

# *The English Rhythm Rule as an accent deletion rule\**

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## **1 Introduction**

### **1.1 A categorical representation of stress**

The culminative nature of stress has led to three common assumptions about its representation. These are (i) that it should allow for an unbounded continuum of prominence levels (the INFINITY assumption); (ii) that it should characterise prominence levels as relative to nearby weaker or stronger prominence levels, not as levels that are phonetically interpretable in isolation (the RELATIVITY assumption); and (iii) that all levels of prominence should be represented in terms of the same mechanism (the UNIFORMITY assumption). The infinity assumption is implicit in the Chomsky & Halle (1968) *n*-ary feature [stress], in Liberman & Prince's (1977: 263) metrical tree, as well as recent interpretations of the grid (Halle & Vergnaud 1987: 35). The relativity assumption was made explicit in Trager & Smith (1957: 35) and Liberman & Prince (1977: 262). The uniformity assumption was commonly held until Liberman & Prince split off the binary feature [stress] (to represent the distinction between reduced and unreduced syllables) from the metrical tree (to represent higher levels of prominence), which formed the basis for Selkirk's (1980) proposal to postulate the foot as a prosodic constituent. The claim defended in this paper is that a representation of stress must be adopted which provides for a finite number of prominence levels (rejecting the infinity assumption); which is locally interpretable (rejecting the relativity assumption); and which is differential in the sense that not all levels of prominence are represented in terms of the same mechanism (rejecting the uniformity assumption).

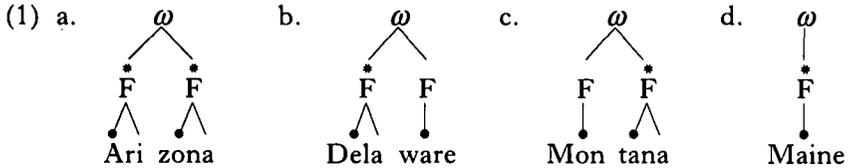
There are many conceivable representations that conform to the above three properties. This article adopts a particularly parsimonious one for English, and demonstrates that this representation can adequately deal with the rhythmic adjustments that have been discussed in the recent

literature. First, the prosodic hierarchy is assumed to provide the mechanism for representing durational structure. Second, foot structure captures the distinction between reduced and unreduced syllables (where a 'foot' is a headed constituent with an unreduced syllable in head position). And third, deviating from current proposals, it is assumed that feet can be marked with 'accent' (symbolised \*, after Goldsmith 1976), where \* marks an insertion slot for postlexical intonational tones. The three phonetic parameters associated with stress (duration, degree of qualitative reduction and pitch) are thus separately encoded, which makes the claim that the correct generalisations concerning stress manipulate only one of these aspects at a time. This article deals with prominence levels above the foot. That is, it deals with accent rules. The discussion assumes a model of Lexical Phonology of English of the type treated in Mohanan (1982), Kiparsky (1982, 1985a) and Kaisse & Shaw (1985). A RHYTHM RULE is formulated as an accent deletion rule, which applies postlexically in the Phonological Phrase ( $\phi$ ). Two lexical accent deletion rules, the COMPOUND RULE and INITIAL ACCENT DELETION, both applying to Stratum-2 formations (Kiparsky 1982), are shown to produce the appropriate accentual configurations for the Rhythm Rule. §2 introduces the two lexical rules, while §3 is devoted to the postlexical rule. It will be argued that postlexical rhythmic adjustments in English receive a simpler analysis in our accentual framework than in conventional stress shift accounts. An important additional advantage of the proposed representation is that it allows focus-sensitive accent assignment rules, necessary in theories with conventional representations of stress, to be replaced with accent deletion rules. It is shown (§4) that it is simpler to write rules that delete accents in unfocused speech than it is to write rules that assign accents to the right syllables in focused speech.

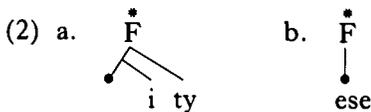
Our representation does not distinguish primary and secondary word stress, other than implicitly in the sense that the last accent in a word will correspond to the 'primary stress' in other analyses. Somewhat surprisingly, this stripped-down representation is capable of handling the English data quite adequately. §5 investigates to what extent the distinction between primary and secondary word stress needs to be referred to in ways that cannot be expressed with the help of accentually formulated rules. It will be seen that, given the accentual theory defended here, the need for an independent representation of primary word stress in English is more difficult to demonstrate than it is for Dutch, which has at least two rules that refer to the distinction in unaccented speech. The tentative conclusion to be reached on this point is that although English lacks the kind of rules to be illustrated for Dutch, the distinction between primary and secondary word stress is nevertheless encoded, and may show up in subtle timing phenomena.

1.2 Lexical representations

Representative examples of lexical representations (Mohanán 1982, 1986) are given in (1):



Uncontroversially, *Arizona* is assumed to have four syllables, of which two, *A-* and *-zo-*, are ‘stressed’ and two, *-ri-* and *-na*, are ‘unstressed’, that is, *Ari-* and *-zona* are two left-headed feet (Hayes 1981; Selkirk 1980; Hammond 1984). Similarly, *Delaware* consists of three syllables and two feet (*Dela-* and *-ware*), and so on. What distinguishes (1) from competing representations is that prominence above the foot is encoded by means of the presence *vs.* absence of accent. Although this article will not concern itself with the lexical rules assigning foot structure and accents (cf. Gussenhoven in preparation), certain claims made in §3 cannot be properly evaluated without some clarification of how representations like (1) are produced. Briefly, stems are assigned feet by rule (unless foot structure is prespecified). Final feet are accented (unless they are extra-metrical). In addition, initial feet are accented, to provide what in other analyses are known as secondary stresses (e.g. *cāntēen*, *Cālifōrnia*). In order to prevent initial accents from being assigned to the first syllable in words like *Japān*, left-over initial open syllables are left unfooted. Such a syllable is later included as an appendix to the next foot (cf. (3)). Although this is not crucial to our analysis, it is assumed that derived words result from the attachment of prosodically prespecified affixes. Thus, a suffix like *-ity* is an accented foot with a segmentally empty head, while the suffix *-ese* is an accented monosyllabic foot, as shown in (2):



Lexical accent deletion and foot-deletion rules apply so as to remove word-internal clashes arising through affixation. In (3), *\*-deletion*, a rule that deletes the left-hand of any two syllable-adjacent accents in a structure of minimally three syllables applies to *Japān\*ese* (though not to the disyllable *Chīn\*ese*), after affixation of *-ese* (which triggers a vowel deletion not relevant here). Foot deletion then applies to the unaccented open-syllabled foot in *Japan\*ese*, followed by the erection of foot structure over unfooted *Japa-*. Then *\*-initial*, already referred to above, applies (to

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*Japanēse*, *cantēen*), while the structure is completed by stray adjunction of initial unfooted syllables (in *obēse* and *Japān*):

(3)					
<i>Structure</i>	obese	China	Japan	canteen	
<i>Morphology</i>					
<i>*-deletion</i>	-	-	-		-
<i>F-deletion</i>	-	-	-		-
<i>Structure</i>					
<i>*-initial</i>	-	-	-		
<i>Appendix</i>		-		-	-
<i>Output</i>					

While durational reduction of initial appendices is always permitted, qualitative reduction of its vowel is subject to restrictions that do not hold word-internally. In particular, vowel reduction in appendices tends to be less common in American English than in British English. For instance, the appendices in words like *O'Brady*, *obese* have [ou] in AmE, but can be reduced to schwa in BrE. In either variety, they contrast with the first syllable of *Auberge*, which has a lexically prespecified initial foot. Or again, consider *Belize*, derived like *Japan*, which even if it retains [ɛ] in the first syllable, has a shorter vowel than a potential *Bellèse* ('a language designed by some Bell'), which would be formed like *Chinèse*. It further needs pointing out that the rule assigning initial accent is inoperative if the initial foot is non-branching and is followed by a branching foot, so that it skips *cantankerous*, *Montana*, but not *canteen*, *Montröse* or *Montour*. While these remarks about the prosodic derivations at Stratum 1 are sketchy, they suffice to allow the discussion of subsequent accent deletions at Stratum 2 and postlexically to proceed.

### 1.3 Surface representations

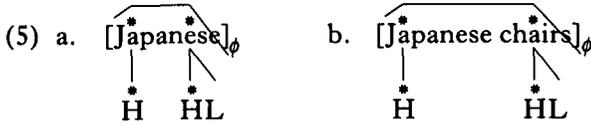
Accents assigned at Stratum 1 are liable to be deleted before they reach the surface. Words like *Delaware*, *Montana* and *Maine* each have exactly two allomorphs. One of these is given in (1), and the other lacks the accent on *Dela-*, *-tana* and *Maine*, respectively. Similarly, a word like *Arizona* has four allomorphs. In addition to the one given in (1a), there is one with an accent on the first foot only, illustrated in (4a), one with an accent on the last foot only, as in (4b, c), and one with no accents, as in (4d):

- (4) a. \*Arizona Avenue  
 b. North Arizona  
 c. Arizona-style avenues  
 d. Even John went to Arizona

### 1.4 Pitch accent insertion

Accents that make it to the surface are provided with pitch accents, like  $\overset{*}{H}$ ,  $\overset{*}{HL}$  or  $\overset{*}{LH}$  (Pierrehumbert 1980). Thus, the \* in our representations serves as an abstract place marker for a pitch accent. As is well known, English has a fairly large number of pitch accents. In contrast to Bolinger's (1958, 1986) pitch-accent theory of English stress, our analysis abstracts away from the different pitch configurations that accents can be provided with at the point tonal structure is inserted (cf. Vanderslice & Ladefoged 1972; Ladd 1980: 16). In (5a), we illustrate the insertion of  $\overset{*}{H}$  and  $\overset{*}{HL}$  on the two accents of the surface form *Japanese*. (A full tonal specification would include the insertion of boundary tones associated with intonational

domains, which we ignore here.) The same tonal structure is also illustrated in a phrase in (5b):



Two observations can be made. First, the initial syllable of *Japanese* is derivationally identical to the first syllable of *Japanese chairs*. No rule has affected their accents after they were assigned in the lexicon, and they will have identical claims to pitch accents. The absence of the accent on the last foot in *Japanese* results from the application of the accentual Rhythm Rule (to be formulated in §3). Second, the greater prominence of the second accent relative to the initial accent in both (5a) and (5b) is explained by its final position, and particularly by the effect that this will have on the insertion of boundary tones. It is significant in this connection that the final accent is not *necessarily* perceived as more prominent than the first. If the second accent is a downstepped H, listeners do not hear it as more prominent than the first (Bolinger 1986: 60; Cruttenden 1986: 51). Thus our representations correctly leave the relative levels of prominence of the two accents underspecified.

## 2 Stratum 2

In this section, we introduce Initial Accent Deletion. It is shown that the rule fits precisely into the model of Lexical Phonology of Kiparsky (1982). It is argued that the rule's sensitivity to morphological information causes phonological descriptions of rhythmic adjustments to miss an important generalisation. This question is considered on the basis of the description offered in Nespor & Vogel (1989). Next, two proposals to deal with the data, Halle & Vergnaud (1987) and Kager & Visch (1988), are discussed, and rejected. Finally, the relation between the Strict Cycle Condition and Initial Accent Deletion is briefly investigated.

### 2.1 Motivating Stratum 2

According to Kiparsky (1985a) and Booij & Rubach (1987), all lexical strata except the last are cyclic, by which they mean not just that forms are built up and phonologically adjusted morpheme by morpheme, but – more importantly – that lexical phonological rules obey the Strict Cycle Condition (SCC). According to the SCC, a rule that applies at a cyclic stratum does so in environments derived in the cycle concerned. It does not apply to the output of previous cycles or to underived forms. For instance, the SCC predicts that a Stratum-1 rule like Trisyllabic Laxing applies to

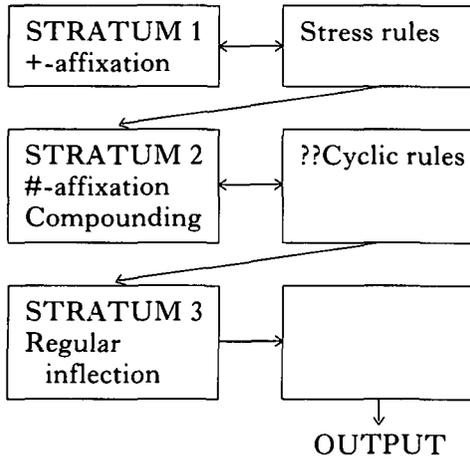


Figure 1

*sanity* (cf. *sane*) in the cycle in which *-ity* is attached, but not to *nightingale*. The model which was suggested by Kiparsky (1982) had Stratum 3, at which inflectional suffixes were attached, as the last stratum. Therefore, according to Kiparsky and Booij & Rubach, Stratum 3 is 'postcyclic' and phonological rules applying here do not obey the SCC. By the same token, Stratum 2, at which compounding and #-affixation take place, must obey the SCC. However, no clear cases of such cyclic Stratum-2 rules have been discovered: the only rules proposed so far are merely compatible with the 1982 model.<sup>1</sup> This model is given in Fig. 1.

A rule that distinguishes between Stratum 1 and Stratum 2 is *n*-deletion, which fails to apply to Stratum-1 formations (*damnation*, *hymnal*), but does apply to Stratum-2 formations (*column-ish*, *hymn-index*). However, the rule also applies to underived items (*damning*, *hymn*) (Kiparsky 1985a), and therefore does not really justify the postulation of a separate Stratum 2: we could just as well merge Strata 2 and 3, and say that *n*-deletion applies at the merged stratum. The absence of rules that demonstrate the need for a cyclic Stratum 2 motivated Kiparsky (1985a: n. 3) to reject this stratum, and to assume that Stratum 2 and Stratum 3 form a single postcyclic stratum. One type of rule that would provide clear motivation for Stratum 2 is one which would apply *only* to compounds and #-affixed forms. Such a rule would not apply to structures derived at Stratum 1, suggesting it applies at a separate stratum, and it would not apply to underived items, suggesting that its stratum is cyclic. It is therefore of considerable theoretical interest that the accentual treatment of English prominence patterns yields a rule of exactly this kind. The facts it is based on are all known from the literature (e.g. Chomsky & Halle

1968; Prince 1983; Gussenhoven 1986), but have not so far received an adequate analysis. It is discussed in the next section.

## 2.2 Initial Accent Deletion

Examples of Stratum-2 formations are given in (6). In (6a, b) two compounds are given, while (6c, d) are derivations with *-hood* and *-ness*. In order to derive these Stratum-2 outputs, we apparently need just a rule deleting the accent(s) in the right-hand constituent of a compound. This Compound rule is given in (7):<sup>2</sup>

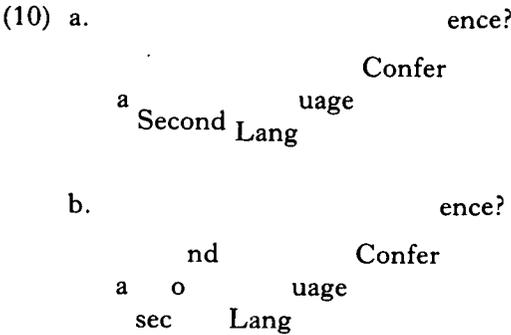
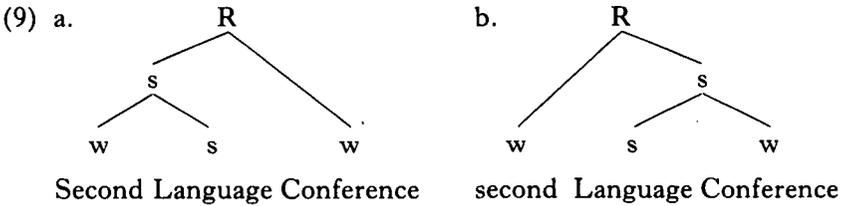
- (6) a. [H<sup>\*</sup>igh] [Stre<sup>\*</sup>et] → [H<sup>\*</sup>igh] [Street]  
 b. [[l<sup>\*</sup>ight][hou<sup>\*</sup>se]][ke<sup>\*</sup>eper] → [[l<sup>\*</sup>ight][house]][ke<sup>\*</sup>eper] →  
     [[l<sup>\*</sup>ight][house]][keeper]  
 c. [[m<sup>\*</sup>other]hood]  
 d. [[l<sup>\*</sup>onely]ness]
- (7) *Compound Rule*  
 \* → ∅ / [ \* ] [—] (Stratum 2)

Rule (7) does not, however, suffice to give us all-correct Stratum-2 outputs. Examples of formations that are not adequately derived are given in (8):

- (8) a. [[S<sup>\*</sup>econd L<sup>\*</sup>anguage] [C<sup>\*</sup>onference]] → [[S<sup>\*</sup>econd L<sup>\*</sup>anguage] [Con-  
     ference]] → [[Second L<sup>\*</sup>anguage] [Conference]]  
 b. [[tr<sup>\*</sup>ial-and-<sup>\*</sup>error] [m<sup>\*</sup>ethod]] → [[tr<sup>\*</sup>ial-and-<sup>\*</sup>error] [method]] →  
     [[trial-and-<sup>\*</sup>error] [method]]  
 c. [[T<sup>\*</sup>om P<sup>\*</sup>aine] [Stre<sup>\*</sup>et]] → [[T<sup>\*</sup>om P<sup>\*</sup>aine] [Street]] → [[Tom P<sup>\*</sup>aine]  
     [Street]]  
 d. [[N<sup>\*</sup>ew Y<sup>\*</sup>ork]er] → [[New Y<sup>\*</sup>ork]er]  
 e. [[<sup>\*</sup>unkind]ness] → [[unkind]ness]  
 f. [[<sup>\*</sup>archb<sup>\*</sup>ishop] hood] → [[archb<sup>\*</sup>ishop] hood]

These data are considerably more subtle than those in (6), but are real enough. First, a structure like (8a) forms a minimal pair with the phrase [[*s<sup>\*</sup>econd*] [*L<sup>\*</sup>anguage Conference*]]. This contrast was accounted for by Chomsky & Halle (1968) by means of a cyclic application of the NSR and the Compound Rule, deriving 213 for the latter phrase and 312 for (8a). Liberman & Prince (1977), rejecting the implications of a multivalued feature [stress], accounted for the distinction in terms of constituency, the general prominence of a constituent being determined by its position in the metrical tree and its *w-s* labelling, as illustrated in (9). A correct prediction that this configurational difference makes is that of a durational, or rhythmic, distinction, as pointed out in Hammond (1984: 5). However, it does not explain why there is one accent, on *Language*, in (9a), but two

accents, one on *second* and one on *Language*, in (9b). Observe that in citation pronunciation, two pitch peaks, one on *sec-* and one on *Lang-*, are present in (9b), but that (9a) lacks such a pitch peak on *Sec-*. Similarly, notice how a queried intonation of (9b) can have rises on both *sec-* and *Lang-*, as illustrated in (10b), but that this pronunciation is not available for (9a). Rather, (9a) would be pronounced with just a single rising movement spread over *Language Conference*, illustrated in (10a). (The pitch on *Second* is low level, and could also be high level; it could *not* have the rising shape found in (10b), however.)



Similar observations can be made about (8b, c). With reference to (8d-f), the suffixal examples, notice that *an archbishophood* is accentually distinct from *an arch bishophood* (i.e. a bishophood which is arch). We could again, in a querying pronunciation, provide both *arch* and *bishophood* in the phrasal formation with rises, but this pronunciation is not available for [[*archbishop*] *hood*]. Yet, *an archbishop* is homophonous with *an arch bishop*. Again, whereas *unkind* can be pronounced with an accent on *un-* as well as on *-kind*, there is no accent on *un-* in *unkindness*. (On the stratum of affixation of *un-*, *arch-*, see §2.6 below.) To account for this lack of initial accent in Stratum-2 formations, Initial Accent Deletion (11) is postulated. It captures the generalisation that after the application of the Compound Rule *no accent survives in a structure derived at Stratum 2 except the last*:

- (11) *Initial Accent Deletion* (IAD)  
 $* \rightarrow \emptyset / \text{---} * \text{ (Stratum 2)}$



adjustment-resistant structures are Stratum-2 formations. If this is correct, one would expect formations with Stratum-2 suffixes to show the same resistance. This is in fact the case (Gussenhoven 1986). Examples are given in (15):

- (15) a. Albert Háll-ish árchitecture (cf. Àlbert Hall's árchitecture)
- b. Third-Wòrldish condítions (cf. Thírd World condítions)
- c. The Forty-Niners' Annual Méeting (cf. the Fòrty-Nínth Annual Méeting)
- d. the New Yòrker's búdget (cf. Nèw York's búdget)
- e. the cream-and bròwnness's ímpact (cf. the crèam-and-brown décor)
- f. second-hòmeless áreas (cf. sècond home devèloppment project)
- g. Piccadilly Cìrcus-style celebrátion (cf. Piccadilly Cìrcus tradítion)
- h. Tàiwàn-type fòod (cf. Tàiwán fòod)

The present description predicts that if 'stress shift' from an accented syllable to a syllable on the left is blocked, it must be the case that the left-hand syllable is unaccented. Such lack of initial accent is of course achieved by the application of (11). In anticipation of the introduction of the Rhythm Rule in the next section, derivations are shown of *the New Yorker's budget* and *Hundred and Thirteenth Street blues* in (16).<sup>3</sup> The Rhythm Rule applies postlexically to the phrase *Hundred and Thirteenth* before it is looped back to Stratum 2. At Stratum 2, Initial Accent Deletion bleeds the Rhythm Rule by removing the initial accent, leaving two accents in the output:

(16) a. Lexicon	New, York, budget
Phrasing	New York
Rhythm Rule	n/a
Looping	
Stratum 2	New York]er
Compound Rule	n/a
IAD (11)	New Yorker
Phrasing	New Yorker's budget
Rhythm Rule	n/a
	[the New Yorker's budget]

b. Lexicon	H <sup>*</sup> undred, Thir <sup>*</sup> teenth, Street, blues <sup>*</sup>
Phrasing	H <sup>*</sup> undred and Thir <sup>*</sup> teenth <sup>*</sup>
Rhythm Rule	H <sup>*</sup> undred and Thir <sup>*</sup> teenth
Looping	
Stratum 2	[H <sup>*</sup> undred and Thir <sup>*</sup> teenth] Street <sup>*</sup>
Compound Rule	[H <sup>*</sup> undred and Thir <sup>*</sup> teenth] Street
IAD (11)	Hundred and Thirteenth Street <sup>*</sup>
Phrasing	Hundred and Thirteenth <sup>*</sup> Street blues <sup>*</sup>
Rhythm Rule	<i>n/a</i>
	[Hundred and Thirteenth <sup>*</sup> Street blues <sup>*</sup> ]

The prosodic patterns of (16) clearly deviate from what may be seen as an unmarked pattern whereby major prominences are situated at the beginning and the end of a constituent (Bolinger 1986: 64). From this point of view it is remarkable that the pattern that results from IAD would appear to be quite stable. Indeed, we would not expect frequent use of *Hundred and Thirteenth Street blues* to lead to a prominence shift from *-teenth* to *Hun-*. This said, it should be noted that in some derivations with agentive *-er*, such shifts may occur. By the side of a *Third-Worldish problem* we may well get a *Third-Worlder's problem*. I assume this pronunciation is invited by the possibility of interpreting *Third Worlder*, structurally if not semantically, as a phrase. In §3.3, the prosodic 'restructuring' of morphological structure is discussed more fully.

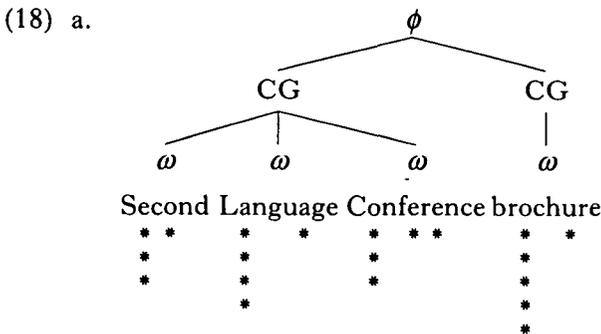
## 2.4 Alternative solutions

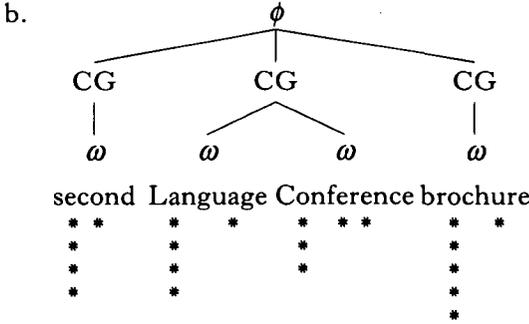
It is easy to show that a purely phonological solution to the data in (13)–(15) cannot work. The syllable-cum-foot structure of *New Yorker's budget* is fully comparable with *West Yorkshire's budget*, in which structure the retraction does, however, take place. Similarly, compare *Albert Hallish architecture* with *Albert Hawley's architecture*. A stress-shift description like that given in Selkirk (1984), for instance, would incorrectly predict stress retraction in all examples in (15) except (15c). (In (15c), it would incorrectly predict its absence in both examples, since the stress on *Niners'/Ninth* is not immediately followed by the primary stress of *Meeting*.) Although Nespor & Vogel (1989) do not discuss data like (13)–(15), it may be instructive to consider them in the light of their proposal to deal with rhythmic readjustments in a grid in which column-height is interpreted categorically. It will be shown that, while their representation can express the distinction between accented and unaccented prefinal feet, it cannot cope with the data presented here, because

their non-relational grid is embedded in a theory which does not preserve the relevant morphosyntactic information. Their theory assumes the syntax-to-phonology mapping rules of Nespor & Vogel (1986), which build an  $n$ -ary prosodic tree. This tree, in its turn, is input to the grid-building rules. These rules assign a first-level grid mark to every syllable, and further-level grid marks to the DTE of each higher prosodic constituent. As a result, each constituent corresponds to a fixed grid level (i.e. the phonological word corresponds to the third level). They define 'clash' as in (17). That is, word-level prominences clash if they are separated by maximally one syllable. The relief of the clash is achieved by Beat Deletion (BD), which deletes either of the two clashing beats. As the deletion of column-internal beats is not permitted, only word-level beats can be reduced to foot-level beats, i.e. grid marks at level 4 or higher are not deleted:

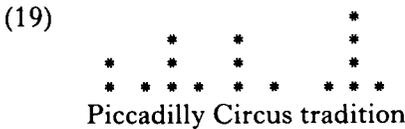
- (17) \*     \*     word  
       \*     \*     foot  
       \* (\*) \*     syllable

The difficulty that this theory would have with the data in (13)–(15) is that it takes insufficient account of the morphosyntactic sensitivity of rhythmic adjustments in English. First, for the purposes of the grid-building rules, Nespor & Vogel assume that there are no constituents between the  $\omega$  and the  $\phi$ , with the result that the representations of ((*Second Language Conference*) brochure and (*Second (Language Conference)*) brochure are identical. In either case, there are four  $\omega$ 's gathered under a single  $\phi$ . We might try to salvage the theory by introducing a further constituent, and therefore a further grid level, between  $\omega$  and  $\phi$ , and make it correspond with the highest  $X^0$  node, i.e. compounds (cf. Vogel 1989). Although we can now express the distinction in the grid, as shown in (18), where the new constituent is labelled CG (for Clitic Group), it is not clear how the syntax-to-phonology mapping rules could keep Stratum-2 formations distinct from other  $X^0$  formations that do not resist rhythmic shifts (cf. *Forty-Ninth vs. Forty-Niner* (cf. (15c)). Apparently, a new type of mapping rule would be needed, one which could see if an  $X^0$  was formed at Stratum 2, in order to build structures like (18).





An additional reason why their description is not up to these data is that the phonological effect of BD is underdetermined. Nespor & Vogel define the configuration in which BD applies without stating *which* of the clashing gridmarks is to be deleted. In (19), the structural description of (17) will cause either the stress on *-dilly* to be deleted or that on *Circus*. However, it is the former which would be reduced. It is difficult to see how this drawback can be remedied in a theory which does not incorporate constituent structure in the representation on which the rhythmic adjustments are defined. Neither could BD decide which grid mark to delete in longer phrases like *the Piccadilly Circus-Soho Square area*, where both *Cir-* and *So-* need to retain their grid marks. If this phrase is a single  $\phi$ , rule (17) will indiscriminately identify four grid marks as deletable.



Thirdly, it would seem that more than one syllable can intervene between the clashing columns. In an informal pronunciation of (19), it would be natural to reduce the stress on *Circus* after the stress on *-dilly* had been reduced (cf. a possible *Oxfordshire Circus tradition*). Thus, a non-relative grid could in principle be used to express the rhythmic adjustments discussed here, but to do so we would have to redefine the syntax-to-phonology mapping rules to make it possible to refer to the derivational history of words (Stratum-2 formations), and would have to include constituency, while the structural description of the rhythm rule would have to be more liberal than that in (17).

It has in fact been recognised by several authors that the reason rhythmic readjustment is excluded in (13) and (14) is a structural one (Prince 1983; Halle & Vergnaud 1987; Kager & Visch 1988). The latter two give rival accounts of the data in (13) and (14), both of which rely on the fact that the embedded structure has a strong left-hand and a weak right-hand constituent. Halle & Vergnaud's solution is to add a condition to the Rhythm Rule, to the effect that shift is blocked when the head (or

DTE) of the subconstituent within which the shift is to take place is not located in the last word (Halle & Vergnaud 1987: 267). Such a condition would block the rule in, for instance, *Hundred and Thirteenth Street blues*, because in the subconstituent within which the stress might shift, *Hundred and Thirteenth Street*, the greatest prominence is found on *Thirteenth*, while *Street* is the last word. Apart from the stipulative nature of Halle & Vergnaud's solution, it fails to account for the data in (15), where the last word is in fact the head of the subconstituent concerned, but where the shift is just as bad as in (14) and (15). The same argument can be used against Kager & Visch's (1988) proposal that rhythmic shift is blocked in strong domains of a metrical tree ('The Strong Domain Principle'). Their principle could not prevent stress shift from applying to (15), since there would not be a branch *New York* which was strong with respect to *-er*. Rather, *New* and *Yorker* would be sisters in a domain which is weak with respect to *budget*, and stress shift would incorrectly be predicted to apply. Moreover, both proposals fail to bring out the connection between the blocking of stress shift and the fact that the structures in which stress shift is blocked fail to attract an initial pitch accent even in other contexts, as was illustrated for *Second Language Conference* in §2.2. Both proposals, therefore, must be rejected.

## 2.5 Initial Accent Deletion and the Strict Cycle Condition

Initial Accent Deletion provides evidence for the lexical organisation proposed in Kiparsky (1982), where Stratum 2 contains compounding and #-derivation, but excludes inflection, for which a separate Stratum 3 was assumed. Moreover, the rule is cyclic, and thus conforms to the assumption that only the last lexical stratum can be non-cyclic (Kiparsky 1985a; Booij & Rubach 1987). That is, it does not apply to underived forms (*chimpanzee*; cf. *chimpanzee blues*). Neither does it apply to forms derived at Stratum 1 (*Japanese*, *vice presidential*, *indemnification*; cf. *vice-presidential car*, *Japanese chairs*, etc.), or to forms derived at Stratum 3, as shown by inflected forms like *dry-cleaned*, *upgraded*, *unsuspected* (cf. *dry-cleaned garments*, *upgraded salaries*, *unsuspected surprises*). There is, however, one aspect in which Initial Accent Deletion deviates from what has been assumed about cyclic lexical rules. Strictly speaking, while the rule indeed applies only to Stratum-2 formations, the domain in which the rule effectively applies is contained within the previous cycle. In all the examples presented above, both the accent to be deleted and the right-hand accent triggering the rule appear outside the morpheme that was attached at Stratum 2. In the formulations of Mascaró (1976) and Halle & Mohanan (1985), cyclic rules cannot apply in such domains, and a rule like Initial Accent Deletion, which applies to *all* formations of some morphological stratum regardless of the phonological content of the morphemes attached there, is predicted not to exist. A simple solution to this problem is to include a right-hand boundary in the context of the rule, to

represent the end of the Stratum-2 formation. Since the relevant morphemes are all attached on the right, the rule now makes reference to the new material, and the SCC is obeyed. The fact that Initial Accent Deletion effectively applies in the domain of the old cycle is in a sense accidental. The analysis predicts that if there had been an accented Stratum 2 suffix (a theoretical possibility allowed in our analysis), derivations with this suffix would end up without any accent in the base. For some speakers, the suffix *-ésque* indeed wipes out all accents in the base, as illustrated by *Kafkaésque*, *Rembrandtésque* (cf. *\*a Káfkaesque situátion*, *\*a Rêmbrandtesque stýle*). But now notice that inclusion of the right-hand bracket causes the rule to delete only a single accent in each formation, *viz.* the penultimate accent. Since the rule will have to delete all non-final accents in formations like *[[Dúndée][ésque]]*, we will add dots in the context between the accent and boundary, to serve as an arbitrary character. This will have the effect of making the rule iterative. Accordingly, we revise (11) here as (11'):

- (11') *Initial Accent Deletion*  
 $* \rightarrow \emptyset / \text{---} * \dots ]$  (Stratum 2)

## 2.6 No prefixes at Stratum 2

Words like *únkínd*, *nón-légible*, *árchbíshop*, *psýchosomátic* cannot be Stratum-2 formations. Neither the Compound Rule nor Initial Accent Deletion is applicable to them. Earlier treatments have assumed that prefixes like *ex-*, *non-*, *un-* are affixed at Stratum 2, because they do not trigger Stratum-1 phonological rules (cf. *\*nollegible*, but *illegible*). This criterion forces attachment after Stratum 1. However, since the Compound Rule and Initial Accent Deletion prevent them from being included in Stratum 2, items like *éx-priest*, *únkínd* must be formed after this stratum. Since Stratum 3 would appear to contain no prosodic rules, these formations can be included there, together with 'phrasal compounds' like *psýchosomátic*, *cóurt-mártial* and *tówn háll*, which similarly retain accents on both constituents. Stratum 3, then, is truly 'stress-neutral': there are no prosodic rules that apply here. An interesting contrast, incidentally, can be found in variations of English which, unlike AmE and southern BrE, have a foot rather than an appendix for Stratum-1 prefixes (Northern English varieties, Scottish English: Wells 1982: 362). In these varieties, accented initial syllables of *éx-priest*, *rê-cóver*, etc., contrast with the unaccented initial syllables of *expriess*, *recover*, etc., although the vowel qualities are the same. The contrast shows up particularly clearly in the context of the Rhythm Rule (cf. *the rê-covered umbrella vs. the recovered umbrella*).<sup>4</sup>

### 3 The Rhythm Rule

In this section, it is shown that an accentual rhythm rule accounts for the 'stress-shift' data that have been presented in the literature. Prince's Type A and Type B data are accounted for in §3.1. It will be argued that the cyclic nature of these derivations should be seen as the effect of the Rhythm Rule's sensitivity to prosodic constituency. In §3.2, we will see that our Rhythm Rule does not have exceptions, and has the characteristics of a postlexical rule. §3.3, which deals with Prince's Type C data as well as data from Hayes (1984), argues that postlexical constituent sensitivity differs from lexical cyclicity in the way material outside the cycle can influence the application of a rule ('eurhythmy': Hayes 1984). The important role that eurhythmy has been given in recent treatments, however, is diminished, because some of the examples presented in the literature in fact appear to require a structural explanation.

#### 3.1 Postlexical cyclicity

The Rhythm Rule, given in (20), claims that rhythmic shifts of prominence of the type exemplified by *fifteen vs. fifteen men* are not shifts at all, but rather deletions of non-peripheral accents. Horne (1990), basing herself on phonetic data, arrives at the same analysis. The description also conforms to the views expressed by Bolinger (cf. also van der Hulst 1984: 175ff; Ladd & Monaghan 1987):

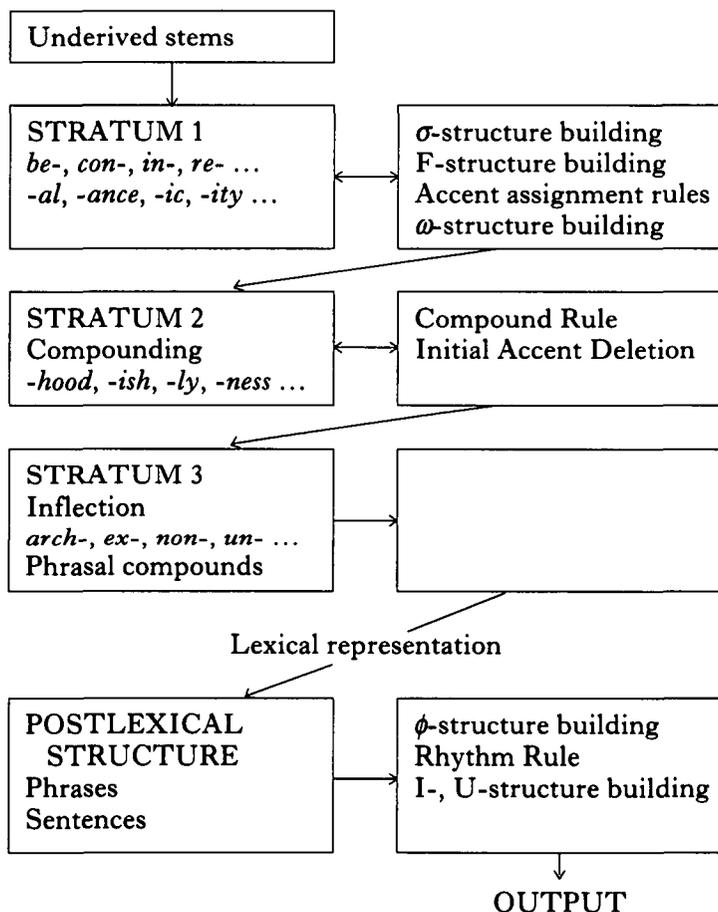
This rather different view of secondary stress puts us in a better position to understand the so-called 'shifts' of stress. If the secondary has about equal claim to prominence, nothing is lost, as far as accenting a word is concerned, if the secondary picks up the accent on that word *in the utterance*, with the primary getting no accent (or a reduced accent). It is not a matter of 'shifting' the stress, since stress as a potential for accent is already there; it is rather the choice of the secondary over the primary in a situation where some intonational advantage accrues.

(Bolinger 1986: 60)

(20) *Rhythm Rule* (RR)

$$* \rightarrow \emptyset / \phi (* \text{ — } * \dots) \phi$$

Rule (20) is a postlexical  $\phi$ -span rule (Selkirk 1981; Nespor & Vogel 1986: 177), which works from left to right. Since, again, the dots are used as an arbitrary character, and may stand for a further accent, (20) can apply twice in the same domain. Fig. 2 presents the model discussed in §2, with the addition of a postlexical component. As shown in Selkirk (1984: 194), phrase-level rhythmic adjustments are unmistakably cyclic. The theory of Lexical Phonology predicts that postlexical rules should apply non-cyclically. This is interpreted to mean that the SCC does not hold postlexically, not that the rule does not respect constituent structure. That

*Figure 2*

is, the cyclic application of (20) is assumed to be the effect of the rule's sensitivity to  $\phi$ . Within this domain, it will apply in lower constituents before it applies in higher ones, a mode of application which is in no way unexpected. Postlexical sandhi rules (Russian or Dutch regressive voicing, English place assimilations of alveolars) apply more readily across lower than across higher constituent boundaries, which fact is easily explained if we assume that such rules apply within lower constituents before they apply within higher ones (Loots 1983; Wells 1987), with the point at which the rule peters out being determined by speech rate (Selkirk 1984). Since phonological words in which the Rhythm Rule is applicable (e.g. *\*individualistic*) are embedded in  $\phi$ 's and  $\phi$ 's may be embedded in super- $\phi$ 's, a 'cyclic' effect is to be observed in more complex phonological



ening stand in need of an explanation. Of course, in the present account, no such undesirable distinctions can arise.

### 3.2 Exceptionless application

The Rhythm Rule has no 'lexical' characteristics. As observed above, it is not subject to the SCC: the rule applies to lexical items like *\*individuality* just as it does to phrasal formations. Moreover, while it is a style-dependent, variable rule, it is exceptionless. The exceptionality noted by Kaisse (1987) with respect to *\*obese mén* and *Chinese mén*, and used by her to support the two-stratum postlexical model of Kaisse (1985), is, in the present description, not a property of the Rhythm Rule, but of the words concerned. A word like *obese*, whose first syllable is never a foot (cf. §1.2), cannot undergo rhythmic shift, since it contains only one accent. By contrast, a word like *Chinese*, which contains two accents, will undergo the Rhythm Rule if an accent follows in the same  $\phi$ . Likewise, the phrasal *good-looking* is accentually distinct from a word like *Montana*: the difference between Liberman & Prince's (1977) *gòod-looking cówboy* and *Montana cówboy* follows from the fact that the structural description of (20) is only met in the former phrase. A second apparently lexical property of the rule discussed by Kaisse is that its output can be lexicalised. Since in some kinds of English *\*abstract* has come to exist alongside *\*abstract* with the specialised meaning 'non-figurative (art)', such lexicalisation would indeed seem possible. But in the present proposal, the representation of the output of the Rhythm Rule in *\*abstract art* contains no features, feature values or structure which do not also occur in lexical representation. Hence, it is possible to reanalyse that output as a lexical representation. (Such reanalysis is of course impossible in the case of postlexical outputs which contain phonological information that cannot exist in lexical representation, like aspirated plosives or alveolar flaps.) A third property that Kaisse claims for postlexical rules is that their output should be invisible to rules of poetry. Since the metre in (24a) requires *Tennessee* to have undergone the rhythm rule, it cannot be postlexical, according to Kaisse. Her claim represents an extension of the claim by Kiparsky (1985b) that poetic metres may refer only to categories that are present in lexical representation (cf. lexical tone in Chinese, as opposed to intonation in English). The extension of this claim to the output of postlexical rules is, however, not otherwise supported. For instance, in British English, 'linking *r*' must be inserted postlexically, yet is relevant to rhymes (e.g. *cataract* rhymes with *scatter act* or *El Fatah-r-act*). This postlexical rule introduces a phonological category, the segment [r], which already figures in lexical representations. Likewise, our Rhythm Rule produces outputs that can be represented with the help of phonological resources that are available in the lexicon (*viz.* accented feet). Kaisse's claim would thus appear to be too strong. Incidentally, in the present analysis, a 'non-shifted' pronunciation of *Tennessee*, as in (24b), would also

have undergone the Rhythm Rule, as the accent on *Tenn-* would be deleted:

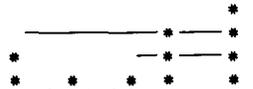
- (24) a. A Ténnessee drúmmer named Bétte (Kaisse 1987)
- b. In Mémphis, in Wést Tenneséé

### 3.3 Eurhythmmy and restructuring

The application of the Rhythm Rule is not always determined by syntactic structure. One way in which deviations may arise is in response to a tendency to produce equal spacings of accents, a phenomenon termed ‘eurhythmmy’ in Hayes, who codified it in his Disyllabic Rule and Quadri-syllabic Rule. In (25), an example from Bolinger (1986: 68) is reproduced. In (25a), the rule applies as expected, but in (25b) it does not first apply to the inner domain *Pennsylvania railroad*, but rather seems to apply non-cyclically to the outer domain:

- (25) a. the Pénnsylvania ráilroad
- b. the máin Pennsylvánia ráilroad

Example (25b) conforms more closely to an ideal alternating pattern than if the rule had first been applied in *Pénnsylvánia ráilroad* so as to delete the accent of *-va-*. The existence of eurhythmmy does not contradict the assumptions of the model in Fig. 2. The presence of the material outside the domain within which the Rhythm Rule is applicable indeed leads one to *expect* it to influence the application of postlexical rules, if the distinction between lexical cyclicity, for which outside material is irrelevant, and postlexical constituent-sensitivity is to be meaningful. Also, one would expect this influence to be variable and non-obligatory: the Rhythm Rule is a variable rule, and eurhythmmy can therefore only be a factor influencing its application, along with factors like speech rate and style. This explains why a ‘cyclic’ pronunciation of (25b) (*the máin Pénnsylvania ráilroad*), if less likely, is in fact well-formed. It is for this reason that we need to reconsider one of Hayes’ central examples to demonstrate the working of his two eurhythmmy rules. One, the Quadri-syllabic Rule, stipulates that spacings of beats four syllables apart are preferred to other spacings, and the second, the Disyllabic Rule, stipulates a similar preference for spacings of two syllables apart. Hayes provides (26) to illustrate the working of these principles:

- (26) a. 
  - b. 
- (a) hundred thirteen men                      one thirteen Main (Street)

Hayes points out that both structures stand to gain by an application of stress shift at the higher level, but that ‘internal’ stress shift in *thirteen*

only takes place in (a), since only there does the Disyllabic Rule allow it. Notice that the pattern given for (26a) is virtually obligatory: a pronunciation *a<sup>\*</sup>hundred thirte<sup>\*</sup>en m<sup>\*</sup>en* is deviant to a much greater extent than is the cyclic pronunciation of (25b). The fact that the deviation is categorical rather than relative leads one to suspect that something else is responsible for the pronunciation of (26a). In order to dispel the belief that it is eurhythmy that causes (26a) and (26b) to be pronounced differently, we need to recognise first that in addition to the difference in the number of inter-stress syllables, there is another difference: in (26a) we have a numeral, while in (26b) we have a sequence of numerals. The pair in (27) shows that the difference in the number of syllables is irrelevant, since both examples behave identically, and differ from (26a):

- (27) a. a<sup>\*</sup>hundred thirte<sup>\*</sup>en M<sup>\*</sup>ain Street (i.e. 100.13)  
 b. o<sup>\*</sup>ne thirte<sup>\*</sup>en M<sup>\*</sup>ain Street

If eurhythmy is not involved, then what is it that causes the difference between (26a) and (26b)? Recall that part of the motivation for the prosodic hierarchy is that, although the prosodic tree is built on the basis of the syntactic tree, there is no necessary isomorphism between them (Selkirk 1981; Nespor & Vogel 1986). Numerals evidently present a case in point: (26a), which has left-branching syntactic structure, is pronounced with right-branching phonological structure, a restructuring that applies inside numerals generally (but not to sequences of numerals). In (28) the derivations of *a hundred thirteen men* and *hundred thirteen Main Street* are given. Notice that if RR applies both in the lower and in the higher constituent, so that both accents of *thirteen* are deleted in (28a) as well as in (28b), there need not be homophony, because, as is explained in §4.2 below, preboundary lengthening will cause the final syllable of *thirteen* to be longer in (28a) than in (28b):

- (28) a. Morpho- [[[a hundred]<sub>Num</sub> [thirte<sup>\*</sup>en]<sub>Num</sub>] [Main Street]<sub>N</sub>]<sub>NP</sub>  
 syntax
- |         |              |                                      |                                           |
|---------|--------------|--------------------------------------|-------------------------------------------|
| Prosody | [[[a hundred | thirte <sup>*</sup> en] <sub>φ</sub> | [Main Street] <sub>φ</sub> ] <sub>φ</sub> |
| RR      | [a hundred   | thirte <sup>*</sup> en] <sub>φ</sub> |                                           |
| RR      | [[[a hundred | thirte <sup>*</sup> en] <sub>φ</sub> | [Main Street] <sub>φ</sub> ] <sub>φ</sub> |
- b. Morpho- [[[a hundred
 thirte<sup>\*</sup>en]<sub>Num</sub> [men]<sub>N</sub>]<sub>NP</sub>   syntax |
- |         |                                                    |                                  |
|---------|----------------------------------------------------|----------------------------------|
| Prosody | [[[a hundred] <sub>φ</sub> [thirte <sup>*</sup> en | men] <sub>φ</sub> ] <sub>φ</sub> |
| RR      | [thirte <sup>*</sup> en                            | men] <sub>φ</sub>                |
| RR      | [[[a hundred] <sub>φ</sub> [thirte <sup>*</sup> en | men] <sub>φ</sub> ] <sub>φ</sub> |

The restructuring is indeed tied to numerals, not to the particular syntactic configuration presented by (26a). For instance, in [[[*hundred and two thousand*] *men*]], where the bracketing is consistently left-branching, we similarly get a restructured pronunciation [*h\*undred and [[two\* thousand] m\*en]*]. While there will be cases of restructuring that do not involve numerals (cf. Prince 1983: 45–46), we generally find that in Prince's (1983) 'Type C' data, whose bracketing corresponds to the syntactic bracketing of [[*hundred thirteen*] *men*], the Rhythm Rule applies cyclically, regardless of the number of syllables, as shown in (29). That is, rhythmic adjustment in *Californian*, *Japanese*, etc., does not take place:

- (29) a. a N\*orth Calif\*ornian \*accent  
 b. a n\*orthern Japan\*ese \*accent  
 c. with \*ethnic Chin\*ese b\*acking  
 d. M\*aine–New Yor\*k r\*ailway

Our analysis accounts for these data, as shown in (30). Notice that RR could fail to apply in the second cycle, so as to produce (29c). There is no way, however, in which the impossible *with ethnic Chinese backing* could be produced. We conclude, therefore, that eurhythmy may have a smaller role to play that has been assumed. In particular, numerals deviate from what our analysis predicts because they receive right-branching prosodic trees. It is this, not eurhythmy, which explains their apparent exceptionality in allowing 'internal rhythm'.

- (30) Lexicon            \*ethnic Chin\*ese b\*acking  
 RR (20)            \*ethnic Chin\*ese  
 RR (20)    with \*ethnic Chinese b\*acking

In addition to numerals, other data have been presented to demonstrate the existence of 'internal rhythm'. Both Hayes (1984) and Selkirk (1984) present data like those in (31), in which an adverb of grade modifies the adjective in an NP:

- (31) a. an àlmost hârd-boiled égg  
 b. a slightly ûnderripe péar  
 c. ràther lily-white hánds

Our analysis does not produce these outputs. In (31a), for instance, the Rhythm Rule would be expected to apply first in the constituent *\*almost h\*ard-b\*oiled*, predicting that *boiled* is stronger than *hard*, or equally strong, if the Rhythm Rule were also to apply in the constituent *\*almost hard-b\*oiled égg*. However, in these examples, the issue is really the variability in the prominence of the A in [[A[BC]]D]: modifiers like *almost*, *rather* often remain unaccented. In *rather lily-white h\*ands*, the structural description of (20) is only met in the stretch from *lily* to *white*, predicting accents on just those items. If instead we do accent the modifier, our judgement would be that the internal adjustment does not take place, and that 'even stress' results for the adjective (cf. *a v\*irtually unknown \*athlete*).

To conclude, the Rhythm Rule is a variable, exceptionless, postlexical  $\phi$ -span rule. Its output may deviate from the expected pattern because (a) outside material can induce eurhythm, a general tendency towards an alternating pattern, and (b) left-branching syntactic structure is re-structured to right-branching phonological structure over numerals and the item they premodify.

## 4 Unaccented speech

In this section, three issues are discussed. First, in §4.1, the accent deletion analysis is related to the presence of focus-sensitive sentence accents. Then, in §4.2, we address the question of how ‘stress shift’ is to be accounted for in unaccented speech. Finally, in §4.3, we discuss the question whether, in unaccented speech, words like *Cali\*for\*nia*, which in traditional terms have a secondary stress followed by a primary stress, need to be distinguished from words like *s\*alamander*, in which a primary stress is followed by a secondary stress.

### 4.1 Sentence accents

Most utterances have fewer accents than are preserved by the three accent deletion rules discussed in §§2–3. At the level of the utterance, accents express focus, and unfocused constituents are not accented. If the context for (32a), a possible output of our accent deletion rules, were to be ‘rent garments’, *a big\* tear\** is likely to lose its accents (cf. (32b)), while in a context in which ‘left trouser-legs’ were the topic of discussion, (32c) would be expected. Moreover, on most current accounts (Schmerling 1976; Gussenhoven 1984; Selkirk 1984; Rochemont 1986), not all focused constituents need be accented. Specifically, a focused predicate may remain unaccented when it is adjacent to a focused argument. The rule that is to bring this about must in the present description be interpreted as an accent deletion rule. For instance, in an all-focus pronunciation, (32a) may lose its accents on the predicate *is in your left trouser-leg*, which also gives (32c):

- (32) a. There’s a big\* tear\* in your le\*ft tr\*ouser-leg  
 b. There’s a big tear in your le\*ft tr\*ouser-leg  
 c. There’s a big\* tear\* in your left trouser-leg

A deletion account obviates all the problems that arise in the determination of which syllable or syllables in the focused constituent are to be accented. As stressed by Selkirk (1984: 269ff), it is not the case that a representation in terms of relative ‘stress’, whether represented in labelled tree-structure or in a grid-configuration, provides the appropriate information about where pitch accents are to be situated. As she points out, *LAKE HILL* and *Lake HILL* (where capitalisation represents the presence

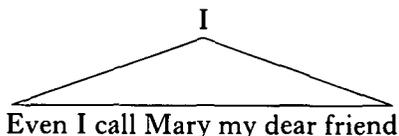
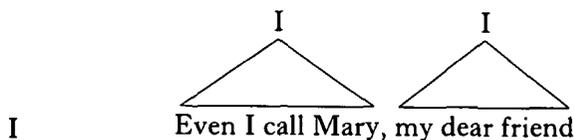
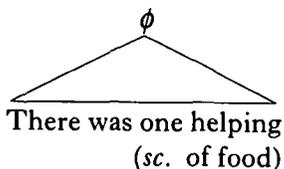
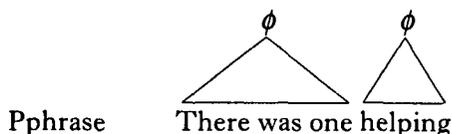
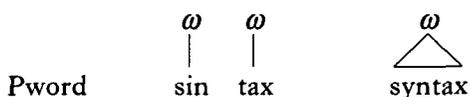
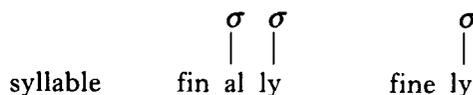
of a pitch accent) have identical metrical structures, which therefore cannot encode the distinction between these forms. Selkirk concludes that a free (though focus-sensitive) pitch accent assignment rule needs to be added to the theory, which can assign pitch accents to semantically transparent constituents. But this solution, too, seems inadequate. For instance, how do we know that for an explicit pronunciation of *California* we need to assign a pitch accent both to the weak branch and to the strong branch of this word? There is clearly no sense in which *Cali-* is a semantically transparent constituent. Rather, what needs to be expressed is that a *single* focus for the word *California* may result in the presence of *two* pitch accents. It is in fact frequently the case that focused constituents contain more than one pitch accent, though we cannot meaningfully say that each of those pitch accents corresponds to a separate focus. For instance, if we find that in a sentence like *Séan Cónnery will attend* there are two accents, we would like to say that these accents are there for the same reason that only a single accent is present in *Cónnery will attend* or in *Séan will attend*, and attribute the presence of the two accents in *Séan Cónnery* to the fact that this structure happens to contain two accentable syllables. Conversely, some multi-word structures contain only a single accented syllable. In addition to items like *second Länguage Conference*, discussed at length in §2, a structure like *the sound [ár]* (cf. also *the book Génesis*, *the film Casablánca*, *the letter á*) can receive a pitch accent only on [ár], while a phrase like *the sóund éye* ('the healthy eye') contains two accentable syllables, *sound* and *eye*. If we say that in this latter phrase *sound* is separately and additionally focused because it is a meaningful word, the question arises why we cannot separately focus *sound* in the former structure, or indeed, why we cannot separately focus the element *eye* in a conceivable compound *sóund eye* ('eye that registers sound'). In a deletion analysis, such facts follow directly from the presence of the appropriate accentual configurations when sentence-level focus rules apply: if a constituent is accented, all its accents are preserved, and if it is not, all its accents are deleted.<sup>5</sup>

#### 4.2 'Stress shift' without accent

Our account explains the facts of rhythmic adjustment as the result of the rule-governed placement of pitch accents, and thus takes a similar view of these facts to Bolinger (1965a, 1986). A possible objection to this view is that unaccented speech displays rhythmic variation just as does accented speech (cf. van Heuven 1987), and that an accent-based description therefore leaves part of the data unaccounted for. This section intends to show that nothing needs to be done in order to explain the facts, if we make the – independently justifiable – assumption that the durational structure reflects prosodic constituent structure. Prosodic constituents like the syllable, the foot, the phonological word, the phonological phrase, the intonational phrase and the utterance provide domains for the application of phonological rules (Selkirk 1981; Nespor & Vogel 1986).

Frequently, reference is made to a phonological rule of 'pre-boundary lengthening', according to which the duration of a final string of segments before some boundary is increased. Although no consensus exists about what constituents trigger final lengthening (cf. Beckman & Edwards 1987), the assumption here is that all phonological constituents trigger final lengthening, including the syllable. For higher constituents, this proposal makes similar predictions to Selkirk's (1984) silent demibeats. Some durational minimal pairs are given in (33):

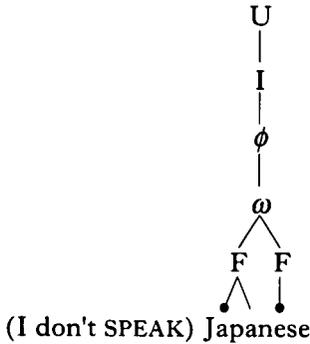
(33)



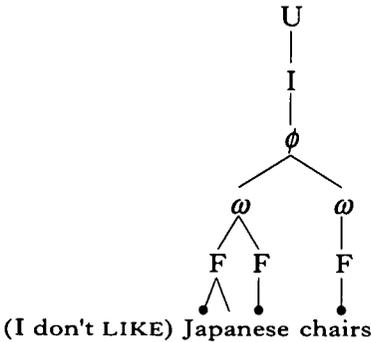
Thus, the syllable [I] in *finally* is longer than the non-syllable [I] in *fnely*. Or, the foot *An-* in *Andes* is longer than the non-foot *An-* in *Andy's*

(Dasher & Bolinger 1982). The phonological word *sin* is longer than the non-word *syn-* (cf. Nakatani & Schaffer 1978), while similar remarks apply to the examples for the  $\phi$  and the I (Selkirk 1986; cf. also Bolinger & Gerstman 1957; Lieberman 1967: 156). As a result of final lengthening, instances of what might be interpreted as 'shifts' of durational prominence are directly encoded as configurational differences in the representation. Consider as an example the difference between the two pronunciations of *Japanese* in (34):

(34) a.



b.



A rhythmic-shift account would transfer some prominence from *-nese* to *Jap-* in (34b), and leave the prominence pattern of (34a) unaffected. In the present account, no prominence is shifted in either case, and neither is one prominence pattern derived from the other. Rather, the different durational structures of the two instances of this word directly follow from the phonological representation. In (34a) the syllable *-nese* gets the durational benefit of final lengthening due to its final position in each of a number of constituents (F,  $\omega$ ,  $\phi$ , I and U), whereas *-nese* in (b) is only F- and  $\omega$ -final. Relative to the word in (34a), therefore, *Japanese* in (34b) will have a low degree of durational prominence on its final syllable, which may well give rise to a sensation of rhythmic shift within the word. While this sensation will correspond to some phonetic reality, the point here is that there is nothing we need to *do* in order to explain it.

Notice that the postulation of a rule to effect a rhythmic shift would run into problems, precisely because of this gradual nature of pre-boundary lengthening. If we were to pronounce (34b) with two separate  $\phi$ 's for *Japanese* and *chairs*, or as two separate I's (pretending that *chairs* was a vocative, say), an impression of greater prominence on *Jap-* than *-nese* might well disappear. A description that would translate this impression into a blocking of the Rhythm Rule would leave the fact that there is still a durational difference between *-nese* in (34a) and *-nese* as pronounced before the vocative unexpressed: in both cases a 'shift' account could only say that no shift had occurred. We conclude that the explanatory power of a rhythm rule would in fact be smaller than that of the phonological representation itself, provided the idea of a general constituent-final lengthening rule is adopted.

### 4.3 Primary vs. secondary word stress

The autonomous representation of the different parameters contributing to the impression of 'stress' makes the prediction that phonological rules refer to these different elements separately. This claim has been defended in this article to the extent that accent was shown to be manipulated independently of foot structure by the Compound Rule, Initial Accent Deletion and the Rhythm Rule. Rules building and deleting feet were referred to in §1.2, where Stratum-1 prosody was briefly dealt with. The question arises if there are rules that refer to the head of the word. In other words, does English possess rules that make a distinction between 'primary stress' and 'secondary stress', either in a situation where the word is accented, or in a situation where it is not? Although there have been claims that such rules exist, it is difficult to find evidence for them. In this section, a number of potential candidates are dealt with. Then, two cases are discussed in which the distinction between 'primary stress' and 'secondary stress' is needed in Dutch. The tentative conclusion will be drawn that while English words are 'headed', it is difficult to find data that unambiguously show that this aspect of the representation is ever crucially referred to.

One claim that has been made (Hayes 1984; Nespor & Vogel 1989) is that 'secondary stresses' and 'primary stresses' are not treated as equal by the Rhythm Rule. The claim is that stress shift is more likely in *Tennessee relatives* than in *Tennessee abbreviations*. The results of one of the experiments in Cooper & Eady (1986), which addressed precisely this issue, show that there is no difference in the way these two structures are treated. Other claims concern unaccented speech. The difference between primary and secondary word stress could be expected to show up in a difference in durational structure. For example, *Hermes* in (35a) might have a longer first syllable and a shorter second than *Burmese* in (35b):

- (35) a. I d<sup>\*</sup>idn't say 'Hermes'  
 b. I d<sup>\*</sup>idn't say 'Burmese'

In addition, a final H% boundary tone after a falling contour on *DIDn't* might well be timed such that the last syllable of *Burmese* has a rising movement, while a relatively greater part of the last syllable of *Hermes* may be high-pitched. However, there has been no experimental verification of these intuitions. Vanderslice & Ladefoged (1972) observed that empirical evidence for a distinction between primary and secondary stress in unaccented conditions is lacking, a conclusion which tallies with the research data referred to in Couper-Kuhlen (1986: 24), e.g. Sharp (1958) and Faure *et al.* (1980).<sup>6</sup>

A suggestion made by two reviewers is that a difference may (also) be found in the duration of the preceding syllable. Thus, *HATE* may be longer in *I HATE alligators!* than in *I HATE allegettos!* (cf. also the rule of Beat Insertion of Nespor & Vogel 1989). The suggestion seems worth investigating. An effect of this nature has been found for syllables before feet, regardless of primary or secondary stress, by Van Lancker *et al.* (1988). Another reviewer suggests that the distinction is relevant in emphatic speech, which is generally characterised by the presence of more accents than other speech styles have (cf. Bolinger 1986: 83). For example, in long Stratum-2 formations, like *a contact-and-destroy\* method*, there may well be an accent on *con* (as opposed to *-tact*) in *You dummy! We used the\* contact and deströy\* method!*, said with  $\bar{L}$  on the first and  $\bar{H}L$  on the second accent. That is, we would appear to have to restore the accent in precisely the position where it was removed by Initial Accent Deletion in the lexicon. It is indeed the case that if *contact* were replaced with *postpone* or *maintain*, the emphatic accent would go to the (primarily stressed) second syllable. The question here centres on the theoretical status of 'restore'. If we use forms like [ju wɪl] for [jul], is it the case that we undo the effect of contraction, or have we rather not applied the contraction? Lexical rules can be optional (Kiparsky ms), and, as the reviewer suggests, emphatic speech may well be a condition in which accent deletion rules are less likely to apply. The results of psycholinguistic research suggest the distinction is not exploited in perceptual processing tasks. Cutler (1986) finds that English listeners do not use word stress in word recognition, even though 'it is unusual to find a source of potential information which is *not* exploited in speech recognition'. This suggests that primary stress is not a reliable property of English words. The neutralisation of accented and unaccented feet in unaccented speech contrasts with the preservation of foot structure. Cutler & Norris (1988) found that English listeners detect a monosyllabic word which forms the first syllable of a two-syllable stimulus faster when the second syllable was reduced (e.g. *mint* in *mintesh*) than when it was unreduced (e.g. *mint* in *mintayf*), and argue on the basis of this finding for a word recognition strategy in which unreduced syllables are taken to be potential word beginnings. If this interpretation of their results is correct, then obviously foot structure must be a robust characteristic of English.

The question whether a representation of primary word stress is needed independently of accent thus requires a careful answer. Although there are

no unambiguous research data to back this claim up, there are indications that it is in fact present in the representation and is reflected in minor, low-level timing effects. Also, reactions by native speakers suggest that the sensation of programming word stress in unaccented speech is quite strong, which suggests that  $\omega$  must be assumed to be a headed constituent. Perhaps we should put it this way: it is not possible, barring conscious efforts to artificially enhance the auditory salience of primary stresses, to mispronounce *Nō\**, said the *Spanish teacher* such that instead of the compound *Spānish teacher* the phrase *Spānish tēacher* is heard, or *vice versa* (cf. Schmerling 1976: 27), or indeed to hear that speakers use an incorrect stress pattern on *alligators* or *allegrettos* in a contexts like *I HATE...* While such mistakes may be programmable, there are no phonological rules to make them apparent.

In order to illustrate what reference to word stress would involve, it is instructive to consider two such cases in Dutch. First, Dutch, like German (Kiparsky 1966), Danish (Rischel 1983: 67) and Swedish (Horne personal communication), has stress shift in unaccented speech. Kager & Visch (1988) give compounds like [*nood[toe stand]*] ('emergency in-state', i.e. 'state of emergency'), [*band[op name]*] ('tape on-tape', i.e. 'tape recording'), in which the (unaccented) right-hand constituent is itself compound. In this context, the embedded compound has a weak-strong pronunciation, which contrasts with the strong-weak pronunciation it has in other contexts (whether accented or not). Such shifts do not occur in English (Selkirk 1984: 69). Second, the distinction is referred to by an intonational spreading rule. Consider (34), from Gussenhoven (1988), which illustrates an intonation contour like the English 'vocative chant'. While in English, a pronunciation of *Abernathy* with this tune has two descending level pitches, on *Aber-* and *-nathy* respectively (Lieberman 1975), Dutch can have three: on *Aber-*, *-na-* and *-thy*. In multi-word post-nuclear stretches of speech, such level pitches begin at the primarily-stressed syllable of every major-class lexical word, as well as on the last syllable. (In (36), *niet* ('not') and the article *het* do not start a new level.) Thus, the noun '*antwoord*' begins a new level at its first syllable; however, if '*antwoord*' is replaced with *kan'toor* ('office'), the pitch level of *-teen het* would continue on *kan-*, the third level starting only at *-toor*. Thus, Dutch has at least two phonological rules that require an accent-independent representation of primary word stress:

- (36)   
 \*  
 Je moet niet me-teen het antwoord ge-ven  
 You must not at-once the answer give

## 5 Summary

In order to account for the accentual and rhythmical structure of English, a binary-branching prosodic constituent structure is assumed, in which minimally the syllable and the foot must be headed. Feet are potentially marked as accented. This representation makes it possible to describe the prominence patterns of word groups as resulting from three accent deletion rules, the Compound Rule, the Initial Accent Deletion Rule and the Rhythm Rule. It was shown that the structural change effected by Initial Accent Deletion cannot be expressed in theories which represent stress as a relative concept. Moreover, this rule, which like the Compound rule is a lexical rule, provided evidence for the existence of a stratum in the lexical phonology of English in which compounding and so-called Class-II derivation take place. The Rhythm Rule is a postlexical rule, which was shown to apply to the output of the other two rules. Without the aid of any conditions or constraints, it accounted effortlessly for the stress-shift data presented in the recent literature. It could moreover be shown that apparent cases of stress shift in unaccented speech (in which the Rhythm Rule does not apply) should not in fact be viewed as the output of any stress-shift rule at all, but should be explained as the effect of pre-boundary lengthening as applying to the different constituents in the prosodic hierarchy. It was argued that an analysis of sentence accentuation whereby focused constituents have to be assigned accents can run into problems that do not exist in a 'deaccenting' analysis, in which non-focused constituents are deprived of their accents. Finally, it was argued that English, unlike Dutch, lacks phonological rules that refer to primary word stress, and that, at best, primary stress may reveal itself in low-level timing distinctions.

### NOTES

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[1] One type of rule which is incompatible with the model in Fig. 1 would be a rule that applied non-cyclically at Stratum 2. Halle & Mohanan (1985) propose a rule of this kind to account for final [i] in English. Their dialect B is representative of the situation they describe: *city*, *cities* and *city hall* have final [ii], *happiness* has [i] and *happily* has [i]. To account for these facts, Halle & Mohanan assume (a) that Class-II affixation and compounding take place at separate strata (their strata 2 and 3 respectively); (b) that underlyingly the vowel is [i] and that a non-cyclic rule of *i*-tensing applies at stratum 2 except in the environment of some affixes like *-ly* (causing all the above items except *happily* to have [ii]); (c) that a non-cyclic rule of *i*-lengthening applies at Stratum 3 (causing all the above items except *happiness* and *happily* to have [ii]). The rules obviously need to be non-cyclic, since they apply to underived words like *city*.

This account runs counter to a number of assumptions implicit in the model in Fig. 1 (see also Borowsky 1986: 250ff). In addition to the lexical non-cyclicity and the splitting up of Stratum 2, their solution makes it necessary to reject the attractive property of Structure Preservation (Kiparsky 1982), as it creates three vocalic segments in the lexicon ([ii, i, i]), where only two are needed to unambiguously specify the morphemes of English. The same facts can be accounted for without violating the integrity of Stratum 2, Structure Preservation or the cyclicity of lexical rules, if we assume that 'final [i]' is underlyingly long /ii/. Foot structure rules assign a weak branch to syllables with the long final vowels /ii/ and /oo/ (as in *city* and *fellow*). Adjustment of the final weak /ii/ to whatever quality it has in the dialect concerned ([i] in Yorkshire and conservative RP, [i] in Southern British English, [ii] in most American English) takes place postlexically. In foot-internal position, as in *happily*, *beautiful*, *happiness* ([-nəs]), reduction to [i], [i] or schwa takes place, again postlexically, in part perhaps depending on segmental environment. In foot-final but word-internal position (as in *cityhood*, *happiness*, with [nes]) reduction to [i], but not to schwa, may take place. (Words like *pedigree*, *Andes* and *Hermes* of course have final monosyllabic feet; cf. *mimicry*, *Andy's*, *Hermie's*.) This solution, while avoiding any of the problems of Halle & Mohanan's description, also accounts for the different degrees of reduction that the medial vowel in *happiness* can undergo as a function of the quality of the vowel in the final syllable. When *-ness* forms a foot and the final vowel in *happi-* is merely word-internal, as opposed to foot-internal, reduction to schwa is blocked. Although the phonological effect is different, the situation for *happi-* is paralleled by that of *inte-* in *interest*. If the final syllable of this word is a foot, the schwa in the preceding (foot-final) syllable is retained, but if the final syllable is reduced to schwa and the preceding syllable is therefore foot-internal, the foot-internal schwa is deleted.

- [2] Liberman & Prince (1977) point out that when the right-hand constituent of a compound branches, it attracts the greatest stress, as in *lâw degree lánquage re-quirements*. This fact is explained if compound formation is constrained so as not to allow the right-hand constituent to be a compound. Such examples as offered by Liberman & Prince (1977), then, would be phrasal. Such phrasal structure will also have to be assumed in many cases in which the right-hand constituent does not branch. For example, *Mádison Street búis* is just like *Mádison Street búis station*, and *kitchen sínk* has the same phrasal structure as *kitchen tówel rack*. A solution that relies on a conditioning of the Compound Rule, as offered in Halle & Vergnaud (1987: 272), is therefore not adopted here.
- [3] The ordinal suffix *-th* must be inflectional (Stratum 3) rather than derivational. An item like *fifteenth* does not undergo Initial Accent Deletion, as shown by *the fifteenth mán*. This seems consonant with the idea that ordinal formation is fully productive, and is not subject to semantic drift.
- [4] I assume non-crucially that Stratum-3 prefixes are  $\omega$ 's, so that words like *unkind* are represented as two separate  $\omega$ 's.
- [5] A question that requires investigation is when prefinal accents are deleted. In addition to structures like *the film Casablánca*, it would appear that contrastively accented words lose their prefinal accents, as in *She doesn't live in Arizóna, she lives in Califórnia*. In this context, the pronunciations *Arizóna*, *Califórnia* seem odd.
- [6] The view that 'word stress' is abstract is not new, of course. It is held by Bolinger (1958), Lehiste (1970) and Jassem & Gibbon (1980). Lehiste (1970: 150) says: 'Word-level stress is in a very real sense an abstract quality: a potential for being stressed'. For Bolinger a stressed syllable 'gets the accent IF the word is important enough to get one' (1964).

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