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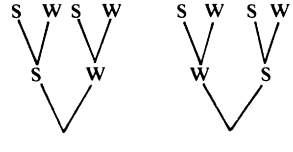
Extrametricality and English Stress

1. Introduction

One distinguishing trait of generative phonology is a belief in the explanatory value of notational devices: in many cases, the invention of a good notation has revealed the simplicity behind systems that initially seemed complex. A good formal device takes on a life of its own, revealing previously unseen connections and stimulating further inquiry. A successful notation also increases our understanding of how complex phonological systems can be learned by children: if children undertake language learning equipped with some mental analogue of our graphic formalisms, their task is a much easier one. In this article, I offer a small extension of our set of formal devices, the extrametricality rule, and attempt to demonstrate its explanatory value.

In the metrical theory of stress, a syllable is called *extrametrical* if it is ignored by the stress rules; that is, treated as if it were not there. This notion was first introduced in Liberman and Prince's (1977) pioneering article as a means of handling the deviant stress patterns of words like *állegòry, álligàtor*, and *Áristòtle*. These words are exceptional in that they have branching constituents on the right that are labeled *weak*; compare *Áristòtle* with the regular *ànecdótal*:

(1) Áristòtle ànecdótal



Liberman and Prince (hereafter LP) suggested that if certain cases of word-final *-y*, *-r̩*, and *-l̩* are extrametrical, then the word trees in which they appear can be labeled by the normal rule for nouns, which makes final nonbranching constituents weak. *Aristotle* would thus be labeled in the same way as, say, *anecdote*:

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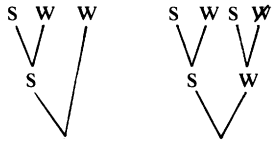
(2) ánecdòte Áristòt̬l



LP equivocate on the formal means by which syllables are to be designated as extrametrical, but opt tentatively for an analysis based on Chomsky and Halle (1968, hereafter SPE), in which surface final [i,r̩,l̩] are derived from underlying nonsyllabic /y,r,l/ by a rule of *Sonorant Syllabification*, which applies after metrical labeling:

(3) *Sonorant Syllabification*
[+son] → [+syl] / C ____ #

In a later note, however, Nanni (1977) pointed out that essentially the same behavior that is displayed by *-i*, *-l̩*, and *-r̩* is found in words ending in the suffix *-ative* (cf. *ímitàtive*, *ínnovàtive*), where an analysis in which a final syllabic sound is derived from a nonsyllabic sonorant would be impossible. Nanni's analysis of *-ative* shows that extrametricality must be a diacritic property of at least some morphemes.

My purpose here is to extend the notion a step further, arguing that languages may contain extrametricality *rules*, which may apply to large segments of the vocabulary. The use of extrametricality rules will be shown to have explanatory value in capturing insights about the English stress system, in the treatment of word-final syllables in languages where stress is sensitive to syllable quantity, and in the construction of a universal theory of possible foot shapes.

What does an extrametricality rule look like? With a couple of doubtful exceptions, the candidates known to me all adhere to the following format,

(4) $X \rightarrow$ [+extrametrical] / ____ $]_D$

where X is single phonological constituent, such as rhyme, segment, consonant, or suffix; and $[\ \ldots\ ]_D$ is the domain in which the stress rules of the language apply (usually the phonological word or phrase). There are two claims embodied in (4). First, the material marked as extrametrical must always be a single, unvarying unit, so that, for example, we could not replace the familiar Latin stress rule with a rule of final stress plus an extrametricality rule of the form (5):[1]

(5) $(C_0\breve{V}C)(VC_0) \rightarrow$ [+ex] / ____ $]_{word}$

The second claim of (4) is that extrametricality is assigned only at the right edge of stress domains. This generalization holds true of a large number of stress systems, but may not be absolute; see the discussion of Winnebago stress in Hayes (1981, 71–72). It thus may be necessary to include the mirror image of (4) in the theory as a marked option.

[1] In this respect extrametricality differs crucially from the notion of "stripping" developed in Lee (1969; 1975).

Let us now consider two examples of extrametricality rules. According to McCarthy (1979a,b), the stress pattern of Classical Arabic (and some of its modern descendents) is based on the distinction of light (CV), heavy (CVV and CVC), and superheavy (CVVC and CVCC) syllables. Stress falls (a) on superheavy syllables, which may occur only in phrase-final position; (b) otherwise, on the rightmost nonfinal heavy syllable; (c) otherwise, on the initial syllable. Some examples are as follows:

(6) kaatibáat 'writer (fem. pl.)'
yušáariku 'he participates'
mámlakatun 'kingdom (nom. sg.)'
kátaba 'he wrote'

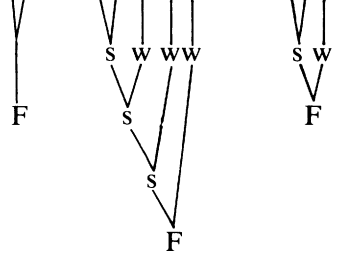
One way of looking at the pattern of (6) is to say that word-final syllables are demoted one position down the hierarchy of syllable weight: superheavy syllables are treated as heavy, while heavy syllables are treated as light. We can then say that stress is placed as far to the left as possible, subject to the condition that only light syllables may be skipped over. The "demotion" of word-final syllables is accomplished straightforwardly with an extrametricality rule of the form (7):

(7) *Final Segment Extrametricality*
$[+\text{seg}] \rightarrow [+\text{ex}] \; / \; \underline{\quad} \;]_{\text{word}}$

Once (7) has applied, we can proceed with the stress derivation. Following Selkirk (1980), I assume that the feature [+stress] is to be excluded from phonological representations, to be replaced by a division of the prosodic structure into a level of *feet*, dominated by a *word tree*. In Classical Arabic, we can say that at the right edge of the word, a metrical foot is constructed which is left-branching and unbounded in size, and in which all syllables dominated by right branches must be light. Adopting McCarthy's formalism, we express this by requiring that all right branches dominate nonbranching nodes on a projection consisting solely of syllable rhymes. Sister nodes of the foot are labeled *s w*:

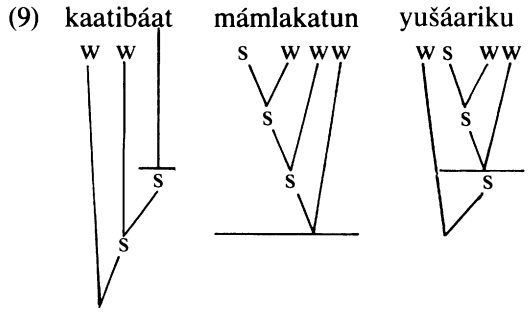
(8)

kaatibaat	mamlakatun	yušaariku	
aa i aat	am a a un	u aa i u	rhyme projection
aa i aat	am a a un	u aa i u	Final Segment Extrametricality
aa i aat	am a a un	u aa i u	Foot Construction



After the application of Foot Construction, a universal convention to be discussed below adjoins the final rhyme of *yušaariku* to the neighboring foot. The complete metrical structure involves the creation of a word tree which is right-branching, with sister nodes labeled *w s*. For clarity I will represent the division between foot and word trees with a horizontal line, as follows:

(9)



It should be clear from these derivations that an extrametricality rule can carry out just the demotion in weight of final syllables that is needed to derive the Arabic stress pattern with a maximally simple foot construction rule. Similar extrametricality rules can account for the deviant criteria for syllable weight in final position that are found in many other languages, for example Hindi, Meadow Cheremis (Hayes (1981)), Ancient Greek (Steriade (1979)), Estonian (Prince (1980)), and Spanish (Harris (forthcoming)).

Stress in Hopi, as discussed in Jeanne (1978), is another case in which extrametricality provides a straightforward analysis. As (10) shows, Hopi stress normally falls on the first syllable if it is heavy, and on the second syllable if the first syllable is light:

(10)	a.	táavo	'cottontail'
		páawik^{y}a	'duck'
	b.	ʔácvewa	'chair'
		léstavi	'roof beam'
	c.	qötő̱sompi	'headband'
		melóoni	'melon'

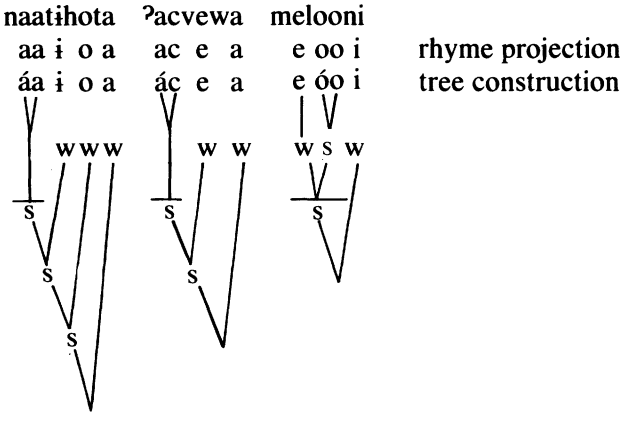
I hypothesize that this pattern is the result of applying the following rules:

(11) a. At the left edge of a word, construct a foot on the rhyme projection, such that
   1. the foot contains at most two syllables;
   2. the left node of the foot, if any, dominates a nonbranching rhyme;
   3. the sister nodes are labeled *w s*.

b. Incorporate this foot and any leftover syllables into a left-branching word tree, in which sister nodes are labeled *s w*.

Some examples of how (11) works are as follows:

(12)



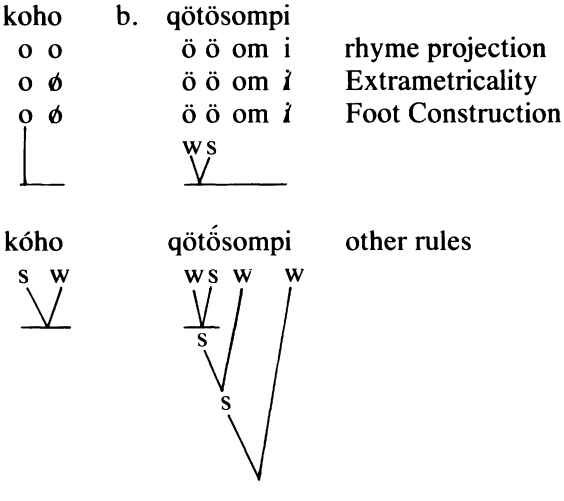
There is an additional complication in the Hopi stress rules that must be accounted for: a disyllabic word always receives initial stress, even if its first syllable is light: cf. *kóho* 'wood', *wári* 'to run', *láho* 'bucket'. The problem can be resolved if we assume that there is an additional rule in Hopi that marks word-final syllables as extrametrical:

(13) *Hopi Extrametricality*

$$\text{syllable} \rightarrow [+\text{ex}] \; / \; \underline{\quad} \;]_{\text{word}}$$

Rule (13) forces the Foot Construction rule to ignore the final syllable of *koho*, resulting in the construction of a nonbranching foot:

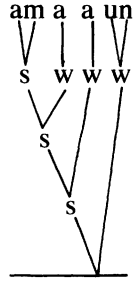
(14)



The two preceding examples show that the device of rule-governed extrametricality can play a useful role in the formulation of stress rules. What I wish to argue here is that there are reasons to prefer the extrametricality analyses over other devices that seem a priori equally plausible. For example, stress in Classical Arabic is handled by McCarthy (1979a,b) under quite different assumptions. McCarthy claims that the ca-

nonical foot template for Classical Arabic is not uniformly left-branching, as I have suggested, but rather that the rightmost node of the foot is free. This allows word-final heavy syllables to be skipped over without the device of extrametricality, as in (15):

(15) mamlakatun

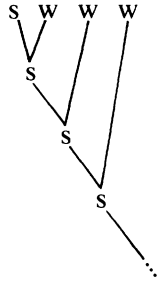


rhyme projection

Foot Construction

The word-final superheavy syllables are handled with an entirely different device, which will not be discussed here. As far as I know, there are no language-internal grounds available to decide between McCarthy's analysis of *mamlakatun* and the one proposed here. We can make an argument, however, if we address questions of stress rule typology. Following Halle and Vergnaud (1978), I assume that an adequate metrical theory of stress rules must include an inventory of possible foot types. Each foot type may be regarded as a template, usually of varying size, which is fitted to the string of syllables or rhymes. I would hypothesize that the conditions on the terminal nodes of a foot are of just two kinds: a terminal node may be free, or it must belong to one of two classes defined by some binary distinction of prominence, such as branching versus nonbranching rhymes, long versus short vowels, high versus low tone, and possibly a few others. Crucially, the same criterion of prominence must be used throughout the foot template. Here we will express templates as disembodied trees, using X to designate free terminal nodes and x for nodes which must dominate members of the less prominent class. Using this notation, the foot templates for my analyses of Classical Arabic and Hopi stress are as given in (16a) and (16b), respectively.[2]

(16) a. X (x) (x) (x) . . .

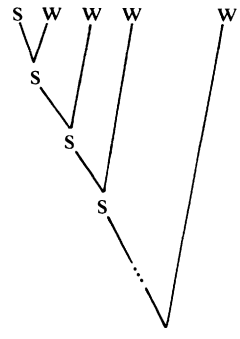


b. (x) X

[2] The templates of (16) contain information that is in fact redundant under the theory: given a (left/right) branching foot, it is in general true that the optional branches are the (right/left) ones, that only the (right/left) nodes may be restricted to the less prominent category, and that labeling will usually be (s w/w s). Justification for these claims may be found in Hayes (1981).

McCarthy's analysis of Classical Arabic requires a somewhat different template, as in (17):

(17) X (x) (x) (x) . . . (X)



(17) is equivalent to (16a) with the addition of a free final node.

The argument here arises from the question of whether we can strengthen metrical theory by eliminating any of these templates from the universal inventory. The data in Hayes (1981) and other works indicate that the template (16a) is widespread: it is employed in all positions of the word, in numerous languages. By contrast, the template (17) appears *only in word-final position* in all well-motivated analyses of which I am aware. This is a mystery which extrametricality is well suited to clear up: languages in which feet have the surface form of (17) are to be accounted for with extrametricality rules, either rules of the form I have posited for Classical Arabic, or in the simpler cases, just rules marking final syllables as extrametrical. The restriction of such feet to word-final position follows from the more general restriction that extrametricality rules apply only at the right edge of the stress domain; (17) need not be included as a primitive foot template. We see, then, that although both of the foot templates (16a) and (17) allow for a descriptively adequate account of Classical Arabic stress, only the former is consistent with a more restrictive, explanatory theory of stress rules.

A similar argument can be made for the extrametricality account of Hopi stress. The most plausible rival analysis would be to posit a late stress fronting rule, which would apply only in disyllables:

(18) *Stress Fronting*

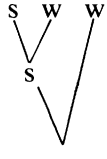
X X ## → *## X X ##*

This rule would correctly front the stress in *kóho* (< *kohó*), but would not apply to *qötősompi*, since the relevant *w s* constituent is not word-final (cf. (14b)). To decide between the rival analyses, we can appeal to universal grounds. It appears that cases similar to Hopi are fairly common; that is, languages in which stress placement is calculated from the beginning of the word, but with an overriding restriction that the

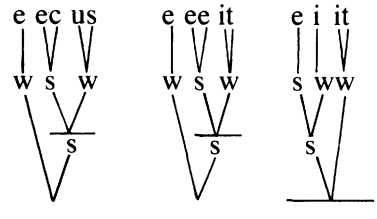
final syllable must not be stressed (cf. Hayes (1981, 79)). As Hyman (1977, 42) points out, however, the mirror image case is conspicuously missing: no language calculates stress from the end of a word, with an overriding restriction barring stress from the initial syllable. Once again, the theory of extrametricality offers an explanation of the phenomenon: if we use it to account for stress systems like Hopi, then the asymmetry follows from the restriction of extrametrical syllables to word-final position. This restriction is independently motivated by the role that extrametricality plays in the construction of word-final feet, as in Classical Arabic.

Another foot template that extrametricality would allow us to eliminate from the general theory is the one governing stress in Latin and a number of other languages, in which the antepenult is stressed in words of more than two syllables having a light penult; otherwise the penult. Under orthodox metrical assumptions, this would follow from a foot template of the form (19a), along with a word tree subordinating any remaining syllables in the word to the final foot. (19b) illustrates this with words from Latin:

(19) a. X (x) (X)



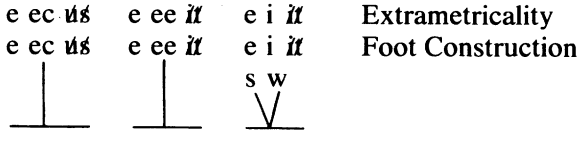
b. refé́ctus refé́cit réficit

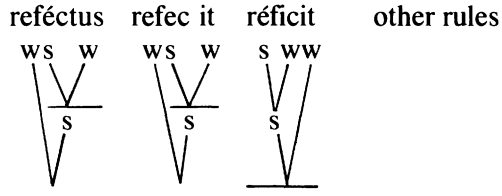


However, all the known cases of stress templates having the form (19a) appear in word-final position (see Hayes (1981, 67)). This fact again suggests an extrametricality analysis, in which the extrametrical elements are word-final rhymes. The foot template would be as shown in (20a), the mirror image of Hopi:

(20) a. X (x)

b.





Again, the restriction of feet having the form (19a) to final position is a consequence of the extrametricality theory, but would go unexplained if we allowed (19a) as part of the primitive inventory of foot templates.

A final, trivial constraint must be added to our account: in order to stress Latin monosyllables, we must assume that extrametricality rules are blocked if their application would mark the entire stress domain as [+ex]. This condition is apparently universal, and thus should not add any cost to the grammars of particular languages.

Thus far I have left aside the question of how extrametrical elements are adjoined to the prosodic structure. I assume here that the constituent structure of syllables is present in underlying representation, so that no adjunction rule is needed for extrametrical segments; extrametricality does not mean that these segments are unattached from their syllables in any way, but simply that they are ignored for purposes of foot construction. Extrametrical syllables, by contrast, must be attached to feet by rule, if feet are to be created in phonological derivations. We may tentatively formulate a Stray Syllable Adjunction convention as follows:

(21) *Stray Syllable Adjunction* (SSA)
Adjoin a stray syllable as a weak member of an adjacent foot.

SSA can be identified as the missing rule completing the derivations of (8) and (20b). Notice that a convention of this sort is needed in metrical theory anyway, in order to assign a metrical interpretation to syllables that are rendered stray after the feet have been constructed, either through destressing (i.e. defooting) rules or through segmental epenthesis and vocalization processes. I assume, then, that SSA is a universal convention, which applies whenever it can after the rules of foot construction have applied. Notice that (21) is formulated ambiguously in the case of stray syllables occurring between feet. We will find evidence later to make the formulation of SSA more precise, removing this ambiguity.

In this section, I have tried to argue for the plausibility of rule-governed extrametricality on universal grounds. The theory allows us to constrain the inventory of possible foot templates; explains the restriction of certain surface foot shapes to word-final position; accounts for the fact that special "avoidance clauses" such as the one in Hopi refer to final syllables but not initial ones; and provides an account of the deviant criteria for syllable weight that are found in final position. What is needed to establish the extrametricality theory firmly, however, is to show that it can provide insights into the workings of complex but reasonably well understood stress systems. One good example, I believe, is Harris's (forthcoming) account of stress in Spanish, which adheres

to an extrametricality framework quite close to what is proposed here. In the remainder of this article, the theory is applied to English stress. I will show that by using extrametricality, we can simplify the rules, capture new generalizations, and account for previously unexplained phenomena.

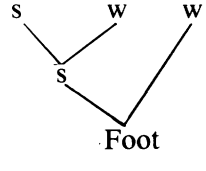
2. An Account of English Stress

2.1. Productivity and Other Matters

An important question facing anyone dealing with the English stress rules concerns their productivity: do our rules represent some sort of mental reality for the native speaker, or is the phonologist simply groveling in the muck left behind by historical change? As Selkirk (1980, 596–597) points out, there is substantial evidence that English words are listed in the lexicon already stressed (i.e. already having metrical structure), rather than having their stress derived as, say, aspiration would be. We thus might regard the rules that follow in a sense as lexical redundancy rules, despite their rather derivational appearance.

The productivity of certain aspects of English stress is unquestionable. LP point out, for example, that forms like *pódectal* and *pónitode* ([pánəDôwd]), which violate the rules of foot construction, are not only missing from the corpus, but also sound strange to native speakers. Notice also that the Russian words *Nínotchka, bábushka* were borrowed into English with penultimate stress: the original Russian stressings would be very strange for English words. However, these cases do not necessarily show that there is a set of rules deriving stress in English. Selkirk (1980) has suggested that speakers' knowledge about English stress is embodied only in their knowing the maximum possible size of a metrical foot, the template being roughly as shown in (22):[3]

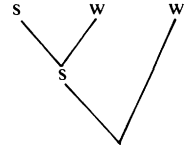
(22) $C_0VC_0\ (C_0\check{V})\ (C_0\check{V}C_0)$



Pódectal, póni[D]ode, Nínotchka, and *bábushka* all constitute metrical feet that could not be encompassed by the template (22). They thus can be ruled out without a pho-

[3] Selkirk's template is actually of the form (i),

(i) $C_0VC_0\ (C_0\check{V}C_0)(C_0\check{V}C_0)$



which incorrectly predicts *pódectal, Nínotchka* to be normal English words. I assume that this is simply an oversight.

nological stress derivation. Selkirk further claims that, contrary to derivational accounts, there is no structural pressure for feet to be constructed maximally going from right to left—that is, any sequence of feet that are less than or equal to the template of (22) constitutes a regularly stressed word in English. Some examples supporting this view are *ànténna, Àlabáma, Mìssissíppi*, which with maximal feet would be stressed *ántenna, Alábama, Missíssippi*.

Several considerations argue against Selkirk's claim, however: (a) Historical change: we will see below that the various changes that have occurred in English stress since the eighteenth century can be explained as the removal of irregular diacritic markings from lexical representations. The explanation crucially requires that we invoke a phonological derivation, in that the relevant words were well-formed in Selkirk's sense before the change as well as after. (b) Experiment: Trammell (1978) has shown that when subjects are asked to read unfamiliar words of English, for the most part they prefer pronunciations having feet that are maximal according to the rules that follow. (c) The cycle: in Hayes (1981, 163–164), it is argued that there are serious reasons for doubting Selkirk's explanation of the phonological cycle as being merely the result of the language's history. Only a derivational account of English stress appears to be adequate to explain cyclic phenomena.

On the basis of this evidence, I propose that English stress is both listed in the lexicon *and* derived by rule; that is, that the output of the stress rules is stored in the lexicon. A lexical entry in English is highly valued to the extent that its feet are maximal, but more costly entries with nonmaximal feet are also permitted. The claim here is that languages may vary in the principles of maximality that govern foot construction. For example, in Latin and Classical Arabic, feet must always have the maximum size compatible with the foot template, so that stress is invariant and predictable. In Estonian (Prince (1980)), maximality plays no role for a part of the template, giving rise to free variation in stress. English represents an intermediate position: maximal feet are not required, but, of the variants that are generated, one is always listed in the lexicon, at a cost commensurate with whether its feet are maximal or not.[4]

A few additional preliminaries: I assume LP's (p. 271) division of English vowels into "long" and "short", where most long vowels surface as diphthongs. In the numbered examples, vowels will be transcribed orthographically in most cases, but phonetically where the length distinction is crucial. The proposals of Kiparsky (1979) for constructing the word tree are assumed, as well as (temporarily) the rule for word tree labeling given in LP (p. 308). In section 2.7, we will find evidence for revising LP's rule substantially.

[4] Spanish (Harris (forthcoming)) might be considered as the counterpart of English: if we take the domain of stress assignment to be the derivational stem, then we can say that the system prefers feet of *minimal* size, with maximal foot construction as the marked option.

2.2. Extrametricality Rules in English

We can now examine in detail some of the stress placement phenomena of English. An area of particular interest is the stress behavior displayed by English verbs and unsuffixed adjectives. These words receive final stress if they end in a string of at least two consonants or with a syllable having a long vowel, otherwise penultimate stress, as in (23):

(23)

obéy	torménT	astónish
atóne	usúrp	devélop
divíne	robúst	cómmon
discréet	ovért	illícit

The situation is quite similar to that of Classical Arabic: the criterion for prominence in word-final syllables (at least in these words) is different from the one that prevails nonfinally, which (as we shall see) is simply the distinction between branching and nonbranching rhymes. The facts are easily handled by an extrametricality rule of the following sort:

(24) *Consonant Extrametricality*

$[+\text{cons}] \rightarrow [+\text{ex}] \; / \; \_\_\_\_ \;]_{\text{word}}$

If we ignore word-final true consonants, as (24) specifies, then the foot construction rule for this class of words turns out to be identical to the rule proposed above for Latin:

(25) *English Stress Rule*

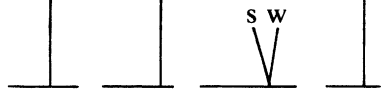
At the right edge of a word, form a maximally binary foot on the rhyme projection using the template X (x)—that is, the right node of a branching foot

must dominate a nonbranching rhyme. Label feet *s w*.

The application of (24) and (25) is illustrated in the following derivations:

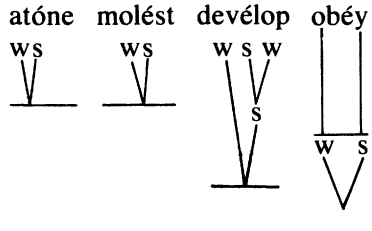
(26)

atone	molest	develop	obey	
a own	o est	e e op	o ey	Consonant Extrametricalit
a own	o est	e e op	o ey	English Stress Rule



The surface metrical structures are derived by further rules of foot construction, word tree construction, and destressing, to be discussed below:

(27) atóne molést devélop obéy



The stress pattern of nouns is somewhat different. Here, the final syllable always receives stress if it contains a long vowel:[5]

(28) Mánitòu cávalcàde mísanthròpe
mònsóon vétò plánetòid

The final syllable also sometimes receives stress even if its vowel is short. The stressing of these syllables is lexically idiosyncratic, although tendencies can be discerned which are governed by the final consonant or consonants of the word (see Ross (1972)).

(29) mániàc Ísaac ínsèct súbject
pársnìp cátsup gýmnàst témpest
prótòn ápron nárthèx hélix

Generally, the final syllable is more likely to be stressed if it contains a consonant cluster or a noncoronal consonant in its rhyme. However, these are only tendencies, as (29) shows.

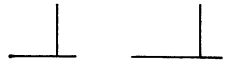
The stressing of final syllables containing long vowels will be accounted for here by a rule assigning them to a nonbranching foot:

(30) *Long Vowel Stressing*

$$\bar{V}C_0\# \rightarrow \underset{|}{\bar{V}}C_0\#$$
$$F$$

I further assume that final stress in words like those of (29) follows from their being represented prior to the application of the stress rules with a word-final monosyllabic foot:

(31) insect parsnip



The loose regularities in final stressing discovered by Ross can be accounted for by redundancy rules correlating the presence or absence of this final foot with the nature of the final consonant(s).

In the nonfinal syllables of nouns having stressless final syllables, the situation is considerably more regular: stress is generally assigned to a heavy penult, while the antepenult receives stress if the penult is light:

(32) América Arizóna agénda
díscipline factótum appéndix
lábyrinth elítist amálgam

The situation here is clearly the same as in Latin, and under our framework justifies a rule marking word-final rhymes as extrametrical:

[5] Underlyingly; cf. the discussion of Final Lengthening in LP (pp. 272–273).

(33) *Noun Extrametricality*
Rhyme → [+ex] / ___]$_N$

Given (33), no further rule is needed to stress the words of (32): the English Stress Rule motivated for verbs and unsuffixed adjectives is sufficient. This is illustrated below with the stressing of *labyrinth, Arizona*, and *agenda*:

(34)

a i inθ	a i ow a	a en a	Consonant Extrametricality
a i ɪ́nθ	a i ow á	a en á	Noun Extrametricality
a i ɪ́nθ	a i ow á	a en á	English Stress Rule
s w			
a i ɪ́nθ	a i ow á	a en á	Stray Syllable Adjunction
s w w	s w	s w	
s			
lábyrinth	Àrizóna	agénda	other rules
s w w	s ws w	w s w	
s	w s	s	

This is our first argument in favor of the extrametricality approach: with extrametricality, we can capture the unity of stress assignment in nouns on one hand, and verbs and unsuffixed adjectives on the other.

It is reasonable to inquire whether LP's analysis is also capable of capturing this generalization. If one takes the LP analysis at face value, the two cases can be collapsed (p. 306), but at the cost of requiring the stress rule to be based on segmental sequences, rather than syllable types. Elsewhere (p. 272, fn.), LP admit that the stress rules are in all likelihood syllable-based. If so, the only solution remaining to them would be to posit deviant constituent structures for word-final syllables, along the lines of Prince (1980, 531). As far as I know, there is no independent evidence that would support such a claim. In fact, the evidence from phonotactics argues against it: the restrictions on possible syllables in English (Halle and Vergnaud (1978)) crucially presuppose that word-final consonants form part of the rhyme, and thus would have to be included in the domain of the stress rules, barring an extrametricality analysis.

Our argument receives further support from the stress pattern of suffixed adjectives, which is the same as that of nouns:

(35)

munícipal	adjectíval	fratérnal
magnánimous	desírous	treméndous
signíficant	clairvóyant	relúctant
ínnocent	complácent	depéndent
prímitive	condúcive	expénsive

These words contrast with the unsuffixed adjectives of (23), which are stressed according to the pattern of verbs. We can account for the difference with the following rule:

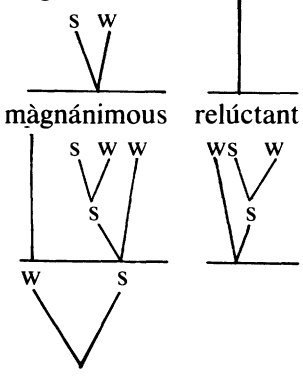
(36) *Adjective Extrametricality*

$[X]_{Suffix} \rightarrow [+ex] / \_\_\_\_]_{Adj}$

Rule (36) marks adjectival suffixes as extrametrical in final position. The stress pattern of (35) then follows automatically from the English Stress Rule, as is shown below with the derivations of *magnanimous* and *reluctant*:[6]

(37)

ag a i os	e uc ant	Consonant Extrametricality
ag a i ⟨s⟩	e uc ⟨ant⟩	Adjective Extrametricality
ag a i ⟨s⟩	e uc ⟨ant⟩	English Stress Rule



To summarize, we have proposed two rules of foot construction for English words: Long Vowel Stressing and the English Stress Rule. These rules interact with three extrametricality rules (Consonant, Adjective, and Noun Extrametricality) to produce the relatively complex pattern of stress found at the right edge of English words. Most of the lexical idiosyncrasy occurs in short-voweled final syllables, where only vague tendencies of stress placement can be formulated. The constraints embodied by the two stress rules, by contrast, are fairly rigid, providing an explanation for the deviance of LP's hypothetical **póni[D]ode* (where Long Vowel Stressing has not applied) and *pódectal* (where stress has been retracted further back than the English Stress Rule will

[6] There are two adjectival suffixes which are exceptions to Adjective Extrametricality: *-ic* and *-id*. Adjectives formed with these suffixes are regularly given penultimate stress, as if they were monomorphemic; cf. *intrépid, económic*. However, these two exceptions are greatly outweighed by the 18 regular cases; cf. the list in Hayes (1981, 162).

allow). The rules also explain why the Russian words *Nínotchka* and *bábushka* were adapted into English with penultimate stress.

2.3. Stress Retraction

In this section we will fill in some further details of our system, discussing how the feet are constructed which lie to the left of the one created by the English Stress Rule. In the course of doing so, we will discover an argument that supports our proposal to construct word-final feet in English with the aid of extrametricality rules.

The account of the English stress retraction pattern found in LP is admirably clear. LP assume a segmental rule of the form (38), which applies iteratively from right to left, assigning all the stresses of the word:

(38) *English Stress Rule* (LP's version)

$$V \rightarrow [+\text{stress}] \,/\, \underline{\quad} \; C_0(\check{V}C_0^1)_a(\check{V}C_0)_b \left\{ \begin{matrix} \# \\ [+\text{stress}] \end{matrix} \right\}$$

The indices *a* and *b* allow for the suppression of the parenthesized material in certain morphological contexts. For example, when the [+stress] term of the rule analyzes the vowel of the verbal suffix *-ate*, the term *a* is normally suppressed. LP call the resulting subrule *Strong Retraction*:

(39) *Strong Retraction* (LP)

$$V \rightarrow [+\text{stress}] \,/\, \underline{\quad} \; C_0(VC_0)\,[+\text{stress}]$$

This rule accounts for the fact that *-ate* generally places stress two syllables to its left, without regard to the quantity of the preceding syllable:

(40)	désignàte	cóncentràte	sálivàte (cf. sal*i*va)
	exácerbàte	artículàte	ídeàte[7] (cf. id*e*a)
	cónfiscàte	córuscàte	

Similarly, when term *b* of (38) is suppressed, we derive the *Weak Retraction* subrule:

(41) *Weak Retraction* (LP)

$$V \rightarrow [+\text{stress}] \,/\, \underline{\quad} \; C_0(\check{V}C_0^1)\,[+\text{stress}]$$

Weak Retraction is triggered by a fair number of suffixes, such as *-ite*, *-oid*, and *-ide*:

(42)	molýbdenìte	stalágmìte	sólenòid	mollúscòid
	sélenìte	archimándrìte	cýanìde	peróxìde

Notice that it would be easy to carry over the LP analysis into a foot-based framework:

[7] The last two examples are derived by a special provision in the LP rule, not stated under (38): if the rightmost term of the rule analyzes [+stress], rather than #, the term under *b* is permitted to analyze a long-voweled syllable.

we would simply attach the indices *a* and *b* to the two weak nodes in Selkirk's foot template, as cited under (22). However, there is evidence to support a substantially different approach to stress retraction in English: contrary to LP, we will claim that Strong Retraction and the English Stress Rule are entirely separate rules. We further propose that Weak Retraction is not a subpart of the English Stress Rule, but rather that the two rules are one and the same.

We begin by formulating our separate rule of *Strong Retraction*:

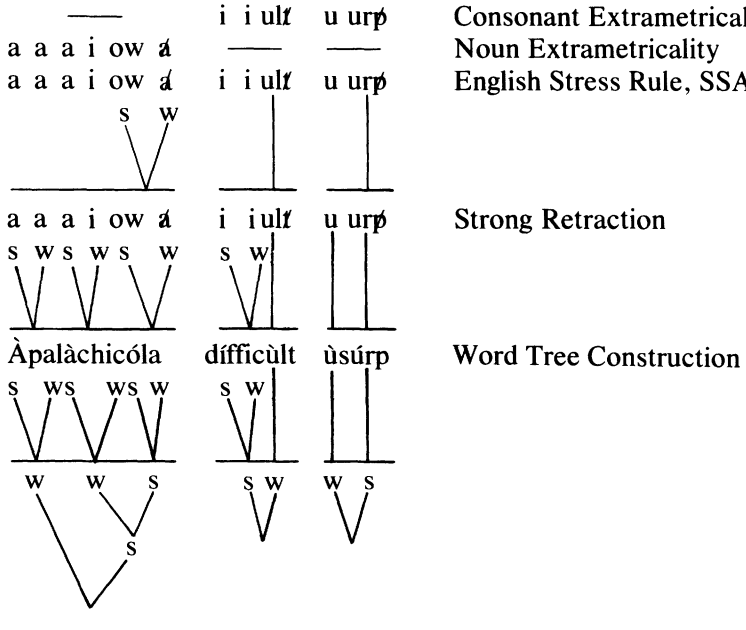
(43) *Strong Retraction*

Going from right to left across the word, group any unattached rhymes into metrical feet, using the template X (X)—that is, each foot has at most two

syllables; the rhymes of each foot are free to branch or not; and sister nodes are labeled *s w*.

The application of Strong Retraction is illustrated below with the derivations of *Apalachicola, difficult*, and *usurp*:

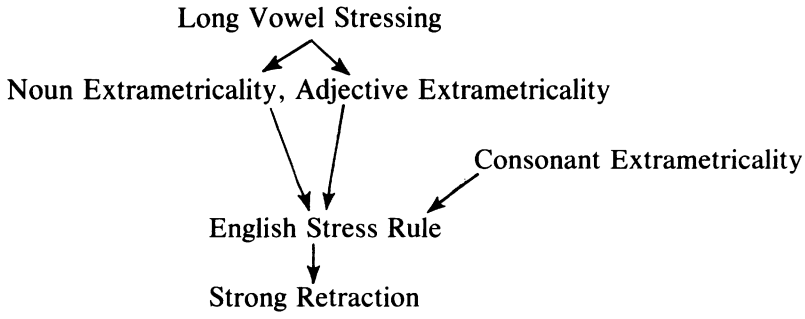
(44)



Notice that when Strong Retraction applies to *usurp*, only one syllable is present which is not already incorporated into a foot. Since the two-syllable requirement on Strong Retraction expresses only a maximum, the rule is free to assign a nonbranching foot to this syllable.

The rules we have presented are subject to the following extrinsic orderings:

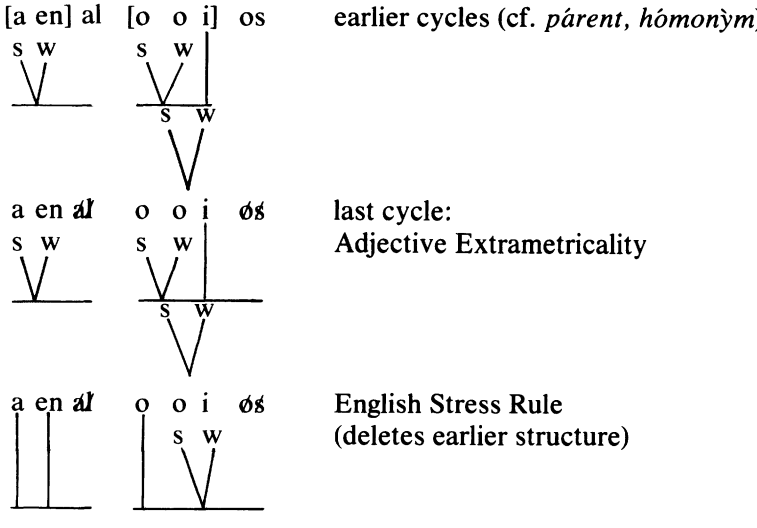
(45)

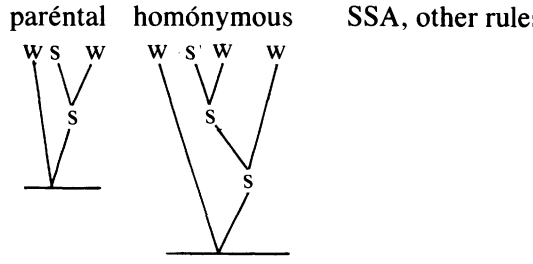


Long Vowel Stressing must precede Noun Extrametricality and Adjective Extrametricality because it stresses all long vowels in final syllables, regardless of whether or not they are in a position to be marked as extrametrical. The extrametricality rules must obviously precede the English Stress Rule, in order to obtain the results of the previous section. Finally, the English Stress Rule must precede Strong Retraction, because the latter begins its right-to-left binary count at the left boundary of the foot constructed by the English Stress Rule: compare *Àpalàchicóla*, where the secondary stresses fall on even-numbered syllables from the end, with *hàmamèlidánthemum*, in which they fall on odd-numbered syllables from the end. These words also demonstrate that Strong Retraction may organize into feet only those syllables which do not already belong to metrical structure: clearly the wrong results would be obtained if we allowed the rule to rebracket the syllables already provided with structure by the English Stress Rule.

It will be important in what follows to show that the English Stress Rule differs from Strong Retraction in this respect; that is, that it can delete structure that was assigned earlier in the derivation. The evidence for this comes from cases in which the stress rules apply cyclically, in words like *parental* and *homonymous*:

(46)

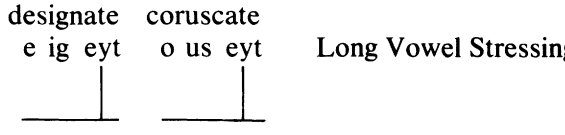




If the English Stress Rule were forced to respect the foot boundaries assigned earlier, we would expect the stressings **párental* and **hòmonýmous*.

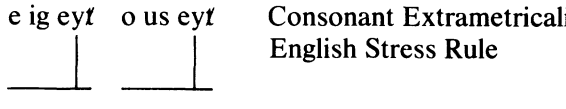
Now that we have established a fairly explicit analysis, we can present a rather striking argument for it: unlike LP's system, the new theory makes it by and large unnecessary to mark individual suffixes for the mode of retraction they trigger. Their retraction behavior follows automatically from the rules of extrametricality, which are needed anyway. Consider first how the analysis will handle the Strong Retraction behavior of the verbal suffix *-ate*. The first rule to apply will be Long Vowel Stressing, which will create a nonbranching foot over *-ate* itself:

(47)



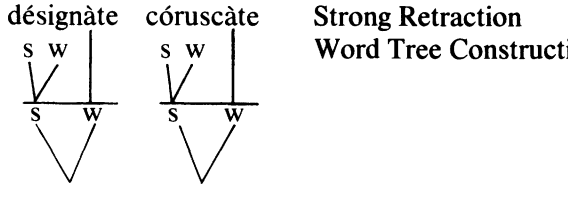
The extrametricality rules come next in the ordering, of which only Consonant Extrametricality is applicable. We then apply the English Stress Rule, which, it will be recalled, ignores the boundaries of feet created earlier in the derivation. The rule will accordingly apply vacuously in this case, restressing the final syllable:

(48)



The next rule is Strong Retraction, which constructs a binary foot over the first two syllables of both words, without regard to syllable quantity. The end result follows from Word Tree Construction:

(49)



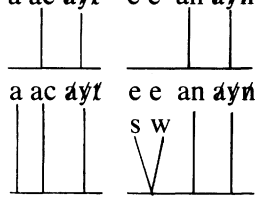
It should be clear that under a theory that applies the English Stress Rule and Strong Retraction as separate rules in the order given, the status of *-ate* as a Strong Retractor follows automatically from its being a verbal suffix, hence not extrametrical.

Let us now examine two typical weak retracting suffixes: *-ite* and *-ine*. We will derive two examples, the noun *staláctìte* and the adjective *èlephántìne*. In both words, the final syllable will be stressed early in the derivation by Long Vowel Stressing:[8]

(50) stalactite elephantine
a ac ayt e e an ayn Long Vowel Stressing

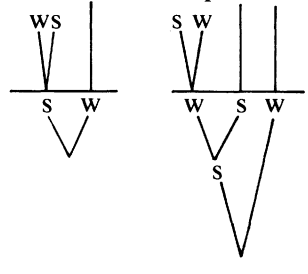
The extrametricality rules will apply next: Noun Extrametricality to *stalactite* and Adjective Extrametricality to *elephantine* (since *-ine* is an adjectival suffix). We then apply the English Stress Rule and Strong Retraction:

(51) a ac ayt e e an ayn Noun Extrametricality
Adjective Extrametricality
English Stress Rule
a ac ayt e e an ayn Strong Retraction
s w



The final result derives from Word Tree Construction and destressing:

(52) staláctìte èlephántìne



It should be noted that these derivations are almost exactly the same as the derivations of other nouns and suffixed adjectives, such as *amálgam* and *relúctant*. The only difference is that the words of (52) have long vowels in their final syllables, so that they are stressed by Long Vowel Stressing.

The general prediction of the analysis is that the Weak Retraction pattern should be observed whenever a stressed syllable is made extrametrical—that is, to the left of stressed adjectival suffixes and stressed final syllables in nouns. Taking into account an additional rule motivated in section 2.5, the prediction is generally correct, accounting automatically for the Weak Retraction characteristic of the following suffixes:

[8] *Elephantine* will actually have a cyclic derivation, as discussed below. The effects of the earlier cycle will not be relevant to the argument made here.

(53) a. *Adjectival Weak Retractors*
-ane, -ary, -ate, -ative, -atory, -ile, -ine, -oid, -ory, -ose
b. *Nominal Weak Retractors*
-ary, -ēs, -i, -ide, -ine, -ite, -oid, -on, -ory, -ose

The adjectival suffix *-ate*, which occurs in words like *apóstàte, ecóstàte, intéstàte*, and *arístàte,*[9] points out an interesting advantage of the present analysis. Under our account, it follows automatically that *-ate* should be a Weak Retractor when it occurs in adjectives, but a Strong Retractor in verbs: the difference follows from whether or not Adjective Extrametricality is applicable. By contrast, under LP's account, the retraction properties of each suffix are listed idiosyncratically, so that an ad hoc statement would be necessary.

A further argument can be derived from the history of English stress retraction around the first half of the nineteenth century. As Halle and Keyser (1971) point out, prior to this time verbal *-ate* was a fairly regular Weak Retractor, while the long-voweled nominal and adjectival suffixes often triggered Strong Retraction. The shift in retraction behavior can in both cases be regarded as a step toward regularizing the system: the verbs ending in *-ate* took on the normal pattern of verbs in not having their final rhymes marked for extrametricality, while the nouns and adjectives, which earlier had to be marked as irregular in not having extrametrical final rhymes, simply lost their exceptional markings.

Our theory clearly needs some further work to be firmly established: in particular, we must show that Noun and Adjective Extrametricality are fairly regular processes, and that Strong Retraction is in general adequate to derive all of the feet found to the left of the foot assigned by the English Stress Rule. None of these claims appears to be true on immediate inspection (cf. *Háckensàck, mércantìle, Wìnnepesáukee*), but a closer look at the facts will show that each claim can in fact be supported.

2.4. The Phonological Cycle

In this section we will discuss the role of the phonological cycle in the present theory. We will find that cyclic application of the rules proposed here provides a substantial advantage over the LP theory, as well as handling the most commonly cited evidence for the cycle, pairs like *còmpensátion ~ còndènsátion.*[10]

Recall that under the LP analysis, all stressed suffixes in English are diacritically marked for their mode of retraction, which can be Strong ($-a$ in rule (38)), Weak ($-b$), or Long (with neither term of (38) suppressed). Further, LP assume that on each phonological cycle, the stress rule iterates leftward until the syllables of the word are exhausted. It is easy to show that under these assumptions, there is no one diacritic

[9] I assume that in the unmarked case, the syllable division of V s [−son] V sequences is V s/[−son] V. For justification, see Hayes (1981, 147–149).

[10] A further argument for the cycle appears in section 2.6.1. Many researchers (e.g. Selkirk (1980), Schane (1975)) have denied the validity of the cycle. For some refutation of their claims, see Hayes (1981, 163–164).

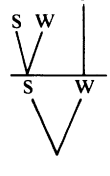
marking that will derive the correct stressing in words ending in the suffix *-ation*. If *-ation* is a Weak Retractor, secondary stress will appear incorrectly on the second syllables of words like *fòrestátion, ìndignátion, còruscátion, cònfiscátion*, and *òbfuscátion*.[11] If *-ation* is a Strong Retractor, we incorrectly derive words like **dìplomàtizátion, *dèmocràtizátion, *lègitìmizátion*, and **sỳllabìfícátion*. Finally, the Long Retraction mode fails in generating stressings like **stàndàrdizátion, *solèmnizátion*, and **fratèrnizátion*.

It is undeniable that stress retraction in English is subject to lexical idiosyncrasy, even among the better-behaved suffixes. However, in the case of *-ation*, the LP analysis fails quite seriously, in that the surface positioning of secondary stresses to the left of *-ation* is in fact quite predictable: they fall on the syllables that are stressed in the word from which the noun in *-ation* is derived, excepting those syllables that have been destressed by generally accepted rules. The same pattern is found among other morphologically complex words; cf. the second syllables of *dòmèstícity, àbnòrmálity*. The situation clearly suggests cyclic rule application, but with an added complication: after *-ation* has been stressed on the topmost cycle, we must somehow prevent any further stressing from taking place. One additional fact makes the problem more difficult: because of words like *ìndignátion, còmpurgátion*, and *òstentátion*, it will not do to say that *-ation* triggers no retraction at all, in that retraction must be allowed in cases where the derivation involves only one cycle. In this context, *-ation* appears to act as a Strong Retractor.

We will now show that the analysis proposed here, without modification, can account for all of the facts. Recall that the English Stress Rule and Strong Retraction differ in whether they must respect the boundaries of feet constructed earlier in the derivation: Strong Retraction obeys these boundaries, while the English Stress Rule obliterates earlier metrical structure. Keeping these properties in mind, let us consider the derivation of the word *fraternization*. On the first cycle, we stress *fraternize* in exactly the same way as *designate*, described under (47)–(49):

(54) fraternization

[a er ayz] ey on

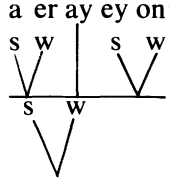


On the next cycle, *-ation* is stressed in the normal way by Noun Extrametricality and

[11] The reader might object that in the latter three examples, it could be *-ate*, rather than the full suffix *-ation*, that is triggering the apparent Strong Retraction. However, there is evidence available elsewhere that compound suffixes like *-ation* are treated by the stress rules as single units: the suffix *-ative*, being adjectival, triggers Weak Retraction no matter whether it is affixed as a morphological unit, or as the concatenation of *-ate* and *-ive*: pairs like *íllustràte ~ illústrative, démonstràte ~ demónstrative* are entirely parallel to pairs like *consérve ~ consérvative, árgument ~ àrguméntative*. Hence, it is reasonable to infer that it is *-ation* as a whole that must be marked to trigger the retraction discussed above.

the English Stress Rule. Strong Retraction is then blocked, since all of the syllables present are already organized into metrical structure:

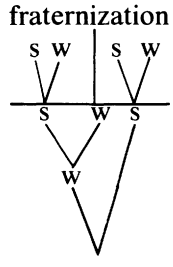
(55) ⇒ English Stress Rule, SSA



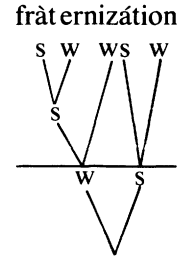
⇒ Strong Retraction blocked

The remainder of the derivation is carried out by Word Tree Construction and a destressing rule to be discussed below:

(56) ⇒ Word Tree Construction



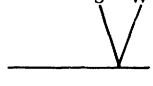
⇒ Destressing, SSA



The derivation of *fraternization* should be compared with that of *compurgation*, in which there is no internal cycle. The rightmost foot of this word is created by Noun Extrametricality, the English Stress Rule, and SSA:

(57) compurgation

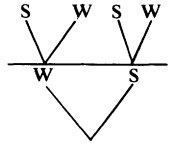
om ur ey ǿn



Noun Extrametricality
English Stress Rule
SSA

At this point, Strong Retraction is free to apply, since the first two syllables are not yet organized into metrical structure. The final result derives from Word Tree Construction:

(58) còmpurgátion



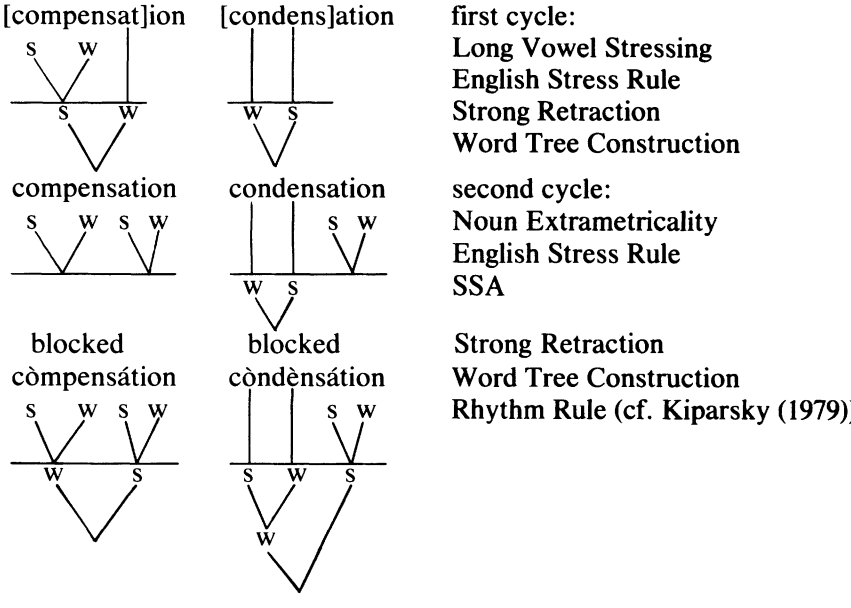
Strong Retraction
Word Tree Construction

It can be seen that under the analysis proposed here, the unusual retraction behavior of *-ation* is no accident. The fact that *-ation* assigns stress to its left only when no previously assigned stress occurs there follows from an independently motivated prop-

[12] I assume that the suffix spelled as *-ion* is phonologically /yV̆n/. This assumption is justified in section 2.6.3.

erty of the Strong Retraction rule: namely, that it is blocked whenever its application would obliterate previously created metrical structure.[13] The standard examples motivating the cycle also fall out straightforwardly from the analysis, as (59) shows:

(59)



It is worth pointing out that Kiparsky (1979) has come to essentially the same conclusion concerning the organization of the cyclic stress rules as I have, although on quite different grounds. Kiparsky's argument is based on the contrast between words like those in (60a) and those in (60b):

(60)

a.		b.	
3 2 1	iconoclastic	2 3 1 3 2 1	Ticonderoga ~ Ticonderoga
3 2 1	anticipation	2 3 1 3 2 1	Ompompanoosuc ~ Ompompanoosuc
3 2 1	superiority	2 3 1 3 2 1	Dodecanesian ~ Dodecanesian

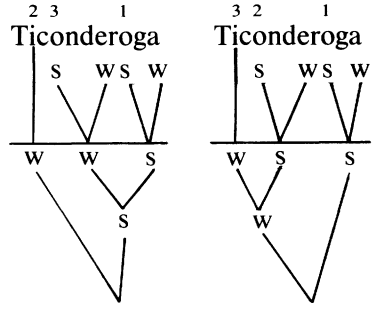
For many speakers, the words of (60a) must be pronounced with weaker stress on the initial syllable than on the second, whereas in the words of (60b), either secondary stress may be the stronger. The difference presumably results from the derivational history of the words of (60a), as the base words from which they are formed all have second syllables with stronger stress than their initial syllables: *ìcónoclast, àntícipate, sùpérior.* To account for the difference, Kiparsky makes two assumptions: first, that word trees in English are freely constructed as right- or left-branching; and second, that the cyclic

[13] One initially plausible way of saving LP's analysis would be to say that their stress rule may not apply unless there is at least one syllable in its domain that has not yet been incorporated into the metrical structure. This alternative will fail, however, for all Weak Retractors, as in cases like *móllusk ~ mollúscòid.* For full discussion, see Hayes (1981, 167–169).

application of the stress rules is governed by the following principle: "Metrical structure assigned in earlier cycles is kept, insofar as it is not redrawn by (the foot construction rules)" (p. 422).

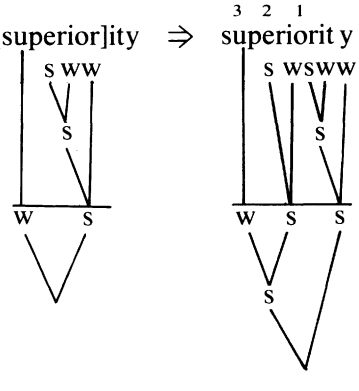
The first assumption allows for two metrical structures to be erected over *Ticonderoga*, one left- and one right-branching:

(61)



This will account for the phonetic stressings, given LP's algorithm (p. 259) for determining the relative prominence of secondary stresses. In *superiority*, however, cyclic application of the stress rules will force the construction of a left-branching tree, so that only the 3–2–1 stressing is derived:

(62)



Kiparsky's assumption that metrical structure is preserved as much as possible agrees fully with our own proposal, in which only the English Stress Rule is allowed to obliterate previously created structure. Our analysis has the advantage of formulating in an explicit and well-motivated way the principle of rule application that Kiparsky must assume to make his analysis work.

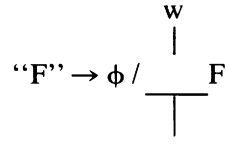
2.5. Destressing Rules

I assume, following Selkirk (1980), that destressing rules are actually rules of foot deletion: they wipe out the metrical structure of a foot, leaving its syllables to be adjoined to another foot by SSA. In this section, I will discuss two destressing rules, each of

which has the effect of removing a large number of apparent exceptions to our rules of foot construction.

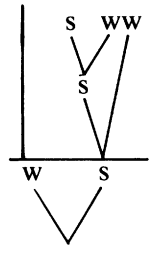
The most important destressing rule deletes a nonbranching foot structure when it is nonfinal and metrically weak. We will call the rule *Prestress Destressing*, stating it with formalism borrowed from Prince (1980):

(63) *Prestress Destressing*



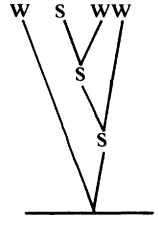
In one of its functions, the rule expresses an insight due originally to Halle (1973): at the left edge of English words, it is far easier to specify when a syllable is *not* stressed, rather than when it is. Our analysis accounts for this pattern in the same way as LP's: the foot construction rules inevitably will stress the first syllable of any word, which then loses its stress if the conditions of (63) are met:

(64) Connecticut



Noun Extrametricality
English Stress Rule, SSA
Strong Retraction
Word Tree Construction

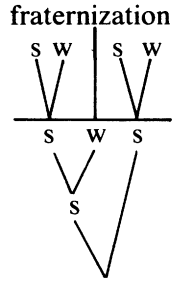
Connécticut



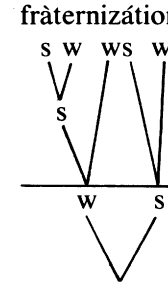
Prestress Destressing
SSA

Prestress Destressing also removes certain feet that arise in cyclic derivations. An example is the end of the derivation under (56) for *fraternization*:

(65) ⇒ Word Tree Construction



⇒ Prestress Destressing, SSA



The rule is subject to a number of segmental conditions, motivated at length in LP. Roughly, these are that only light syllables destress in initial position (with a special exemption for Latinate prefixes), and only open syllables in medial position. The important point here is that the rule can trim back most of the excess structure created by the rules proposed so far. Notice that our rule does *not* remove feet in poststress position, as in *cúrsòry*, *provócàtive*. We will show below that this form of destressing must be carried out by a separate rule.

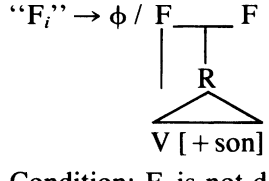
Another important destressing rule is presented in Kiparsky (1979). Kiparsky observes that before the suffixes *-ory* and *-ary*, the Weak mode of stress retraction is normally found:

(66)

olfáctory	eleméntary	prelíminàry
trajéctory	annivérsary	premónitòry
perfúnctory	valedíctory	líteràry

This much follows automatically from the rules proposed so far, provided that we adopt the additional machinery developed in LP: specifically, we assume that the two suffixes are underlyingly monosyllabic, with final /y/ glides that are syllabified by rule (3) only after the construction and labeling of the word tree. The destressed variants of *-ory* and *-ary* follow from a rule to be presented in section 2.6.1. Aside from these peculiarities, *-ary* and *-ory* are entirely parallel to other weak retracting suffixes like *-oid* and *-ine*. What is of interest here is the fact that numerous putative exceptions to Weak Retraction with these suffixes can also be found: cf. *légendàry, mómentàry, vóluntàry, désultòry, répertòry, ínventòry*. The exceptionality is systematic: what appears to be Strong Retraction applies when the word-final foot is preceded by two syllables, of which the second ends in a sonorant. To handle this, Kiparsky proposes that Weak Retraction applies normally in these words, but that the foot it constructs is sometimes deleted by a destressing rule, which we will phrase as follows:

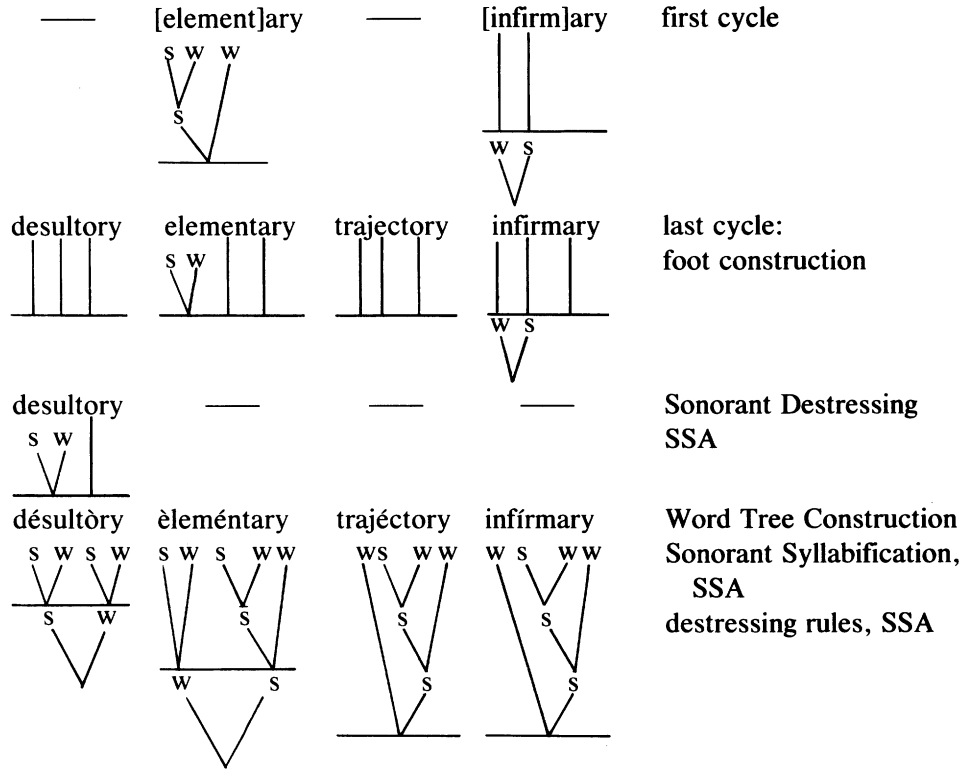
(67) *Sonorant Destressing*



Condition: F_i is not dominated by *s*.

The condition that F_i not be dominated by *s* ensures that strong feet created on earlier cycles will not be removed: cf. *infírmary, respónsory, dispénsary*. This means that Sonorant Destressing has to apply in the cycle after the foot construction rules, but before Word Tree Construction, since the word tree would mark the second syllables of *legendary, desultory*, etc., as strong, just like the corresponding syllables of *olfactory, elementary*. Some illustrative derivations are as follows:

(68)



Kiparsky points out that Sonorant Destressing also removes many of the supposed exceptions to the Weak Retraction pattern of other nominal and adjectival suffixes, as the following data show:

(69)	a.	sàlamándròid	mollúscòid	hélminthòid
		èpicýclòid	aráchnòid	cýlindròid
	b.	qùadripártìte	staláctìte	gílbertìte
		àrchimándrìte	gelígnìte	árgentìte
	c.	èlephántìne	smarágdìne	sérpentìne
		àdamántìne	ùléxìne	sáturnìne

There are only a few exceptions to the generalization, such as *òdóntòid* and *Trìdéntìne*.

Here I would like to extend the rule a bit further, and suggest that it applies pervasively among monomorphemic words as well. With this assumption, we can improve the predictions made by earlier analyses, as well as remove a very large class of potential counterexamples to the rules proposed here. The words in question are of the form (70):

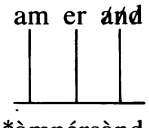
(70)	a.	Hóttentòt	Jáckendòff	b.	dávenpòrt	Áppelbàum
		bálderdàsh	ámpersànd		cávalcàde	pálindròme
		Háckensàck	Árkansàs		mérchandìse	mísanthròpe
		Álgernòn	máckintòsh		Áberdèen	níghtingàle

These words all have final secondary stress, determined either by a foot present in underlying representation, as in (70a), or by Long Vowel Stressing, as in (70b). Without Sonorant Destressing, we would predict penultimate main stress for these words, as (71) shows for *ampersand* and *merchandise*:

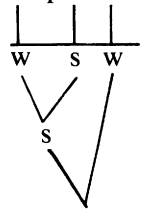
(71) a. am er and — er an ays — underlying representation

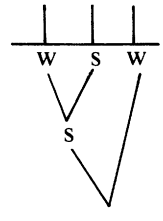
b. — er an ays — Long Vowel Stressing

c. am er and — er an ays — Noun Extrametricality; English Stress Rule; Strong Retraction



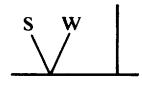
d. *àmpérsànd — *mèrchándìse — Word Tree Construction

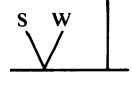




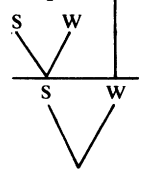
But if we assume that Sonorant Destressing may apply here, the right pattern results. After (71c), the derivations would continue as under (72):

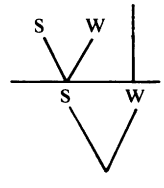
(72) d. am er and — er an ays — Sonorant Destressing, SSA





e. ámpersànd — mérchandìse — Word Tree Construction





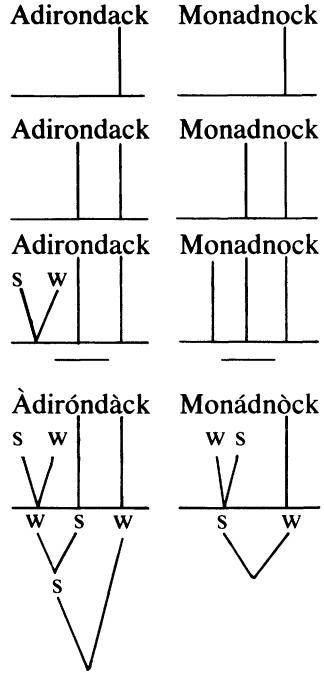
There is good evidence that the words of (70) are derived by Sonorant Destressing rather than by some other means, in that among the cases where Sonorant Destressing is not applicable, penultimate stress is the norm:[14]

(73) a.	Àdiróndàck	Màssapéquòd	b.	Monádnòck	delíctì
	Èniwétòk	Mèmphremágòg		Hopátcòng	Òjíbwày
	Àgamémnòn	Àniákchàk		Aquídnèck	decáthlòn
	Kàlimántàn	Gìrilámbòne		Penóbscòt	Aróostòok

[14] Note also the following datum from Trammell (1978): 89 percent of Trammell's subjects who had never heard the word *òpodéldòc* before guessed that it would have penultimate main stress.

These words will be derived by our rules as follows:

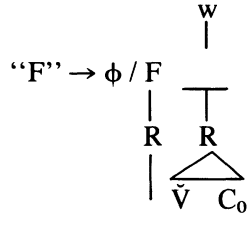
(74)



Notice that a system such as that of SPE, which postulates that Strong Retraction is the norm for monomorphemic items, is unable to distinguish between the regular patterns found in (70) and (73). Under the present analysis the difference derives automatically from independently motivated rules. Only a handful of words need have exceptional markings in the lexicon: in particular, words like *pálimpsèst, Árbuthnòt*, and *ánecdòte* must be marked as exceptions to Noun Extrametricality, so that the English Stress Rule will stress their final syllables and allow Strong Retraction to form a binary foot.

The rules of Prestress Destressing and Sonorant Destressing have a common property, which is that neither ever acts to remove a foot in strong metrical position. This is written into the formalism of Prestress Destressing, and is an external constraint on Sonorant Destressing. Other destressing rules have this property as well. An example is the "Arab" Rule, motivated in Ross (1972, 255), which takes the form (75) when translated into a metrical framework:

(75) "*Arab*" *Rule* (metrical version)



A further rule to be presented in section 2.6.1 also must be prevented from deleting strong feet, as must a rule from Tiberian Hebrew presented in Hayes (1981, 98). I would conjecture, then, that this is a general property of destressing rules; that is, that we can simplify the formulation of all of them by replacing the extraneous *ws* and external constraints with the universal condition (76):

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

$$*\overset{|}{S}$$

The constraint (76) takes over much of the work done by LP's filter [−stress], which must be abandoned in a theory lacking a stress feature.[15]

2.6. *Ternary Feet in Nonfinal Position*

One important aspect of the rules presented here is that they can create trisyllabic feet on the surface, even though they are formulated only to produce maximally disyllabic feet. In word-final position, this results from the joint effects of extrametricality and SSA. However, not all surface ternary feet in English are word-final. The possibility of accounting for these feet using extrametricality is precluded by the constraint that extrametricality rules may apply only at the right edge of the stress domain. As it turns out, however, the three regular cases in which such feet turn up can all be fitted into the system with only minimal, independently motivated adjustments—no additional foot construction rules are necessary.

2.6.1. Cases of the Type Winnepesaukee. Nonfinal ternary feet frequently show up in long monomorphemic words, such as *Wìnnepesáukee, Tàtamagóuchi.* Our rules as formulated so far would appear to produce the incorrect stressings **Winnèpesáukee, *Tatàmagóuchi*, by the application of Strong Retraction in all syllables preceding the penult. A closer look at the data, however, shows that this need not be so. Observe first the pattern displayed by the following list of words, which is apparently the norm among long monomorphemic words in English.

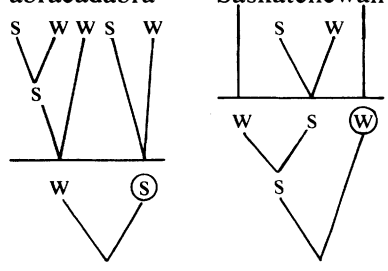
(77) a.	àbracadábra	b.	Mamáronèck	c.	Kàlamazóo
	Lùxipalílla		Èscúminàc		Hàrdecanúte
	Pèmigewássett		Sàskátchewàn		Àllamakée
	Òkefenókee		Assínibòine		Ìlliloué́tte
	Nèbuchadnézzar		Òktíbbehà		Màttamuskéet
	pàraphernália		Àshurbánipàl		Àntigonísh
	Kìlimanjáro		Genádenhùtten		Gàllipolís

If the rightmost foot of the word is the strongest, as in (77a), then the foot that precedes

[15] The "Foot Fixing" rule in Prince (1980) would be a counterexample to (76). As Prince points out, however, the rule is not at all essential to his analysis.

it is ternary. If the rightmost foot is weak, the foot that precedes it is binary. The contrast is illustrated in (78):

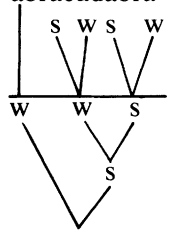
(78) àbracadábra Sàskátchewàn



Note that the relevant factor has to be the labeling of the final foot, rather than its syllable count, since in the words of (77c), we find that monosyllabic final feet that are idiosyncratically strong follow the same pattern as the more common polysyllabic strong final feet.

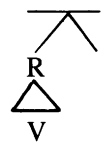
This relationship initially seems to pose an ordering paradox: the word tree, which establishes the relative prominence of the feet, must surely be drawn after the feet are constructed. But the configuration of the feet seems to depend on the labeling of the word tree. The theory proposed here provides a solution to the paradox. We have assumed that all feet in a word to the left of the one assigned by the English Stress Rule are constructed by Strong Retraction, so that at some stage of its derivation a word like *abracadabra* has the following metrical structure:

(79) abracadabra



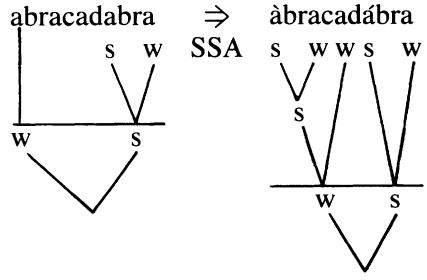
In (79), the rightmost foot has been constructed by the English Stress Rule, the remaining two by Strong Retraction. (79) may be converted to the correct output if we apply a rule that looks like (80):

(80) "F" → ϕ / F



That is, delete a binary foot whose first syllable is open and which is immediately preceded by a nonbranching foot. Rule (80) would apply to the representation of (79) as follows:

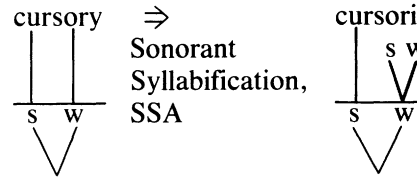
(81) ⇒ Rule (80)



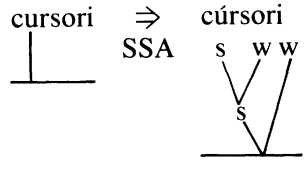
Essentially the same derivation would be observed for words like *Kàlamazóo, Ìllilouétte*. But for the class of words exemplified by *Sàskátchewàn, Màmáronèck*, rule (80) would be blocked: the foot to be destressed would be in strong metrical position, so that to remove it would violate the universal principle (76). It is clear, then, that our analysis can capture the distinction between (77a,c) and (77b) without encountering an ordering paradox.

Interestingly, the rule (80) needed to implement the solution is already motivated elsewhere: it is the Poststress Destressing rule needed to account for the destressed alternants of suffixes like *-ory, -ary*, and *-ative* following stressed syllables—cf. *advísòry* vs. *admónitòry*, *infírmàry* vs. *córollàry*, *altérnative* vs. *ímitative*, etc. The derivation of a typical case, *cursory*, is quite parallel to that of *abracadabra*:

(82) ⇒ foot construction rules, Word Tree Construction



⇒ Poststress Destressing



Just as before, a foot must be metrically weak in order to be removed: cf. *McGróry, canáry, creative*.

The analysis depends on the assumption that, contrary to LP, Poststress Destressing is a separate rule from Prestress Destressing—unlike the latter, it is able to remove branching feet. This seems to be a reasonable claim. First of all, in order to unite the two rules LP must assume a convention for SSA which appears relatively complex when translated into a purely metrical framework: it must join a stray syllable sometimes to the nearest foot, sometimes to the word tree. LP must also posit an ad hoc rule of Foot Formation in order to prevent *-ory, -ary*, and *-ative* from destressing when they follow

a stressless syllable. Finally, there is at least one morpheme which is an exception to Poststress Destressing, but not to Prestress Destressing: many speakers say *Hánòver* but *Hànôvérian*.

The analysis accounts nicely for an unexplained observation made in LP (p. 276). Whenever stress retraction occurs across a domain of four syllables, the normal case is for two binary feet to be created, rather than a nonbranching and a ternary one:

(83) Pòpocàtepétl Òkalòacóochee Àpalàchicóla Àntanànarívo
Hànamànióa ìpecàcuána ònomàtopóeia hàmamèlidánthemum

Under our analysis, these cases are just what we would expect, since it is Strong Retraction, a binary foot construction rule, that erects the nonfinal feet in the words of (83). The medial feet of these words do not delete, since the feet that precede them branch. The examples of (83) are thus parallel in their behavior to words like *prómissòry, apóthecàry*, and *ímitàtive*.

Another bit of evidence that the same rule is applying in both contexts is that in both cases, destressing is blocked if the first syllable of the foot to be removed is closed, as in (84):

(84) a. Monòngahéla Atàscadéro Tìcònderóga Òmpòmpanóosuc
b. cárbùncle áncèstor áutòpsy cúcùmber

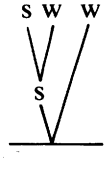
There are a few words that might suggest that Poststress Destressing should be formulated to remove feet whose first syllables are closed as well:

(85) gálaxy líberty chívalry
cylinder próvender Tímilty

However, it is not necessary for Poststress Destressing to apply to these words at all in order to derive the correct output. We can just as well say that their final syllables, including the final /y/ or /r/, are extrametrical, which is the regular case for nouns:

(86) galaxy
a aksy rhyme projection
a áksý Noun Extrametricality
s w English Stress Rule, SSA

galaksi Sonorant Syllabification, SSA

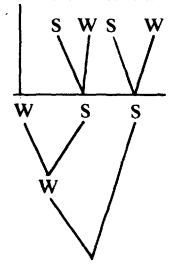


Notice that there are cases where this solution is the only one that will work: words like *présidency, rélevancy* can be derived only with extrametricality, not by Poststress De-

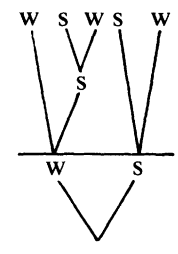
stressing. Cases like *intérminable, indómitable, végetable* (for those who say [véǰəDəbəl]) similarly show that underlying nonsyllabic sonorants that are later syllabified must be counted as part of a preceding extrametrical syllable.

I have mentioned Kiparsky's claim that word trees may be freely constructed as right- or left-branching, insofar as their shape is not dictated by the cycle. This proposal is intended to account for the two possible stressings of words like *Ticonderoga, Ompompanoosuc*, as was shown under (61). The proposal raises a problem for the present analysis, in that it leads us to expect stress doublets for words like *abracadabra* as well: in addition to the derivation given in (79) and (81), the derivation (87) would also be possible:

(87) ⇒ foot construction Word Tree Construction



abracadabra ⇒ Prestress Destressing

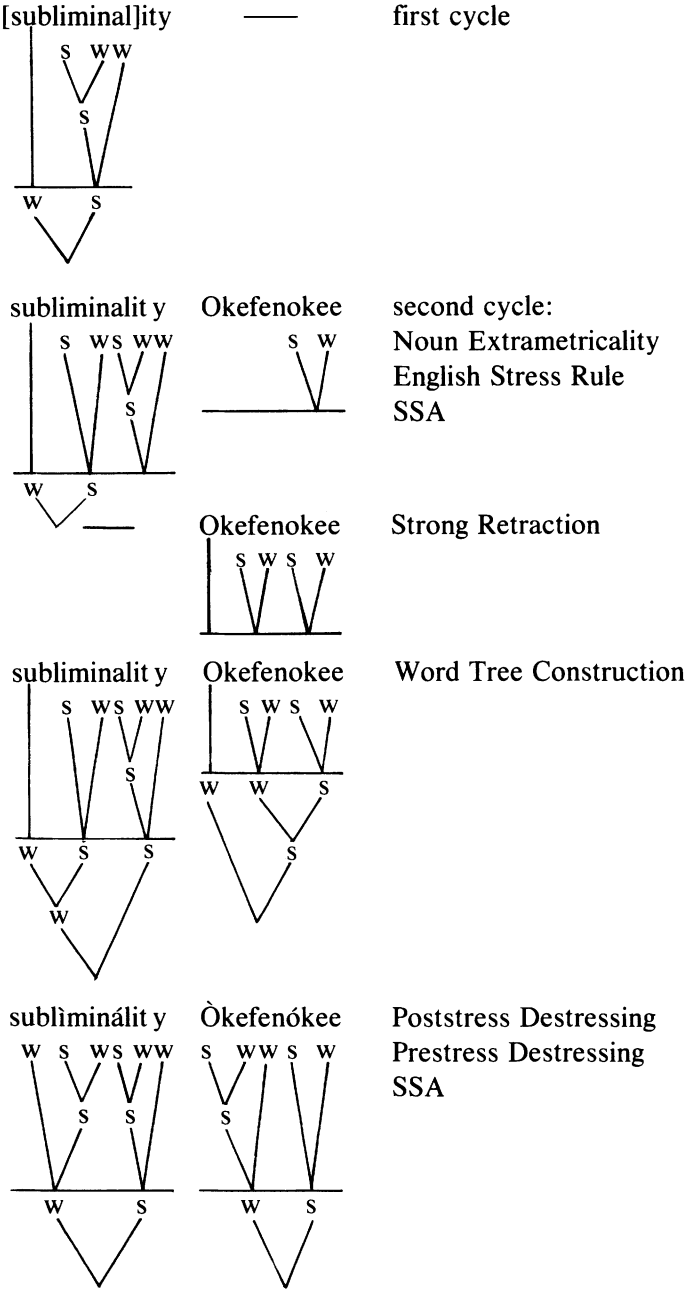


abràcadábra

In (87), the foot *braca* would be immune from Poststress Destressing since it is metrically strong, with the output **abràcadábra* derived by Prestress Destressing. I would venture the following account of the problem. The phonetic variation resulting from left- and right-branching word trees is far greater in words like *abracadabra* than in words like *Ticonderoga*: destressing and vowel reduction are involved, rather than just subtle differences of pitch and timing. Because of this, one of the variants is likely to achieve exclusive listing in the lexicon—for a speaker who hears only the *àbracadábra* variant, the underlying vowel quality of the second syllable is not available, owing to the lack of phonological alternations. In support of this, note that for a few words, the stress contour resulting from a left-branching tree has won out: cf. *amànuénsis, Atchàfaláya, Epàminóndas*. The right-branching stressings are statistically predominant, a fact that finds its parallel in the preference of most speakers for the 2–3–1 over the 3–2–1 stressing of *Ticonderoga*. Notice that for many speakers, the word *Còństàntinóple* may *only* have the 2–3–1 contour, again suggesting arbitrary lexical listing of one of the two possible word trees.

A different aspect of Kiparsky's proposal receives additional confirmation here: his claim that in cyclic derivations, word tree bracketing is always retained, insofar as it is not altered by foot construction. Notice that morphologically derived long words typically do not display the pattern of secondary stress found in monomorphemic words: compare *sublìmináliţy* with *Òkefenókee, demòcratizátion* with *Àpalàchicóla*, and *Macàssarése* with *Gàllipolís*. This follows from our formulation of Poststress Destressing to apply only to feet in weak position, as shown below with the derivations of *subliminality* and *Okefenokee*:

(88)

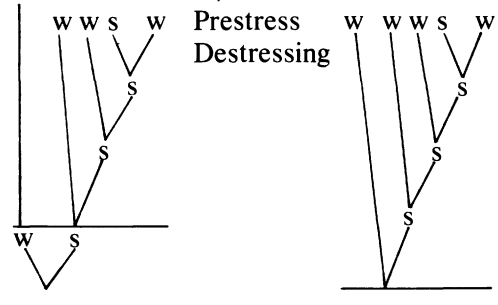


The word *miscegenation* is an interesting example of this phenomenon. Although its hypothetical embedded verb *miscegenate* is not found in the dictionary, it seems like a very plausible word. As a look in the entries in Walker (1791) will show, the back formation of verbs in *-ate* from nouns in *-ation* has been a highly productive process

over the past two centuries. By now, in fact, there are rather few *-ation* nouns left that lack a corresponding verb. It therefore is not surprising that we find two possible pronunciations for *miscegenation*: *miscègenátion*, presumably from speakers who have mentally back-formed the verb *miscégenàte*; and *mìscegenátion*, from speakers for whom the noun is derived in a single cycle.

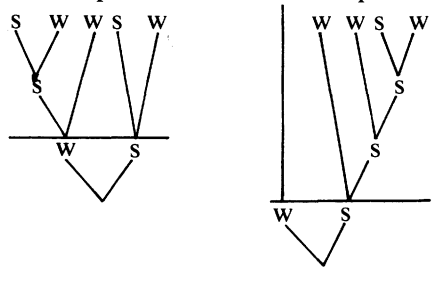
The analysis presented here leads us to sharpen our formulation of SSA. Notice that the rule of Poststress Destressing can create stray syllables that are located between two feet, as in the first step of (81). The SSA convention as it is formulated under (21) is ambiguous with regard to which foot the stray syllables are to be adjoined to. Clearly, we wish to avoid joining them to the right, in that this would allow the rule of Prestress Destressing to wipe out the initial foot as well:

(89) ⇒ SSA (stupid version) abracadabra ⇒ Prestress Destressing *åbråcådåbrå



Even if this result is averted by adding ad hoc complications to the Prestress Destressing rule, we would still have trouble in accounting for the application of foot-bounded rules (cf. Kiparsky (1979), Selkirk (1980)) in parallel cases. In order to account for the flapped /t/ of *Àttawapískat, Màttamuskéet*, we must assume a constituent structure like (90a) rather than (90b):

(90) a. Àttawapískat b. Àttawapískat



(This argument is due to Selkirk (1980).) My suggestion here is that the SSA convention should be augmented with the proviso that, at least in ambiguous cases, it must be *structure-preserving*: stray syllables adjoin (as weak members) to the left in languages in which feet are labeled *s w*, and to the right in languages with *w s* feet.[16] This provision

[16] A more sophisticated version of this structure-preserving constraint is formulated in Hayes (1981, 100–102), with evidence from Tiberian Hebrew.

also ensures that when Sonorant Destressing applies in words like *ampersand* (cf. (72)), the branching structure that results will be ∧ |, rather than | ∧; so that the word tree labeling rule will assign antepenultimate, not final, main stress.

There is a small residue of monomorphemic words in which a nonfinal ternary foot appears in strong metrical position, and hence cannot be derived by destressing:

(91) a. Mánitowòc
cátamaràn
húllabalòo
Áltamahà

b. rígamaròle
tácamahàc
rázzamatàzz

c. góbbledygòok
búdgerigàr

At least the examples under (91a) would appear to require brute force lexical listing. This is not a bad result, however, in that the stress pattern they display is not a productive one in English: the words that have this pattern have for the most part crept in from more regular categories. For example, all the words under (91a) are marked with final main stress in Kenyon and Knott (1944). The more recent shifted stressings have regularized the word tree labeling, while retaining the old foot structure. Quite plausibly, the reduction to schwa of their second vowels has inhibited the regularization of their feet. The words of (91b) all have older trisyllabic variants: *rígmaròle, táckmahàck, rázzmatàzz*, which represent entirely regular stressings. The more recent versions may represent a drift toward the stereotyped pattern found in expressions like *thíngamabòb, whátsamajìgger, Físhamajìg*, and *whátchamacàllit*. Notice that the last expression, with a branching final foot, is highly aberrant within the English word stress system, suggesting perhaps that the phenomenon is phrasal in nature, and not to be included within the word stress rules. The words of (91c) have a highly unusual stressless but tense [i] in medial position. This suggests that they are pseudocompounds, with the structures *gobbledy#gook, budgeri#gar*: the idiosyncratic internal word boundary would allow for the stressless tense [i] by virtue of the word-final tensing rule (LP, 273), and the stress would be derived by the normal rules for nominal compounds.

Aside from these examples, however, the facts do not support the adoption of an additional rule of ternary foot construction: notice that if we did stress words like *Wìnnepesáukee* using such a rule, some ad hoc principle would be required to rule out ternary foot construction in words like *Àpalàchicóla*. By contrast, the analysis presented here requires no rules to derive the regular cases that are not motivated elsewhere.

2.6.2. Greek-Derived Compounds. LP point out that Long Retraction is the norm for morphologically complex words derived from Greek, as in the following examples:

(92) a. hélicogràph síderoscòpe héteronỳm práxinoscòpe
b. eléctrogràph larýngoscòpe kaléidoscòpe hómonỳm

The cases under (92a) pose a problem for our analysis, in that they display nonfinal ternary feet in strong metrical position. The forms involve a further mystery in that they regularly have stress on their final syllables, even though on purely phonological grounds we would often expect stress on a syllable lying further to the left. The situation is

complicated still further by the fact that when suffixes are added to words like those of (92), the final syllables lose their stress, as in (93):[17]

(93) heterónymous pentágonal helicógraphy

We can solve all of these problems by assuming with Siegel (1974) and Strauss (1979) that the words in question are compounds, reduced under normal circumstances to single phonological words. There is evidence for the compound analysis from several sources: (a) The prefixes involved are often used as single words, as in *photo, bio, homo, hetero*. (b) As Siegel (1974) points out, words like those of (92) undergo conjunction reduction in the same way as ordinary compounds: cf. *hyper-* and *hypothyroid*, like *apple and cherry pie*. (c) Though much interspeaker variation prevails, we often find main stress falling on the prefix, in violation of the normal word tree labeling rule: from various speakers one will hear *prótolànguage, bíochèmistry, mónoàcid,* and *pseúdointellèctual*. This would follow straightforwardly from the labeling rule for nominal compounds. (d) In a few words, such as *dàctylopatágium, chòanoflagéllida*, we find three stressless syllables in a row. This is totally underivable within single words, but quite possible in compounds. (e) The final prefix vowel is often tense, as in *eléctr*[*ow*]*gràph, ptérid*[*ow*]*phỳte, àut*[*ow*]*gýro*, and *pól*[*i*]*gòn* from Kenyon and Knott (1944). This results straightforwardly from the rule of Final Tensing, given that a compound would contain an internal word boundary.

The cost of the compound solution is twofold: we need to mark the final rhymes of the Greek prefixes as extrametrical, just like nouns, and we need a rule which sporadically reduces the compounds to the structure of single words, so as to account for the cases of prefix-final *-o* and *-y* that are *not* tensed, and for those word tree labelings that obey the rules for single words, rather than compounds. This can be done by deleting the brackets $[_{\text{word}}$ and $]_{\text{word}}$ in the environment / $[_{\text{word}}$ . . . ____ . . . $]_{\text{word}}$. The rule clearly must follow the foot construction rules, since we do not want them to apply later in the cycle to derive, say, **hetérònym* from *héteronỳm*. In addition, because the only rules that need precede the bracket erasure rule are stress rules, we are free to list its output in the lexicon. This has two favorable consequences: it provides a simple means of accounting for the particular assortment of tensed *-o*s and word tree labelings that an individual speaker prefers; and it predicts that reduced prefix–stem words should be available for further affixation, hence further cyclic stressing, as in the words of (93).

2.6.3. Ternary Feet across V̆V̆ and the i–y *Rule*. There is one further environment where ternary feet systematically occur on the surface in English: LP claim (p. 276) that whenever stress is retracted across a sequence of two adjacent short vowels, the Long mode of stress retraction is selected, no matter what type of retraction would be indicated by the morphological environment. For example, *váriegàte* and *detérioràte* exhibit Long

[17] Stress shifts like *mícroscòpe ~ mìcróscopy, íchthyophàge ~ ìchthyóphagy* seem to violate the phonological requirements on stress placement. To derive them, we must invoke the allomorphy rule motivated in Kiparsky (1979, 431–432), which shortens the vowel of a stem before a suffix.

Retraction, despite the status of *-ate* as a Strong Retractor; while in *méteoròid* and *Ébionìte*, the Weak Retraction characteristic of *-oid* and *-ite* is overridden by the presence of V̆V̆.

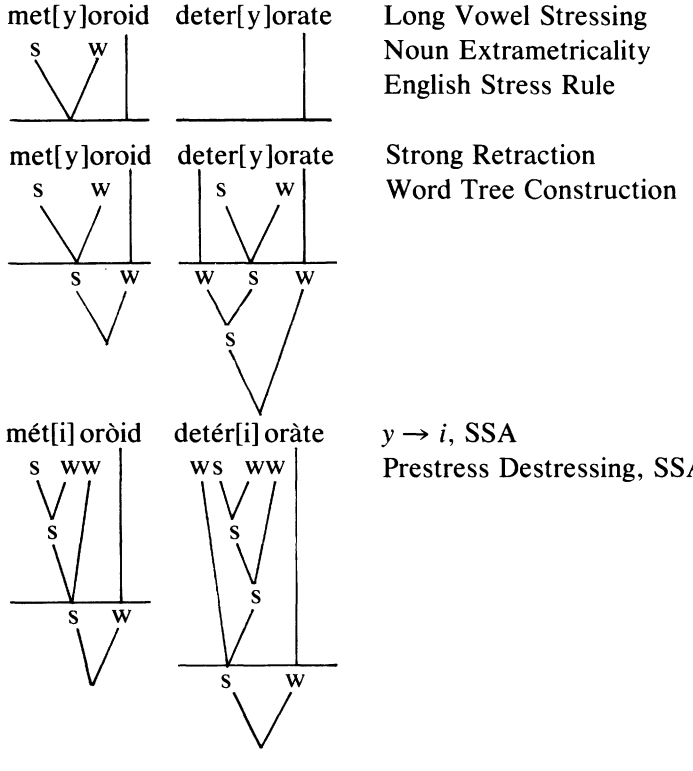
A closer look at the relevant cases shows that they all fit a pattern much more specific than V̆V̆: in each case the first short vowel is [i].

(94)

álienàte	váriolòid	própionàte
amélioràte	méteoròid	pétiolàte
detérioràte	vesúvianìte	tóreadòr
váriegàte	Ébionìte	
étiolàte	méteorìte	

LP list more cases, but these can be handled by devices already presented. (Their *etoilate* is apparently a misprint for *etiolate*.) Chomsky and Halle (1968) point out that the appearance of [i] or [y] in the environment / C ___ V is to a large extent predictable by rule, although some degree of dialectal and lexical idiosyncrasy is present. This suggests a means (proposed tentatively in SPE) of accounting for words like *deteriorate* and *meteoroid* without directly constructing ternary feet. If we assume that when the stress rules apply the surface [i] of these words appears as /y/, the correct stressings will result from the ordinary application of the English Stress Rule or Strong Retraction. A later rule is needed to change /y/ to [i].

(95)



The theory is made plausible by cases in which the /y/ optionally shows up on the surface: *amel[i,y]orate, al[i,y]enate*. In addition, we find two cases, *merídĭónál* and dialectal *éspĭónáge*, in which a quaternary foot is found. These stress patterns cannot be derived at all under LP's theory, but they follow nicely from the underlying representations *merid*[y]*onal* and *esp*[y]*onage* under the suggested analysis.

In order to make our solution work, we must (a) assume that all instances of [i] in the relevant positions are underlyingly /y/; (b) show that the later rule which governs the surface distribution of [i] and [y] operates in the direction *y* to *i* rather than *i* to *y*. The latter task is especially important, since in SPE it was proposed that the rule works in the opposite direction.

The main reason SPE assumed an *i* to *y* rule was to account for the behavior of suffixes like *-ion* and *-ious*, which always assign stress to the immediately preceding syllable. Under the SPE rules, this would follow only if these suffixes had underlyingly disyllabic forms such as /iV̆n/ and /ios/, so that two syllables would be available for the stress rule to skip across. However, under the theory assumed here, stress rules are based on syllable quantity, so that representations like /yV̆n/ and /yos/ will do just as well. At the relevant stage of the derivation, no syllable-initial C*y* clusters exist in English, so that any C_0VC sequence preceding /yV̆n/ or /yos/ will count as a closed syllable, and thus receive stress just like any other heavy penult. Because of this, the behavior of suffixes like *-ion* and *-ious* cannot be taken as an argument against assuming a *y* to *i* rule.

In fact, one can argue that the rule *must* have the form $y \rightarrow i$. Notice first that there are a fair number of environments in which [i] always appears:

(96) a.	i / [d,t,r,θ] ____ V		invidious, Poinsettia, imperial, Cynthia
b.	i / n + ____ + V		centennial, felonious, colonial
c.	i / $\begin{bmatrix} C \\ -cor \end{bmatrix}$ ____		Vesuvianite, champion, Kentuckian
d.	i / C [$_F$ ____		delineate, pecuniary, teleology

(The last environment of (96) would in more traditional terms be expressed as / C ____ $\begin{bmatrix} V \\ +stress \end{bmatrix}$.) These facts in themselves do not require a rule of the form $y \rightarrow i$, since they could as easily be expressed as lexical redundancy rules. However, there is also an environment where [y] is the norm:

(97) y / ____ Vn# onion, companion, opinion, vermilion, rebellion, rapscallion

When the two opposing rules conflict, the segment that wins out is always [i]:

(98)	i / [d,t,r,θ] ____ Vn#	Kantian, accordion, criterion, Pythian
	i / n + ____ + Vn#	Newtonian, Oxonian, Darwinian
	i / $\begin{bmatrix} C \\ -cor \end{bmatrix}$ ____ Vn#	champion, Vivian, Parseghian
	i / C [$_F$ ____ Vn#	julienne

This systematic pattern cannot be expressed using redundancy rules, without the introduction of ad hoc and hitherto unattested precedence principles. The situation seems to demand rule ordering: the pattern of (96) must be expressed as a phonological rule, applying in the direction $y \rightarrow i$ and ordered after (97). Rule (97) need not precede any phonological rule, so we are free to formulate it as a lexical redundancy rule.

In the environment / $\bar{V}$l ____ , the relevant vocabulary splits into two categories: words with invariant [i] and words with free variation between [i] and [y]. There is naturally a great deal of variation among speakers; for the dialect of Kenyon and Knott (1944) we find:

(99) a. Invariant [i]: memorabilia oleoresin hemophilia
Castalia *-ium* words (helium, endothelium, etc.)

b. Free Variation: camellia portfolio heliotrope
mammalian regalia

If we assume a $y \rightarrow i$ rule, the split can be described quite neatly: invariant [i] words have /i/ in the lexicon, while alternating words have /y/, optionally vocalized by rule (100):[18]

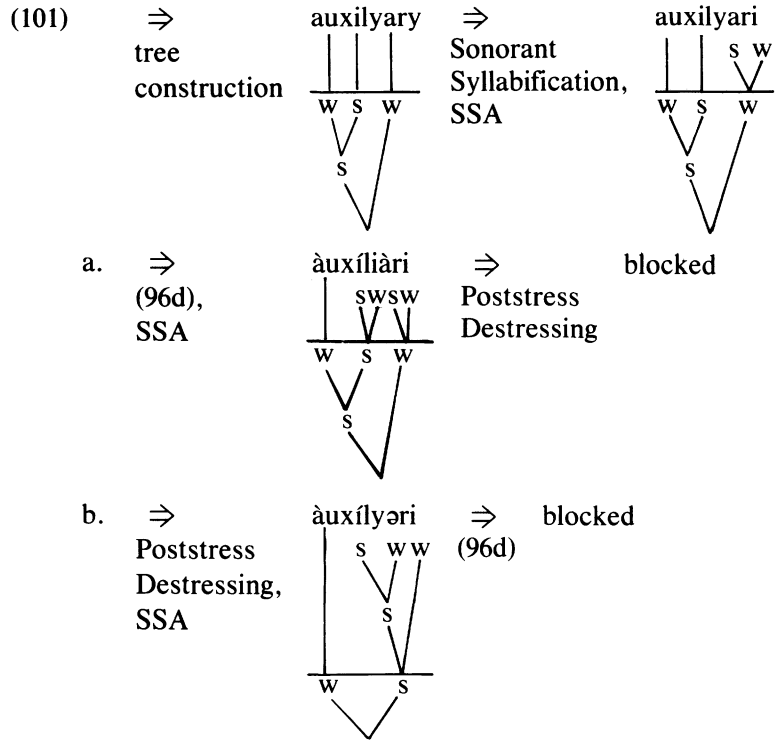
(100) $y \rightarrow i / \bar{V}l$ ____

By contrast, if the rule goes in the direction $i \rightarrow y$, the lexicon must be riddled with exception features. Our claim is reinforced by the words ending in $\bar{V}l\begin{Bmatrix} y \\ i \end{Bmatrix}Vn$, which generally show free variation: cf. *sesquipedalian, mammalian, episcopalian, Aristotelian, Mongolian, tatterdemalion, chameleon, Napoleon.* This is just what the theory predicts: the redundancy rule (97) specifies underlying /y/, which is then optionally vocalized by rule (100).

Looking back at the cases of mysterious Long Retraction, we find that every one involves an [i] in one of the environments for vocalization—either (96a), (96c), or rule (100). In the last case, the rule correctly predicts free variation: *al*[*i,y*]*enate, amel*[*i,y*]*orate*. Thus, by postulating underlying /y/ in these words, we can solve the problem of apparent Long Retraction over $\breve{V}\breve{V}$.

Another argument in favor of a $y \rightarrow i$ rule can be based on words like *beneficiary, auxiliary*. These words have two possible pronunciations, one with [i] and a full, stressed vowel in *-ary*, the other with [y] and a reduced vowel in *-ary*. (In *beneficiary*, [y] is deleted by a later rule.) The two pronunciations follow straightforwardly from the following assumptions: (a) Orthographic *i* in these words is phonologically /y/; and (b) rule (96d) and Poststress Destressing are ordered freely with respect to each other. This will derive the two pronunciations of *auxiliary* as follows:

[18] Rule (100) has two exceptions, *Australian* and *peculiar*. These are vastly outnumbered by the words falling into one of the patterns of (99).



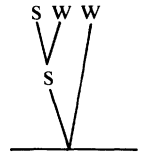
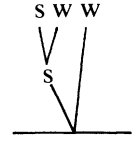
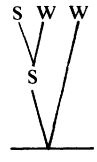
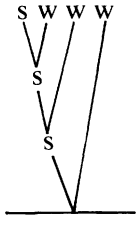
The $y \rightarrow i$ rule and Poststress Destressing bleed each other, producing the correct outputs. Notice that it would be impossible to derive the same results with an $i \rightarrow y$ rule, without adding a thoroughly ad hoc provision to it: we would have to allow /i/ to become [y] before *-ary* and *-ative* (which alternates in the same way), despite the fact that [y] is otherwise never found in the environment C ___ V́. Even worse, this analysis would miss the generalization that it is exactly those stressed suffixes that have stressless alternants which may be preceded by [y]. Again, we conclude that a $y \rightarrow i$ analysis is the superior one, thus reinforcing our account of Long Retraction over V̆V̆.

2.7. The Fate of Extrametricality Markings

I have so far left unresolved the issue of where in the phonological derivation (if at all) words lose their markings for the feature [+ex]. The problem can be split into two issues: the fate of [+ex] through successive phonological cycles, and whether [+ex] must ever be eliminated within the course of a single phonological cycle. These questions will be addressed in turn.

It is easily argued that [+ex] must not persist through more than one cycle of a phonological derivation. Consider, for example, the cyclically derived adjectives *paréntal* and *medícinal*. If the extrametricality markings assigned on the first cycle were retained, we would erroneously derive initial stress, as follows:

(102)

parental	medicinal	
[a ɛ́ɲ ɫ] al	[e i ɪ́ɲ] al	first cycle:
		Noun Extrametricality English Stress Rule SSA
a ɛ́ɲ ɑ́ɫ	e i ɪ́ ɑ́ɫ	second cycle:
		Adjective Extrametricality
*á ɛ́ɲ ɑ́ɫ	* é i ɪ́ ɑ́ɫ	English Stress Rule
		(applies vacuously) SSA

Some means must therefore be found of removing the extrametricality diacritic from the penults of these words. A simple solution has been proposed by Harris (forthcoming) to handle similar facts in Spanish: Harris suggests that any element marked for extrametricality must lose its marking if it is not at the right edge of the stress domain. This is carried out by a universal Peripherality Condition, which we can express as follows:

(103) *Peripherality Condition*

$$\overset{X}{[+ex]} \rightarrow [-ex] \,/\, \_\_\_\, Y]_D$$

where $Y \neq \phi$ and D is the domain of the stress rules.

The Peripherality Condition will convert a representation like *a ɛ́ɲ ɑ́ɫ* (on the rhyme projection) to *a en ɑ́ɫ*, leading to the proper stress contour *parɛ́ntal* once the stress rules have applied.

Notice that by adopting the Peripherality Condition, we may dispense with the requirement that all extrametricality rules apply in the environment / ____]$_D$, since any constituent that was assigned extrametricality in any other context would have its marking removed by the condition. We can thus formulate all extrametricality rules in a very simple fashion. For English, we would say

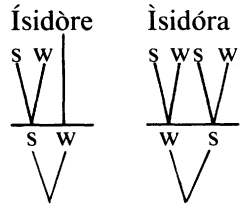
(104) Mark $\left\{\begin{array}{l}[+\text{cons}]\text{ segments} \\ \text{rhymes in nouns} \\ \text{adjectival suffixes}\end{array}\right\}$ as extrametrical.

The Peripherality Condition also leads us to sharpen our notion of where the extrametricality diacritic appears in phonological representations. The rule of Adjective Extrametricality applies to the polysyllabic suffixes *-ative* and *-atory*, which accounts for their Weak Retraction behavior. When this happens, however, it is crucial that the Peripherality Condition not annul the extrametricality of the first rhyme of a suffix in the environment of a following rhyme. Similarly, we wish to ensure that the earlier segments in an extrametrical rhyme do not lose their extrametricality in the environment of later ones. I would infer from this that extrametricality markings must *not* be percolated down from higher phonological constituents to lower ones—the suffix *-ative* is a single extrametrical unit, and remains so, since it occurs in word-final position. Similar reasoning applies to extrametrical rhymes.

The fate of extrametricality markings within a single cycle is a more difficult question—in particular, we want to know if the extrametricality diacritics play a role in the construction and labeling of the word tree, as well as the feet. The complexity of the English word tree labeling rules makes it difficult to come to firm conclusions, but several facts suggest that extrametrical entities are just as invisible to word tree construction as they are to foot construction.

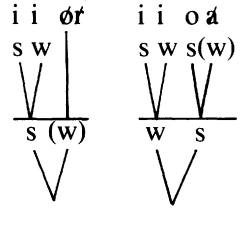
According to LP, the ordinary way of labeling the word tree in English nouns is to make right nodes strong if and only if they branch. This is illustrated below with the labelings of *Ísidòre* and *Ìsidóra*:

(105)



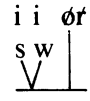
Suppose, however, that we allow extrametricality markings to persist throughout the derivation, except when they are removed by the Peripherality Condition. In this case, an even simpler generalization emerges: the strongest foot is the rightmost one that the labeling rule can "see", as in (106):

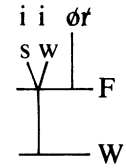
(106)

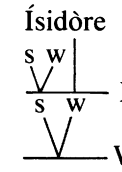


To be specific, we propose first that the word tree rules do not bracket or label any feet that are completely extrametrical; second, that the word tree labeling rule for English is simply "make right nodes strong"; and finally, that any feet that remain stray after Word Tree Construction are joined up as weak members of the tree. The latter is

obviously a generalization of the Stray Syllable Adjunction convention, moved up one level on the prosodic hierarchy. The effects of "Stray Foot Adjunction" can be seen below:

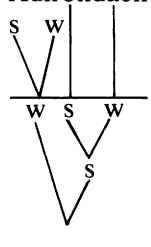
(107) ⇒ foot construction 

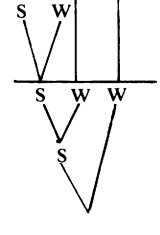
⇒ Word Tree Construction 

⇒ Stray Foot Adjunction 

By assuming that Word Tree Construction respects extrametricality markings, we can convert many of the peculiarities of English word tree labeling into entirely expected phenomena. For example, LP must add an additional provision to their labeling rule (their (96D)) stating that verbs and adjectives receive iambic labeling even if the rightmost foot does not branch, as in *surróund, divést, rotúnd, divíne*. This follows automatically from the extrametricality hypothesis, since these words do not mark the final rhyme as extrametrical—the iambic labeling required by rule shows up on the surface. The argument is strengthened when we note that adjectives ending with stressed suffixes generally have trochaic labeling: compare *òvért, àugúst, àbstráct* with *núbìle, schízòid, cúrsory* (<*cúrsòry*). This pattern would require yet another addition to the LP rules, but follows automatically here from the interaction of Adjective Extrametricality and word tree labeling.

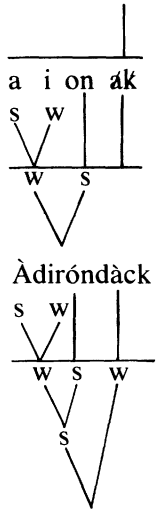
Kiparsky's (1979) account of word tree construction in English provides another argument for the extrametricality approach. Recall that in order to derive the two possible stressings for words like *Ticonderoga*, we must assume that the word trees for English monomorphemes may be freely left- or right-branching, as was shown under (61). This raises a serious problem when we construct the possible trees for words of the type *Àdiróndàck, Àgamémnòn*. Assuming that the labeling convention for nouns is "right strong iff branching", we derive two different stress contours:

(108) a. Adiróndack 

b. *Ádirondack 

The situation is somewhat reminiscent of the *àbracadábra* ~ *Epàminóndas* contrast mentioned above, but with a crucial difference: while both *àbracadábra* and *Epàminóndas* conform to canonical English stress patterns, the stress contour of **Ádiròndàck* is quite generally excluded from the corpus. This is a serious problem for Kiparsky's proposal, but one that is neatly solved under the extrametricality analysis. Using extrametricality, there is only one possible word tree for *Adirondack*, whose full derivation is as follows:

(109) a i on ak — underlying representation



Noun Extrametricality
English Stress Rule
Strong Retraction
Word Tree Construction

Stray Foot Adjunction

The tree that comes to the surface is the one we want. For *Ticonderoga*, however, it is still possible to derive two distinct word trees, so that the good of Kiparsky's analysis is retained.

A final argument derives from the adjectival suffix *-ative*. The behavior of this suffix is very peculiar under the LP analysis, in that it forms a foot that must be labeled weak even though it branches. Under the present analysis, this follows automatically from its status as an extrametrical suffix, which is independently motivated by its Weak Retraction pattern.[19]

We see, then, that there are several cases in which the extrametricality analysis provides a motivated explanation for what appear in LP to be arbitrary patterns of word tree labeling in English. The remaining ad hoc accretions to the LP labeling rule translate straightforwardly into the present framework as ad hoc accretions to the extrametricality rules, ordered in this case after foot construction.[20] For example, LP note that verbs and unsuffixed adjectives eschew their normal iambic labeling when their first foot branches, as in *díffícùlt, tácitùrn, gállivànt, ímplemènt*. We can capture this fact with an additional rule of the form (110):

(110) *Late Extrametricality*

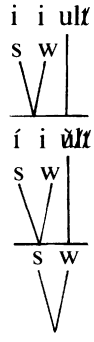
Subject to the Peripherality Condition, mark rhymes as extrametrical when they are preceded by a branching foot.

[19] Some means is still necessary to place stress on *-ative* itself. The simplest appears to be to mark its final syllable as idiosyncratically extrametrical prior to the application of the stress rules, whereupon Long Vowel Stressing will stress *-ate* as if it were word-final. The device of marking the rhymes of adjectives as idiosyncratically extrametrical is necessary anyway to handle exceptional cases like *áwkward* and *stándard*.

[20] I believe that LP's accretion (96C), stating that disyllabic nouns with light initial syllables are labeled iambically, is simply incorrect. As evidence, note the dialectal innovations *gúitàr, chíffòn*: we would not expect these forms to arise if they were exceptional to the general rule for labeling nouns. The statistical generalization that underlies (96C) more or less disappears if we assume the "Arab" Rule (75) as part of the system.

Using this rule, we can derive the stress contour of *difficult* as follows:

(111) difficult



Consonant Extrametricality
English Stress Rule
Strong Retraction

Late Extrametricality
Word Tree Construction
Stray Foot Adjunction

Verbal stems regularly do not undergo (110), as is shown by *ìntersèct, còmprehénd*, and other examples.

The verbal suffixes *-ate* and *-ize* must also receive an extrametricality mark before word tree labeling: cf. *dónàte, báptìze* versus the normal *retáin, delíght*. In British English, this rule is not needed, as we regularly find the pattern of *dònáte, bàptíze* (Jones (1928)). Historically, disyllabic *-ate* verbs had trochaic labeling in British English: this is the norm for the verbs in Walker (1791). Interestingly, the shift in their labeling appears to have been simultaneous with the shift of *-ate* from Weak to Strong Retraction among the longer verbs. This can be determined by consulting the entries in Walker's dictionary, which also has quite regular Weak Retraction in the longer verbs; in the OED, which shows variation in both cases; and in Jones (1928), in which the two changes are nearly complete. Under our theory, the parallel stress shifts have the same underlying cause, the loss of idiosyncratic extrametricality on *-ate*. This rather striking evidence is of course weakened by the failure of *-ate* to shift its stress in American English disyllables.

The various late extrametricality adjustments that are needed appear to be limited to the addition of [+ex]—there are no cases in which [+ex] must systematically be removed. Such a case would be, for example, an adjectival suffix that triggered Weak Retraction, but also bore main stress. To be sure, there are isolated words like *Tènnessée, pìcturésque*, having final main stress, but the great majority of these will have their stress derived correctly if they never bear extrametricality markings in the first place, being exceptions to the appropriate extrametricality rules. A small residue of exceptional cases, such as *chìmpànzée, ròdomòntáde*, can be regarded as the idiosyncratic construction of nonmaximal feet by Strong Retraction, and are thus parallel to words like *Hàlicàrnássus, ìncàntátion*.

3. Summary

To conclude, I will summarize the advantages that extrametricality brings to our description of English stress. The principal arguments are five in number: (a) The analysis

can capture the unity of stress assignment in nouns and suffixed adjectives on one hand, and verbs and unsuffixed adjectives on the other. (b) It is no longer necessary to mark each suffix in the lexicon for one of three modes of retraction behavior; all systematic stress retraction follows from independently motivated rules. (c) The retraction behavior (actually *non*retraction behavior) of *-ation* in cyclic derivations is an automatic consequence of the rules, rather than a mystery. (d) The stress pattern of long monomorphemes exemplified by *Háckensàck* ~ *Àdiróndàck* ~ *Monádnòck* is a direct result of the system, augmented by an independently motivated destressing rule. (e) Much of what is arbitrary in the LP rules for labeling the word tree follows automatically from the extrametricality rules.

In addition, the theory has forced us to examine three areas where it initially appeared to fail. In each case, the examination led to a deeper understanding of the phenomenon in question: (a) The stress retraction pattern exemplified by *Wìnnepesáukee, Àpalàchicóla*, and *Mamáronèck* turned out to follow neatly from the rules proposed, augmented by the independently needed rule of Poststress Destressing. (b) The stress behavior of Greek prefix–stem words followed straightforwardly from a compound analysis. (c) The supposed Long Retraction induced by V̆V̆ sequences turned out not to involve a stress rule at all, but rather a segmental rule of glide vocalization, which had favorable consequences elsewhere.

I believe that this represents progress, in fact, progress of just the right sort: ideally, a formal device that is motivated by its ability to capture universal generalizations about stress rules should provide clearer and more insightful accounts of complex individual stress systems. This is the case with the present analysis. We originally proposed a theory of extrametricality rules to account for three very general phenomena: the restriction of certain foot templates to final position, the frequent need for differing criteria in determining the weight of final syllables, and the asymmetry in "avoidance clauses" such as the one governing Hopi stress. Once adopted, the new device led quite directly to a more insightful account of the English stress pattern.

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