

# The Stress of English Words 1968–1998

*Morris Halle*

The article begins with reflections on the theory of Chomsky and Halle 1968, which constituted a new departure in phonology. The indebtedness of the theory to Chomsky 1951 is noted, and certain inadequacies in the theory are discussed as well as the ways these were overcome in subsequent work, including Idsardi 1992. The revised theory is illustrated with an improved account of English word stress that includes a new treatment of the ‘‘Rhythm Rule,’’ in particular, of contrasts such as *anécdôte* vs. *eléctròde*; vowel shortening in poststress position (e.g., *sálivàte* (cf. *salíva*), *ínfamous* (cf. *fámous*)); and ‘‘weak’’ syllable effects (Burzio 1994) (e.g., *Lómbarðy* but *Lom-bárði*).

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*For Noam Chomsky, on the thirtieth anniversary of the publication of SPE*

## 1 Introduction: *SPE*, Before and After

The essential novelty of *The Sound Pattern of English* (Chomsky and Halle 1968, hereinafter *SPE*) derives from its basic assumption that phonology is an aspect of the knowledge that speakers/hearers have of their language and that a crucial component of this knowledge consists of ordered rules. As we wrote in *SPE*:

The person who has acquired knowledge of a language has internalized a system of rules that determine sound-meaning correspondences for indefinitely many sentences. . . . It is this system of rules that enables him to produce and interpret sentences that he has never before encountered. (p. 3)

This conception of the subject matter of linguistic inquiry was in direct contrast with the view dominant in American linguistics in the 1940s and 1950s, which regarded the task of linguistics as that of assembling inventories of elements—phonemes, morphemes, immediate constituents, and so on—and constructing a taxonomy of these entities without special concern for the status of the entities or a search for rules. Instead, as Chomsky wrote in his contribution to the Third Texas Conference on Problems of Linguistic Analysis in English held in May of 1958, the then dominant view—which I refer to below as *American phonemics*—defined these entities

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in such a way as to provide an essentially mechanical method that an investigator might use, in principle, to isolate the phonemes, morphemes, and constituents in the analysis of a particular language. This interest in a discovery procedure for linguistic elements has motivated the strict separation of levels, bi-uniqueness of phonemic transcription . . . phonemic identifiability of morphemes and many other widely held doctrines. . . . Neither the conception of a grammar as an inventory of elements nor the requirement that there be a discovery procedure for elements of the inventory is very easy to justify. A grammar of a language should at least be expected to offer a characterization of the set of objects that are sentences of this language. . . . It is not at all clear how an inventory of elements provides this information. . . . And as soon as we attempt to give a rigorous account of the process by which a grammar generates sentences . . . [w]e find that some requirements that have been imposed on linguistic elements (e.g., the bi-uniqueness condition for phonemes) lead to extensive and unnecessary complication of the grammar . . . while others (e.g., the strict separation of levels) become almost unstatable. . . . (1962:125)

This criticism could be met only by a fundamental reorientation of the goals of the field from a concern with inventories of elements and the procedure for their discovery to an inquiry aimed at characterizing “the internalized, mentally represented system of rules that we call ‘grammar’” (*SPE*, 4).

Our view of the proper aims of linguistics had been anticipated by other scholars in a variety of ways. We were especially influenced by Sapir, who observed that

back of the purely objective system of sounds that is peculiar to a language . . . there is a more restricted “inner” or “ideal” system, which, while perhaps equally unconscious as a system to the naive speaker, can far more readily than the other be brought to his consciousness. . . . (1921:57)

It is this inner system, according to Sapir (1933:50), that must be represented in the “phonologic orthography” and that enables “a slightly schooled native” to deduce the phonetic forms “by the application of absolutely mechanical phonetic laws . . .” In the case of Southern Paiute, the particular language Sapir was discussing, both the “laws” and their interactions are quite complex, but this fact was not brought out in Sapir’s paper and we discovered it—with some surprise—in the course of writing *SPE*.<sup>1</sup>

Sapir’s work did not become part of the mainstream of American linguistics of the 1940s and 1950s. It, as well as similar work of Bloomfield’s on Menomini and other Algonkian languages, was thought to belong to a special subdiscipline, called *morphophonemics*, and was set aside in favor of the taxonomic researches mentioned above.<sup>2</sup> It was only at the end of the 1950s

<sup>1</sup> For details of Sapir’s rules, see *SPE* (pp. 344–349).

<sup>2</sup> It is this fact that is in the background of the comment by Martin Joos, editor of the 1957 anthology *Readings in Linguistics*, that

[w]hen we look back at Bloomfield’s work, we are disturbed at this and that, but more than anything else Bloomfield’s confusion between phonemes and morphophonemes disturbs us. Bloomfield kept himself out of trouble here, usually, by describing just one language at a time, or one area within each at a time, adjusting for the effects of the confusion. But it made his procedure an unsafe model for neophytes and made the corpus of his work an inadequate source to distill procedural theory out of. (p. 92)

Although Joos implies that Bloomfield’s work reflected the majority view of American phonemics, he offers no supporting evidence. The total exclusion of Bloomfield’s descriptive work from Joos’s anthology, whose subtitle was *The Development of Descriptive Linguistics in America since 1925*, suggests rather the simpler hypothesis that like Sapir’s work, Bloomfield’s did not share the central tenets of American phonemics and was therefore excluded.

that proper attention was focused on the “morphophonemic” studies in the literature, and this in turn led to the recognition, reflected in the above quotations from Chomsky, that there was no sound basis for the fundamental doctrines of American phonemics, among them for the separation of morphophonemics and phonemics.

Although the earlier literature thus contained examples of approaches to phonology other than American phonemics, none of these—and this was true not only of the work of Sapir and Bloomfield, but also of Trubetzkoy 1939 and Jakobson 1948—provided a detailed and explicit formalism for the representation and organization of the rules that in our view constitute the crux of the phonology of a language. To a large extent such a formalism was given in Chomsky’s 1951 master’s thesis. There we find the first worked-out proposals for the format of the rules, discussions of the effects of rule ordering, a simplicity metric for selecting among alternative accounts, abbreviatory schemata for the representation of sets of rules, and the effects of these schemata on rule ordering.

During the 1950s and 1960s various issues that had been explored in Chomsky’s master’s thesis became the subject of studies by Chomsky and others. The earliest such work was the paper on stress in English compound words and phrases by Chomsky, Halle, and Lukoff (1956), and these efforts continued through the succeeding decade with a series of papers written individually and jointly by Chomsky and by me<sup>3</sup> and, after the establishment of the MIT doctoral program in linguistics in 1961, by others—faculty, students, and postdoctoral researchers—associated with the MIT program (most of these are listed in the bibliography of *SPE*). It is this body of work—in addition to our own research—that is summarized, integrated, and extended in *SPE*.<sup>4</sup>

Many aspects of the phonological theory of *SPE* have survived intact to this day. As illustrated in detail in sections 2 through 6 below, the data of English word stress strongly support such fundamental propositions of the *SPE* theory as that phonology is based on ordered rules and that the order of rule application reflects in part the syntactic structure of the word (the transformational cycle).

A proposition of *SPE* that has received relatively little attention, but gains notable support from the stress facts discussed below, is that rules may have lexically marked exceptions. We wrote that

not infrequently an individual lexical item is exceptional in that it alone fails to undergo a given phonological rule or, alternatively, in that it is subject to some phonological rule. . . . The natural way to reflect such exceptional behavior in the grammar is to associate with such lexical items diacritic features referring to particular rules . . . (*SPE*, 374)

<sup>3</sup> See Chomsky 1957a,b, 1962, 1964, 1967, Halle 1959, and Chomsky and Halle 1965.

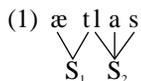
<sup>4</sup> It has been noted that *SPE* contains hardly any criticism of previous work, especially of American phonemics. We omitted such criticism because the book had grown in size beyond our original target and because our own critical writings were available in widely read publications. Moreover, we knew that a book specifically devoted to a critical examination of these phonological theories—Paul Postal’s (1968) *Aspects of Phonological Theory*, a book that has preserved much of its original interest to this day—was to appear almost simultaneously with *SPE*.

Sections 2 through 6 include numerous examples showing that this way of dealing with exceptions is crucial for obtaining the correct results in a number of rather complex instances.

As noted in its opening sentence, *SPE* was conceived of as “an interim report on work in progress,” and, as anticipated there, more recent advances in phonology have shown that several proposals in *SPE* were mistaken. The two that are considered below are both consequences of the fundamental assumption of linearity of the phonological sequence, which *SPE* shared with American phonemics as well as with other approaches to phonology: namely, that the object of study consisted exclusively of linear sequences of phonemes (segments) and junctures (boundaries). It was this assumption that caused us to exclude syllables as entities in our rules and that led us to treat stress as a feature parallel to [nasal] or [back] or [anterior]. Once linearity was abandoned in the 1970s, both of these treatments lost their main motivation and were quickly supplanted by more attractive alternatives.

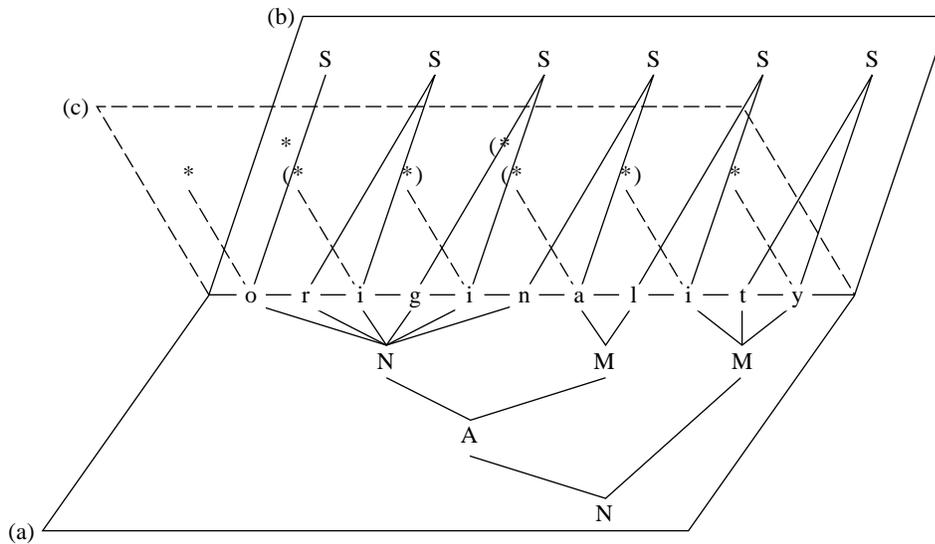
Because of the linearity assumption, *SPE* defined words as segment sequences delimited by consecutive occurrences of word boundaries, and morphemes as segment sequences delimited by consecutive occurrences of formative boundaries. A special feature, [+/- word boundary], distinguished the two types of boundaries. (See *SPE*, sec. 8.6, for details.) As I recall it, we did not add syllables to the list of theoretical units, because the only way we could conceive of representing such units formally was by means of boundaries; and to add a further ad hoc set of boundaries to the notation did not make sense to us, so instead we did without syllables.

Kahn (1976) showed that syllables could be delimited without recourse to boundary markers. Kahn’s demonstration depended crucially on the results of studies by Leben (1973), Williams (1976), and Goldsmith (1976), who had shown that to deal with the tonal facts of the Bantu languages it was necessary to set up representations with at least two parallel sequences of segments—tones and phones—and that the widely accepted assumption shared by *SPE* that a phonological representation is a linear sequence of phonemes and boundaries was therefore untenable. This *autosegmental* conception of the phonological representation cleared the way for Kahn’s treatment of the syllable. Rather than define the syllable by means of special boundaries, Kahn defined it as a unit on a separate autosegmental tier. This is illustrated in (1), where I have reproduced Kahn’s (1976:20) syllabification of the English word *atlas*.



If syllables can be projected on a separate autosegmental tier, so can words and morphemes, a fact first pointed out by Rotenberg (1978). This recognition has two consequences: on the one hand, it eliminates the need for boundaries altogether, and, on the other hand, it transforms the phonological representation from a sequence of phonemes and boundaries into a three-dimensional object of the kind illustrated in figure 1 (cf. Halle 1985).

In conformity with traditional views, stress in *SPE* was treated as a phonetic feature similar in kind to nasality, backness, rounding, and so on. This traditional view of stress was challenged by Liberman (1975), who suggested that stress in all languages is a reflex of the grouping of



**Figure 1**

Representation of the noun *originality* as a three-dimensional object. The phoneme sequence is represented at the intersection of the three orthogonal planes, which reflect (a) the word's morphological structure, (b) its syllable structure, and (c) its metrical (accentual) grid.

phoneme sequences into *feet*. In many languages, one of the two end-elements of the foot is designated as its head, and it is to heads of feet that stress is assigned. Most commonly, stress is implemented phonetically by assigning high tone to the heads of feet, but some languages—for example, Tubatulabal (see Swadesh and Voegelin 1939) and Carib (see Kenstowicz 1994)—mark heads with the help of vowel length, and others assign special tones or tonal melodies to feet (see Purnell 1997).

It was originally thought that feet are made up of syllables, but subsequent work has shown this to be incorrect. For example, in Southern Paiute and some other languages, syllables with short rimes contribute a single unit for purposes of foot construction, whereas syllables with long or complex rimes contribute two units for foot construction. Moreover, in Southern Paiute a foot may begin or end in the middle of a syllable. It was therefore proposed in Halle and Vergnaud 1987 that feet are composed not of syllables, but of those pieces of a syllable that may bear stress. A natural way of reflecting this fact formally is by representing feet on a separate autosegmental plane, which is distinct both from the plane on which syllables are represented and from the plane on which morphemes and words are represented (see figure 1). It is on this autosegmental stress plane, where only the stress-bearing phonemes in the sequence are projected, that stress is computed.

Liberman and Prince 1977 was one of the earliest attempts at formalizing Liberman's insight. In this work, feet were represented as groupings of syllables by means of nested constituent trees

composed exclusively of binary branches that were labeled S(trong) and W(eak). In a modified form this theory was used by Hayes (1980) and in other publications of the period in order to analyze the stress patterns of a number of languages, in addition to English.

The proposition that feet are nested binary constituents, which was central to the studies just mentioned, was challenged in Prince 1983. Prince showed that the elaborate nested constituent structure erected by the theory had few empirical consequences and that it encountered serious difficulties in trying to express phenomena such as the stress shift in *fifteen men*. He therefore proposed to eliminate all constituent structure and grouping of stressable elements, thereby contradicting Liberman's central insight that stress is a reflection of foot structure. Instead, he proposed that stress contours of words be expressed by means of a metrical grid. The bottom line of the grid was composed of projections of the stressable elements in the sequence, and higher lines were constructed by projecting certain of these elements upward. The two main devices for this upward projection were an End Rule, which projected the element at one or the other end of the string onto the next higher line, and a rule of Perfect Grid Construction, which projected alternate elements in the bottom line of the grid onto the next higher line.

With some modifications and with one important exception, Prince's proposals have been adopted in most subsequent work. The exception is Prince's attempt to do without foot structure, because this suggestion was shown to be inadequate. The crucial fact, as noted by Halle and Vergnaud (1987:30), is that in many languages deletion of a stressed vowel results not in the elimination of stress on the word, but in the stress being shifted to an adjacent syllable. (For examples, see Hayes 1995:42ff.) In such cases the direction of the stress shift is predictable, but only if one assumes the existence of feet, for stress is shifted to the syllable that belongs to the same foot as the deleted syllable. Thus, when B is deleted, stress shifts to the left in (2a), but to the right in (2b).

- (2) a.        \*                    \*                    line 1  
               \* \*) \* >> \*) \*        line 0  
               A B C                A C
- b.        \*                    \*                    line 1  
               \* (\* \* >> \* (\*        line 0  
               A B C                A C

The effects of deletion on stress placement illustrated in (2) cannot be expressed without recourse to foot structure, because in the absence of foot structure there is no way to differentiate (2a) from (2b). The examples in (2) therefore constitute decisive counterevidence to the denial of the existence of feet.

A question that was not resolved until the 1990s was the nature of feet. It was recognized that in the light of Prince's (1983) criticisms, metrical feet do not have the structure of nested binary constituents. In Halle and Vergnaud 1987 account was taken of these criticisms by treating feet as constituents of flat, unnested structure. What remained unquestioned there was the proposition that feet are constituents akin to the phrases and sentences encountered in syntactic structures. This proposition is reflected formally in the notational convention of demarcating feet by matched

pairs of parentheses. This proposition was challenged by Idsardi (1992), who proposed that the matched-parenthesis requirement should be abandoned and that a foot should be delimited by a single boundary. This change in the notation implies a change in the nature of feet. Whereas matched parentheses construct constituents (i.e., units that have independent status and may, for example, be moved about), Idsardi's single unmatched boundaries are like the junctures of American phonemics in that they delimit element sequences without constructing higher-level units.<sup>5</sup>

In Idsardi's notation a boundary foots (= groups) all elements in the sequence up to the next boundary or to the end of the sequence. The notation recognizes two boundaries, a left one and a right one. A left boundary foots the elements on its right; a right boundary foots the elements on its left. Elements that are neither to the right of a left boundary nor to the left of a right boundary are unfooted; that is, they belong to no foot.

A simple formal difference between the two notational frameworks—that of Halle and Vergnaud and that of Idsardi—is illustrated in (3). I use parentheses to represent the boundaries in both frameworks.

(3) a. (\* \* \* \* \*      b. \* \* \* \* \*      c. (\* \* \* \* \*)

Since in the framework of Halle and Vergnaud 1987 (and of many other studies) a foot is defined by a matched pair of boundaries (parentheses), only (3c) is formally a well-formed foot; (3a) and (3b) have no status in this framework. By contrast, all three arrays in (3) constitute well-formed feet in Idsardi's framework, where a single boundary suffices to define a foot. As always in empirical inquiries, the choice between notational alternatives must be decided by appeal to the data, and as shown below the data favor the unmatched-parenthesis over the matched-parenthesis notation.

A relevant example is provided by the Leka dialect of Russian discussed in a celebrated paper by Shakhmatov (1913). In order to appreciate the discussion, consider first the following information about the accentual system of Russian. As explained in Halle 1997, in Russian a morpheme may or may not be accented. In Russian, as in many other Indo-European languages, stress is assigned to the leftmost (first) accented morpheme; in words without an accented morpheme, stress is assigned to the leftmost (first) syllable.

A Russian noun, typically composed of a stem and a case ending, may have as many as two accented morphemes (4a) or as few as none (4d).

<sup>5</sup> McCarthy and Prince (1993:144, n. 5) take specific note of the significance of this change in notation. They observe that this change is "sharply at odds with other work which . . . has rejected boundary-symbol theory elsewhere in phonology and morphology." They are critical of this move on theoretical grounds, citing the abandonment of boundaries "elsewhere in phonology and morphology." Their criticism loses much of its relevance since they do not support it with a discussion of stress and other facts of the kind surveyed below, which constitute the empirical motivation for Idsardi's proposals. It is also to be noted that to the extent that Idsardi's nonconstituent conception of feet is correct, it raises fundamental questions about the widespread use of constituent-type feet in Optimality Theory—specifically, the ALIGN constraints.

(4) <i>Instr. pl.</i>		<i>Nom. pl.</i>	
a.	* *	b.	* line 1
	(* (* *		(* * line 0
	kóž-ami 'skin'		kóž-y
c.	* *	d.	* line 1
	** (* *		** * line 0
	golov-ámi 'head'		gólov-y

Feet in Russian are left-headed. In (4) the instr. pl. case ending /-ami/ is accented on the first syllable, whereas the nom. pl. ending /-y/ is unaccented. Moreover, the noun stem /kož-/ 'skin' is accented, whereas /golov-/ 'head' is unaccented. The stress assignments in (4b) and (4c) follow directly from these simple facts and the universal convention that heads of feet are projected onto the next higher line in the metrical grid.

To obtain the stress assignment in (4a), a bit of additional machinery must be deployed. Specifically, we need a formal means to implement the fact noted above that in Russian, stress falls on the first accented morpheme. To do this, we posit that Russian words are subject to a rule that constructs a foot on line 1 by inserting a left parenthesis to the left of the leftmost asterisk. The stipulation that feet constructed on line 1 are left-headed, just like those on line 0, then projects the stem accent in (4a)/(5a) to line 2. The further assumption that the word stress is assigned to the head of a line 1 foot then correctly places the stress in (5a). As shown in (5b) and (5c), the construction of feet on line 1 does not change the location of the stressed syllable in these words.

(5) <i>Instr. pl.</i>		<i>Nom. pl.</i>	
a.	* *	b.	* line 2
	(* *		(* line 1
	(* (* *		(* * line 0
	kóž-ami 'skin'		kóž-y
c.	* *	d.	* line 2
	(* *		* line 1
	** (* *		** * line 0
	golov-ámi 'head'		gólov-y

We must still account for the initial stress in (4d), where both stem and case ending are unaccented. To obtain this, we posit an edge-marking rule that inserts a right parenthesis to the right of the rightmost asterisk on line 0. As shown in (6), this produces the correct stress assignment in (6d) without affecting the stress assignment in any of the other three forms.

(6) <i>Instr. pl.</i>		<i>Nom. pl.</i>	
a.	* *	b.	* line 2
	(* *		(* line 1
	(* (* *)		(* *) line 0
	kóž-ami 'skin'		kóž-y

c.	*	d.	*	line 2
	(*		(*	line 1
	** (* *)		** *)	line 0
	golov-ámi ‘head’		gólov-y	

With this as background, let us turn to the facts of the Leka dialect. In this dialect the rounded back nonhigh vowel [o] appears when stressed in two varieties, a diphthongized mid variant [uo] and a monophthongal low variant [ɔ]. Specifically, it appears as the diphthong [uo] in (6a–b) and as the low monophthong [ɔ] in (6d).<sup>6</sup> As Shakhmatov immediately recognized, the difference between the two stressed vowels has to do with the different accentual structure of the words. In present terms, the stressed vowel is diphthongized when preceded on line 0 by a left parenthesis—that is, in (6a–b) but not in (6c–d). The distinction between a stressed vowel preceded by a left parenthesis and a stressed vowel *not* preceded by a left parenthesis is formally expressed by the distinction between (3a) and (3c). As noted above, this distinction is available only in Idsardi’s unmatched-parenthesis notation, not in Halle and Vergnaud’s matched-parenthesis notation. The Leka data therefore require that we choose the former notation over the latter.<sup>7</sup>

In Idsardi’s notation parentheses are the only means for forming feet. It is therefore important to note that the rules of parenthesis insertion are subject to severe restrictions. In fact, parenthesis insertion rules are limited to the three kinds in (7).

- (7) a. *Syllable-marking rules* insert a left/right parenthesis to the left/right of a (projection of a) syllable with specific properties (e.g., syllable quantity). This is the analogue of Prince’s (1983) “gridding heavy syllable.”
- b. *Edge-marking rules* insert a left/right parenthesis to the left/right of the (projection of the) leftmost/rightmost syllable in the string. These are the analogue of Prince’s End Rule.
- c. *Foot-marking rules* insert left/right parentheses from left to right or from right to left before every other/third syllable. These may or may not be iterative. When applying iteratively, they are the analogue of Prince’s Perfect Grid Construction.

In addition to the rules in (7), which insert parentheses, Idsardi’s framework admits rules that delete parentheses in particular contexts. These are the counterpart of Prince’s “stress clash avoidance.” Finally, there are also rules deleting, or rendering non-stress-bearing, certain elements in the metrical grid. These rules will play an important part in the treatment of English stress below.

<sup>6</sup> When unstressed, as in (6c), underlying /o/ merges with /a/ (i.e., [galav-ámi]).

<sup>7</sup> Purnell (1997) has shown that Idsardi’s notation readily accounts for tonal contours of many African languages and of different Japanese dialects. In particular, he shows that the tonal contours of words in the African language Margi require the three-way distinction in (3).

## 2 English Stress: The Core Cases

In the remainder of this article I employ the metrical framework just sketched to account for the facts of English word stress. I examine facts that were central to the account in *SPE*, as well as interesting new facts, most of which were first noticed by Burzio (1994). I show that the new framework makes possible a significant advance in our understanding of English stress.

The most noteworthy result of this investigation is that the core of the English stress system is constituted by the Main Stress Rule supplemented by two edge-marking rules. Every English word is subject to the Main Stress Rule, and most English words are also subject to one of the two edge-marking rules. I first explain how these rules operate. I then work through a variety of examples in order to show that these rules—with a few important, yet quite minor additions—assign stress to every word in the English lexicon.

Formally, the Main Stress Rule has two parts. The first part constructs a binary foot at the end of a string whose last asterisk projects a light syllable. Where this is not the case—that is, where the last syllable is heavy or there are not enough syllables in the word to construct a binary foot—a unary foot is constructed. The effects of the Main Stress Rule in the unembellished state are illustrated in (8a).

(8) a.	*(* *	*(*	*(*	(*
	devélop	usúrp	cajóle	pút
	clandésthine	robúst	divíne	bláck
b.	* (* *]*	*(* ] *	*(*] *	(*]*
	América	agéndá	Tacóma	vílla
	cómpetent	consístent	cohérent	cúrent
	orígnal	paréntal	anecdótal	móral
c.	(* * [*	*(* [*	* * (*[*	(* [*
	málachète	stalágmète	monophýsète	Hússète
	amýgdalòid	mollúscòid	epicýclòid	cóllòid
	plátinòde	eléctróde		ánòde

The Main Stress Rule also applies in the words in (8b) and (8c), but these words are subject in addition to an edge-marking rule, which applies before the Main Stress Rule. As noted, there are two edge-marking rules, and both insert parentheses (boundaries of metrical feet) to the left of the rightmost element of a polysyllabic word. As illustrated in (8b), the first of the two edge-marking rules inserts a right parenthesis before the final syllable of the word if the syllable contains a short vowel. I shall refer to it as *RLR Edge Marking*, for it inserts a right parenthesis to the left of the rightmost syllable. The second edge-marking rule is *LLR Edge Marking*; it inserts a left parenthesis to the left of the rightmost syllable. *LLR Edge Marking* applies in words where *RLR Edge Marking* has not applied. This is illustrated in (8c). In (8b–c) and below I indicate the effects of the edge-marking rules using square brackets. In this way I graphically distinguish the effects of the edge-marking rules from the effects of the Main Stress Rule, which are represented by ordinary parentheses. Moreover, the feet constructed on line 0 are left-headed.

The edge-marking rules are stated more formally in (9). RLR Edge Marking (9a) is ordered before LLR Edge Marking (9b), implying that RLR Edge Marking has precedence over LLR. Specially marked words (e.g., those in (8a)) are exceptions to both edge-marking rules.

As already noted, all words—whether or not subject to the edge-marking rules—are subject to the Main Stress Rule, whose two subrules are stated more formally in (10). Here too the order of the rules reflects precedence: the rule assigning penultimate stress (10a) takes precedence over the rule assigning stress to the final syllable (10b).

(9) *Edge-marking rules*

a. *RLR Edge Marking*

$\emptyset \rightarrow ]$  in env. \* \_\_\_\_ \* ## line 0

Condition J: Final asterisk projects short vowel.

b. *LLR Edge Marking*

$\emptyset \rightarrow [$  in env. \* \_\_\_\_ \* ## line 0

(10) *Main Stress Rule*

a.  $\emptyset \rightarrow ($  in env. \_\_\_\_ \* \* <P \* > ## line 0

Condition K: Second asterisk projects vowel in light rime.

b.  $\emptyset \rightarrow ($  in env. \_\_\_\_ \* <P \* > ## line 0

In (10) the subsequence enclosed in angled brackets, <P \* >, reflects the effects of the prior application of one of the edge-marking rules. The *P* here stands for a boundary of either kind: ) or (.<sup>8</sup>

There are important lexical exceptions to the rules in (9) and (10) or their parts. Of special importance below are exceptions to Condition K of the Main Stress Rule. As stated, Condition K limits the construction of a binary foot to sequences ending in a light syllable. In specially marked words, Condition K need not be satisfied and a binary foot is generated even in sequences ending with a heavy rime. Below, I will show that such words are quite numerous.

Like the Main Stress Rule, the edge-marking rules have significant lexical exceptions. It was already noted in *SPE* that unsuffixed verbs and adjectives are generally not subject to edge marking of any kind. Some examples of this are cited in (8a). However, not all unsuffixed verbs and adjectives are exceptions to the edge-marking rules. As shown in (11), the verb *govern* and numerous unsuffixed adjectives are subject to RLR Edge Marking; they differ in this respect from the majority of such adjectives and verbs.

(11) (\*] \*      (\*] \*      (\*] \*      (\*] \*      (\* ] \*      (\*] \*  
góvern    módest    sólemn    módern    áuburn    cóvert

Near-minimal pairs such as *módest* vs. *augúst* and *cóvert* vs. *ovért* suggest that whether an unsuffixed adjective is or is not subject to the edge-marking rules is, to some extent, an idiosyncratic property of the adjective.

<sup>8</sup> Work in progress indicates that under a proper reformulation of the Main Stress Rule it should be possible to state the rule so as to eliminate the <P \* > subsequence and combine (10a) and (10b) into a single formula.



Besides applying to the words in (8c), the Rhythm Rule was said to apply to those in (16). These examples have been discussed in the literature under the label *strong retraction*.

(16) anecdòte    exácerb-àte    sáliv-àte

The examples in (16) differ from those in (8c) with regard to the manner in which the Main Stress Rule applies. Since in (16) the prefinal syllable is heavy rather than light, the Main Stress Rule would be expected to assign stress to the prefinal syllable. This does not happen here; instead, stress is assigned to the syllable preceding the prefinal. Formally, words such as those in (16) are marked as being subject to the Main Stress Rule without regard to the effects of Condition K.<sup>9</sup>

#### 4 Vowel Shortening in Posthead Position

In addition to being exceptional with respect to Condition K, the verb *salivate* has another property that is in need of explanation. Since it has the same stem as the noun *saliva*, we must assume that in its underlying representation the verb has a long vowel in the second syllable. To account for the fact that the surface vowel of the verb is short, we posit the rule (17), which shortens vowels directly following the head of a foot.<sup>10</sup>

(17) 
$$\begin{array}{ccc} \text{V} & & \text{V} \\ \diagdown & \diagup & | \\ \text{X} & \text{X} & \text{X} \end{array} \rightarrow \text{in env. } \begin{array}{c} \text{---} \\ | \\ (* \quad *) \text{ line 0} \end{array}$$

Like all unstressed short vowels, vowels shortened by rule (17) are subject to reduction (cf. *SPE*, 125, rule (125), and Halle and Vergnaud 1987:240).

The combined effects of being marked as not subject to Condition K and of undergoing the shortening rule (17) explain a great many additional cases, including the stress and vowel length alternations in the words in (18).

(18) infamous – famous; impotent – potent; immigrate – migrate; confident – confide;  
resident – reside; affluent – fluent

<sup>9</sup> Additional cases of the special role of LLR Edge Marking:

1. Verbs of the *export*, *permit*, *survey* type are supplied with final stress by (10b). Their nominal cognates are subject to LLR Edge Marking and hence surface with main stress on the prefix.
2. Nouns like *Slovak*, *coupon*, *tamarack*, *Saskatchewan*, *Omaha* are subject to LLR Edge Marking. By contrast, nouns such as *Berlin*, *Saigon*, *Tibet* are not subject to the edge-marking rules, and are assumed to have final geminates. As Burzio notes, this is supported by the stress of the adjective *Tibétan* (cf. *Púritan*, *mètropólitán*). *Russell* and the adjective *Russéllian* (cf. *comédian*, *tragédian*) imply that the stem ends with a geminate but is subject to the unmarked RLR Edge Marking. The geminate accounts for the short vowel in the adjective. Geminates must also be posited in *Kentucki-an*, *spaghetti*, *vanilla*.

<sup>10</sup> The context of this rule resembles that of Trochaic Shortening (see (24c)). Both rules apply to vowels that on line 0 of the metrical grid appear in the environment (\* \*). Rule (17) shortens the second of these vowels; Trochaic Shortening, the first. This resemblance is readily expressed in a metrical grid notation such as that of Halle and Vergnaud (1987) and Idsardi (1992); it is captured only with difficulty in other notations of stress.

Though all of these words are exceptional with respect to Condition K of the Main Stress Rule, each is completely regular with respect to the shortening rule (17), as illustrated in (19).

- (19) (\* \* [ \*            (\* \* ] \*            (\* \* ] \*            line 0  
           saliv-ate        infam-ous        preced-ent

It is worth observing that the short vowel in words such as *confidential* indicates that the shortening rule (17) belongs in the cyclic rule block and that shortening implemented on an earlier cycle is preserved in the output. Shortening differs in this respect from foot structure, which, as noted in section 5, is deleted at the beginning of each pass through the cyclic block of rules. I draw particular attention to this result here as it is a type of generalization that is not accessible to accounts without rules and derivations.

I have listed in (20) additional words—most copied from Burzio 1994:134—where the lifting of Condition K on the Main Stress Rule combines with rule (17) to produce the correct output.<sup>11</sup>

- (20) a. \* (\* \* ] \*  
           centrífugal  
           àntípodal  
           váginal
- b. (\* \* ] \*  
           résident  
           ímmigrant  
           cónfident  
           ígnorant  
           précedent  
           ábstinent
- c. (\* \* ] \*  
           blásphemous  
           carnívorous  
           gángrenous  
           sónorous<sup>12</sup>
- d. (\* \* ] \* .  
           ádmirable  
           cómparable  
           irrévocable

<sup>11</sup> As explained in section 6, the final syllables in the words in (20d–e) and (21d–e) are unstressable and thus not projected onto line 0 of the metrical grid.

<sup>12</sup> See (21c). *sonórous* is the only pronunciation given in Kenyon and Knott 1944 and is the preferred pronunciation in Webster's Third, which cites *sónorous* as an alternative. When stress is on the initial syllable, it is—as expected—subject to Trochaic Shortening (i.e., [sánərəs] rather than [sównərəs]).

- e. (\*[\*\* .  
 sálivàry  
 prothónotàry (cf. nótary)

As expected, there are a fair number of words with the same structure as those in (20), where Condition K on the Main Stress Rule is maintained. Some examples are given in (21).

- (21) a. \* (\*] \*  
 ànecdótal  
 sùicídál  
 sàcerdótal
- b. \* (\*] \*  
 translúcent  
 adjácent  
 cohérent  
 àntecédent  
 complácent
- c. \*( \*] \*  
 desírous  
 sonórous  
 pòlyhédrous
- d. \* (\*] \* .  
 restórablé  
 refínablé  
 oppósablé
- e. \* (\*[\* \* .  
 illúsory  
 advísory

Burzio's (1994:chap. 10) attempt to deal with these exceptions by means of a competition between two violable constraints—General Shortening and Stress Preservation—is not successful. For example, since there is no base word in such words as *adjácent*, *translúcent*, *sonórous*, there is also no base stress to be preserved. On Burzio's account, these words should therefore satisfy General Shortening. But in fact they do not. Forms such as *remédial*, *Newtónian* violate both General Shortening and Stress Preservation, casting additional doubts on Burzio's attempt to account for these facts by recourse to violable surface constraints. Even where the two constraints account for the facts, they provide no new insights into the nature of language or of English beyond those provided by the rule-based account developed here. In particular, minimal contrasts such as *àntecédent* vs. *précedent* indicate that we are dealing here with idiosyncratic properties of individual words, readily captured in a rule-based framework by marking certain words as exceptions to a specific rule, in the present instance to Condition K of the Main Stress Rule.

## 5 Pre-Main Stresses and Noncyclic Rules

We have yet to account for the secondary stresses that precede the main stress in long words such as those in (22).

(22) Tàtamagóuchi    Àpalàchicóla    Hàlicàrnássus    Còstantìnopólitan

These will be accounted for in the manner proposed in Halle and Kenstowicz 1991, namely, by means of the rule called Iterative Foot Construction, which constructs binary feet iteratively by inserting right parentheses from left to right. This rule differs from the rules in (9), (10), and (13) in that it is part of the noncyclic block of rules, whereas the others are part of the cyclic block.<sup>13</sup>

The distinction between cyclic and noncyclic rules reflects the fact that words have internal constituent structure. For example, the adjective *developmental* has the constituent structure [[[develop]<sub>V</sub>-ment]<sub>N</sub>-al]<sub>A</sub>. One of the important discoveries of *SPE* was that the constituent structure of a word determines to some extent the manner in which the rules of the phonology apply to it. It was assumed in *SPE* (see chapter 2) that the rules of the phonology apply to each constituent of the word in turn, beginning with the innermost and proceeding outward constituent by constituent. It was also noted there that constituents formed with certain affixes were exceptions to many of the phonological rules.

Subsequent work led to the proposal made in Halle and Vergnaud 1987 (q.v.), which is adopted here. Central to this proposal are the twin assumptions that the rules of the word phonology are organized into two separate blocks (cyclic and noncyclic) and that for purposes of the phonology a given constituent belongs to one of two categories (cyclic or noncyclic). Thus, in [[[develop]<sub>V</sub>-ment]<sub>N</sub>-al]<sub>A</sub> the verb stem *develop* is cyclic, the noun constituent *development* is noncyclic, and the adjective *developmental* is cyclic.

The rules of the cyclic block apply to each cyclic constituent of the word in order, beginning with the innermost and proceeding outward, constituent by constituent. When a noncyclic constituent is encountered, it is simply skipped and the rules of the cyclic block are applied to the cyclic constituent that is next in order. After all constituents have thus passed through the cyclic block, the rules of the noncyclic block are applied, but these rules apply only once to the entire word.

I follow Halle and Vergnaud 1987:sec. 3.1. in assuming that whether a given constituent is or is not cyclic is a purely idiosyncratic (lexical) matter. For example, the English suffixes *-ic*, *-al*, *-ity* form cyclic constituents, whereas *-ment*, *-ing*, *-ness* form noncyclic ones. The cyclic rule block includes, of course, other rules in addition to the stress rules in (9), (10), and (13) and the shortening rule (17). In particular, the cyclic block must include a rule that deletes metrical structure (i.e., parentheses) assigned on earlier passes through the cyclic rules. As a consequence, the surface stress of a word is that assigned to the word on its last pass through the cyclic stress

<sup>13</sup> For some discussion of iterative rules, see Halle and Idsardi 1995. It is also worth noting that since, as formulated in (10), the Main Stress Rule is noniterative, and it assigns no stresses to syllables preceding the main stress. This has the technical advantage of obviating the need for invoking a special conflation rule in order to remove any such stresses that would interfere with the proper application of Iterative Foot Construction. (For additional discussion, see Halle and Kenstowicz 1991:489.)

rules. This fact, which was overlooked in *SPE*, is illustrated by the stress of the adjective *asteroidal*, which has the internal constituent structure shown in (23b–c). The stress rules in (9), (10), and (13) assign the metrical structure (23a) to the innermost constituent *asteroid*.

- (23) a. \*  
 (\* \*  
 (\* \*[\*  
 ásteròid
- b. \*  
 (\* \*  
 (\* \*[\* ] \*  
 [[ásteròid]-al]
- c. \*  
 (\*  
 \* \*[\* ] \*  
 [[àsteróid]-al]

As shown in (23b), if the metrical structure in (23a) is not erased on the next pass through the cyclic rules, main stress is incorrectly assigned to the initial syllable. The correct stress is computed if the structure assigned to the innermost stem constituent is erased, as shown in (23c).

In (24) I have listed some well-known rules that belong to the cyclic rule block.

(24) a. *Stress Deletion*

Delete stresses and metrical structure assigned on previous passes through the cyclic rule block.

b. *CiV Lengthening*

rém[ə]dy → rem[íy]d-ial

c. *Trochaic Shortening*

t[ów]ne → t[á]n-ic

div[áy]ne → div[f]n-ity

d. *Closed Syllable Shortening*

w[íy]p → w[é]p-t

w[áy]d → w[í]d-th

e. *Regressive Devoicing*

five ~ fif-th

lose ~ los-t

## 6 Unstressable Syllables

### 6.1 Nouns in -ure

The rules developed to this point do not adequately handle the stress of nouns ending with *-ure*.

- (25) \*  
 (\*  
 (\* \*]\*\* .  
 músclature  
 cándidature  
 témpérature  
 líterature

These rules will place stress on the antepenult, not on the syllable before it (cf. *congénital*, *América*, *partícipant*). In discussing this class of examples, Burzio (1994:68) writes that ‘English

has a class of syllables which simply may or may not be metrified, [and] which we will call ‘weak syllables.’”

I suggest a rather different treatment: namely, that “weak” syllables are *unstressable*. In the formalism used here, syllables that are not stressable do not project an asterisk on line 0 and as a result are invisible to the stress rules. An immediate consequence of this fact is that such syllables can never be metrified. As illustrated by the grid in (25), where the last syllable is represented by a dot rather than an asterisk, the above proposal immediately explains stress placement in these examples.

Treating some syllables as unstressable is a perfectly natural move within the framework proposed by Idsardi and adopted here, since for every language it is necessary to specify what part(s) of a syllable is(are) stressable. It was assumed above that in English all and only syllable heads are stressable. The facts in (25) imply that there are some restrictions on this assumption—specifically, that the syllable head of the suffix *-ure* is not stressable. As shown by the grid in (25), once this fact is formally recognized and the suffix is not projected on line 0, the rules developed so far correctly compute the stress pattern of these words, provided we assume that the words are subject to the neutral RLR Edge Marking.

Like the words in (8), not all words ending in *-ure* are subject to RLR Edge Marking; some, like the words in (8b), are subject to LLR Edge Marking, whereas others, like the words in (8a), are subject to no edge marking (EM) at all.

- (26) a. (\* \* [\* . (LLR)  
 nomenclàture  
 législàture  
 mágistràture  
 árchitècture  
 ágricùlture  
 préfècture
- b. \* \*[\*\* . (no EM)  
 mànufactùre  
 erásure  
 sùpersédure  
 compósure  
 advénture  
 primogéniture

The words in (26a) are, in addition, subject to “strong retraction”; that is, Condition K of the Main Stress Rule does not apply to these words. It is also worth noting that some of the words in (26a) have the same stress contours as their unsuffixed stems (e.g., *législàture* like *législàte*, *mágistràture* like *mágistràte*, *árchitècture* like *árchitèct*).

What is the mechanism whereby “weak” suffixes such as *-ure* are rendered unstressable? I propose that it is the rule shown in (27), which is part of the cyclic rule block and which applies only to specifically marked suffixes.

- (27) \* → . in the env. \_\_\_\_ ]##  
 where ]## represents a word-final constituent

Like the effects of all rules of metrical structure, the effects of (27) are wiped out on the next pass through the cycle by rule (24a). Forms such as *architectural* or *agricultural* have no unstressable syllables, and they receive their antepenultimate stress in exactly the same way as such words as *América* or *original*. Additional support for this proposal is provided by the irregular stress of such adverbs as *momentarily*, *elementarily*, briefly discussed in section 6.3.1.

## 6.2 Word-Final -y

There is extensive additional evidence to support the proposition that some suffixes of English are unstressable. Let us begin with the word-final -y illustrated in (28).

- (28) a. *índustr-y* *Lómbard-y* *gálex-y* *adjácenc-y* (RLR)  
 b. *recálcitranc-y* *rélevanc-y* *résidenc-y* *áccurac-y*  
     *éfficac-y* *mágrac-y* (RLR)  
 c. *áutòps-y* *cóntrovèrs-y* *céremòn-y* *ápoplèx-y* (LLR)  
 d. *telégraph-y* *àutócrac-y* *ecónom-y* *aristócrac-y* (no EM)  
 e. *Lòmbárdi* *Tebáldi* *sephárdi* *efféndi* *sàlmagúndi* (cf. (28a))

Like *-ure*, the suffix *-y* is unstressable (i.e., not projected on line 0). This immediately explains the otherwise puzzling fact that nouns with and without this suffix have identical stress contours (e.g., *résidence/résidency*; *rélevance/rélevancy*). Parallel examples with the suffix *-ure* were noted just above. The examples in (28a–b) are moreover subject to RLR Edge Marking, and as a result some of them have stress on the pre-antepenult (e.g., *rélevancy*, *accuracy*, *recalcitrancy*). These are the counterparts of the nouns in (25). The contrast in stress placement between *adjacency* (28a) and *residency* (28b) parallels that between the adjectives in (21) and those in (20); that is, Condition K of the Main Stress Rule applies in assigning stress to the former but not to the latter. Like the words in (26a), those in (28c) are subject to LLR Edge Marking. Finally, like the words in (26b), those in (28d) are subject to no edge marking at all.

The orthography of English distinguishes the unstressable word-final /i/ from ordinary word-final /i/ by writing *y* for the former and *i* for the latter.<sup>14</sup> Examples of the latter are cited in (28e). These nouns are completely regular: they are subject to the unmarked RLR Edge Marking and the rest of the rules in (9) and (10). Note especially that unlike the words in (28b), none of the words in (28e) is subject to the Rhythm Rule. This is fully predicted in the present account since LLR Edge Marking does not apply to any of the words in (28e).

<sup>14</sup> In *SPE*, words ending with a ‘‘weak’’ /i/ were said to end not with a vowel but with a glide that became a vowel in certain contexts.

### 6.3 Additional Unstressable Suffixes

In this section I review the stress contours of additional words with unstressable syllables and show that all these cases—like those in (25), (26), and (28)—are handled by the stress rules in (9), (10), and (13) with only a minimum of additional machinery.

6.3.1 *Adjectives in -ory/-ary* As Burzio (1994) points out, the word-final -y in the suffixes *-ory/-ary* is “weak”—that is, unstressable on the present account. Examples are given in (29).

- (29) a. \*  
 (\* \*  
 \* (\* \*[\* .  
 inhíbitòry admónitòry sècretàry lúminàry  
 perfúncory refèctory èleméntary rùdiméntary  
 b. infírmory dispénsary compúlsory respónsary placéntary  
 c. légendàry mómentàry sédentàry frágmentàry  
 dýsentèry [sic] íventòry vóluntàry répertòry

The behavior of *-ory/-ary* is seen to be quite regular once the final -y is not projected on line 0. By assuming that words in *-ory/-ary* are subject to LLR Edge Marking and hence also to the Rhythm Rule, we account for the fact that there is secondary stress on the suffix and main stress on a presuffixal syllable. The examples in (29c) differ from those in (29a–b) in that Condition K of the Main Stress Rule is not applicable in the former. The three sets of examples in (29) thus illustrate the three possible effects of the Main Stress Rule.

As illustrated in (29b), when main stress falls on the syllable immediately preceding the suffix, the *-ory/-ary* suffix is reduced. Rule (30), which deletes one of two consecutive parentheses (clash), accounts for this fact.

- (30) ( → ∅ in env. (\* \_\_\_\_ \* ## line 0  
 |  
 +o/ary

Recall that unaccented vowels are shortened foot-internally by rule (17). Application of the general reduction rule, which turns unstressed short nonhigh vowels into schwa, completes the derivation. This accounts, in particular, for the reductions in (29a–b).

Burzio (1994:15) states that one of the two main intuitions driving his analysis is “that there cannot be rules of ‘destressing.’” He provides no convincing evidence to support this intuition, and he overlooks several unfortunate consequences that it entails. For one thing, his ad hoc exclusion of destressing makes it impossible to bring out formally the parallelism between the examples in (29) and those in (28c), where rule (30) does not apply. It also masks the parallelism between the adjectives in *-ory/-ary* and those in *-ative* discussed in section 6.3.2.

Of central importance to English segmental phonology is the rule of Trochaic Shortening. This rule—called Trisyllabic Laxing in *SPE*—was discussed by Myers (1985), who showed that

it shortens heads of branching feet (i.e., trochees, hence the new name). (For additional discussion of this rule, see Halle and Vergnaud 1987:sec. 7.8.) Items that are subject to rule (30) end with a trochaic foot and should therefore be subject to Trochaic Shortening. As shown in (31), this usually is not the case. In fact, the two examples in (31b) seem to be the only ones of this type that undergo shortening.

- (31) a. *advísory* *derísory* *rótary* *vótary* *rósary* *ívory*  
 b. *gránary* *plénary*

I will therefore assume that rule (30) is ordered after Trochaic Shortening and that as a result, forms undergoing destressing by (30) are not subject to shortening. The short vowels in the two examples in (31b) must then be attributed to the underlying representations of these words.

A curious fact often noted in discussions of English stress is the behavior of the adverbial derivatives of those adjectives that do not undergo the Rhythm Rule (e.g., *mòmentáryly*, *èlementáryly*). We can account for this behavior without modifying any of the rules, provided we assume that in these cases the adverbial suffix *-ly* is cyclic rather than noncyclic. Since in English all metrical structure assigned on a given pass through the cyclic stress rules is deleted at the beginning of the next pass, on the last pass through the cyclic rules we obtain the structures illustrated in (32), where the unmarked RLR Edge Marking also applies.

- (32)
- |               |              |
|---------------|--------------|
| *             | *            |
| (*            | (*           |
| * * * (* *] * | * * (* *] *  |
| elementari-ly | momentari-ly |

6.3.2 *Adjectives in -at-ive* Before turning to the adjectives in *-atory*, let us examine the adjectives in *-at-ive*, illustrated in (33), where the line 0 footing is represented above the first example in each set.

- (33) a. \* (\* ]\* . (RLR)  
 altérnative  
 infórmative  
 consérvative  
 sédative
- b. \*( \* \* . (no EM)  
 derívative  
 provócative  
 declárvative  
 compárvative
- c. \* (\*] \* . (RLR)  
 restórvative  
 denótative

- d. \* (\*\*)\* . (RLR)  
 agglútinative  
 imáginative  
 assóciative  
 contínuative
- e. (\* \*[\*] . (LLR)  
 ínnovàtive  
 quálitàtive  
 authóritàtive  
 législàtive

To account for the stress distributions in (33), I assume that the suffix *-ive* is unstressable. The suffix *-at-* is underlyingly long, as shown by the forms in (33e). The suffix is shortened by rule (34) in the following two contexts: if preceded by a heavy syllable (33a–c) or by a sonorant onset (33d).<sup>15</sup>

- (34) In *-at-ive* the suffix *-at-* is shortened if preceded by a heavy syllable or by a sonorant onset.

As expected, the words in (33e) with long *-at-* then undergo LLR Edge Marking, whereas the rest—(33a–d)—are subject to RLR Edge Marking. This conforms to the facts, with one important exception: the stem vowel in the forms in (33b) is systematically shortened. We account for this straightforwardly by assuming that these forms undergo Trochaic Shortening. However, Trochaic Shortening applies only if the stem vowel is part of a branching foot. If RLR Edge Marking had applied to these forms, their stem vowel would not be in a branching foot and Trochaic Shortening could not apply (cf. (19a,c)). Since shortening does take place in the adjectives in (33b), we must assume that these adjectives are exceptionally marked as *not* being subject to any edge-marking rule (cf. (8a)). It is in this way that the foot structure shown in (33b) is generated.

A final set of adjectives with the suffix *-ive* is shown in (35).

- (35) a. (\*] \* . (RLR)  
 ádject-ive  
 súbstant-ive
- b. (\* \*[\*] . (LLR)  
 súbstitùt-ive  
 cónstitùt-ive
- c. \* (\*\*) . (no EM)  
 constítut-ive  
 consécut-ive

<sup>15</sup> The fact that there is no shortening in words where *-at-* is preceded by an obstruent in the onset was first observed by Nanni (1977).

- dimínut-ive  
distribut-ive  
execut-ive
- d. \* (\* .  
objéct-ive (no EM)  
digést-ive  
percépt-ive
- e. (\* \* .  
pósit-ive (no EM)  
inquisit-ive

Like those above, the examples in (35) are subject to different kinds of edge marking. In the words in (35a–b), edge marking is predictable: RLR if the prefinal syllable has a short vowel and LLR if it has a long one. The absence of edge marking in (35c–e) is an idiosyncratic property of the individual words. In the case of the words in (35c), it must be assumed in addition that the vowel in presuffixal *-ut-* is shortened, by an extension of rule (34).

In sum, the adjectives formed with the unstressable suffix *-ive* undergo rule (34), which shortens the suffix *-at/-ut-*. The adjectives are moreover subject to normal edge marking: RLR if the final stressable is short, and LLR otherwise. In marked words, there is no edge marking (e.g., (33b) and (35c–e)).

6.3.3 *Adjectives in -at-ory* I conclude this section with a review of the adjectives in *-at-ory* illustrated in (36).

- (36) a. \* (\* \* [\* .  
confiscatòry  
compensatòry  
incantatòry
- b. \*( \* \* [\* .  
defamatòry  
explanatòry  
declaratòry
- c. \* (\* \* .[\* .  
ànticipatòry  
àrticulatòry  
gèsticulatòry
- d. (\* .[\* .  
víbratòry  
ròtatòry  
appròbatòry
- e. (\* \* .[\* .  
réspiratòry

It is obvious that in *-at-ory* the *-at-* suffix is shortened everywhere, presumably by an extension of rule (34).

Since all of the words in (36) have secondary stress on *-ory*, they are all regularly subject to LLR Edge Marking. Placement of main stress in these words must therefore be the result of the application of the Main Stress Rule. This account works well in (36a–b) but fails in (36c), where *-at-* is preceded by a syllable ending with a light rime. In this case it is necessary to assume that *-at-* not only is shortened but also becomes unstressable. To account for main stress placement in (36d–e), we extend the destressing of *-at-* to these lexically marked words. In effect, the words in *-at-* are subject to rule (37).

(37) In *-at-ory* the suffix *-at-* is shortened. In addition, *-at-* becomes unstressable if the preceding syllable ends with a light rime and in certain lexically marked cases.

In (38) I have illustrated the metrical grids assigned to the different classes of words in (36).

(38)	*	*	*	*
	(* *)	(* *)	(* *)	(* *)
	* (* *[*] .	* (* *[*] .	* (* * .[*] .	* .[*] .
	confíscatòry	defámátòry	antícipatòry	víbratòry

At first sight it might appear that *-at-* in *-at-ory* should be unstressable everywhere. Two sets of facts, however, militate against this proposal. First, as shown by the examples in (36b), Trochaic Shortening applies in *-at-ory* adjectives. If *-at-* were unstressable in these adjectives, Trochaic Shortening could not apply since the foot with main stress would contain but one syllable. We use this difference to account for the presence of Trochaic Shortening in (36b) and its absence in (36d). Second, by assuming that the second syllable in *respiratory* (36e) is rendered unstressable by rule (34), we also account for the shortening of the stem vowel here. As shown by the pair *aspíre* – *áspiràte*, the stem *-spire-* is not subject to Condition K of the Main Stress Rule and is therefore shortened by rule (17).

One of the striking differences between British and American English involves the accentuation of the suffixes *-ory/-ary*. According to Procter (1978), in British dialects the *-at-ory* suffix has the two competing pronunciations illustrated in (39a) and (39b). The dialects agree in that the suffixes *-ory/-ary* are consistently unaccented.

(39) a.	* * (*[*] .	* (*[*] .	* * (*[*] .
	ànticipátory	ròtátory	còmpeñsátory
b.	* (* * .[*] .	* (* *[*] .	* (* *[*] .
	ànticipátory	compéñsátory	explánatòry

Formally we can capture this by positing that in the British dialects the vowel in the first syllable of the suffixes *-ory/-ary* is short. Since the last stressable vowel in the word is thus short, the forms are subject to RLR Edge Marking, which places a right bracket before the suffix. RLR Edge Marking also explains the systematic reduction of *-ory/-ary* in these dialects.

As illustrated in (39a) vs. (39b), British dialects differ with regard to the counterpart of rule

(37). In the dialect represented in (39a), rule (37) does not apply and main stress consistently is placed on *-at-*. In the dialect represented in (39b), rule (37) applies much as it does in the American dialects discussed above: *-at-* is generally shortened and it is also rendered unstressable if preceded by a light rime, as in *anticipatory*. Procter (1978) gives three pronunciations for the adjective *respiratory*. These are reproduced in (40) together with the line 0 metrical grid assigned to each.

- (40) a. \* (\* \*)\* .      b. \* (\* .)]\* .      c. (\* \* [\* . . .  
           [rɪ'spɪrətəri]      [rɪ'spaɪərətəri]      ['respɪərəɪtəri]

The stress contour of (40a) is the exact counterpart of (39b) *explanatory*. To obtain the stress of (40b), we must assume that this is one of the listed words mentioned in rule (37) where *-at-* is both shortened and rendered unstressable. The stress contour in (40c) is most unusual in that the word has main stress on the initial syllable. To obtain this contour, we must assume that both syllables of the *-ory* suffix are unstressable. This stress contour raises interesting further questions, which must be left for further investigation.

#### 6.4 Additional Unstressable Suffixes

In (41) I have listed further examples where the word-final syllable is not stressable.

- (41) a. (\* ])\* .  
           Wáshing-ton  
           bádmín-ton  
           Gálves-ton  
       b. (\* \* ])\* .  
           Nóttingham-shire  
           Wólverhamp-ton  
       c. (\*)]\* .  
           mínister  
           cýlinder  
           chárácter  
           cáalendar  
           lávender  
           cárpenter  
       d. (\*)]\* .  
           pédestal  
           sácristan  
           órchestra  
       e. (\*[)\* .  
           cúcumber  
           cárbùncle

- f.  $*( * ]*$   
 Decémbér  
 disásáter

The examples in (41a–d) are subject to the neutral RLR Edge Marking. The words in (41b) must in addition be marked as not being subject to Condition K of the Main Stress Rule. By contrast, the two nouns in (41e) are exceptionally subject to LLR Edge Marking. As illustrated by the examples in (41f), word-final *-er* and *-a* are stressable in many words; like most unmarked words in the language ending in a syllable with a short vowel, such words are subject to RLR Edge Marking.

Finally, we must consider the possibility that the examples in (41a,c,d) end with stressable syllables, but are exceptions to Condition K. This alternative can be ruled out on the grounds that it would treat these three sets of nouns as being very different from the quite similar nouns in (41b,e).

## 7 List of Rules and Concluding Remarks

The following is a list of rules that have been discussed or mentioned above, in the order of their application.

### *Cyclic rules*

- (24) a. Delete stresses and metrical structure assigned on previous passes through the cyclic rule block.
- (27)  $* \rightarrow .$  in the env.  $\_\_\_\_ ] ##$   
 where  $]##$  represents a word-final constituent
- (34) In *-at-ive* the suffix *-at-* is shortened if preceded by a heavy syllable or by a sonorant onset (similarly *ut-ive*).
- (37) In *-at-ory* the suffix *-at-* is shortened. In addition, *-at-* becomes unstressable if the preceding syllable ends with a light rime and in certain lexically marked cases.

### (9) *Edge-marking rules*

#### a. *RLR Edge Marking*

$\emptyset \rightarrow ]$  in env.  $* \_\_\_\_ * ##$  line 0

Condition J: Final asterisk projects short vowel.

#### b. *LLR Edge Marking*

$\emptyset \rightarrow [$  in env.  $* \_\_\_\_ * ##$  line 0

### (10) *Main Stress Rule*

a.  $\emptyset \rightarrow ($  in env.  $\_\_\_\_ * * \langle P * \rangle ##$  line 0

Condition K: Second asterisk projects vowel in light rime.

b.  $\emptyset \rightarrow ($  in env.  $\_\_\_\_ * \langle P * \rangle ##$  line 0

c. Line 0 heads are leftmost.

- (13) a. *Rhythm Rule*  
 $\emptyset \rightarrow ($  in env. ## \_\_\_\_ \* line 1 LLL  
 b. Line 1 heads are leftmost.
- (24) b. *CiV Lengthening*  
 rém[ə]dy  $\rightarrow$  rem[íy]d-ial  
 c. *Trochaic Shortening*  
 t[ów]ne  $\rightarrow$  t[á]n-ic  
 div[áy]ne  $\rightarrow$  div[í]n-ity  
 d. *Closed Syllable Shortening*  
 w[íy]p  $\rightarrow$  w[é]p-t  
 w[áy]d  $\rightarrow$  w[í]d-th  
 e. *Regressive Devoicing*  
 five ~ fif-th  
 lose ~ los-t

- (17)  $\begin{array}{c} \text{V} \\ \diagup \quad \diagdown \\ \text{X} \quad \text{X} \end{array} \rightarrow \begin{array}{c} \text{V} \\ | \\ \text{X} \end{array}$  in env.  $\begin{array}{c} \text{---} \\ | \\ (* \quad *) \end{array}$  line 0
- (30)  $( \rightarrow \emptyset$  in env.  $(* \text{---} * ##$  line 0  
 $\begin{array}{c} | \\ +o/ary \end{array}$

### Noncyclic rules

#### *Iterative Foot Construction*

Construct binary feet by inserting right parentheses iteratively from left to right.

#### *Vowel Reduction*

[–high]  $\rightarrow$  ə if unstressed

I began this article with remarks about the origins of the theoretical stance and empirical approach of *SPE*, which, I argued, represent a discontinuity in the evolution of phonology. Although there were antecedents to the *SPE* approach, notably in the descriptive work of both Sapir and Bloomfield, this work, to which the special term *morphophonemics* was applied, was viewed as being marginal to the main concerns of the field, as these were understood in the 1940s and 1950s. I also noted that the earlier studies did not include a detailed formalism for the representation and organization of the rules. A first attempt at providing this was made by Chomsky in his 1951 master's thesis, and this effort was refined and extended in the next decade and a half in a series of papers written mainly by workers connected with the linguistics program at MIT. *SPE* was conceived as a detailed illustration of this work.

I noted that two principles in particular were central to the *SPE* account of English phonology and that they have been supported by much of the research carried out in the thirty years since the publication of the book. The first is that the phonology of a language consists of a set of ordered rules that relate underlying representations of morphemes to their surface forms. The

second is that specific morphemes may be exceptions to a given rule. A morpheme marked as exceptional in this manner is otherwise completely regular: all other rules of the phonology apply to it in the normal fashion. Both principles played a crucial role in the treatment of the stress facts in sections 2–6 of this article. To the extent that this treatment is correct, it therefore provides evidence for the correctness of these principles as well.

Research conducted since 1968 has uncovered a number of inadequacies in *SPE*. One was the decision not to admit syllables as special entities in the theoretical machinery; another was the treatment of stress as a phonetic feature like [nasal] or [back]. I suggested that the crucial step in the development of better alternatives was the discovery that phonological representations are autosegmental—that is, composed of several parallel sequences of segments, rather than of a single string of phonemes and junctures. This led directly to a conception of the phonological representation as a three-dimensional object of the kind shown in figure 1 in which both syllables and stress are represented on separate planes.

Sections 2–6 of the article were devoted to showing how these modifications in the theoretical machinery have made possible a number of improvements in the treatment of the English stress data. I noted in particular three such improvements. The first was the new treatment of words subject to the so-called Rhythm Rule exemplified in (14) and (16). The second arose as a consequence of the recognition that there are numerous lexical exceptions to Condition K of the Main Stress Rule, which in turn led to the discovery of the shortening rule (17). Together, these two discoveries made possible an insightful treatment of the stress in the words exemplified in (18) through (21). The third improvement resulted from the discovery that certain syllables are unstressable. As shown in section 6, an elegant treatment of the stress in nouns ending in *-ure* and *-y* as well as in further classes of words becomes possible by exploiting the notational fact that unstressable syllables must not be projected on line 0 of the grid.

As in *SPE*, a consistent effort was made above to bring out as much as possible the relationship between sets of facts that at first sight might not appear to be related. That the rules in (9) and (10) were shown to govern the placement of main stress in every word is, to my mind, a major empirical result of this inquiry. An alternative account that assigns stresses correctly, but fails to do so in the uniform fashion sketched above, must be regarded as inferior.

I conclude by remarking that although the rules discussed above can surely not be written on the head of a pin, they are not so complex as to make it implausible that they are learned by normal children in the short time in which children master this and other aspects of their native language. The challenge for alternative approaches, such as the currently popular Optimality Theory, is to produce an account that is comparable to the one described here in insightfulness and coverage of the data and that is no more complex.

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E39-218

MIT

Cambridge, Massachusetts 02139

halle@mit.edu