Applying Stress

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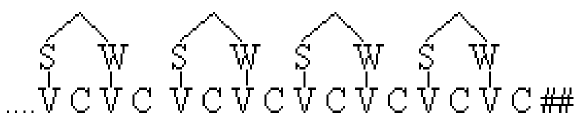
In this section we consider the nature of those rules that determine the placement of [+stress], i.e. that regulate the structure of the lowest level of metrical units, in which every node dominates a syllable, W dominating always [−stress]. The nature and construction of the higher levels, which determine subordination of stress, will be discussed elsewhere.

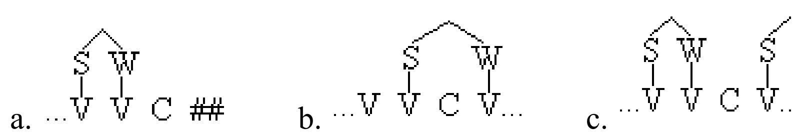
Consider a rule of alternating stress that applies iambically from the end of the word, creating an accentual pattern like this:

(1) $\ldots \acute{V}\ C\ V\ C\ \acute{V}\ C\ V\ C\ \acute{V}\ C\ V\ C\ \acute{V}\ C\ V\ C\ \#\#$

Let us regard this pattern as the result of dividing the word into metrical units ($_U$ S W), starting from the right end.

(2)


Now it is usually the case that alternating stress phenomena are not so simply described. A very common rule takes this form: all long vowels are stressed, and in sequences of short vowels alternation is found. If we assume that long vowels are represented as bi-moraic, i.e. as geminate vowel clusters, then every long vowel will receive stress by the simple alternation principle, as we easily see by examining the three possible cases:

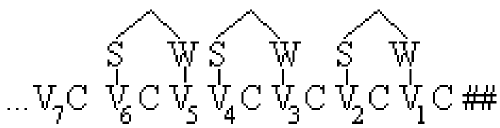
(3)


Case (b) reveals an interesting, and I believe characteristic, feature of the rule. Alternation in a sequence of short vowels begins at word-end and before a syllable containing a long vowel. So we find, e.g.,

(4) $\ldots\ \acute{V}_7\ C\ V_6\ C\ \acute{\bar{\mathbf{V}}}_{4,5}\ C\ V_3\ C\ \acute{V}_2\ C\ V_1\ \#\#$

Note that the long vowel receives stress under the provision of case (b).

If stress were applied simply as described, the expected output would be

(5) 

because the long vowel is stressed on its rightmost mora (V_4) and skipping over the left mora (V_5) we arrive at V_6 as the next strong, or stressed, vowel. To my knowledge, this never happens.

Of course, there is no compelling *descriptive* problem within the standard theory; we simply take account of the phenomenon by writing the rule as

(6) $V \rightarrow [+str] \,/\, –C_0\ V\ C_0\ (V)\ \acute{V}$

rather than

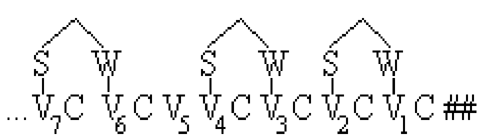
(7) $V \rightarrow [+str] \,/\, –C_0\ V\ C_0\ \acute{V}$

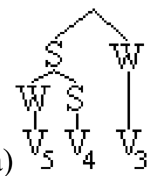
which describes the pattern of (1) above.

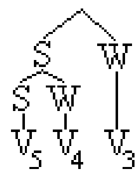
The interesting question is, of course, why the pattern should be as in (4), not in (5); that is, why stress is *applied* to moras but retracted, as it were, from *syllables*. Metrical theory gives us the following principle:

Principle of Syllabic Integrity: The contents of a syllable may not be divided between two metrical units.

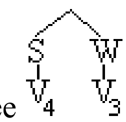
Observe that in (5) the tautosyllabic sequence V_5V_4 is split up metrically, being parsed into different units, in contradiction to the PSI. If we attempt a maximally continuous partition, moving leftward, into units (S, W), in accord with the PSI, we obtain the following metrical pattern, contrasting with (5):

(8) 

(The principles necessary to ensure that the correct ultimate ramiculation of metrical structure is (a) 

not (b) 

will emerge from discussion below of independent issues.

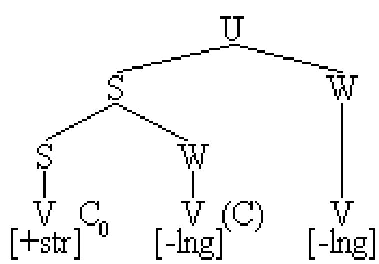
To anticipate, we will see that (b) is not 'congruent' to the assigned tree 

, but that (a) is.

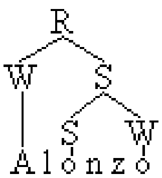
To apply stress, then, we need (1) a formula for metrical structure, in this case just (S W), & (2) a method of propagating the formula throughout the word, here basically an instruction to start at one end or the other, and do the best you can. Let us turn now to somewhat richer examples, which will point us toward an understanding of the relation between 'application' of stress and 'application' of intonational melodies.

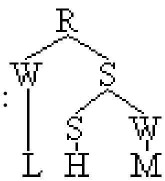
English Stress

Following Halle & Chomsky, Halle & Keyser, and Halle in basic points of analysis, and simplifying slightly, but only for purposes of clarity, we find that the largest English metrical unit looks something like this:

(9) 

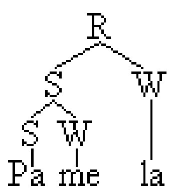
So scan the final three syllables of e.g. *Pamela, America, serendipity*; and the first three e.g. of *Tatamagouchi, catamaran,heliocentric, helicophobic*, *ideological*. How does this full pattern relate to the other possibilities of stressing stretches of less than three syllables in length? To see this in its generality, let us review the proposals of Liberman (1975) regarding the mapping of metrically-structured melodies (intonation contours) onto metrically-structured texts. The basic principle is one of matching the elements of the melodic pattern with the elements of the textual pattern. So in a case like this:

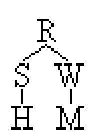
(10) Text: 

Tune: 

there is a simple point-for-point correspondence; simply superimposing the trees puts the melodic pitches on the appropriate syllables: 

. Not all texts are so obliging in their intrinsic structural properties; consider ‘Pamela’:

(11) 

Here the first metrical unit below the root (R) is a trochee (S W); but the first unit below R in the tune is an iamb (W S): no direct match is possible. Liberman proposes certain conventions for attaining a 'least of evils' match which intuitively speaking serves to preserve and bring into correspondence the essential features of each pattern. His rules may be conceived of as working like this: match the roots and, working downward, any node pairs that are identical in labelling; if you run into a conflict – (S W) vs. (W S) at some hierarchical level – ignore the weak (W) branch of the tune. Thus in the example above, ‘Pamela’ conflicts with the tune at the first level below R; lopping off the weak branch gives 

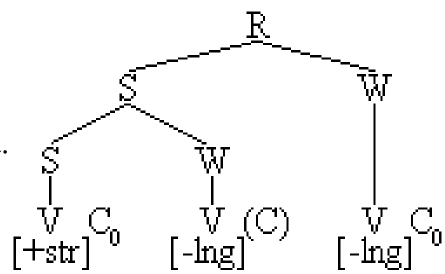
where the node labels now match those at the same level of ‘Pamela’. The only problem is that the ‘H’ is not associated with a syllable: to find its proper syllable, one now lops the W-branch(es) from the metrical unit of the text with which it is associated, leaving in this case,

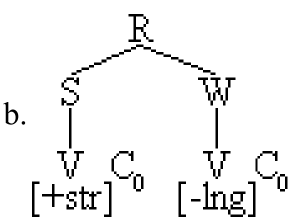
"pa-", giving the association 

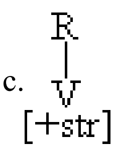
as desired. (Or maybe 

.). This procedure will obviously result in a unique map of any melody onto any text.

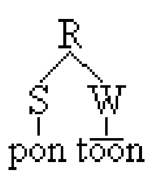
Returning to the formula governing English stressing, the metrical pattern for disyllabic sequences (and monosyllabic units) derives from the most general pattern by *deletion of weak branches*.

(12) a. 

b. 

c. 

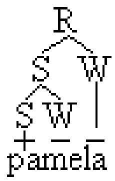
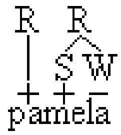
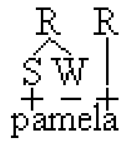
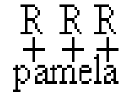
We therefore conceive of structure (12a) as the basic well-formedness condition on the level of metrical structure (in English) that we are addressing. For a word to be metrically well-formed, it must consist of metrical units that can be brought into conformity with (12a) by deletion of W-branches from (12a). Note the difference between these structures and those of intonation, that these have absolute segmental conditions on nodes, and therefore certain possible trees cannot be brought into conformity with (12a), whereas an intonational match can always be achieved. whereas an intonational match can always be achieved. For example, of the structures

(13) a. 

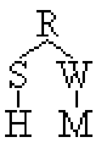
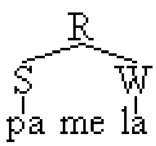
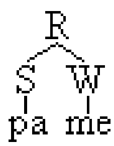
b. 

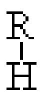
only (13b) is legitimated by our procedures, since the incorrect (13a) has a W dominating a long vowel, which is in no way countenanced by (12a, b, c).

Let us call such a match a “congruence”, and let us say that two trees are congruent if such a match is obtainable. Observe that for any given polysyllable, a number of metrical analyses with congruence to (12a) are possible; consider, for example, "Pamela ":

(14) a.  b.  c.  d. 

But only one — (14a) — is correct. This is clearly parallel to the fact that W-deletion *per se* yields several possible congruences between the cited tune and the text “pamela”.

(15) i.  ≃ a.  OR b. 

ii.  ≃ 

To get beyond (14a) and (15a), you have to (as it were) ignore possible good matches. Congruence, as defined so far, is a necessary condition on matching, but we must fortify it to ensure uniqueness:

Principle of Maximality: Only maximal congruences count in matching.

Definition of *maximal*: forth coming.

A well-formed English stress (+, −) pattern, then, consists of a sequence of “matches” to (12a), moving leftward across the word.

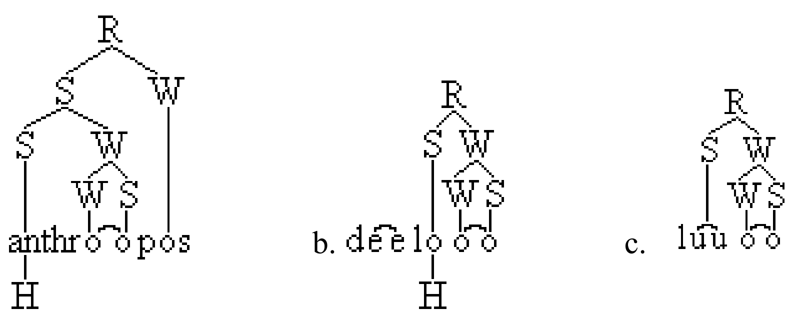
The Principle of Maximality subsumes the theory of disjunction, which was associated in classical phonology with the parenthesis notation. We now have grounds for an explanation of the often noted apparent limitation of authentic disjunction to prosodic rules; namely that the possible congruences are completely incompatible with each other in a way that segmental rule outputs are not. Consider for example the rule (of English)

(16) $V \rightarrow [+long] \; / \; \_ \, (V) \, \#$

The output structures $\bar{V}\,\#$ and $\bar{V}\,V\;\#$ involve no contradiction; and in fact we find conjunctive application: rodeo, radio, etc. The Principle of Maximality enables us to pick one output from a class of intrinsically incompatible possibilities. (For other opinions, see Halle 1975, Kiparsky 1973, Vergnaud 1975).

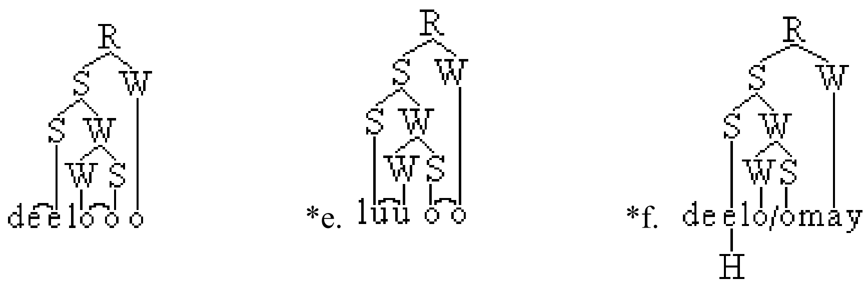
Turning now to a somewhat more complicated case, consider the rule determining the placement of accent (high tone) in Classical Greek. The yoke linking the adjacent morae indicates that they must lie in the same syllables. Thus we find:

ἄνθρωπος δηλόω λύω

(18) a.


NOT:

*δήλοω *λῦω δήλοομαι

*d.


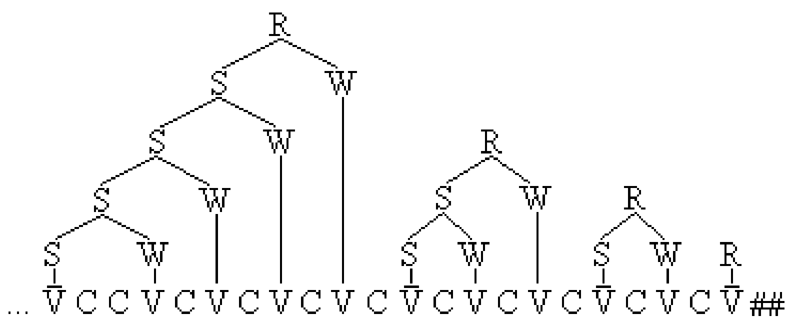
Observe that *d. and *e. follow independently from the PSI, because the integrity of the last syllable is violated in both cases. The 1igature is however necessary to block *f. Note though that the structure of the tree is not a simple left-branching structure (if it were the two vowels could not be in the same syllable), suggesting that the structural peculiarity reflects an intrinsic property of these representations vis-a-vis the notion 'syllable', which, when understood, will alleviate the need for special marking.

The reader is invited to ascertain by experiment that W-deletion of pattern (17) will generate all and only the familiar recessive accentual contours of Greek.

Everywhere Valid Templates

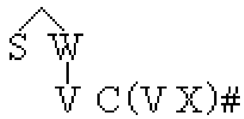
In certain authentic native traditions, the rule for stressing Classical Arabic is given as follows (cf. Janssens for linguistic arguments that this is factually correct): all heavy syllables bear a degree of stress; and excepting the last syllable, primary stress falls on the last heavy syllable of the word; if there is no heavy syllable, main stress falls on the initial syllable. This gives rise to (+, −) stress structures like this:

(19)



(In fact, quite long words may be constructed.) There being no principled limit on the length of words, or the distance between heavy syllables, a single metrical unit may be of any dimension whatever. But the structure of these units is severely constrained, and may in fact be represented by the following simple formula

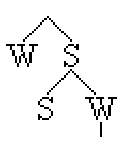
(20)



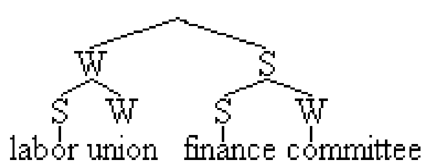
The well-formed metrical units of Classical Arabic are the largest structures for which the formula (20) is everywhere true, i.e. for which every subtree is congruent to (20). Now this usage may sound very different from our earlier conception of matching, but in fact the same locution may be used of the examples discussed above: in them the restriction of all terminals to the domination of syllabic (or segmental) material effectively limited the size of the largest congruent metrical tree. The fact that in (20) ***S*** is unrestricted as to domination opens the way toward this final interpretation of the notion “match”. Observe that this formulation automatically predicts initial syllable stress. Observe further that the effects of the zero-subscript notation are achieved without allowing it to be used in descriptive formalism; rather it (or, more exactly, its correlates) lies in the general algorithm determining the meaning of the concept ‘match’.

This interpretation of maximal congruence is not limited in use to describing stress-placement alone. The Compound Stress Rule and the so-called Detail Rule determining primary word-stress can be represented as the following template:

(21)

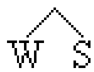


The classic phrase



is seen to be everywhere congruent, because each of the two top branches , (labor union) and (finance committee), are obtained by the minimal modification of (21) – deleting the left *W*. (This is minimal because it removes one mark, the other *W* bears on it the further mark of restriction to non-branching.) And the whole collocation is certified by the full pattern (21) which matches from the root down to the *W* over (labor union) and the very nodes governing (finance) and (committee).

The NSR is of course simply:

(22) 

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