    x
        x     x          x         x
     x  x   x x          x  x    x x
     thirteen pontoons --> thirteen pontoons
```

In neither instance is there a clash on the grid, yet in the latter case, rhythm occurs. To deal with this problem, Prince proposes that additional ticks are added in the examples in (14) so that they actually exhibit stress clashes. This has the consequence that the forms in (14)

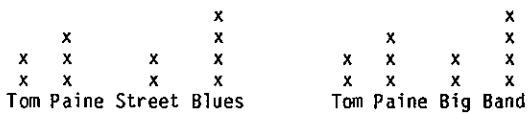
all contain clashes, while the forms in (13) do not. On this view, the actual grid for (16) above is (17) below.

(17)

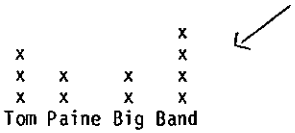


However, it appears that the difference between (13) and (14) is nothing more than a stipulation of the theory, as there are modifiers with identical structure in both classes. Contrast the following two examples. Here, there does not seem to be any kind of independent motivation for the additional ticks. Prince says that the latter gets one, yet only the latter undergoes rhythm, illustrated in (19).

(18)

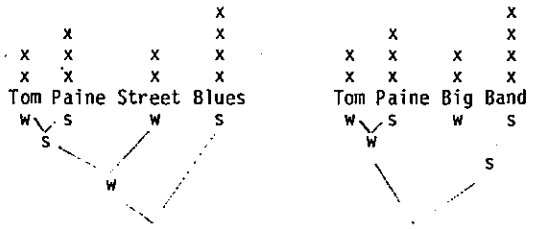


(19)

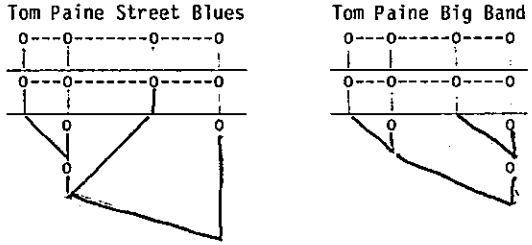


However, under an analysis that makes use of tree structure, these two classes of examples, and the examples above, can be distinguished without recourse to any ad hoc moves. Example (20) gives the Liberman & Prince representations of the examples in (18), and (21) gives the same examples in DTE-trees with clashes marked with hyphens.

(20)



(21)



The DTE-trees correctly predict rhythm in the latter structure since it contains a clash, and the former does not.

3.1.4 Summary

The preceding discussion has established that it is preferrable to state the structural description of the Rhythm Rule in terms of the revised DTE-trees, rather than traditional metrical grids. The arguments for this were of three sorts. First, it was shown that DTE-trees are preferable because they receive independent linguistic motivation in the treatment of word-internal rhythm and destressing, whereas the grid does not receive analogous motivation in terms of word-internal rhythm and destressing. Second, it was shown that the DTE-theory provided a theoretical advantage in that only one representation of stress and rhythm was necessary, while the alternative traditional account

relied on two parallel representations. Finally, it was shown that the DTE-theory was empirically superior, as it could account straightforwardly for facts that the grid theory accounted for in an ad hoc manner.

It should be clear that this is not simply an argument for one representation over two representations, as there are alternative monorepresentational theories in the literature which do not have the same advantages. One such theory is proposed in Prince (1983a). This theory, while it does have a single representational system instead of two, cannot account for the facts sketched under (14) above. Moreover, it offers no account of the word-internal rhythm and destressing facts, and therefore should be rejected in comparison with the DTE-theory.

3.2 Eurhythmy and Clash Resolution

It was argued above that one could best represent clash in terms of the DTE trees proposed in Chapter Two and revised in 3.1. This goes through only if clash is, in fact, a crucial factor in rhythmic adjustment. It has been claimed in the recent literature that this is not so. Hayes (ms.), for example, has argued that clash is totally irrelevant for rhythmic adjustment, and that the proper notion is not avoidance of clash, but aspiration to "eurhythmy", where eurhythmy indicates specific target grid configurations.

In the following section, I will outline the motivations for this kind of approach, sketching out the three eurhythmic targets Hayes proposes. I will then show that while Hayes is basically correct in his observation that some instances of rhythmic adjustment are not instances of clash avoidance and are best characterized in terms of eurhythmic targets, he has judged clash avoidance too harshly, and thrown the baby

out with the bathwater. Though eurhythmy does play some role in phrasal rhythmic adjustment, so does clash avoidance.

3.2.1 The Eurhythmy Theory

Hayes' (ms) theory of eurhythmy posits three eurhythmic targets for the Rhythm Rule and the rule of Beat Addition. In this section, I will explain these targets, and how they guide the Rhythm Rule and Beat Addition. In addition, I will show that at least one of these targets, the Disyllabic Rule, is better seen as Clash Avoidance rather than as a eurhythmic target per se. Moreover, another of these constraints, the Quadrisyllabic Rule, will be shown to be a eurhythmic condition on Clash Resolution, rather than an independent eurhythmic target.

3.2.1.1 The Quadrisyllabic Rule

Hayes argues that the Rhythm Rule is sensitive to the distance between stresses. He cites the following data to support this claim. The first column gives forms where the clashing stresses are two syllables apart, while the second column gives forms where the clashing stresses are three syllables apart. Rhythm is inhibited in the second column.

(22)		
	Mîssissìppi Mábel	Mìnneâpolis Míke
	Pùnxatàwny Péte	Pàssacônaway Péte
	ânalytic thóught	ànalŷtical thóught
	dîacrìtic márkings	dìacrîtical márkings
	the Pâssamaquòddy vérb	the Pòtowâtomi vérb
	Âlabàma rélatives	Àlabâma connéctions
	Èuropèan hìstory	Èuropêan histórian
	Ôklahòma cóngressman	Òklahôma congréssional district
	twô thòusand óne	twò thôusand and óne

These and other data move Hayes to suggest the following principle.

(23) Quadrisyllabic Rule

> A grid is eurhythmic when it contains a row whose marks are spaced close to four syllables apart.

(23) accounts for the forms in (22) in the following manner. The input grids for rhythmic adjustment for the first items in both columns are the following:

(24)

```
                x                       x
          x     x                 x     x
    x     x     x           x     x     x
    x  x  x  x  x x         x  xx x x   x
    Mississippi Mabel       Minneapolis Mike
```

The output grids are the following:

(25)

```
                x                       x
    x           x           x           x
    x     x     x           x     x     x
    x  x  x  x  x x         x  xx x x   x
    Mississippi Mabel       Minneapolis Mike
```

In the case of Mississippi Mabel, the interval on level three of the grid has been expanded from 2 to 4; in the case of Minneapolis Mike, the interval has been expanded from 3 to 5. If rhythm applies so as to move

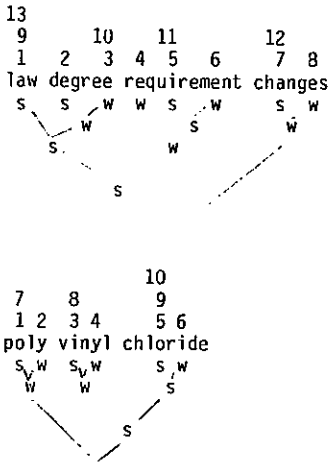
a representation closer to the quadrisyllabic ideal, then clearly it will apply in the case of Mississippi Mabel, since that ideal has been achieved. It will not apply in the case of Minneapolis Mike, because the output grid is no closer to the eurhythmic ideal: both input and output grids are one shy of the target.

3.2.1.1.1 Beat Addition

Hayes observes that there is a further rule, Beat Addition, that also aspires toward the eurhythmic ideal of the Quadrisyllabic Rule. In this section I digress to explain Liberman & Prince's version of the rule, Hayes' revision of it, and to demonstrate that it aspires toward the quadrisyllabic ideal.

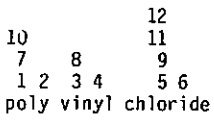
Liberman & Prince's system (cf. the rules of (4)) supplies the minimal grid alignments in (26) for right-branching and left-branching structures.

(26)



However, the grid in (27) below seems better in accord with speakers' intuitions of rhythmic structure in the right-branching structure above.

(27)



Liberman & Prince propose that tick #10 and #12 have been added by a rule of "Beat Addition". Liberman & Prince do not formalize this rule, but Hayes does. His preliminary formalization is given below as (28).

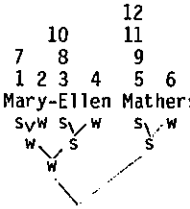
(28) Freely add additional marks to the grid columns, provided the relative prominence relations specified in the tree are preserved.

Hayes rightly points out that this rule "has no structural description", which prompts him to seek the structural impetus for Beat Addition in his eurhythmy conditions. He cites the examples in (29) to demonstrate that Beat Addition falls under the sway of the Quadrisyllabic Rule. These are the input trees and grids for Rhythm and

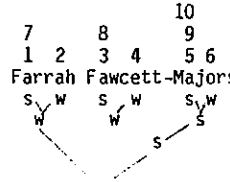
Beat Addition respectively.

(29)

Rhythm Rule



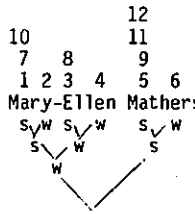
Beat Addition



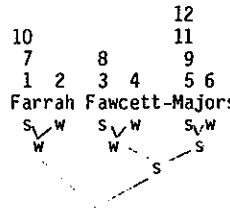
In (30) below are the outputs of both rules.

(30)

Rhythm Rule



Beat Addition



In both cases, eurhythmy is increased by the Quadrisyllabic Rule.

3.2.1.2 The Disyllabic Rule

Having established that clash avoidance is insufficient to account for the treatment of quadrisyllabic spans by Beat Addition and the Rhythm Rule, Hayes goes on to show that there are other eurhythmic targets aspired to by the rules of Rhythm and Beat Addition. The next case he considers is the Disyllabic Rule, which accounts for alternations of the sort illustrated in (31). The first column exhibits "internal rhythm". That is, one observes rhythm in the internal underlined portions. The phrases in the second column do not exhibit this "internal rhythm".

(31) a húndred thírtèen mén — óne thírtéen Máin Street

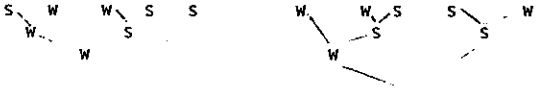
an álmost hárd-bòiled égg — a nón-hàrd-bóiled égg

an éxtremely únkínd cómment — a móst ùnkínd cómment

In terms of trees and grids, the first items of each column have the following input structures.

(32)

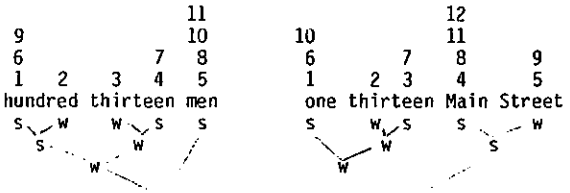
```
                    11                          12
                 9  10                       10 11
   6             7  8          6             7  8  9
   1  2  3  4    5             1  2  3       4     5
a hundred thirteen men      one thirteen Main Street
```



Both structures undergo the Rhythm Rule to satisfy the Quadrisyllabic rule, producing the outputs in (33). In the first case, the distance between #9 and #10 is increased from 1 to 4; and in the second case, the distance between #10 and #11 is increased from 1 to 3, thus increasing eurhythmy via the Quadrisyllabic Rule.

(33)

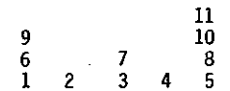
```
                    11                          12
   9                10                     10   11
   6             7  8          6             7  8  9
   1  2  3  4    5             1  2  3       4     5
a hundred thirteen men      one thirteen Main Street
```



However, the first structure then undergoes the Rhythm Rule a second time producing the following grid-tree structure.

(34)

```
                    11
   9                10
   6             7  8
   1  2  3  4    5
a hundred thirteen men
```



To account for this, Hayes proposes the Disyllabic Rule, given as (35) below.

(35) Disyllabic Rule

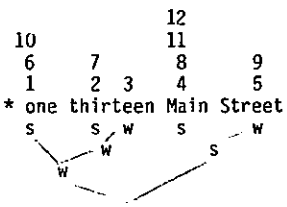
> The domains delimited on the level of scansion should be divided evenly by a mark on the next lower grid level.

We saw above that the level of scansion corresponded to the level on which the Quadrisyllabic Rule applied. In (34), that level is the level occupied by ticks #9 and #10. The level beneath it, occupied by #6, #7, and #8, is divided evenly by tick #7.

In contrast, were the Rhythm Rule to apply to the internal portion of one thirteen Main Street, it would not result in an even division of the level below the scansion level. This is illustrated in (36) below.

(36)

```
                    12
              10    11
   6          7     8        9
   1          2  3  4        5
* one thirteen Main Street
```



Here the level beneath the scansion level, occupied by #6, #7, #8, and #9, is not divided evenly by #7. Rather #7 is adjacent to #6 and one away from #8. Thus this derivation is not legitimized by the Disyllabic

Rule.

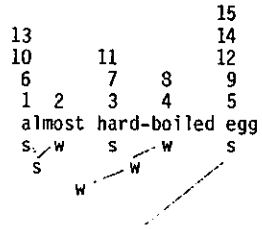
Hayes observes that the Disyllabic Rule constrains Beat Addition as well. The following pair can be compared.

(37)

Rhythm Rule	Beat Addition
álmost hárd-bòiled égg	Péter's thrée rèd shirts

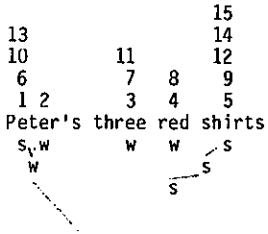
In the first case there are two applications of the Rhythm Rule leading to the following output.

(38)



In the second case, two applications of Beat Addition lead to the output in (39). The higher application of Beat Addition is motivated by the Quadrisyllabic Rule, and the lower application is motivated by the Disyllabic Rule.

(39)



3.2.1.3 The Phrasal Rule

Lastly, Hayes proposes that there is a eurhythmic target for the level above the scansion level. The target is called the Phrasal Rule, given in (40) below, and is supported by the data in (41).

(40) Phrasal Rule

A grid is more eurhythmic if its second highest level bears two marks, spaced as far apart as possible.

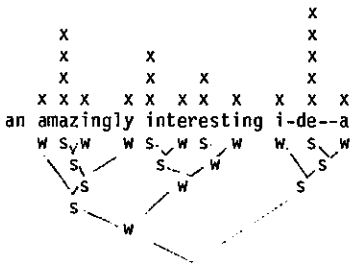
(41) an amázingly interesting idéa

the Ítaly-Gèrmany fóotball match

the Ságinaw, Mìchigan Jóurnal

The data in (41) all undergo the Rhythm Rule even though it does not improve eurhythmy by either the Quadrisyllabic Rule or the Disyllabic Rule. The output grid for the first example is given in (42) below.

(42)



The same rule applies to Beat Addition cases. Moreover, as indicated in (40), the rule seems to be asymmetrical, in that it does not specify a distance. The data in (43) below justify this point. In each case, Beat Addition applies, but not in some kind of iterative fashion across a span. Rather it applies once only to position a tick at the beginning of the utterance.

(43) Únion of Sòviet Sòcialist Repúblics

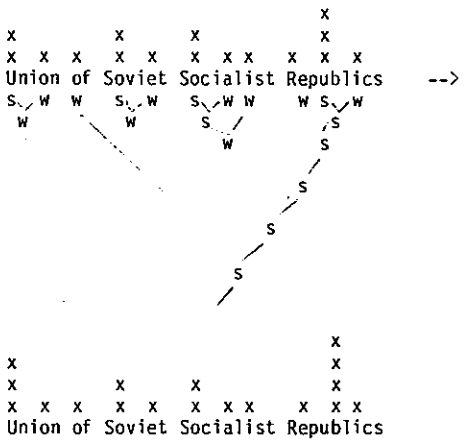
Tópics in the Thèory of Gènerative Grámmar

when wé were disagrèeing about Stàcy and éric

Í think you're nòt being entírely hónest

Following I give the derivation of the first example in (43) above.

(44)



The tick introduced does not contribute to eurhythmy via the Quadrisyllabic Rule or the Disyllabic Rule; its introduction is motivated by the Phrasal Rule.

3.2.2 Clash Resolution

What does all this have to say about the Clash Resolution Hypothesis of chapter two? Faced with such facts, must we abandon the Clash Resolution Hypothesis? No, although Hayes seems to be correct in noting the intrusion of eurhythmy into the clash resolution picture, I will argue that it is inappropriate to deny clash any role at all in this system. Rather, the picture that emerges from the eurhythmy proposal is that eurhythmy has to be considered a condition on clash resolution.

In the following two sections I will show that first, the Disyllabic Rule is more profitably construed as Clash Resolution rather than an independent eurhythmic target. Second, that the Quadrisyllabic Rule is not a eurhythmic target in itself, but a constraint on Clash Resolution.

Recall the original formulation of the Clash Resolution Hypothesis, repeated below from (37) in chapter two.

(45) Clash Resolution Hypothesis

If a language has one or more destressing rules, then those rules must operate so as to remove clashes.

This principle guarantees that prune alpha only applies to remove clashes. The question before us is whether it also constrains the phrasal Rhythm Rule.[5] In particular, are the phenomena described by the Disyllabic Rule explainable under the Clash Resolution Hypothesis?

The Disyllabic Rule seems rather close to the Clash Resolution Hypothesis in the following sense: the Disyllabic Rule seems to have the "function" of allowing clashes to be resolved, provided new clashes are not created. In other words, one can see the Disyllabic Rule as Clash Resolution expressed as the condition that its output contain fewer clashes than its input. This reconceptualization of the Disyllabic Rule is tantalizingly close to the formulation of the Clash Resolution Hypothesis, and seemingly identical in spirit. With this in mind, one can reformulate the Clash Resolution Hypothesis to include this "clash-reducing" function of phrasal rhythm. The reformulation is given as (46) below.

(46) Revised Clash Resolution Hypothesis

Prosodic transformations must operate so as to minimize clashes.

The principle in (46) has been revised in two respects. First, it has been generalized to include any rule manipulating prosodic structure

[5]Notice that this is an independent question from what the structural change of phrasal rhythm is. Saying that phrasal rhythm is governed by the Clash Resolution Hypothesis does not necessarily oblige us to

instead of just destressing rules. Second, it incorporates the intuition expressed in the discussion above, that prosodic rules minimize clashes, rather than simply eliminating particular clashes.

This formulation of the principle has several advantages. First, it accounts for the apparent alternating pattern produced by the Rhythm Rule at the level below the scansion level that Hayes attributes to the Disyllabic Rule. Second, it can account for the same property of Beat Addition; namely, that it too creates an alternating pattern at the level below the scansion level. Beat Addition must have this property, because, as a rule manipulating prosodic structure, it must fall under the Revised Clash Resolution Hypothesis. The condition that it not produce clashes is required by the clash minimization clause of the Hypothesis.

3.2.3 Why prefer Clash Resolution?

Given that the revised Clash Resolution Hypothesis and the Disyllabic Rule cover the same data, which is preferable? Clearly, the Clash Resolution Hypothesis is preferred in light of the word-internal data accounted for by the Clash Resolution Hypothesis but unaccounted for by the Disyllabic Rule. The Clash Resolution Hypothesis can account for word-internal rhythm and destressing and phrasal alternation below the scansion level. The Disyllabic Rule is far less general because it can only handle the phrasal alternation facts below the scansion level. Thus we adopt the more general theory.

---

see phrasal rhythm as prune alpha, although there might be motivation for such a position. This will be explored below.

In addition, the Clash Resolution Hypothesis is also more general in scope phrasally, as there are phrasal data that the Clash Resolution Hypothesis can account for that the Eurhythmy Theory cannot account for. It is to these data that I now turn.

3.2.4 The Quadrisyllabic Rule and Metrical Locality

In the following section, I argue that the Quadrisyllabic Rule must also be seen as an instance of Clash Resolution. In this case though, the eurhythmic principle remains as a condition on Clash Resolution.

This section is organized as follows. First, it is shown that there is a class of exceptions to Hayes' Quadrisyllabic Rule. These forms and others can be accounted for by the Clash Resolution principle. However, there still remain some additional forms that require that some form of the Quadrisyllabic Rule be retained: the Quadrisyllabic Condition on prosodic rules. The particular class of data requiring this condition suggest that an additional principle governing the access of the Rhythm Rule to the Quadrisyllabic Condition is necessary. The requisite condition is Metrical Locality, and has independent motivation.

3.2.4.1 Some Apparent Counterexamples to the Quadrisyllabic Rule

There are cases where the Quadrisyllabic Rule is apparently violated. In (47) below we repeat the original data from (22) which motivated the Quadrisyllabic Rule. These can be contrasted with (48) where some apparent counterexamples are given.

(47)

Mîssissìppi Mábel	Mìnneâpolis Míke
Pûnxatàwny Péte	Pàssacônaway Péte
ânalỳtic thóught	ànalŷtical thóught
díacrìtic márkings	dìacrîtical márkings
the Pâssamaquòddy vérb	the Pòtowâtomi vérb
Âlabàma rélatives	Àlabâma connéctions
Êuropèan hístory	Èuropêan históríàn
Ôklahòma cóngressman	Òklahôma congréssional district
twô thòusand óne	twò thôusand and óne

(48)

Sânta Mònica Cóllege

Sôuthern Àrkansas Téch

Míddle Amèrica Blúes

ôddly còmical féllow

ânti-gòvernment rálly

êager-bèaver àcrobátics

grîd-theorètic appróach

Sôuth Korèan diplómacy

nôn-trìvial ánswer

The output grid shapes for the first example from the second column in (47) and the first item in (48) are given below in (49).

(49)

```
             12                              13
          10     11               11           12
        7   8     9               8      9     10
        1  23 4 5  6              1  2  3 4 5   6  7
       Mìnneápolis Míke           Sánta Mònica Cóllege
```

There is rhythm in the latter, although the two examples are prosodically identical. In neither, does rhythm move the grid toward the eurhythmic goal of the Quadrisyllabic Rule.[6] In addition, note that one cannot simply throw up one's hands at these examples. The class is potentially infinite as we will see below.

The generalization separating the counterexamples from the good cases seems to be that the counterexamples all involve more than one word or a #-level prefix. In contrast, relabelling is always within the domain of the word for the cases obeying the Quadrisyllabic Rule. The problem though is that this does not follow from anything in the theory.

3.2.4.2 An Analysis

In this section, I will demonstrate how the generalization sketched above can follow from a simple principle governing prosodic rules if the Quadrisyllabic Rule is reformulated not as a eurhythmic target, but as a condition on Clash Resolution.

3.2.4.2.1 The Quadrisyllabic Condition on Clash Avoidance

Let us assume that the Quadrisyllabic Rule is better stated as a condition on Clash Avoidance. This requires that we revise the Quadrisyllabic Rule and give an appropriate formalization that will allow the good cases to be generated. Below, in (50), I give the Quadrisyllabic Rule, repeated from (23) above.

(50) Quadrisyllabic Rule

> A grid is eurhythmic when it contains a row whose marks are spaced close to four syllables apart.

In (51), the rule is restated as a condition on Clash Resolution.

---

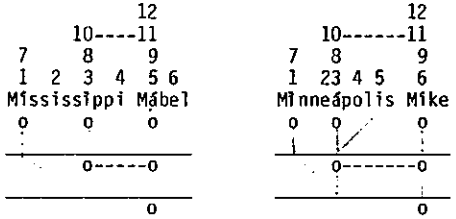
[6] One might well wonder why application does not move these examples toward the rhythmic ideal expressed by the Phrasal Rule. Apparently, the Phrasal Rule does not exert sufficient pressure to induce relabelling in these contexts. It should be clear though

(51) Quadrisyllabic Condition

> A prosodic rule may apply if its output increases eurhythmy by containing a row whose marks are spaced close to four syllables apart.

This is meant to apply in conjunction with the Clash Resolution Hypothesis, and has the effect of only allowing Rhythm or Beat Addition to apply when they satisfy both the Clash Resolution Hypothesis AND the Quadrisyllabic Condition. This mode of operation can account for the same data that Hayes accounted for with his Quadrisyllabic Rule. Following are the arborealizations of the first examples from each of the columns in (22). In both cases there is a clash, as indicated in the grid or tree, but only in the former are both the Quadrisyllabic Condition and the Clash Resolution Hypothesis satisfied. This means that Rhythm will apply only in the former although both contain clashes.

(52)



that this is not a problem just for the counterexamples presented, but for Hayes' original examples as well: Mínneàpolis Míke should also be more eurhythmic by the Phrasal Rule. This will not turn out to be a problem for the analysis to be presented.

3.2.4.2.2 Metrical Locality

To account for the possibility of rhythm in the examples in (48), we need an additional constraint: Metrical Locality. In earlier work (Hammond, 1982) I proposed Metrical Locality as a constraint on what kind of information a prosodic rule can refer to in its structural description.

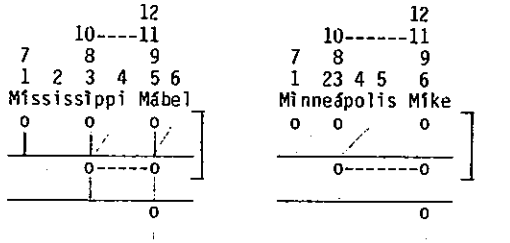
> "...rules manipulating elements at one level [can] refer to their immediate structural level, but not to structure beyond their domain--be it syllable, foot, etc." (p. 215)

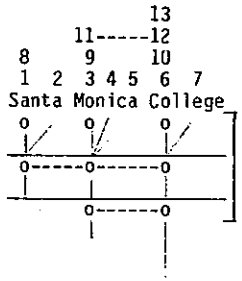
This principle was motivated by several sets of facts. First, it has been observed that tree construction is local in this sense. Specifically, rules of tree construction can look at the branchingness of immediate constituents, but no deeper. Thus word tree construction can be sensitive to the branching of feet, but not to the constituent structure of syllables of those feet. Second, it has been argued that foot-domain rules in phonology, rules manipulating segments on the basis of foot-constituency, are excludable in principle from phonological theory. This exclusion is effected by Metrical Locality as well. (Hammond, 1982, p. 215)

This condition also predicts the division of data presented above in (47) and (48). That is, under this condition, one expects that the Quadrisyllabic Condition will be inapplicable on the word level, because when the elements manipulated are on the word level, to invoke the Quadrisyllabic Condition would require access to nonlocal information. To see this, compare the following arborealizations of examples from (47) and (48) above. In each case, the grid is included redundantly. To determine a syllable count for satisfying the Quadrisyllabic

Condition in the first two cases, one only has to look one level down. In the third case though, one has to look <u>two</u> levels down to determine a syllable count for satisfying the Quadrisyllabic Rule.

(53)





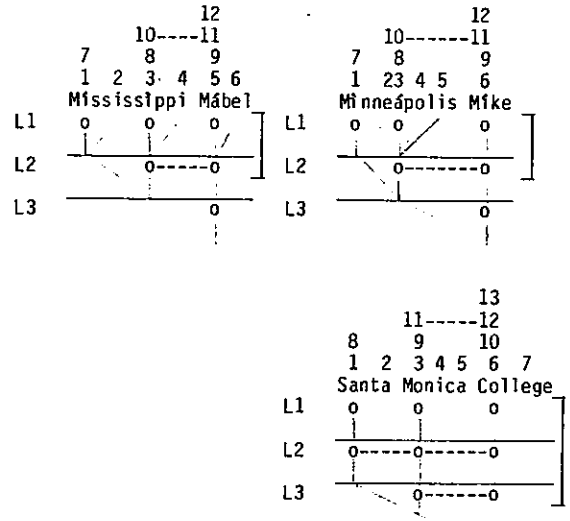
To make this clear, let us formulate explicitly the condition of Metrical Locality. It is given below as (54).

(54) Metrical Locality

A rule operating on level n in the metrical hierarchy cannot refer to structure on level m, where $m > n+1$ or $m < n-1$.

To make sense of the formalism, let us reconsider the trees above, but with the levels indexed as required by (54).

(55)



Clearly nothing hinges on whether the levels are numbered top to bottom or bottom to top, since Metrical Locality is bidirectional. The crucial property of these trees is that in the first two, the clash is on L2 and syllables are on L1; in the third representation, the relevant clash is on L3 and syllables are on L1. If 'n' equals 3, then the Rhythm Rule cannot consider number of syllables, because that would have to be determined on L1, $n = 1$, and $3 > 1 + 1$.

3.2.5 Summary

In the preceding section, it was demonstrated that eurhythmic targets must be included in any conception of phrasal rhythm and Beat Addition in English. It was also established that this did not preclude the operation of the Clash Resolution Hypothesis phrasally. In fact, a

trivial reformulation of that Hypothesis enabled it to constrain the rule of Beat Addition also. Moreover, it allowed us to simplify the complex of Eurhythmy targets by factoring out the Disyllabic Rule, which was shown to be an artifact of Clash Avoidance.

Finally, it was shown that the Quadrisyllabic Rule operated in conjunction with Clash Resolution to account for the data presented above in (47) and (48). This account was made possible by the simple extension of the Metrical Locality condition to mediate the applicability of the Quadrisyllabic Condition to instances of the Rhythm Rule or Beat Addition. The prediction is that the Quadrisyllabic Condition is relevant only to the relabelling of feet, because only then can one have access to syllable count.

An additional argument for the current theory is that it accounts directly for the apparent asymmetric nature of the Phrasal Rule. Recall the formulation of the Phrasal Rule, repeated from (40).

(56) Phrasal Rule

A grid is more eurhythmic if its second highest level bears two marks, spaced as far apart as possible.

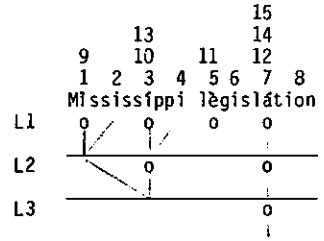
Hayes observes that this rule is asymmetrical compared to the Quadrisyllabic and Disyllabic Rules: "...the target is not really a doubling of the quadrisyllabic interval. Instead, the second strongest stress is placed as early as possible in the phrase, even at the expense of binary alternation." (p.25)

This asymmetry follows though as a natural consequence of the inaccessability of information concerning syllable-counts at levels L2 and up. At these levels, Metrical Locality will always prevent access to

L1, thus preventing the quadrisyllabic influence from pervading the system. We therefore do not expect perfect binarity to pervade the higher levels.

A further consequence is that the cases of conflict between the Quadrisyllabic Rule and the Phrasal Rule are no longer anomalies. Hayes observes that in examples like the following the Quadrisyllabic and Phrasal Rules make different predictions.

(57)



Hayes claims that the Phrasal Rule wants tick #13 to retract to initial position, but that the Quadrisyllabic Rule wants it to remain where it is. To account for the stability of #13, Hayes suggests that the Quadrisyllabic Rule has more "weight" than the Phrasal Rule. On the view being developed here, no such "weightiness" is necessary. Tick #13 does not retract because that would require a retraction on level L2 of the arboreal grid. Such a retraction is out because it violates the Quadrisyllabic Condition on the Rhythm Rule. The Phrasal Rule does not even enter the picture because it is only applicable when Metrical Locality permits the Quadrisyllabic Condition to be violated - on level L3 or higher. Thus there is a straightforward explanation for the apparent ranking of the two eurhythmic targets that on the alternative view had to be stipulated.

3.3 Rhythm in Disyllables: Prune Alpha and the Rooting Constraint

The preceding sections have established: 1) that DTE-trees are perspicuous representations for phrasal stress, and 2) that the Clash Resolution Hypothesis holds at the phrasal level. In this section, I will test whether the theory of Chapter Two extends to the phrasal level; that is, does phrasal rhythm reduce as well to prune alpha?

The organization of this section is as follows. First, I outline the facts for rhythm in disyllabic modifiers like divine, supreme, and bamboo. I argue that the current treatment of these in the literature is backwards. Examples like bamboo that undergo phrasal rhythm in phrases like bamboo curtain are, in fact, the exception, not the rule. On the other hand, examples like divine and supreme that do not undergo rhythm in phrases like divine guidance or supreme court are rule-governed, not part of an exceptional class. This switch in perspective turns out to be crucial. It allows straightforward derivations of the divine guidance class of examples, and also provides for a simple treatment of the exceptional cases: bamboo curtain.

This treatment rests crucially on the utilization of the prune alpha mechanism as the mechanism of rhythm rather than relabelling. In addition, it rests on an additional principle - Prosodic Rooting. This principle constrains prune alpha in a superficially trivial way: it disallows it from destressing a word completely. This is shown to have deeper consequences than imagined.

3.3.1 Disyllabic Modifiers

The examples in (58) below show the application of the Rhythm Rule to simple disyllabic modifiers. The application of the rule is predicted here by the eurhythmy theory in virtue of both the Quadrisyllabic Rule and the Phrasal Rule. It is predicted by the Liberman & Prince theory because all applications here relieve clashes on the grid. The grid of the input to rhythm for the first example is given in (59).

(58)

bâmbòo cúrtain

Mâltèse fálcon

Chînèse chéckers

thîrtèen mén

wêll-bùilt bridge

(59)

```
          7
      5---6
  1   2   3   4
bàmbôo cúrtain
 +   +   +   -
 w   s   s   w
  \ /     \ /
   w       s
```

The examples in (60) below show that the Rhythm Rule does not apply when the modifier has a reduced penult. The input grid for the first example is given in (61)

(60)

*êxàct chánge

*mâtùre áudiences

*bâssòon blúes

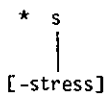
*dîvîne wind

(61)

```
          6
    4-----5
  1 2     3
exâct chánge
 - +     +
 w s     s
  \ /
   w
```

This is predicted by the Liberman & Prince theory because of their

filter (62), repeated from (41) in chapter two.

(62)


If the Rhythm Rule were to apply in (61) above, it would be retracting stress onto a [-stress] syllable thereby violating (62).

This does not account for the following data, though.[7] In these cases, rhythm is judged ungrammatical.

(63) *únîque stóry
*grótèsque sight
*fórlòrn hópe
*bábòon's clútches
*óvèrt PRO
*úrbàne póet
*Súprème Court

These cases are not observed by Liberman & Prince, and would presumably have to be marked as exceptions to the Rhythm Rule.

3.3.2 Trisyllables and Longer

There are, however, additional facts that bear on the treatment of the exceptional items in (63). Following in (64) are polysyllabic modifiers like Tènnessée and Mîssisippi, where the secondary precedes the primary syllable by at least two syllables. There are no exceptions to the Rhythm Rule whatsoever among examples of this sort.

[7]Some of these data are originally due to Hayes (forthcoming).

(64)

M̂ississippi Mábel	Tênnessèe Williams
Cônestòga Cónnie	Lâfayètte Squáre
Âlabàma Rólls	Bêrnadètte Péters
Ânacònda Stéel	Jûliètte Jónes

This is in contrast to trisyllabic modifiers like Mòntána or sàlvátion, where one does observe some exceptionality. In (65) below, are given some forms of this sort that do not undergo the Rhythm Rule (under a.) and some that do undergo the Rhythm Rule for some speakers (under b.).

(65)

a.	b.
Mòntâna cówboy	Sâlvàtion ármy[8]
àblâtion blúes	côsmètic súrgery
dîdâctic réasoning	trânspàrent fálsehood

What is left unexplained by the treatment of Supreme Court as an exception to the Rhythm Rule is why the exceptions cluster the way they do. Why are phrases like Supreme Court and Montana cowboy exceptions, while Mississippi Mabel and Lafayette Square are not?

3.3.3 The Generalization

If one compares the two classes of cases, the generalization that seems to emerge is that exceptions are possible where retraction would only pull the stress one syllable away; i.e. where the extraction site and landing site are adjacent. In more theory-dependent terms, exceptions are permitted when a syllable-level clash is present.

It is not immediately clear how this generalization can find formal

[8]Some of the data in column two are originally due to Bollinger (1982).

reflection in the theory, however. The tack I would like to take is to attempt to derive this generalization from a deeper one. Exceptions to the Rhythm Rule like Supreme Court and Montana cowboy will be related to examples like divine right. These do not undergo rhythm because of the reduced penult. The reason Supreme Court and Montana cowboy cannot undergo rhythm is that, in a sense to be made precise below, their initial syllables are stressless, though this does not show up as reduction.

The data in (66) are suggestive in this regard. (66a) gives disyllables that undergo rhythm, where the penults have been replaced with schwas. (66b) gives disyllables that do not undergo rhythm, and again the penults have been replaced with schwas. When confronted with these pronunciations, speakers overwhelmingly judge the second class as more "natural".

(66)

a.		b.	
	*bəmbú		ʔyəník
	*əbstrǽkt		ʔgrətísk
	*məltíz		ʔfərlórn
	*cəníz		ʔbəbúnz
			ʔəvít
			ʔsəprím

On independent grounds, something has to be said to explain the possibility of reduction in the second column, but not in the first. This "something" will also explain why rhythm is impossible in the second column. Basically, the words in the second column have undergone prune alpha, making their penults susceptible to reduction. The words in the first column have not undergone prune alpha, rendering their

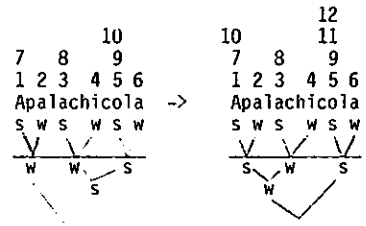
penults invulnerable to reduction, but, as we will see below, allowing them to undergo phrasal rhythm.

In order to make this analysis go through, several auxiliary principles will have to be made clear. In the following sections, I digress to explain the necessary principles, and the motivations for them. Fortified with the necessary equipment, I return to formalize the analysis sketched here in section 3.3.7.

3.3.4 Beat Addition

Hayes, in his eurhythmy theory, is led to claim that Beat Addition is actually arboreal adjunction. That is, rather than an operation solely on the metrical grid, Beat Addition actually adjoins one limb of a metrical tree to another. Below, in (67), a partial derivation of <Apalachicola> is presented, showing how his rule operates. The medial branch is adjoined as a weak sister of the preceding branch. This increases eurhythmy by the Quadrisyllabic Rule, the Disyllabic Rule, and the Phrasal Rule.

(67)



Reformulating the rule in this fashion affords Hayes a number of advantages. The major advantage is that it allows him to collapse the Rhythm Rule and Beat Addition, because the Rhythm Rule can also be seen as an adjunction. Hayes' generalized rule is given below as (68).

(68) Rhythmic Adjustment

In the configuration ... X Y ..., adjoin Y to X.

Discussing (68) and the Rhythm Rule, Hayes says the following:

> "A final argument for the approach I have taken involves the relationship of the Rhythm Rule and what was earlier referred to as Beat Addition. When Beat Addition is reformulated as Rhythmic Adjustment, it turns out to incorporate the Rhythm Rule as a special case: the Rhythm Rule is simply Rhythmic Adjustment when X and Y happen to be sisters. In such a configuration, adjunction is vacuous as far as constituent structure goes, but the universal requirement that adjoined elements be labeled weak induces a shift of labeling." (p.46)

In this section, I will argue that it is possible to gain the same result - collapsing Beat Addition and the Rhythm Rule - within the prune alpha framework. This has the advantage of collapsing not just Beat Addition and the Rhythm Rule, but, as demonstrated in Chapter Two, of also collapsing these rules with word-internal rhythm and destressing.

In collapsing Beat Addition and the Rhythm Rule, both theories have to deal with a phenomenon that has two formal steps. One step is pruning and the second step is adjunction. Liberman & Prince handled this with a single operation: relabelling. Hayes' theory attempts to get the pruning part for free. If Y is adjoined to X, then Y is automatically pruned from its mother node (whatever it happens to be). The prune alpha theory does this the other way around. Nodes are pruned from the tree, and the adjunction follows by general principle: nodes are not left unmoored, but must be remoored as weak sisters on their own prosodic levels.

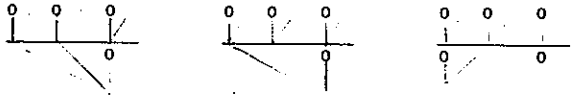
The question to ask when evaluating these alternatives is which alternative is cheaper. Does pruning come for free, or does adjunction? Viewed at in the light of word-internal rhythm and destressing, one must

answer that the latter - adjunction - is what comes for free. This is because one needs for independent reasons a convention of Stray Syllable Adjunction to adjoin extrametrical syllables or syllables created by rule.[9] This independently required principle extends straightforwardly to provide the adjunctions needed in the phrasal applications of prune alpha.

In contrast, there is no evidence of a pruning convention elsewhere in the grammar. Thus an appeal of the sort Hayes requires to get his version of Rhythmic Adjustment to work must be reckoned as an ad hoc effect adding cost to that analysis.

This being the case, we must show that prune alpha plus automatic weak adjunction on the phrasal level can do the same work as Beat Addition. This, in fact, is rather trivial. Prune alpha can provide a derivation of (67) above nearly analogous to the one provided by Rhythmic Adjustment. The only difference is that prune alpha is followed by the adjunction convention. This derivation is given below as (69).

(69) Apalachicola -> Apalachicola -> Apalachicola



Since Stray Syllable Adjunction has been extended in this way, it should be reformalized for explicitness. The reformulation is given in (70) below.

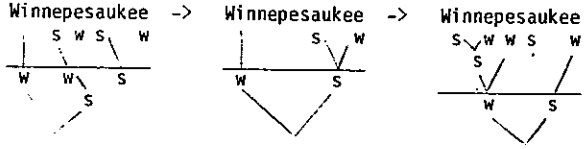
[9] Cf. Hayes (1981).

(70) Weak Sister Adjunction

A pruned constituent is remoored to the tree as a weak sister, preferably to the left.

The underlined clause is the phrasal instantiation of Hayes' structure-preserving condition on Stray Syllable Adjunction. In word-internal destressing cases, Hayes observed that the unmoored syllable was remoored to the left if there was something on the left to remoor to. This is exemplified in the following partial derivation involving Poststress Destressing.

(71)



Hayes attributed this fact to structure-preservation since feet are left-dominant. However, this clearly will not wash on the phrasal level, and we substitute the directional preference for the structure preservation condition, since it will work on all levels.

3.3.5 Prosodic Rooting

In this section, I argue for the existence of a constraint on prune alpha called Prosodic Rooting. This constraint is independently required and is crucial in the analysis of phrasal rhythm sketched above.

The constraint, in its simplest form, is actually a formalization of a truism of prosodic phonology. It requires that all words bear a word stress. To say it is a truism though does not exempt it from formalization, and, in fact, by formalizing it we find that there are additional consequences of the constraint not evident on casual assumption.

The constraint is given in (72) below.

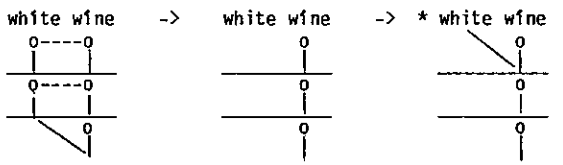
(72) Prosodic Rooting

A lexical item must contain a word stress (word-level DTE) at all levels of the derivation.

The most direct consequence of the constraint is that lexical items must receive a word stress. Thus a word like book must receive stress via the stress assignment mechanism. The constraint does not require that words like and receive a word stress though. Since and is a function word, it is free to remain unstressed from the very beginning of the derivation. Without this constraint, one might expect to find nouns in English that were stressless alongside of the stressed nouns.

Within the prune alpha framework, another consequence of the constraint is that it prevents prune alpha from removing word stresses and leaving words stressless in order to resolve clashes. The following derivation exemplifies the kind of derivation precluded by the constraint.

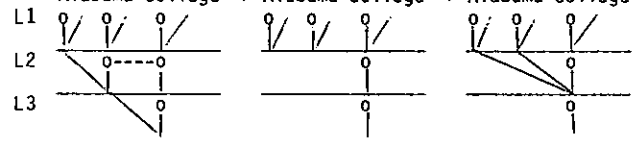
(73)



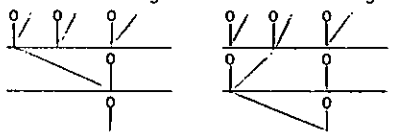
The constraint also governs the application of prune alpha in its Beat Addition mode. When a constituent is removed in a clash environment, the output can then undergo further applications of prune alpha to meet the eurhythmy conditions. In such a case, the impetus for further application of prune alpha can also be based on potential violations of the Prosodic Rooting Constraint.

This is exemplified in the following derivation (74). First, prune alpha applies to relieve the clash on L2. Then Weak Adjunction adjoins the remnants to the right since there is nothing to the left. Then prune alpha, motivated by the eurhythmy conditions, applies a second time to prune the medial foot. This allows Weak Adjunction to reapply adjoining the pruned medial foot to the left, since there is now an element to the left to be adjoined to.

(74) Alabama college -> Alabama college -> Alabama college ->



-> Alabama college -> Alabama college



This last point does not argue that the constraint is independently needed, because the derivation is guaranteed by the eurhythmy conditions. It demonstrates that the constraint operates in concord with existing principles and mechanisms.

Notice though that the constraint need not be satisfied at all levels of the derivation. In this case, the constraint is violated for much of the derivation. All that matters is that at the end of the derivation, the constraint is satisfied.

3.3.6 Syllable-Adjunction Prohibition

In this section, I will argue that there is also independent evi-

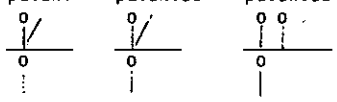
dence for a constraint against adjoining syllables to mere syllables via the Adjunction convention.

The argument for this concerns the existence of stressless stress-neutral suffixes in English like -able, -ed, or -es. These suffixes adjoin to words without altering the stress patterns of the word. For example, the verb plánt has the past tense form plánted, and the stress is not altered by adding the suffix. Presumably, this is because the suffix is merely adjoined by convention as a weak sister, and stress is not reassigned.

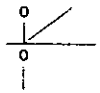
However, contrast this with the following example: pátent and pátented. In this case, the suffix also does not affect the stress pattern of the base. However, given the formulation of the Adjunction Convention, it is not at all clear why suffixation here does not produce pátènted.

The derivation below in (75) exemplifies how this might happen. First, the suffix is added to the base. This provides the input to Adjunction which is then faced with the apparent option of adjoining the suffix to the preceding foot, or the preceding syllable. If it is adjoined to the preceding syllable, the form *pátènted results. If it is adjoined to the foot, then pátented results. The second form is given in (76) below.

(75) pátent -> pátented -> pátènted



(76) pátented



This fact about the adjunction convention suggests that it should be restrained so that it does not adjoin syllables to other syllables thereby creating additional stresses. This constraint is given below as (77).

(77) Syllable-Adjunction Prohibition

Weak Adjunction cannot adjoin syllables to other syllables.

3.3.7 The Analysis

Let us now return to the original problem, showing how Rooting and the Syllable Adjunction Prohibition provide a solution. Recall that disyllabic modifiers in which the penult is reduced or "susceptible to reduction" are insusceptible to phrasal rhythm. We assume that words like divine have undergone word-internal prune alpha. This produces one of the following representations.[10]

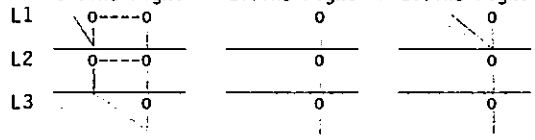
(78) divine divine

In either case, there is no way to apply prune alpha phrasally without violating one of the conditions proposed above. This is demonstrated in the following derivations. First, a derivation where prune alpha has removed the DTE of divine because of clash must end up

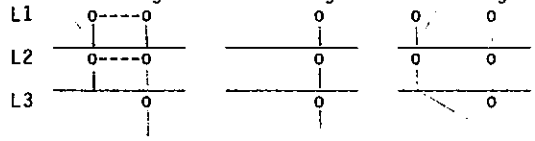
[10]Hayes adopts the analog of the second structure because of his structure-preservation condition. Since we have eliminated this condition in favor of the directional bias for adjunction, this particular structure is unmotivated, and can be replaced with the first. I know of no argument choosing between these, so personal esthetics will dictate the first.

feeding Weak Adjunction. This forces either of the adjunction strategies illustrated in (79) or (80) below. In the first case, the Prosodic Rooting Constraint is violated as the output of the derivation has no word stress for divine. In the second derivation, the Rooting convention is not violated, but the Syllable Adjunction convention is violated, because the pruned syllable has been adjoined to the initial syllable.

(79) divine right -> divine right -> divine right

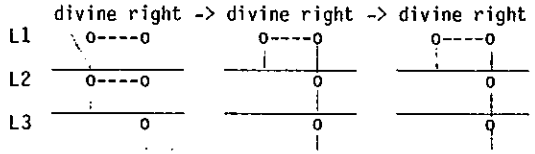


(80) divine right -> divine right -> divine right

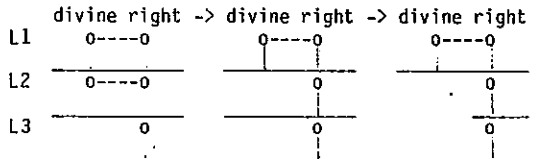


One possible alternative to these derivations is to leave the syllable level clash unresolved, and go straight for the L2 clash. This also does not work, for the same reasons. The unmoored foot has no place to reattach without violating Rooting. This is illustrated in (81) and (82) below.

(81)



(82)



Recapitulating, the analysis presented avoids rhythm in forms like divine by allowing word-internal prune alpha to bleed phrasal rhythm. The inapplicability of rhythm to divine therefore has nothing to do with the reduced penult, although, of course, the reduced penult provides independent confirmation that pruning has applied word-internally.

This can be contrasted with allegation, where word-internal prune alpha does not bleed phrasal rhythm. This is because prune alpha does not apply until the word level. At that point the Trigger Prominence Principle guarantees the correct output.

This analysis predicts the existence of cases where phrasal rhythm is inapplicable, yet the penult is unreduced. Such a case would have to have a heavy penult or be marked as an exception to reduction, but would provide support for the analysis presented. In fact, this possibility seems to be instantiated in the examples like overt PRO presented above in (62). While these do not undergo reduction, and some would presumably have to be marked as exceptions to the reduction rule, they also do not undergo the Rhythm Rule. The nonapplicability of the Rhythm Rule falls out from their having undergone word-internal prune alpha;

the nonapplicability of the reduction rule from their having heavy penults or being marked as exceptions to that rule.

3.3.8 Summary

In the preceding section, it has been argued that it is possible to account for phrasal rhythm with the rule prune alpha. This new account treats rhythmic stress shifts not as a relabelling process on trees, or an asterisk movement on grids, but as a pruning process on the arboreal grid. As such, the analysis has the virtue of positing only one mechanism for dealing with both word-internal and phrasal rhythm and destressing.

The analysis presented above is modular in the following sense. It results from the interaction of several independently motivated principles of grammar. One of these principles is prune alpha, a "rule" that prunes constituents subject to the Clash Resolution Hypothesis and the Eurhythmy Conditions discussed in sections 3.1 and 3.2. This rule performs the function of both the Rhythm Rule and Beat Addition. It is limited by a set of conditions that are general in nature, and are independently motivated. One of these principles is Metrical Locality. This principle limits the accessability of metrically distant information. In this capacity, it limits the constraining effects of the Quadrisyllabic Condition. Because the Quadrisyllabic Condition requires access to L1, it cannot apply on L3 or higher. Another principle limiting the application of prune alpha is Prosodic Rooting. This principle formalizes the isolate truism that all lexical items are stressed, and uses this to prevent the rule of prune alpha from decimating the stress system. Another major principle of the system is the

Syllable-Adjunction Condition which prevents Weak Adjunction from adjoining syllables to syllables and creating new DTEs on L1.

These principles interact to account for the application of phrasal rhythm - prune alpha - to different modifiers. Modifiers like divine cannot undergo phrasal rhythm because word-internal pruning has rendered them unprunable on the phrasal level, as any pruning would result in a violation of one of the principles discussed above, i.e. Rooting or the Syllable Adjunction Prohibition. Modifiers like overt also cannot undergo phrasal rhythm. This is for the same reason, as these words have also undergone word-internal pruning rendering them unprunable on the phrasal level. In the case of this latter class, as argued above, the reduction rule is inapplicable.

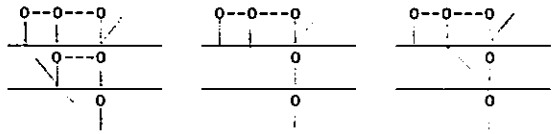
3.3.9 Examples like bamboo curtain

There are still a few questions left unanswered. First, what of the disyllabic modifiers in which Rhythm does take place, such as bamboo? Second, why is there a difference in the availability of reduction for the penults of words like bamboo (no reduction) and overt (possible reduction)? Lastly, why are there exceptions to rhythm only when the extraction site and landing site are adjacent?

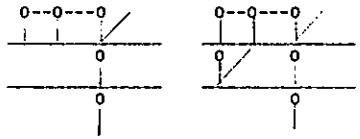
With regard to the first point, I would like to suggest that phrasal rhythm is possible in bamboo curtain because such words are marked as exceptions to syllable-level prune alpha. This means that, on the phrasal level, these items can undergo prune alpha without violating either Prosodic Rooting or the Syllable-Adjunction Condition. This is exemplified in the derivation of bamboo curtain in (83). In this derivation, prune alpha applies on L2 phrasally, removing the word

stress of bamboo. Weak Adjunction then adjoins the unmoored material to the foot on the right. Prune alpha, propelled by the eurhythmy conditions, then prunes the medial foot, allowing Weak Adjunction to adjoin it to the left. Since this occurs on L2, the Syllable Adjunction Prohibition is not violated, and the derivation is legal.

(83) bamboo curtain -> bamboo curtain -> bamboo curtain ->



-> bamboo curtain -> bamboo curtain



Thus the different lexical entries for the three classes of modifiers now look like (84).

(84) divine_A overt_A $\text{bamboo}_{A,[\text{-prune alpha}]}$

In fact, by treating the traditionally "normal" bamboo curtain examples as exceptions, a number of desiderata are achieved. First, it is now clear why reduction in the overt class is preferred to reduction in the bamboo class. The overt class actually "should" undergo reduction more readily, in the sense that the reduction rule is more applicable to such forms, because the penults are stressless. In contrast, the bamboo class could never undergo reduction because they never undergo word-internal prune alpha. The exceptionality marking predicts the different intuitions about the applicability of reduction.

Second, this treatment can account for why the exceptions to rhythm seem to cluster in modifiers where the extraction site and landing site are adjacent: bamboo vs. overt, and Salvation vs. Montana. These are the classes where one would expect word-internal prune alpha to bleed phrasal rhythm. This bleeding relationship does not exist when the extraction site and landing site are nonadjacent. It is therefore going to be in these classes that an exception feature like [+prune alpha] can play a role. In other cases, where landing site and extraction site are nonadjacent, prune alpha is not applicable word-internally, and the exception feature is irrelevant.

The examples in (85) show this point graphically. The left column gives forms where word-internal prune alpha is applicable. The right column gives forms where word-internal prune alpha is inapplicable. The top row gives forms where prune alpha (PA) has applied, feeding reduction (R). The second row contains forms where prune alpha has applied, but where reduction is inapplicable. The third row contains forms that are marked as exceptions to word-internal prune alpha, or where it is inapplicable.

(85)

	PA applicable	PA inapplicable
PA and R apply	divine, banana	---
PA applies	overt, Montana	---
	no rhythm	
neither applies	bamboo, Salvation	Tennessee, Mississippi
	rhythm	

3.3.10 Conclusion

The modular analysis proposed above can account for facts not even considered by the previous analysis. First, the present analysis can account for intuitions about reduction and its relationship to phrasal rhythm, as in bamboo vs. overt. Second, the current analysis can account for why there are "exceptions to rhythm when only one syllable precedes the main stress, but none in other words. Both of these explanations depend crucially on prune alpha being the core of the phrasal rhythm process. Prosodic Rooting and the Syllable Adjunction Prohibition were indispensable as well. However, the overarching methodology of extracting out universal principles from language-particular rules has been pivotal in achieving the advances indicated.

Chapter Four

Rhythm and Destressing in Tunica

4.0 Introduction

In the preceding chapters, a modular theory of metrical transformations has evolved, motivated mainly by data from English. In this chapter, I will consider the stress system of Tunica, showing how it can be characterized in terms of the theory developed.

First, I outline some of the nonprosodic phonology: vowel harmony, syncope, and apocope. Some of these are considered so as to make the remainder of the exposition intelligible, but some interact directly with the principles developed in Chapter Three, and thereby provide motivation for that theory.[1]

Next, I present the basic stress facts, showing how stress is assigned to monomorphemic forms. In short, the last syllable is made extrametrical, and trochees are constructed left to right. However, polymorphemic forms seem to be stressed differently. Rather than undergoing stress assignment directly, polymorphemic items are basically the result of concatenating morphemes that have undergone stress assignment, with the subsequent resolution of clashing stresses by various processes.

To account for the absence of clashing stresses, an analysis incorporating rhythm and destressing must be adopted. I argue, then, that

[1]For a more complete discussion of Tunica vowel harmony in particular, see Hammond (manuscript).

the most appropriate framework for this analysis is the framework developed in Chapters Two and Three.

4.1 Background

Tunica is a Native American language formerly spoken in Louisiana. The primary work on Tunica was done by Haas (1940) in the late 1930's. Additional work includes Gatschet (unpublished notes) and Swanton (1921), but Haas' is the most comprehensive. Since Haas' grammar, the only relevant work I am aware of has been done by Kisseberth (ms). In an early unpublished paper, he argues that Tunica exemplifies a rule conspiracy in the sense of his earlier paper on Yawelmani (Kisseberth, 1972). In Tunica, however, the rules conspire so as to avoid adjacent stresses. This early work is cited in the later Kenstowicz & Kisseberth texts (1977, 1979).

A caveat is in order. Tunica is quite extinct. The speaker Haas worked with in the thirties was the last speaker and he was in his seventies. Thus, despite the comprehensiveness of Haas' grammar, dictionary, and texts (1940, 1950, 1953), relevant data are not always available. This is not surprising as Haas could scarcely have predicted the relevance of forms for a theory to be developed a half a century later. There are therefore occasions when one would like more data, and the data are simply not there. Rather than attempting to reconstruct the crucial items, I have left gaps where they occur.

4.2 Phonemic Inventory, Syllabification, and Transcription Conventions

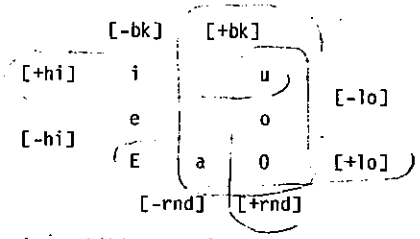
Haas gives the following as the vowels of Tunica.

(1)

	i	u
	e	o
	ɛ	ɔ
	a	

These vowels have their IPA values, except for [ɛ] which seems to be more like [æ]. Hereafter these will be given the representations and feature decompositions in (2)

(2)



Tunica exhibits the following consonant inventory. These segments have their IPA values, except <č> = [tʃ], <š> = [ʃ], <y> = [j], and <r> = [ɹ]. The segments in parentheses are very rare in native vocabulary.

(3)

p	t	č	k	ʔ
(b)	(d)		(g)	
f	s	š		h
w		y		
m	n			
	l			
	r			

Oversimplifying somewhat, the syllable in Tunica can be schematized as in (4).

(4) CVC^2

Onsets are obligatory, and codas are maximally bipositional. In (5) below are given some syllabified examples. Periods indicate syllable boundaries.

(5)

sá		'dog'
tás.le		'beautiful'
tír.wa.si		'claw,nail'
tá.wist.ʔE.ku		'the Mississippi'
ʔins.ʔE.pa		'we are happy'
há.yiht		'on top of'

Syllabification is not quite this simple, but this is sufficient to provide a frame of reference for the relevant nonprosodic phonology.

4.3 Height Harmony

Given the vowels above, one would expect a random distribution of vowels within roots. However, this is not the case. The following vowels are very rare in unstressed position: [e, o, E, O]. In fact, there are early borrowings from French that have high vowel reflexes for French mid vowels.

(6)

tíni	Fr. diner	'to dine'
súhpi	Fr. souper	'to eat supper'
káfi	Fr. café	'coffee'
téni	Fr. tinter	'to ring'

There are additional gaps as well: one does not find [E] or [O] word-finally or preceding a nonlow vowel. Conversely, one does not find the mid vowels before [a].

(7) * E C_0 # * e C_1 a * E C_1 (i, u, e, o)

* O C_0 # * o C_1 a * O C_1 (e, u, e, o)

The following patterns all occur, though.

(8)	E C_1 a	nÉra	'ghost'
		ʔíyusÉ̌la	'opossum'
		nÉla	'to roll'
	O C_1 a	cÓ̌ha	'chief'
		lÓta	'to run'
		hÓsani	'vine'
	e C_0 #	tá̌sle	'beautiful'
		mé	'to search'
	o C_0 #	hón	'yes'
		pó	'to look'
	e C_1 u	ʔéru	'to laugh'
		-éyu	'arm'
	e C_1 i	méli	'black'
		héri	'canoe'
	e C_1 e	-éhekuma	'younger brother'
		-éneri	'horns'
	o C_1 u	mólu	'full'
		wóru	'to teach'
	o C_1 i	ʔóni	'person'

For three cases, e C_1 o, o C_1 e, and o C_1 o, examples could not be found, but this may be because of the difficulty in finding examples with [e, o, E, O] in stressless position. The generalization is that the vowels [E] and [O] do not occur unless followed by [a], while [e]

and [o] do not occur before [a]. This suggests that there is a harmony rule like that in (9). This rule lowers nonhigh vowels before low vowels.

(9) Height Harmony

$$V \rightarrow [+lo] \;/\; \_\_\_\; C_0\ [+lo]$$
$$[-hi]$$

Interestingly, the rule does not apply across morpheme boundaries.

(10)	pó + káti	→	pókati	*pOkati
	look she-does		'she looks'	
	mé + káti	→	mékati	*mEkati
	search she-does		'she searches'	

The rule does apply within certain suppletive auxiliary verbs. The second feminine singular prefix is [he]. When this prefix occurs with these suppletive auxiliaries, there are alternations.

(11)	hÉra	'you lie'
	hÉna	'you sit'
	hÉsa	'you come'
	hÉya	'you go'
	híhki/héhki	'you are'

To account for this, the rule must be allowed to fill in feature values before morphemes are concatenated. On this view, the suppletive verbs are entered in the lexicon, and the "rule" applies to monomorphemes and suppletive polymorphemes before any morphological operations.

4.4 Rounding/Backness Harmony

Consider the class of prefixes marking inalienable possession.

(12)

	sg	du	du/pl	pl
1	ʔi		ʔin	
2m	wi		win	
	hi		hin	
2f				
	he		hen	
3m	ʔu	ʔun		si
3f	ti		sin	

Below, in (13), we see some simple forms which show how possession is marked.

(13)

ʔu + lu	-->	ʔúlu
his tongue		'his tongue'
ʔi + lu	-->	ʔílu
my tongue		'my tongue'

When these prefixes are combined with vowel-initial noun stems though, as given in (14), one observes a series of interesting alternations. It looks as if the two vowels coalesce into a single vowel with the backness and rounding values of the prefix vowel, but the height of the stem vowel. We will see below that actually the second vowel assimilates to the first in backness and rounding and then the first deletes.

(14)

ʔu + esi	-->	ʔósi
his father		'his father'
ʔi + esi	-->	ʔési
my father		'my father'
ʔu + ančayi	-->	ʔončayi
his wife		'his wife'
ʔi + ančayi	-->	ʔenčayi
my wife		'my wife'

Similar alternations occur when the quotative morpheme áni is

affixed to stems.

(15)

mólu	-->	molóni
full		'They say it's full.'
tášle	-->	tašlÉni
beautiful		'They say it's beautiful.'
míli	-->	milÉni
red		'They say it's red.'
lúpitEhE	-->	lúpitEhÉni
she didn't die		'They say she didn't die.'
mól?OhO	-->	mól?OhÓni
not full		'They say it's not full.'

As claimed above, the process should be factored into two separate rules: Syncope and Backness/Rounding Harmony. Evidence for this position is given in (16), where only the harmony rule is applicable. The syncope rule apparently does not apply here.

(16)

mé ʔáki	-->	mé?Eki
search she-did		'she searched'
pó ʔáki	-->	pó?Oki
look she-did		'she looked'

This suggests that the syncope rule is separate from the harmony rule. A preliminary formulation of the rule of Backness/Rounding Harmony is given below in (17). The rule says that a nonhigh vowel agrees in backness and rounding with a preceding vowel, possibly with a glottal segment intervening.

(17) Backness/Rounding Harmony[2]

$$V \rightarrow \begin{bmatrix} \alpha bk \\ \beta rnd \end{bmatrix} / V \; (([+glot]) \_\_ \begin{bmatrix} \alpha bk \\ \beta rnd \end{bmatrix}$$

$$[-hi]$$

[2]This rule is more detailed than the data presented so far justify. As it is not the focus of this thesis, full motivation is not attempted here.

The data in (16) would seem to suggest that the syncope rule (as yet unformulated) only applies in hiatus. Actually, this is not the case, as the data in (18) below demonstrate. Syncope also occurs when glottal stop intervenes between the vowels. The following forms contain the negative suffix ?aha.

(18)

míli	mí1?EhE
red	'not red'
mólu	mól?OhO
full	'not full'

What is the difference between (16) and (18)? The crucial difference between the two classes of examples seems to be the presence of stress. The vowel that syncopates cannot be stressed. This suggests that the syncope rule should be formulated as in (19). This rule syncopates a stressless vowel when it precedes another vowel possibly with an intervening glottal segment.

(19) Syncope

$$V \rightarrow 0 \;/\; \_\_\_ \; ([+glot])\; V$$

This rule is formulated so that it can apply over any [+glot] element. Since [h], a glottal continuant, occurs in Tunica, this rule should apply over [h]. In fact, this is borne out by the data below. These are cases with the suffix hat. The difference between [h] and [?] is that the [h] deletes postconsonantally.

(20)

má	máhat
you	'on your part'
?úwi	?úwEt
he	'on his part'
tánaraku	tánarakOt
the-snake	'on the snake's part'

In fact, the sequence 'consonant-[h]' never occurs. To account for this, I posit the following rule. This rule deletes [h] after a consonant.

(21) H-deletion

$$h \rightarrow \emptyset \;/\; C \;\_\_\_$$

Following are some derivations to exemplify the rules so far.[3]

(22)	?u esi	mili ?aha	?uwi hat	me ?aki
Harmony	?uesi	mili?EhE	?uwihEt	mé?Eki
Syncope	?ósi	mí1?EhE	?uwhEt	---
h-deletion	---	---	?úwEt	---

4.5 Syncope and Apocope

Tunica has additional rules that syncopate and apocopate vowels in various environments. In this section, these rules are described and formalized. These rules will be considered in three parts. First, I discuss the rules syncopating vowels in different positions, and then the rules apocopating vowels. Consonant deletion rules are then considered.

[3]The rules of harmony interact in an interesting way. Basically, the output of Height Harmony cannot undergo Backness/Rounding Harmony. In the following example, the auxilliary [?Ónta] has undergone Height Harmony, but not Backness/Rounding Harmony.

?ámi	?ónta	áni	?ám?Ontáni	* ?ám?Entáni
go	they-did	quot	'they left'	

4.5.1 Vocalic Syncope

I argued above that there was a rule that deletes a stressless vowel when it precedes another vowel, possibly with an intervening glottal stop or [h]. The rule, given as (19) above, is repeated below.

(23) Syncope

$$V \dashrightarrow \emptyset \;/\; \_\_\_ \;([+glot])\; V$$

In fact, the same rule applies over word boundaries as well. The forms in (24) attest to this.

(24)

túwaku ?úwakÓni	->	túwak ?úwakÓni
owl hooted		'the owl hooted'
kánahku ?unpíratik?ahčáni	->	kánahk ?unpíratik?ahčáni
something they-would-turn-into		'they would turn into something'
?úwi ?onÉni	->	?úw ?onÉni
he person		'he was a person'
káku ?ihpó?uhki	->	kák ?ihpó?uhki
someone saw-me		'someone has seen me'

However, as the following forms indicate, the rule is blocked if it would occasion a stress clash.

(25)

sáhku ?úhkiškan	-/>	*sáhk ?úhkiškan
'although there is one'		
?uší́ra ?áhkihtan	-/>	*?uší́r ?áhkihtan
'behind his back'		

This is in contrast to word-internal applications of the rule that indicate that the rule may create clashes. These clashes are subsequently resolved by the destressing rules that will be considered below. In (26) below word-internal instances of syncope are presented where a clash is produced by syncope, and resolved by some destressing rule.

(26)

?áka ?úhki	->	?ák?uhki
enter he-did		'he entered'
?ámi ?áhkini	->	?ám?Ehkini
go I-did		'I went'

This fact about destressing is possibly related to the Clash Resolution Hypothesis, but if so, why does it affect the rule differently when it applies phrasally? In both cases, the rule avoids clashes, but by different strategies. The word-internal syncope rule can produce clashes, but these clashes are eventually resolved by the destressing rule.[4] Syncope, in its phrasal applications, is simply blocked from producing clashes.

If word-internal and phrasal syncope are formalized as separate rules, then it clearly becomes desirable to find some explanation for the prohibition against producing phrasal clashes. This is necessary since such a condition, when formalized as part of the rule, is very complex. In (27) and (28) we see what two applications of the rule

To account for this, I propose that the harmony processes be autosegmentalized. Both rules should be viewed as spreading on an autosegmental tier. By autosegmentalizing the rules, the nonapplication of Backness/Rounding Harmony to [?ám?Ontáni] is explained as a consequence of a convention Steriade (1982) adopts from SPE. This convention prohibits autosegmental spreading processes from altering part of a linked matrix without affecting the other part. This hypothesis is explored in Hammond (manuscript).

[4] We will assume the existence of a destressing rule for now; below it will be motivated and formalized.

would look like if formulated as separate rules. (27) is the word-internal rule, repeated from (19) above, and (28) is the phrasal rule. Notice that the phrasal syncope rule does not parenthesize the [+glot], since syllable structure constraints eliminate the possibility of hiatus at word juncture.

(27) Word-internal Syncope

$$\overset{|}{V} \rightarrow \emptyset \;/\; \_\_\_ \; ([+glot])\; V$$

(28) Phrasal Syncope

$$\overset{|}{V} \rightarrow \emptyset \;/\; \underset{[\alpha str]}{V} \; C_0 \; \_\_\_ \; \# \; [+glot] \; \underset{[\beta str]}{V}$$

Condition: alpha or beta equal minus

Kisseberth (ms) argues that the condition on the phrasal syncope rule should be abstracted out and rephrased as a constraint on the entire grammar. The constraint says, in effect, that certain rules cannot have adjacent stresses in their output, where the set of rules not subject to the constraint is a list. This comes down to being a statement about markedness, since one cannot determine a priori whether any particular rule is subject to the constraint, but only that most are. Notice that this is rather like saying that the Clash Resolution Hypothesis extends to nonprosodic rules, but not that all such rules must be clash resolving.

One would like to find some way of determining in advance whether particular rules will be subject to the constraint, and, in this way, provide a way to test the claims of the theory in particular cases. One possibility is that the rule of word-internal syncope is permitted to avoid the constraint because any clashes occasioned by the rule will be

eliminated by the destressing rule. In contrast, the phrasal syncope rule cannot produce clashes because there is no phrasal destressing rule to come along and patch things up. If this were the case, inspection of the grammar, i.e. determining when a destressing rule could patch up bad output, would be sufficient to decide whether some rule should follow the constraint.

In fact, this proposal fails in Tunica because there is a rule of phrasal destressing. The rule removes the first of two adjacent stresses over a word boundary. However, such junctures only arise when the anti-clash condition on the phrasal syncope rule is suspended lexically. This lexical abrogation of the condition happens with two words: híhčˇi 'here, there', and káta 'where'. The forms in (29) below show how these forms undergo syncope and phrasal destressing.

(29)

híhčˇi ?úk?Eráni	->	hihčˇ ?úk?Eráni 'they stayed there'
káta ?árahčˇ	->	kat ?árahčˇ 'where it lies'

Therefore it is not the case that a simple inspection of the grammar will determine whether a rule should be on Kisseberth's list or not. The existence of a rule of phrasal destressing, as evinced by the forms in (29) should be sufficient to permit phrasal syncope to produce clashes since these clashes would presumably be destressable via the phrasal destressing rule that eliminates the clashes in (29).

However, in the light of the theory developed in Chapter Three, it is possible to determine by inspection of the grammar whether a rule is subject to Kisseberth's constraint. I would like to suggest that the rule responsible for the destressing in (29) is in principle inappli-

cable to the forms given in (25). Below, in (30), I give both classes of words: the undestressable words in (25) versus the destressable words in (29).

(30)	sáhku	'one'	hǐhčǐ	'here,there'
	ʔušǐra	'his back'	káta	'where'

The words in column one are lexical items, while the words in column two are function words. Recalling the principles presented in chapter three, this kind of contrast was also seen in the motivation of the Prosodic Rooting Condition. That condition, as argued in Chapter Three, required that all lexical items bear a stress at the end of the derivation. Here we find that the same condition is at work in Tunica. The function words in column two of (30) are not subject to Prosodic Rooting since they are nonlexical. Therefore they can undergo phrasal destressing. The lexical items in column one of (30) are subject to Prosodic Rooting since they are lexical. Therefore they cannot undergo phrasal destressing since it would leave them stressless on the surface, and thereby violate Prosodic Rooting.

The data above are not sufficient to demonstrate this point conclusively, and further data will be adduced below to support it, but it should be clear that the theory in Chapter Three looks quite promising as a means of explaining empirical problems outside the domain of English stress. First, the notion of a clash avoidance constraint is already captured by the Clash Avoidance Hypothesis. All that must be done is extend the hypothesis in Tunica to govern segmental rules as well. This naturally has some cost, but the cost is far less than any alternative which lacks the Clash Avoidance Principle in the grammar.

Second, the full extension of the Clash Avoidance conspiracy can probably be determined by inspection of the grammar in the sense indicated above. This elevates the clash avoidance constraint from a claim about markedness to a more direct empirical claim about particular grammars.

4.5.2 Vocalic Apocope

Tunica has several other rules that apocopate high vowels. The following forms motivate a rule of I-Deletion. These forms show how an [i] optionally deletes after a continuant in derived environments word-internally and phrasally.

(31)

nókuši káli ʔúra áni	-> nókuš_ kálʔuráni	
bear stand he-did quot	'A bear stood.'	
tá ʔOškacéhkini kíču n	-> tOškacéhkin_ kíčun	
the pot in prt	'in the pot'	
tá nEhtali kíču n	-> tánEhtal_ kíčun	
the bed in prt	'in the bed'	
šíkuri pʔaha	-> šíkurpʔaha	
knife no	'no knife'	
ʔOškacéhkini tʔE	-> ʔOškacéhkintʔE	
pot big	'big pot'	

This rule can be formalized as follows.

(32) I-Deletion

i --> Ø / [+cont] ___]

We can now test the hypothesis outlined in the section above. Does this rule apply so as to produce clashes? We predict that it should only produce clashes with nonlexical items. The data below illustrate that the rule is blocked when it would produce a clash where the first word is a lexical item as in (33a), but it is not blocked from producing a clash word-internally as in (33b).

(33)a. tá rí kícu n -> tári kícun
the house in prt 'in the house'

míli yá káti áni -> míli yákatEni
red turn she-would quot 'They say it would turn red.'

b. ?óni rOwa -> ?ónrOwa
person white 'white person'

?óni máhoni -> ?ónmahoni
person Indian 'Indian'

There do not appear to be any function words in the language of the appropriate shape to undergo this rule, and so there are no examples of that sort. Nevertheless, the fact that this rule is blocked by potential clash is predicted by the hypothesis above.

Haas argues for an additional rule of High Vowel Deletion. This rule is meant to account for data of the sort presented in (34) below. These examples show that a high vowel is optionally deleted after a fricative and a stop word-internally and phrasally. Notice that the rule feeds certain consonant deletion rules. These will be discussed in 4.5.3 below.

(34) híkuwa nahku píta ku áni -> híkuwanah pítakOni
panther like walk 3msg quot 'He walks like a panther.'

tá háli hci hékina áni -> táhali hékináni
the land fsg far-away quot 'The land was far away.'

tá sá tóhku sínima n -> tásatosíniman
the dog dim. mpl prt 'the puppies'

The rule can be formulated as follows.

(35) High Vowel Deletion

$$V \rightarrow \emptyset \;/\; [+cont] \begin{bmatrix} -cont \\ -vcd \end{bmatrix} \_\_$$
$$[+hi]$$

Again, the hypothesis above predicts that this rule should be subject to the Clash Avoidance constraint. It is, as the data in (36)

demonstrate.

(36) tá ríhku kícu n -> tárku kícun[5]
the wood in prt 'into the woods'

In this case, it is possible to test whether the rule is applicable to function words, since híhci fits the structural description of the rule. The example in (37) below shows that High Vowel Deletion does apply to produce a clash when the first member of that clash is a nonlexical item and can undergo phrasal destressing.

(37) híhci yák?uhkEni -> hi yák?uhkEni
'He came there'

Thus it seems that the hypothesis presented in 4.5.1 is supported by evidence of such apocope rules in the language. This explains why particular rules of the phonology follow the clash avoidance constraint, and why particular words are apparent exceptions to these rules. An alternative would be to mark rules for whether they fall under the constraint, and to mark particular words for whether they can undergo phrasal destressing. Such a proposal is at best descriptively adequate, but clearly inferior in scope and import to that presented above. In this light, the theories of Clash Avoidance and Prosodic Rooting find significant support in these facts.

4.5.3 Consonantal Deletion Rules

The data presented above also motivate several rules of consonant deletion. In depth study of these rules is far beyond the intent of this thesis. However, I will attempt to give the bare bones in the remainder of this exposition since these rules occasionally render

[5]The alternation ríhku/rku is lexically governed.

underlying forms quite opaque. First is a rule that deletes final noncontinuants before consonants. This is given in (38) below.

(38) [-cont] -> ∅ / ___ C

Second is another rule of consonant deletion fed by (38). This rule deletes [h] when it precedes a continuant. This rule is given in (39) below.

(39) $h \rightarrow \emptyset \; / \; \underset{[+cont]}{\_\_\_} \; C$

In fact, this rule is reminiscant of the other rule of h-deletion presented above as (21). These two rules can be collapsed if we take an additional rule into account.

The phoneme /h/ is realized as a velar fricative before a consonant, necessarily a noncontinuant, since the [h] deletes before continuants via (39). This being the case, the rule converting /h/ to [x] can be ordered before (39) and (21), which allows those two latter rules to be collapsed via the mirror-image convention. The new rules are given below as (40) and (41).

(40) $h \rightarrow x \; / \; \underset{[-cont]}{\_\_\_} \; C$

(41) h -> ∅ % ___ C

The first rule bleeds the second rule by converting all [h]'s before noncontinuants into velar fricatives. The second rule, which deletes [h]'s can then delete them in the environment of any consonant, since the ones that are ordained to stay will already have been converted into velar fricatives by (40).

4.6 Stress Assignment

In the following section, the basic stress pattern of Tunica is outlined. It is argued that the domain of stress assignment in Tunica is the morpheme.

In monomorphemes, one gets initial stress. The data in (42) demonstrate this.

(42)

mé	nára	tírwasi
search	snake	claw, nail
pó	cOha	íngrasa
look	chief	Englishman,American
sá	wísi	síkuri
dog	water	knife

Larger monomorphemes are rare, and seem to follow two patterns: ó o o o (o) or ó o ó o (o). The data in (43) illustrate both patterns.

(43)

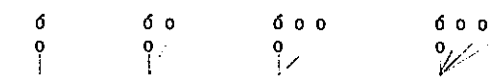
-álawÉca	wáhatahani
ear	often
lOpatÉra	rópuhtini
a vine	cotton
síhkapúca	?úsumula
onion	lizard

Haas does not mark degrees of stress, and she claims that all stresses are equal phonetically in terms of the "force" with which they are uttered. To account for this, we will assume for now that there is no word tree. This insures that there is no ranking of stresses phonetically. It will be argued below that there actually is a word tree in Tunica, though it is of an abstract sort.

Depending on which of the polysyllabic cases is to be taken as basic, there are two analyses. The simpler analysis, given in (44) below, is that an unbounded left-dominant foot is constructed. This

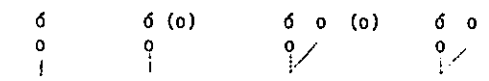
requires that the ó o ó o (o)-cases be lexically listed.

(44)



The more complex analysis, in (45), is that final syllables are marked extrametrical, and then binary left-dominant feet are constructed left to right.

(45)



This requires that the ó o o o (o)-cases be lexically listed. Since nothing appears to hang on this choice, the simpler analysis in (44) will be adopted for now.

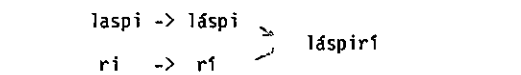
Polymorphemic forms seem to be stressed by a different algorithm. The data in (46) below exhibit the stress pattern 'ó o ó'. These forms are all polymorphemes where the boundary falls after the second syllable.

(46)

laspi + ri	-->	láspirí	
money house		'bank'	
?aru + po	-->	?árupó	
? see		'dream'	
?ayi + wo	-->	?áyiwó	
fire kindle		'fire'	

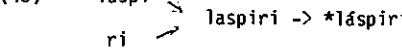
The simplest way to account for such forms would be to assign stress to the parts and then concatenate them. This procedure is illustrated in (47) below. First, stress is assigned and then the parts are attached to each other, giving the stress pattern exemplified in (46).

(47)



The derivation in (48) shows that the ordering is crucial; if concatenation applies first, stress will be assigned incorrectly.

(48)



The same point can be demonstrated with larger polysyllables. The examples in (49) exhibit stress patterns that are anomalous in terms of the basic analyses in (44) or (45). But, in each case, if stress is assigned to the constituents first, no problems arise.

(49)

halayihku + cOha		hálayihkucOha
Biloxi chief		'Biloxi chief'
kohina + ma(h)kini		kóhinamákini
cup deep		'bowl'
nisara + yawa		nísarayáwa
young person promiscuous		'young prostitute'
sirihka + mili		sírihkamíli
ant red		'red ant'

The examples in (46) and (49) have established the need to assign stress to certain elements prior to morphological concatenation. Therefore I propose that one of the stress assignment procedures shown in (44), (45) applies in the lexicon prior to certain morphological concatenations.

4.7 Destressing

Given the stress assignment procedure outlined above, the fact that there are monosyllabic morphemes, and the existence of word-internal syncope rules, we should expect to find a certain range of stress patterns. In fact, not all patterns predicted under the analysis presented thus far are attested. Above I showed what happened to polymorphemic trisyllables where the morpheme boundary was between the second and

third syllables. When the morpheme boundary is between the first and second syllable, something different happens; we'd expect to get 'ó+ó o', but we actually get 'ó+o o'. This is illustrated in (50) below.

(50)

po + yaka	póyaka
see come	'to court'
ya + nuhci	yánuhci
deer female	'doe'
ke + wista	kéwista
wasp tame	'honeybee'
ra + maku	rámaku
tobacco chew	'chewing tobacco'

To account for this gap, and others to be illustrated below, I propose that Tunica has a destressing rule. First, I will motivate this claim, and then I will show that there are apparently two destressing rules, leftward destressing and rightward destressing, and a rhythmic stress shift as well. This section will make these processes explicit, while the following section will reformulate them all as a single rule: prune alpha.

Let us consider larger polymorphemic polysyllables. Quadrisyllabic polymorphemes exhibit gaps analogous to the trisyllabic cases. When the morpheme boundary separates the first and second syllables, the expected stress pattern 'ó+ó o o' does not occur. Rather we get 'ó+o o o'. This is exhibited by the data in (51).

(51)

ri + hayisi	->	rihayisi
house above		'upstairs'
ya + tisuma	->	yátisuma
deer meat		'venison'

The other two possible quadrisyllabic polymorphemes do exhibit the

expected stress configurations. In (52) below are quadrisyllabic forms where the morpheme boundary occurs between the second and third syllables. This predicts the configuration: 'ó o+ó o', and that is, in fact, what surfaces.

(52)

hahka + kayi	->	háhkakáyi
corn yellow		'yellow corn'
kiru + mili	->	kírumíli
peach red		'red peach'
kuwa + hipu	->	kúwahípu
duck dance		'Duck Dance'

Likewise, when the morpheme boundary precedes the last syllable of a quadrisyllable, the expected result obtains: 'ó o o+ó'. This is illustrated in (53).

(53)

rowina + ra	->	rówinará
paper stiff		'cardboard'
sirihka + ri	->	sírihkarí
ant house		'ant house'
?iyut?E + si	->	?íyut?Esí
hog male		'boar'

To complete this overview, consider what happens in polymorphemic disyllables. In such a case one might expect: 'ó+ó', but one actually gets: 'ó+o'. This is illustrated in (54) below.

(54)

ya + si	->	yási
deer male		'buck'
sa + si	->	sási
dog male		'male dog'

In (55) below, a chart showing all the cases presented so far in schematic form is given. From this chart it is possible to generalize that there is a rule of destressing which removes the right member of two clashing stresses.

(55)

disyllables	trisyllables	quadrisyllables
ó o	ó o o	ó o o o (and ó o ó o)
ó+ó -> ó+o	ó+ó o -> ó+o o	ó+ó o o -> ó+o o o
	ó o+ó	ó o+ó o
		ó o o+ó

The chart shows that in each case where one might expect a stress clash, and in no other, the right stress is removed.

To account for this, a rule of destressing must be posited. At this point it is instructive to formulate the rule in two different ways. First, in (56) below, the rule is formulated according to Hayes' theory. This rule removes a foot when it follows a monosyllabic foot.

(56) "F" -> $\emptyset$ / F ___
|

In terms of the DTE-theory developed above, the rule in (57) below is appropriate. This rule prunes the constituent dominating the right member of a pair of clashing DTEs.

(57)

In the configuration:

|	|	
ó	ó	
1	2	

Prune the constituent dominating 2.

Rule (57) falls under the Clash Resolution Hypothesis, but is <u>not</u> obviously an instance of <u>prune alpha</u>. This is because the directionality of the rule must be stipulated. In English, as we have seen in Chapters Two and Three, <u>prune alpha</u> prunes the weaker constituent dominating one of two adjacent DTEs. Here, as there is <u>apparently</u> no word tree, the Trigger Prominence Principle is inoperative, and directionality must be stipulated in the rule's formulation.

4.7.1 Bound Morphemes

The picture above is complicated by the stress assignment procedure for bound morphemes. In this section, I digress to explain their properties and some ideas for dealing with them. The analysis here is tentative, but as the problem is orthogonal, it does not adversely affect the destressing story. First, I consider suffixes, and then prefixes.

4.7.1.1 Suffixes

Bound morphemes are either stressed or unstressed. All monosyllabic suffixes are stressless. All polysyllabic inflectional suffixes are stressed on their first syllables. These general rules can be illustrated with the semelfactive suffixes given in (58) below. These are added to verb stems to form the semelfactive paradigm.

(58)

	sg	du	pl
1	ni	ʔína	ʔíti
2m	ʔi	wína	wíti
2f	ʔa	hína/héna	híti/héti
3m	wi	ʔúna	ta
3f	ti	sína	síti

As with free stems though, the suffixes can undergo the destressing rule above. The examples in (59) show how the semelfactive suffixes are added to verb stems. When the suffix is monosyllabic, it is never stressed, but when it is polysyllabic, it shows up stressed if it is not adjacent to a preceding stressed syllable.

(59) a. monosyllabic endings:

ho wEsa wi áni -> howEsawEni
out jump 3msg quot 'he jumped out'

séhi ti hc -> séhitihc
sunrise 3fsg when 'tomorrow'

?a híru ta hc -> ?ahírutahc
e.o. rub 3mpl when 'when they rubbed them together'

b. clashing disyllabic endings:

ho+pí síti hc -> hopísitihc
come-out 3fpl when 'when they emerged'

c. nonclashing disyllabic endings:

ho póru síti hc -> hopórusítihc
out float 3fpl when 'when they float out'

yúki hótu síti hc -> yúkihótusítihc
cook finish 3fpl when 'when they had finished cooking'

These same facts can be observed with the gender/number suffixes for nouns. These are given in (60) below. Observe that the polysyllabic suffixes all bear initial stress, while the monosyllabic suffixes are all stressless.

(60)	sg	du	du, pl	pl
m	ku/kúhu	?únima		sEm/sEma
f	hci/hcíhi		sin/sínima	

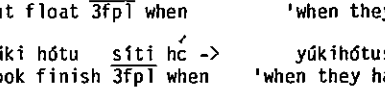
There are two problems for the analysis of bound morphemes in Tunica. First, how does one capture the generalization that all polysyllabic inflectional affixes are stressed? Second, how does one capture the generalization that all polysyllabic inflectional morphemes are stressed exactly like free morphemes - on their initial syllables?

I propose that affixes in Tunica should define a separate class of elements in the lexicon - clitics. As such, they can function as

domains for phonological rules, and can therefore be treated just like free stems for purposes of stress assignment. However, as clitics, they are also bound elements morphologically and syntactically. This argument has two parts. First, the procedure for stressing these elements will be outlined. Then their status as clitics as opposed to affixes will be motivated.

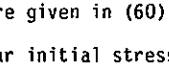
Assume the stress rule for clitics is identical to that of stems given in (45) above: make the final syllable extrametrical, and then build left-dominant binary feet left to right. This accounts directly for the disyllabic and trisyllabic cases.

(61)



However, for the monosyllabic cases, it predicts stress.

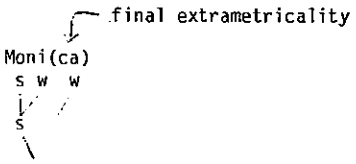
(62)



This occurs because extrametricality theory, as commonly conceived, is not applicable just in case the entire domain would be rendered extrametrical.

Reviewing briefly, Hayes proposed extrametricality theory as a means of accounting for the fact that certain peripheral elements may be unscanned by the stress assignment algorithm. Thus one finds apparent final ternary feet in English because of a rule of final extrametricality.

(63)



Notice though that this mechanism must be prevented from applying to monosyllables as they would then not receive stress.

I would like to suggest that the monosyllabic "clitic" suffixes do, in fact, become extrametrical, but that such a process does not violate the constraint on exhaustive extrametricality domains. Thus:

(64) (wi)

This application of extrametricality does not violate extrametricality theory, since unlike full-blown lexical items, clitics as bound morphemes do not "need" stress. In what sense do lexical items need stress? In the sense of the Prosodic Rooting Constraint. Elements like clitics which are not lexical items, are members of a closed class of function morphemes. Thus, by becoming extrametrical, they do not violate the Prosodic Rooting Constraint.

On this view, the constraint that prevents extrametricality from making an entire domain extrametrical is Prosodic Rooting. This constraint naturally does not extend to prevent nonlexical clitics from becoming fully extrametrical.

The stress patterns of clitics therefore argue for the stress assignment algorithm given in (45) above, rather than (44). This algorithm extends to assign stress to bound clitics because the prohibition against exhaustive extrametricality is most plausibly seen as a

consequence of Prosodic Rooting, rather than as some ad hoc stipulation of extrametricality theory.

However, the analysis of these items depends crucially on their being clitics. If they were simple bound inflectional affixes, then they could not function as independent domains of phonological rules, but could only undergo phonological rules once affixed to a stem (Mohanan, 1982). Below, I will demonstrate that there is independent evidence that at least the person/number affixes are clitics. This evidence is of two sorts, morphological and syntactic.

First, the nonsingular affixes can occur independently as personal pronouns. These are underlined in the following chart.

(65) personal pronouns

	sg	du	du,pl	pl
1	ʔîma		ʔînima	
2m	má		wînima	
2f	hÉma		hînima	
3m	ʔúwi	ʔúnima		sÉma
3f	tîhci		sînima	

Another fact is that in complex noun phrases, the person number affixes do not occur on the head noun, whose gender and number they mark, but on the last modifier of the NP. Modifiers follow the head in NPs, and are always incorporated into the head noun if they are adjectives. If numbers, then they incorporate only into a definite noun. This is exemplified in (66).

(66) tá ?óni hípu ?Ónta sÉma n
the person dance they-did 3pl prt

tóni hip?OntasÉman
'the people who were dancing'

tá yórum?aha wírataha sínima
the beasts fearful fdu/pl

táyorum?ahawíratahasínima
'some fearful wild beasts'

Thus it does not seem unreasonable to suppose that the person/number suffixes are actually clitics. This accounts for their stressability, their ability to function as independent pronouns, and the fact that they are not affixed to the element whose person/number features they mark.

If there is an independent category clitic, then there should be no problem assigning the semelfactive affixes to this category, even though there is no independent morphological or syntactic evidence for this. They can belong to the clitic class just as the person/number affixes do.

Beyond the inflectional suffixes given so far, there are other classes of suffixes. These follow the rule that no monosyllabic suffix is stressed. However, they do not follow the rule that all polysyllabic inflectional suffixes are stressed on their first syllables. In fact, all polysyllabic noninflectional suffixes are stressless except the following three illustrated in (67).[6] Notice that these too undergo the destressing rule presented above.

[6]plus one more, áni, to be discussed below.

(67) (h)tÉpan

láwu htÉpan -> láwuhtÉpan
night every 'every night'

léhe

híhci léhe n -> híhcilého
there right prt 'right there'

tóhku

kúwa tóhku -> kúwatóhku
duck dim.-sfx. 'bird'

sá tóhku -> sátohku
dog dim.-sfx. 'puppy'

In comparison, there are many other noninflectional polysyllabic suffixes that are not stressed at all. Some of these are given in (68) below.

(68) tá wísi hci ?ama -> táwisihc?Ema
the water fsg and 'and the water'

?áni k?ahca -> ?ánik?ahca
I-go will 'I'll go'

?úwi ?aha -> ?úw?EhE
he not 'It's not him'

?óni nahku -> ?óninahku
person like 'like a person'

We will adopt the simplest proposal: there is a rule making noninflectional suffixes extrametrical prior to stress assignment. The three suffixes in (66) would be stressed lexically.

This completes my discussion of bound suffixes in Tunica. To summarize, these suffixes fall into several classes. First, there are monosyllabic suffixes inflectional or noninflectional. These are always stressless. This is a consequence of the extrametricality rule of the analysis given in (45) above. Second, there are polysyllabic inflec-

tional suffixes. These are always stressed on their initial syllables. This was due to their status as clitics, which allowed them to function as domains for phonological rules like stress assignment. The clitic status of such morphemes explains why the person/number markers can occur as independent pronouns, and why they do not have to occur directly on the noun whose person/number they mark. Finally, there are the noninflectional polysyllabic suffixes. These must be clitics as well, since they can occur outside the person/number clitics. I suggested that these are made extrametrical by a rule applying just to them.

4.7.1.2 Prefixes

Tunica has only monosyllabic prefixes. These can be divided into three classes: noninflectional prefixes, possessor markings, and tá: the agentive and articular prefix. In (69) we see examples of the noninflectional prefixes. These surface consistently without stress.

(69) te míli -> temíli
around red 'It's red all around'

ho póru síti hc -> hopórusítihc
out float 3mpl when 'when they float out'

ha túhku páta káti áni ->hatúhkupátakatEni
resultative kneel fall she-did quot 'she fell to her knees'

Following, in (70), are the prefixes marking alienable possession.

(70) alienable prefixes

	sg	du	du,pl	pl
1	?ihk		?ink	
2m	wihk		wink	
2f	{he, hi} hk		{hi, he} nk	
3m	?uhk	?unk		sihk
3f	tihk		sink	

These are stressless like the prefixes in (69) above. In (71) below are some examples of alienable possession.

(71) wihk ?óni sEm -> wihk?ónisEm
your person mpl 'your people'

?ihk tíra -> ?ihtíra
my cloth 'my cloth'

?ihk hOsani -> ?ihOsani
my vine 'my vine'

Notice that the [hk] is often deleted via the consonantal apocope rules presented in 4.5.3 above.

This set of prefixes can be opposed to the prefixes marking inalienable possession. These are given below in (72) in table form.

(72) inalienable prefixes

	sg	du	du,pl	pl
1	?i		?in	
2m	wi		win	
2f	{he, hi}		{he, hi}, n	
3m	?u	?un		si
3f	ti		sin	

Unlike the alienable prefixes, these prefixes always occur stressed. Also, they occur without the [hk] augment. In (73) below are some inalienably possessed nouns.

(73) sîn hkéni -> sînken
their hand 'their hands'

tî gáci hcíhi n -> tîgacihcîhin
her mother fsg prt 'her mother'

Many inalienably possessed nouns begin with vowels, and so this stress property of inalienable prefixes is not apparent owing to the vowel deletion rules. Some stems of this type are given in (74) below.

(74) ?ú ésini -> ?ósini
his head 'his head'

?ú áhaya hci -> ?OhOyahc
his sibling fsg 'his sister'

Note that inalienably possessed nouns cannot occur without possessor marking.

Lastly, in (75) below, the articular and agentive prefixes are exemplified. Like the inalienable possessor markers, they are stressed, and trigger destressing when adjacent to a following stress.

(75) tá nára ku -> tánaraku
the snake msg 'the snake'

tá wîsi hci -> táwisihci
the water fsg 'the water'

tá hára -> táhara
agent sing 'singer'

tá hîpu -> táhipu
agent dance 'dancer'

To account for these different stress patterns among the prefixes, I propose that some of the prefixes, the inalienable, agentive, and articular prefixes, are stressed lexically, but the other prefixes, the alienables, are subject to normal stress assignment.

This analysis is somewhat problematic for the syncope rule. Comparing (75) and (76), we see that syncope can apply to the articular prefix, but not the agentive prefix. To account for syncope involving the articular prefix, the rule must apparently be revised to allow it to syncopate some stressed vowels. Consider the forms in (76) below.

(76) tá ?óni ku -> tóniku
the person msg 'the man'

tá ?îyusÉla ku -> tîyusÉlaku
the opossum msg 'the opossum'

tá ?éru -> tá?eru
agent laugh 'laugher'

Also, some rule for deleting the glottal stop that should result from application of syncope must be posited. Otherwise one would get: *[t?óniku]. Let us consider first the revisions that must be made for the syncope rule. The original formulation of that rule from (23) above is repeated as (77) below for convenience.

(77) Syncope

V --> ∅ / ___ ([+glot]) V

The [-stress] condition on the focus of the rule was motivated by the examples in (16) repeated below as (78).

(78) mé ʔáki -> méʔEki
search she-did 'she searched'

pó ʔáki -> póʔOki
look she-did 'she looked'

Comparing these examples to the ones involving the articular prefix above, a by now familiar generalization emerges. The syncope rule is apparently blocked not by just any stressed syllable, but only by a stressed lexical item. [mé] and [pó] are verbs, while the articular prefix is a function morpheme. This suggests that the difference is to be traced to the Prosodic Rooting Constraint. However, it is not immediately clear how this should work, as syncope does not produce output where elements are destressed. The following rule will work, but it is clearly ad hoc.

(79) Syncope (revised)

V_i --> ∅ / ___ ([+glot]) V

Condition: V_i cannot be the sole vowel of a lexical item.

If this is the rule though, then why does it not apply in the case of the agentive prefix? (táhara 'dancer' *tára; táʔeru 'laugher' *téru.) The agentive prefix is a function morpheme like the articular prefix, and we would therefore expect it to undergo the rule just like the articular prefix. This does not happen though, leasing us to posit that the agentive prefix is marked as an exception to syncope.

To account for the absence of glottal stop in [tóni], the following housekeeping rule is proposed.

(80) ʔ -> ∅ / # C ___

4.7.1.3 Summary

In the preceding two sections, particular analyses of prefixes and suffixes in Tunica have been offered. These analyses posited several different mechanisms for stress assignment to affixes, but the same rule of destressing for both bound and free morphemes. We conclude then that the evidence from free and bound morpheme affixation motivates a destressing rule like (57).

4.7.2 Left Destressing

In addition to the rule of destressing presented above, there is an another rule of destressing. Hereafter, the rule already presented will be referred to as Right Destressing. In this section, I will outline the evidence for a latter rule of Left Destressing, and give a preliminary formulation of it.

The rule of Left Destressing applies in two environments. First, it removes a stress immediately before the quotative morpheme áni. In addition, it applies to remove a stress immediately before two of the four phrase-final melodies: the high and the falling melodies. The forms in (81) illustrate how the rule applies with the quotative morpheme.

(81) mîli áni -> milÉni
red quot 'They say it's red'

yúru áni -> yurÓni
long quot 'They say it's long'

sin šrúka pánu áni -> sinšrúka panÓni
mdu frightened very quot 'They say they were very frightened.'

4.7.2.1 Phrase-Final Melodies

Before showing how Left Destressing applies before the high and falling phrase-final melodies, I must first explain what these melodies are. Haas says that every phrase ends with one of four phrase-final melodies: high, low, rising, or falling. These melodies are usually realized on the final vowel of the phrase, although under special circumstances they may be realized on the penult of the phrase. Under (82), are examples of the four melodies. The notation is as follows. High is marked with an acute, low with a grave, rising with a hacek, and falling with a circumflex. Stresses never occur in phrase-final position, so using an acute to mark stresses and high melodies is not ambiguous.

(82) ti yasi -> tîyasî
she angry 'she's angry'

lOta wi wana n -> lOta wiwánan
run you want prt 'Do you want to run?'

?u yasi ?aki ani -> ?uyás?EkEnî
he angry she-did quot 'They say he got angry'

wihk ya ki -> wîyakî
you go imper 'go!'

yuka wi hč sehi ti aha ani hístahahk ->
arrive 3msg when sunrise 3fsg not quot still

-> yúkawihč, séhitEhÉnì, hístahàhk
'When he got there, they say it wasn't daylight yet.'

These melodies mark different moods as in (83) below.

(83)High

If the phrase-final word is indicative and predicative.

Rising

If the phrase-final word is interrogative and predicative; or sentence-internally if the phrase-final word is not in the main clause and/or nonpredicative.

Low

If the phrase-final word is quotative and predicative; or sentence-finally if the phrase-final word is not in the main clause and/or nonpredicative.

Falling

If the phrase-final word is imperative and predicative.

4.7.2.2 Left Destressing Formalized

The data in (84) below show how stresses are eliminated before the phrase-final high and falling melodies.

(84)
ʔásа	->	ʔasá
she-comes		'she's coming'
pó ʔa n	->	poʔôn
look 2fsg imper		'Look!'
lÓta káni	->	lÓtakaní
run lsg(hab)		'I (can) run'
pó ʔi n	->	poʔîn
look 2msg imper		'Look!'

This destressing does not apply before the low or rising melodies. This is illustrated in (85) below.

(85) ʔúriš márʔuwánì * ʔúriš márʔuwanì
'They say he went back home.'

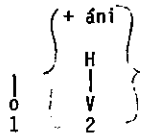
lÓta wiwánán * lÓta wiwanǎn
'Do you want to run?'

To account for the destressing properties of high and rising melodies, I propose: 1) that contour tones be factored into component level tones (rising = Low + High, and falling = High + Low); 2) that there be a rule of Left Destressing that applies before <u>áni</u> and high tones. In Hayes' theory, this gives us the following rule in (86).

(86) F --> ∅ / ___ C_0 { (+ áni) / H / V }

The analogous rule in terms of DTE-theory is given in (87) below.

(87) In the configuration:



Prune the constituent dominating 1.

4.7.3 Rhythm

In addition to the rules of Left and Right Destressing, Tunica also exhibits superficial rhythm. This phenomenon is termed superficial, because it is transparently a subcase of Left Destressing. In this section, the rhythmic stress shift in Tunica is exemplified, and the necessary formulation of the rules is put forth.

4.7.3.1 Data Supporting a Rhythm Rule

In section 4.7.2 above, it was demonstrated that there is an apparent destressing before a high or falling phrase-final melody, and the quotative suffix <u>áni</u>. However, the data in (88) below show that if the destressed syllable is preceded by a stressless (monosyllabic) prefix, then stress shifts onto that prefix.

(88)
ti yási	->	tíyasí
she angry		'she's angry'
wihk yá ki	->	wíyakî
you go imper		'go!'
ho pó ku	->	hópokú
out look 3msg		'he looks out'
ʔu wána	->	ʔúwaná
he want		'he wants'
te míli áni	->	témilÉní
around red quot		'it's red all around'

Notice though that a preceding stressless syllable is <u>not</u> sufficient for rhythm; only a stressless prefix will qualify. This is illustrated in (89) below.

(89)
he érusa káti	->	hérusakatí
2fsg know she-does		'You find out about it'
		*hérusákatí or *hérúsakatí

In addition, the shift does not occur if the prefix is preceded by a

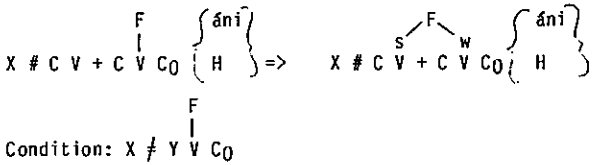
stressed syllable (across a word boundary). This is illustrated in (90) below.

(90) lóta ?iwána → lót ?iwaná
run I-want 'I want to run.'
*lót ?iwaná or *lóta ?iwaná

4.7.3.2 A Rule

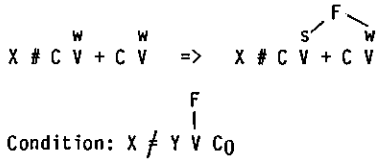
In Hayes' framework, a rule like that in (91) would seem to be adequate. This rule replaces a monosyllabic foot with a disyllabic foot before a high tone or the quotative suffix.

(91) Rhythm Rule



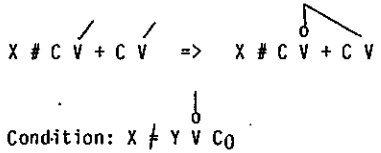
This rule is exceptionally complicated, and it begs for simplification within our present framework. As a first step toward this, notice that the rule above is partially a recapitulation of the rule of Left Destressing. It removes a foot before a high tone or áni. However, it goes on to replant a stress on an initial polysyllable, provided that syllable is not preceded by a stressed syllable. On this latter view, rhythm should be seen not as moving a stress, but as Left Destressing followed by Late Stress Assignment, where Late Stress Assignment builds a binary left-dominant foot at the beginning of a word, just in case this does not create a clash with any preceding syllable. A tentative formulation of this rule is given in (92) below.

(92) Late Stress Assignment



This rule is trivially reformulable in DTE-theory as in (93) below.

(93) Late Stress Assignment (DTE version)



It may be possible to simplify the DTE-version of this rule, if, as a late rule, it can be considered a metrical transformation. If so, then it would fall under the Clash Resolution Hypothesis, unlike normal stress assignment, and would only be allowed to apply when it did not produce clashes. This eliminates the need for a condition on X. Furthermore, the binary requirement need not be included in the rule's formulation, since it too follows from the Clash Resolution Hypothesis. The DTE-version can then be stated as in (94).

(94) Late Stress Assignment (DTE-version; revised)

Build a left-dominant foot on the left margin of the word.

Beyond notational elegance, these formulations are empirically superior. They predict Late Stress Assignment even when Left Destressing has not applied. The data in (95) and (96) below support this. (95) gives forms showing how the prefix [ki] is stressless. In (96), this prefix has been added to a stem already bearing another pre-

fix. (This is the only prefix I have found that can be added on like this.) In this case, the prefix carries stress. This follows though if Late Stress Assignment exists in the grammar. Two stressless prefixes in a row constitute appropriate input to the rule even though Left Destressing has not applied.

(95) ki páta múcu ʔúhki áni -> kipátamúcʔuhkÉni
in fall dive he-did quot 'He dove and fell in'

(96) ʔu niri ki ʔuhk pÉka ʔúhki áni ->
his teeth in him kick he-did quot

-> ʔúnir kíʔuhpÉkʔuhkÉni
'He kicked him in the teeth'

4.7.4 Summary

The preceding sections have outlined the rhythm and destressing properties of Tunica. It has been demonstrated that there is a rule that destresses the second of two consecutive stresses: Right Destressing. Above, this rule was formulated in Hayesian terms and DTE terms. At that point there was evidence favoring one formulation over the other.

It was also demonstrated that a rule of Right Destressing destresses a syllable before a high or falling tone and before the quotative morpheme áni. This rule was also given two formulations: Hayesian and DTE.

Lastly, it was argued that though there is superficial rhythm, this is ultimately a consequence of Left Destressing followed by a rule of Late Stress Assignment. In addition, the DTE theory was shown to be superior for formulating the rule of Late Stress Assignment.

This discussion partially confirmed the Clash Resolution Hypothesis. Each of the rules posited either removes clashes or is limited in clash

environments. However, the theory developed in chapters two and three has not been fully exploited. That theory made crucial use of the rule prune alpha. However, this rule does not seem to be operative in Tunica. One rejoinder here might be that because Tunica does not appear to have word trees, it cannot, in principle, make use of prune alpha. In the following section, I will argue rather that Tunica does have word trees, and that it actually does exploit prune alpha in a direct fashion.

4.8 A New Analysis

In the following section, I propose an analysis of Tunica rhythm and destressing that depends crucially on two assumptions. First, I propose that there is an abstract word tree in Tunica. Second, I propose that the real mechanism of rhythm and destressing in Tunica is prune alpha.

4.8.1 Tunica Word Trees

In this section I will describe and motivate a proposal for abstract word trees in Tunica. In section 4.8.1.1, the proposal is described. In section 4.8.1.2, evidence from destressing in morphologically complex forms is offered in support of the proposal made in the previous section. Lastly, in section 4.8.1.3, evidence from intonation is adduced in support of the proposal.

4.8.1.1 The Word Tree Proposal

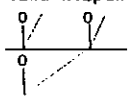
If Haas is right about the amount of "force" with which different stressed syllables are uttered, then any word tree in the language must be viewed as abstract. By this I mean that its effects are indirect rather than direct. Existence of such abstract word trees may be deduced from the consequences such a model has for phonological rules

depending on it, and not by any relative phonetic ranking it might impose on resulting stresses.

Let us assume that the word tree in Tunica is left-dominant, and that it is constructed cyclically. Thus as stressed morphemes are added to a base, they are adjoined as strong left sisters if prefixes, or as weak right sisters if suffixes. If they are stressless, then they are incorporated as weak daughters of the nearest foot.

This is illustrated in the examples below. First, in (97) is an example of a stressed suffix being added to a stem. Since it is a suffix, it is adjoined as a weak sister of the stem.

(97) láwu+htEpan



In example (98) below, a stressed prefix is added to a stem. Since it is a prefix, it is adjoined as a strong sister to the stem.

(98) tá+nára

In example (99) below, a stressless suffix is added to a stem, and its syllables are adjoined as weak daughters of the preceding foot.

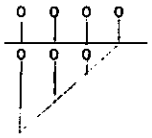
(99) mílí+aha

Lastly, in (100) below, a stressless prefix is adjoined as a weak daughter of the following foot.

(100) ʔuhk+nára

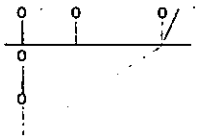
The cyclic nature of word tree construction generates more complex structures though when more than one morphological operation occurs. In addition, the order of morphological operations will to some extent dictate the prosodic structure of a word. This is exemplified in the following example (101). Here we see a compound made up of an agentive noun [tá+pála] 'trap' plus another noun [yá] 'deer'. The agentive prefix is added on first. Next, compounding takes place adjoining [yá] as a strong left sister to [tápala]. Subsequently, the articular prefix is adjoined as a strong left sister as well. The full word means 'the deer trap'.

(101) tá+ya+tá+pala



Following in (102) is another morphologically complex case. Here is a base [kúwa] 'duck' that undergoes diminutivization, and then compounding. The diminutive [tóhku], since it is stressed, is adjoined as a weak sister of [kúwa]. Then the whole complex undergoes compounding and [mílí] 'red' is adjoined as a weak sister as well. The whole complex means 'cardinal'.

(102) kúwa+to(hku)+mí̀li

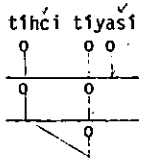


For now, let us put off justification of this tree structure. This brief overview is meant only to show how the tree structure is constructed. In the following two sections, it will be discussed in depth.

On top of the word tree, phrasal trees are constructed as well.[7] These phrasal trees are right-dominant, and are constructed in one fell swoop. This entails that once words are assembled into phrases, they are organized into prosodic phrases as well, and that these phrases are then available as input for phonological rules.

In the following example (103), a sample sentence illustrates how the phrasal trees are constructed. In this case, the phrase only contains two words, and the tree is therefore binary.

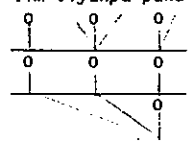
(103) tíhci ti yásí -> tíhci tíyasí
she 3fsg angry 'She is angry.'



Example (104) below illustrates a slightly longer clause.

[7]The phrasal trees will be revised extensively when intonational facts are reconsidered below.

(104) ?íma ?i yáhpa pánu -> ?ím ?iyáhpa panú
1sg 1sg hungry 'I'm very hungry'



4.8.1.2 Destressing in Complex Words

In this section, I will outline certain facts that make problematic the account of Right Destressing presented above. I argue that in order to have an account for these forms, an abstract word tree must be posited in Tunica. This proposal allows us to keep a simple analysis of destressing, to extend prune alpha, and to account for problematic cases previously unaccounted for.

4.8.1.2.1 Right-branching Structures

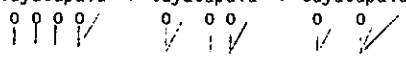
The following data in (105) show the effect of relative embedding on the application of Right Destressing. In each case, an alternating pattern is initiated by the first stressed syllable.

(105)

yá	'deer'	rí	'house'
pála	'trap'$_V$	sára	'pray'
tápala	'trap'$_N$	tásara	'prayer'
yátapála	'deer trap'	rítasára	'church'
táyatápala	'the deer trap'	táritásara	'the church'

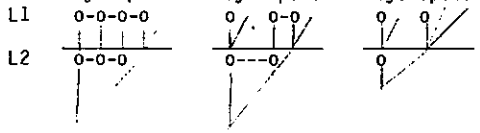
Under the analysis of Destressing sketched in section 4.7, one would have to specify that the rule iterates from left to right. This would produce derivations as in (106) below. Here destressing scans from left to right. Everytime it identifies a clash, it can apply producing the output in (105) above.

(106) tayatapala -> tayatapala -> tayatapala



Notice though that if an analysis in terms of the word trees suggested above is adopted, this apparent directionality of the rule can be seen to fall out from the independently motivated Trigger Prominence Principle and bottom to top application. This is illustrated in (107) below. First, the DTE of the domain is identified on L1. This is the first syllable, and so clashes involving that syllable are eliminated first. After that, clashes involving any other element on L1 are resolved. This results in the correct output.

(107) tayatapala -> tayatapala -> tayatapala



Thus, if the word tree proposal made above is adopted, an analysis using prune alpha can be adopted, and unnecessary stipulations about directionality of the destressing can be eliminated.

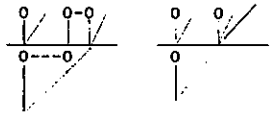
With other right-branching structures where all nodes do not clash, the theory without word trees is equivalent to the word-tree theory. Following in (108) are examples of right-branching structures where the second and third nodes clash, but not the first and second. In these cases, both theories predict that the third node will be the node destressed.

(108) ʔála [tá wúci] -> ʔálatáwuci
reed agent whistle 'whistle'

ríhku [tá tómu] -> ríhkutátomu
stick agent pound 'pestle'

Following in (109) is the derivation entailed by the word-tree theory with prune alpha. Since there is no clash on the lowest level involving the DTE of the domain, other lower level clashes are resolved before the higher level clash. This results in the correct form.

(109) ʔalatawuci -> ʔalatawuci



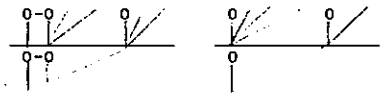
Likewise, when the first two nodes of a right-branching structure are clashing, both theories predict the same results. They predict the the second node will destress when it clashes with the first. The examples in (110) below are instances of this.

(110) tá nísara tɛ́kaha ku -> tánisaratɛ́kahaku
art child poor msg 'orphan boy'

tá hérit?E sáhu hčí -> táherit?Esáhuhč
art bigboat other fsg 'the other boat'

This is because the clash involves the DTE of the entire word, as illustrated below in (111).

(111) taherit?Esahuku -> taherit?Esahuku



Therefore, the word-tree theory can account for all the facts that the word-treeless theory can account for and more. It can account for the cases involving three simultaneously clashing nodes in a right-

branching structure. The word-treeless theory can account for such cases only by using the otherwise unnecessary parameter of directional iteration.

4.8.1.2.2 Left-branching Structures

In cases of left-branching structures, the two theories make different predictions.

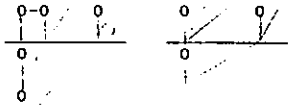
In clashes involving the first two nodes of such a structure though, they both claim that the second stress is destressed. This is illustrated in (112) below.

(112) tá cáhta sEma -> tácahtasEma
art Choc mpl 'the Choctaw'

tá náka sEma -> tánakasEma
art warrior mpl 'the warriors'

This is because, as shown in (113) below, the DTE of the domain is the first node in the tree.

(113) tacahtasEma -> tacahtasEma



In contrast though, the two theories seem to make different claims about clashes between the second and third nodes of a left-branching structure. In such a case, the word-treeless theory predicts that the third node will destress, while the word-tree theory seems to predict that either will destress. That is, since the word tree defines no prominence relationship between the second and third nodes in the tree, the Trigger Prominence Principle says nothing about what should happen.

The data in (114) below show some left-branching forms involving

clashes between the second and third nodes. In these cases, the second node destresses, not the third.

(114) [tihk [?Oka tóhku]] ?únima n ->
her child dim.sfx. mpl prt

-> tihk?Okatohk?úniman
'her children'

[kúwa tóhku] méli -> kúwatoméli
duck dim.sfx. black 'blackbird'

[kúwa tóhku] míli -> kúwatomíli
duck dim.sfx. red 'cardinal'

[tá [?óni sí]] sEma -> tónisísEma
the person male mpl 'the men'

[kúwa tóhku] ?Osta -> kúwatohk?Osta
duck dim.sfx. blue 'bluebird'

To account for these forms, the word-treeless theory would have to say something very complicated. Within the word-tree theory, however, the analysis is straightforward. All that need be said is that when prominence relations do not uniquely define a destresser and a destressee, the right node is the default destresser.

Such a statement may seem ad hoc, but just such a parameter is independently necessary to account for Hawaiian and Warao in Chapter One. Since this is so, one must surmise that the word-tree theory is in better accord with the facts here as well.

I have been unable to find forms illustrating a three way clash in a left-branching form. This is somewhat unfortunate, but does not leave room for doubt since both theories make identical claims about such forms. The word-treeless theory, since it incorporates a left to right directionality stipulation, predicts that the second node would destress. The word-tree theory also predicts that the second node will

destress, since the first node in such a structure is the DTE of the whole domain.

In conclusion, we have seen that when faced with data involving morphologically complex forms, the word-treeless account of destressing in Tunica breaks down. It cannot handle right-branching forms with multiple clashes, and it cannot handle left-branching forms where the last two nodes clash. In contrast, a theory employing an abstract word tree of the sort outlined earlier, and prune alpha, can account for these cases directly without recourse to ad hoc stipulations.

Recall that hĺhčí and káta undergo syncope and destressing because they are function words. In contrast, lexical items cannot undergo destressing because destressing a lexical stress would violate the Prosodic Rooting constraint. In fact there are other apparent lexical stresses that can undergo phrasal destressing (Left Destressing). These are given in (115) below.

(115)
láhoni tóhku nára ta hč ->
early dim.sfx. get-up 3mpl when

-> láhonto náratahč
'when they got up early'

rOhpan stóhku ?úki ?i k?i hč ->
near quite sit 2msg cond when

-> rOhpanstohk ?úk?ik?ihč
'if you sit quite close'

tá ?áyi wó háyiht ->
the fire kindle on

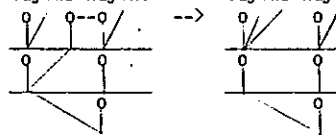
-> táyiwo háyiht
'on the fire'

tá ?áyi wó hÉra wína k?i hč ->
the fire kindle watch 2mdu cond when

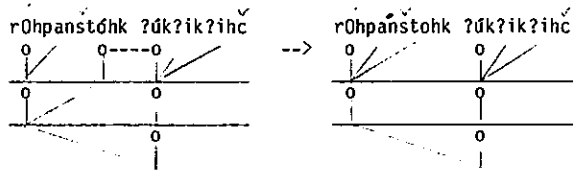
-> táyiwo hÉrawínak?ihč
'if you watch the fire'

The number of examples is not awesome, yet a generalization is apparent. Phrasal destressing can apply whenever the rooting constraint is not violated. This is exemplified in (116) below.

(116)
táyiwó háyiht --> táyiwo háyiht



rOhpanstóhk ?úk?ik?ihč --> rOhpanstohk ?úk?ik?ihč



That destressing is applicable here is predicted by the word trees and Prosodic Rooting. That Left Destressing, rather than Right

Destressing, applies follows from the right-dominant word tree and left-dominant phrasal tree, and the Trigger Prominence Principle.

4.8.1.3 Intonational Support for a Word Tree

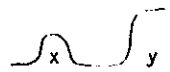
In this section I will outline some evidence from intonational alignment in Tunica that strongly supports an analysis of destressing that makes use of an abstract word tree. This evidence leads one to conclude that an abstract word tree is independently required.

It was observed above that the high and falling phrase-final melodies induce Left Destressing and superficial rhythm. Typologically, this is very strange. I know of no other language with a full-fledged stress system and this kind of degenerate tonal system. It is bizarre that the tonal system should affect the stress system in this way too, and that it should leave lexical items completely stressless in its wake (Cf. 'Look!';(84)). Closer examination though suggests a different analysis. Following I give Haas' (1940) description of the phonetics of the tonal melodies.

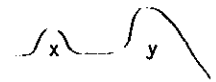
> "(1) When the high melody is used, the ultima is pitched roughly a minor third higher than the penultima. The first stressed syllable is normally a major second higher than any of the succeeding syllables except the ultima. All intervening syllables (stressed or unstressed) are ordinarily uttered on a monotone. If there are any unstressed syllables preceding the first stressed syllable, they will have about the same pitch as those intervening syllables."
>
> "(2) When the falling melody is used the ultima starts about a minor third higher than the penultima and then slides quickly downward about a perfect fourth or fifth. In other respects the contour of this type of phrase is like that of one having a high melody."
>
> "(3) When the low melody is used the ultima is pitched about a perfect fourth or fifth lower than the last stressed syllable which in turn is pitched about a minor third higher than the immediately preceding syllables. Any unstressed syllables coming between the last stressed syllable and the ultima have the same pitch as the latter. The first stressed syllable (unless it is also the last stressed syllable) is ordinarily pitched a major second higher than any succeeding syllable except the last stressed syllable. The intervening syllables are monotonous."
>
> "(4) When the rising melody is used the ultima starts about a perfect fourth or fifth lower than the last stressed syllable and then slides quickly upward about a minor third. In all other respects (including the pitch of the last stressed syllable) the contour of this type of phrase is like that of one having the low melody." (p.19-20)

These descriptions imply the following melody contours.

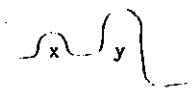
(117) o ó o ó o high melody



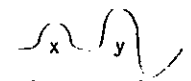
o ó o ó o falling melody



o ó o ó o low melody



o ó o ó o rising melody

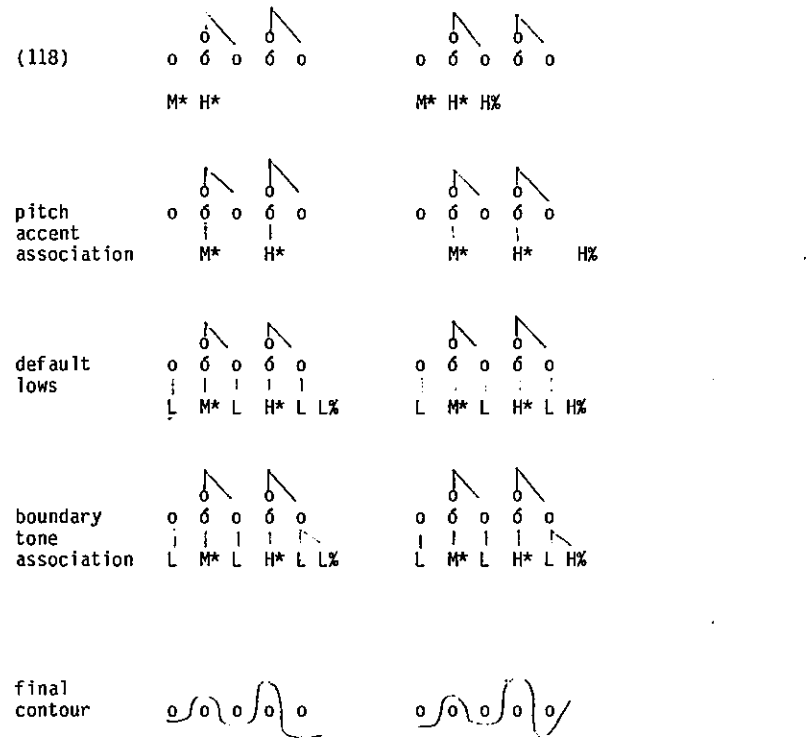


There is more going on than the simple introduction of a tonal melody on the last vowel of a phrase. The consistent presence of two pitch prominences in each melody (marked x and y) is anomalous. The association of the x-tone with the first stressed syllable is unexplained. Likewise, the presence of the y-tone associated with the last stressed syllable of the low and rising melodies is unexplained as

well. Given Haas' view, that these are tonal melodies applied to the ultima, these facts are difficult to countenance. However, if these tonal melodies are seen as intonational melodies, then this can be accounted for.

Consider first the low and rising melodies. In both cases, there are mid (M) and (H) pitch accents aligned with the first and last stressed syllables respectively, but for the rising melody, there is apparently an additional high tone floating off the right margin of the phrase. These require the following melodies: M* H* and M* H* H%. Pitch accents are notated with an asterisk, and boundary tones with a percent sign.[8] The association procedure for the treeless theory is as follows: within an intonational phrase, associate the first pitch accent with the first stressed syllable, and the second pitch accent with the last stressed syllable. The high boundary tone then associates to the last syllable after toneless syllables have been assigned a default low tone. The same rule inserting default low tones can also insert a low boundary tone if the melody has no boundary tone. This gives derivations as follows.

[8]The system adopted here is a simplified version of Pierrehumbert (1980). One difference is that the sagging around pitch accents is achieved by a rule (to be discussed below) inserting low tones. Another difference is the absence of phrase tones and optionality of underlying boundary tones.



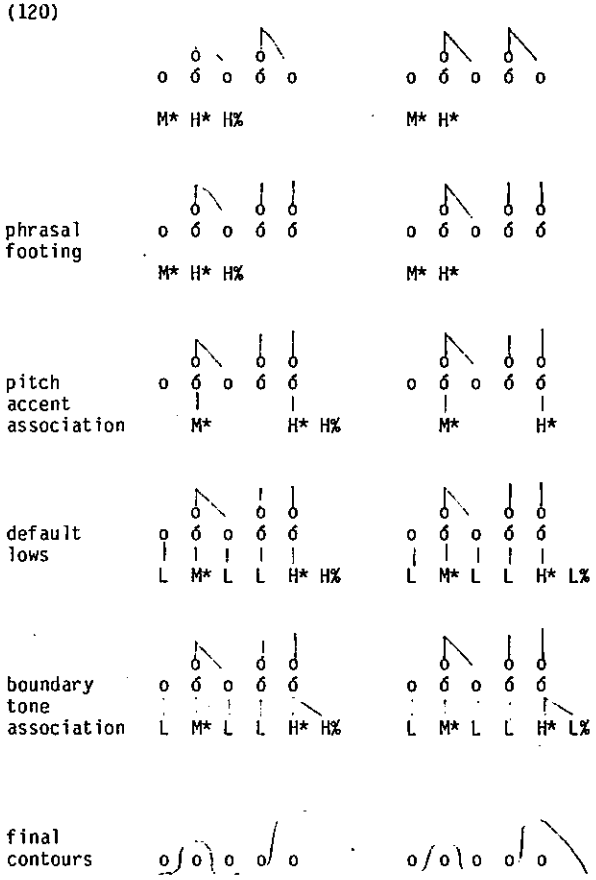
Contrast the cases in (118) with the final high and falling melodies from (117). With these the 'y' tone must associate with the final syllable. There are two methods for dealing with this. 1) Stipulate that for the high and falling melodies, the 'y' tone associates with the final syllable, or 2) Assign stress to the final syllable, and allow the association procedure above to give the right associations. The latter procedure has some nice consequences in accounting for the anomalies mentioned above, so it will be adopted here.

(119) Phrasal Footing

Build a right-dominant foot at the right margin of a phrase for the high and falling melodies.

This provides the following kinds of derivations.

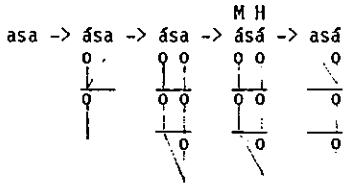
(120)



This analysis allows us to maintain one association procedure, and lays the basis for an answer to the destressing problem. One question

was why do the high and falling melodies trigger destressing? The answer is now obvious: they trigger destressing because they are the DTEs of the phrasal trees. This is illustrated in the derivation below.

(121)



Another argument for the analysis above concerns final devoicing. "In case the ultimate vowel is [u] preceded by [k] or [hk], the low and rising melodies may be placed, if desired, on the penultimate vowel, e.g., [tóniku] 'the man', [láhontohku] 'very early'; in this event the [u] is unvoiced. The remaining melodies are placed on the ultimate vowel without exception, e.g., [pítakú] 'he walks'." (p.14-15) This suggests the following rule.

(122) V --> [-vcd] / k ___ #

A [u] becomes voiceless after a [k] when it is stressless word-finally. The fact that the rule only applies to the low and rising melodies is now a direct consequence of the stresslessness of ultimas under those melodies. On Haas' analysis, there was no explanation for this phenomenon. (122), on the other hand, seems to be a reflection of the natural tendency for stressless vowels to reduce.

One last argument for this analysis is that we no longer have to countenance lexical items completely destressed by tones. A form like ása in (121) above is actually stressed.

One might object that Haas claims that such forms are stressless.

In fact, Haas observes that stresses disappear when a low or rising melody is superimposed on a stressed penult. Rather than disappearing, I would like to suggest that superimposing any melody on a stressed syllable in Tunica eliminates whatever independent cues there are for stress in the language. On this view then, stress disappearance is a more general process than Haas originally thought.

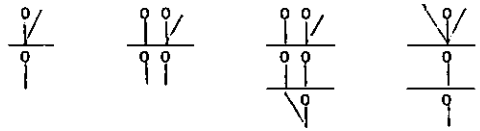
Now consider the suffix áni. This suffix behaves just like the high and falling melodies. It induces leftward destressing and rhythm.

(123) mîli áni — milÉni
red quot — 'They say it's red.'

te mîli áni — témilÉni
around red quot. — 'They say it's red all around.'

To get this result, áni must be added after word tree construction and prior to phrasal tree construction just like the intonational melodies. Thus:

(124) mîli --> mîlEni --> mîlEni --> milEni



What would permit this? There is no other phonological evidence bearing on the issue. Ani behaves just like it is in the word. This should not disturb us though, as the other clitics of the language -- the person/number suffixes --also do not display a great deal of phonological evidence of cliticization. Let us assume áni is a late clitic. That is, while the other "early" clitics are added within the word tree, áni is added outside the word tree. This allows áni to trigger destressing and to receive initial stress since it is a disyllable. It

also displays a certain freedom of occurrence not expected with simple affixes: it occurs on all major categories.

(125) tá páhpahkana hc nîsara áni ->
the woodpecker fsg young-woman quot

-> tápahpahkanahc nîsaráni (N)
'They say the woodpecker was a young woman.'

yúru áni -> yurÓni (A)
long quot 'They say that it was long.'

pîta hk?úna áni -> pîtahk?unáni
walk he-was quot 'They say he was walking along'

sin srúka pánu áni -> sinsrúka panÓni
mdu frightened very quot 'They say they were very frightened'

In addition, áni occurs outside all other affixes and clitics. "The quotative postfix [áni] follows any other postfix which is used with the same word . . . ." (p.24) Following are some of Haas' examples.

(126) lûpi wi k?ahca áni -> lûpiwik?ahcáni
die 3msg future quot 'They say he'll die.'

sink sáku ti aha áni -> sinsákutEhÉni
3mpl eat 3fsg neg quot 'They say she didn't eat them.'

tihk pó wi stuk?OhO áni -> tihpówistuk?OhÓni
3fsg see 3msg can't quot 'He couldn't find her.'

This means that there must be two levels of cliticization.[9] One level, with the person/number suffixes, prior to word-tree construction, and one level, with áni, after word-tree construction is complete. The different properties of the clitics involved seem to merit this treatment. The person/number markers do not destress a preceding stress in a binary structure, but áni does. Also, áni occurs outside the person/number markers.

[9]This is a counterexample to level-ordering. Cf. Mohanan (1982), but also Dresher (1983).

4.9 Summary

The analysis of Tunica has demonstrated the utility of trees in accounting for destressing, even when hierarchical structure is not apparent in the phonetic record. The trees proposed account for: 1) directionality of destressing. 2) intonational alignment, and 3) the interaction of destressing and intonation.

The account has also made crucial use of prune alpha. The different directionalities of the rule could only be collapsed by a rule as general as prune alpha. Superficially, there seemed to be at least two destressing rules: Right Destressing, which destressed the right member of a pair of stressed syllables in the environment of a clash, and Left Destressing, which destressed the left member of a pair of stressed syllables in the environment of a clash, in certain intonational contexts, and before áni. It was only by exploiting the generality of prune alpha, that these rules were collapsable.

The Rooting Constraint was also crucial to the analysis. It was imperative in accounting for the anticlash constraint on the syncope rules. These rules were shown to be blocked by an extension of the Clash Resolution Hypothesis. However, when the clash produced by syncope could be eliminated without violating Rooting, syncope was not blocked. Rooting was also crucial in accounting for the applicability of prune alpha phrasally. Prune alpha only applies phrasally when the output would not violate Rooting.

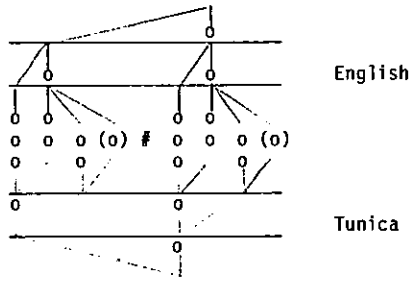
The Trigger Prominence Principle and bottom to top application were also confirmed. These independently required principles allowed us to avoid the ad hoc stipulation of left to right directionality for forms

like táyatápala.

In conclusion, the same principles that were required to account for English have been confirmed in this analysis of Tunica. This is an interesting result because English and Tunica seem quite different on the surface. The theory developed here captures the core phenomena in both languages. They both exhibit prune alpha subject to the principles above: the Clash Resolution Hypothesis, Metrical Locality, the Trigger Prominence Principle, bottom to top application, and Prosodic Rooting. This entails that metrically local clashes are resolved in accordance with the Trigger Prominence Principle and bottom to top application, provided that Rooting is not violated.

The two languages differ in certain respects though. First, the arboreal grids constructed are different. English builds left-dominant binary feet right to left with a right-dominant word tree and a right-dominant phrasal tree. Tunica builds left-dominant feet left to right under a left-dominant word tree and a right-dominant phrasal tree.

(127)



In the transformational component, English exhibits certain eurhythmy constraints like the Quadrisyllabic Constraint. This

eurhythmy constraint allows prune alpha to apply in cases where it does not eliminate clashes, i.e. to apply in its Beat Addition mode. However, prune alpha is still constrainable by the Revised Clash Resolution Hypothesis, which required that clashes be minimized. In contrast, Tunica does not exhibit any eurhythmy constraints, and therefore does not have anything like Beat Addition, though Late Stress Assignment is vaguely reminiscent of it.

A modular approach to metrical transformations has proved profitable in English and Tunica. To the extent that this approach captures language-specific and crosslinguistic gneeralizations, the theory is validated.

Abbreviations

GLOW	Generative Linguistics in the Old World
IJAL	International Journal of American Linguistics
IULC	Indiana University Linguistics Club
LA	Linguistic Analysis
LI	Linguistic Inquiry
MIT	Massachusetts Institute of Technology
NELS	Northeastern Linguistic Society
SCOPIL	Southern California Occasional Papers in Linguistics
UCLA	University of California at Los Angeles
WCCFL	West Coast Conference on Formal Linguistics

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