Stress (1976)

Section 6: concerning word stress, templates, moras
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6. Words: II. 'Applying Stress'.

We have given an informal characterization of the notion 'Lower Foot' in remark (18a), designed to transmit an intuitive feel for the metrical patterning of stressed and unstressed syllables. Let us now investigate in greater depth the nature of those rules that determine the location of + and – stress, i.e. that regulate structure at the level of 'Lower Feet'.

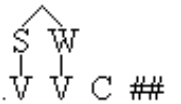
Consider a rule of alternating stress that applying trochaically from the end of the word, creating an accentual pattern like this:

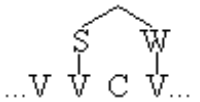
(29) . . . V́ C V C V́ C V C V́ C V C V́ C V C ##

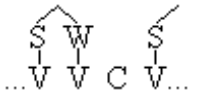
We regard this pattern of stresses as the result of dividing the word into metrical units (S W), starting from the end.

(30)

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, following Trubetzkoy (Grundzüge Anglice, p. 174), that 'long' vowels are actually geminate vowel clusters – i.e. bi-moraic, with each atomic vowel a mora – , then every long vowel will receive stress by the simple alternation principle, as we see by examining the three possible cases:

(31) a. . . . V́ V C ## = 

b. . . . V V́ C V . . . = 

c. . . . V́ V C V́ . . . = 

Case (b) reveals an interesting, and characteristic, feature of the phenomenon. Suppose the substring of (b) is flanked on the left by a weak syllable, giving . . . C V C V́ V C V . . .. By the alternation principle, defined on moras, we should expect that weak syllable to receive stress, since it lies at a distance of one mora from a stressed segment. Metrically we expect

(32) 

This output contradicts our statement of the rule, and indeed is never, to our knowledge, found in those languages which display alternating stress. What actually happens is that a vowel preceding a long-vowel is always stressless, marking a resumption of the trochaic pattern over syllables.

(33) . . . C V́ C V C V V́ C V . . . = . . . C V C V C V̄ C V . . .

Languages evidencing this pattern quite clearly are Tűbatulabal (Voegelin, 1935) and St. Lawrence Island Eskimo (Krauss, 1971, sketchily reported in Anderson, 1974).

Given the facts as described, there is of course no compelling *descriptive* problem with the standard theory. We simply take account of the 'extra' mora by writing the retraction rule as something like

(34) $V \rightarrow [+str] / - C_0\ V\ C_0\ (V)\ \acute{V}$

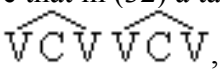
rather than

(35) $V \rightarrow [+str] / - C_0\ V\ C_0\ \acute{V}$

which describes the naive pattern of (29) above.

The interesting question, though, is *why* the pattern should be (always) as in (33), and never as in (32); that is, why stress is *applied* to moras, but retracted, as it were, from *syllables*. Metrical theory gives us grounds for an explanation in terms of the following principle:

(36) **Principle of Syllabic Integrity**. The contents of a syllable may not be divided between two metrical units.

Observe that in (32) a tautosyllabic V V sequence is split up metrically, parsed into two different units  , in contradiction to the PSI.

If we impose a maximally continuous partition of a word embodying the crucial case, moving leftward, into units (S W), in accord with the PSI, we obtain the following metrical pattern, which stands in contrast to (32):

(37) 

The PSI, within a metrical theory, serves to prohibit absolutely a pattern like that of (32), and thus has explanatory force. It is interesting, in this regard, to recall Trubetzkoy's move in the face of the same problem. Discussing Tűbatulabal (op. cit. p. 223, fn. 219), he remarks

In long syllables only the first mora may be accented. If, based on iambic rhythmic law, a secondary accent falls on the second more of a long vowel, it is shifted to the first mora of that vowel. The secondary accents then continue regularly in distances of one mora.

The experienced reader of scientific argument will be able to guess that the limiting of stress to first moras has no observational correlate, and is justified only by its success in sustaining the calculus of alternation. The PSI makes the stronger claim that even in languages where such a restriction is untenable, the pattern of alternation will be the same. St. Lawrence Island Eskimo tests and confirms the claim, for it has the pattern of alternation we insist on, and in addition, long vowels stressed on the first mora bear a high tone; those stressed on the second mora do not (cf. Anderson, pp. 277-279). Initially and finally stressed long vowels are thus kept apart quite palpably, and Trubetzkoy's neutralizing solution is therefore not readily available.

To 'apply stress', then, we need (1) a formula for metrical structure, and (2) a method of propagating the formula through the word, so far just an instruction to start at one end (or the other) and do the best you can. (The language is heuristically iterative; a simultaneous formulation can be given; but the use of metrical feet somewhat becalms the controversy, since in themselves they accomplish much of what iteration of disjunction aimed at.)

The formula itself consists of a metrical tree, with a stipulation as to what kind of material the nodes may dominate. Let us call such a formula – the archetype of the lowest level of metrical structure for a language – a *template*.

The template for the pattern we have been investigating looks like this:

(38)

The symbol *m* is intended to signify that the notes daughter to T dominate *moras*. The placement of + and – (stress) follows from principles (4) and (14) above.

[*Repeated here*: –AP

(4) Def. A metrical unit *U* is a two branched tree of which one node is labeled *S* and the other *W*:

(14) If a vowel is *S*, then it is [+stress].

$\forall V$, S → V
| [+stress]
V

]

Now the exact mode one selects to represent the restrictions on the terminal *S*'s and *W*'s is to a large degree independent of the rest metrical theory. However, given the role of the PSI, it seems worthwhile to explore the question a bit further at this point.

The alternating pattern we've dealt with is known to have prevailed in Biblical Hebrew (vide Prince, 1975) and PreProtoGermanic (Kiparsky, class lectures 1975, and Kiparsky and O'Neil 1976). In these languages, however, the relevant distinction was not *long* vs. *short* vowel, V vs. VV, but *heavy* vs. *light* syllable, where a light syllable is one containing a short vowel followed by at most one consonant. Because the structure of alternation is the same, it is appropriate to give an account of the heavy-light distinction which admits of a prosodic treatment parallel to that of the long-short distinction. Following essentially the line of Trubetzkoy, let us portray the contrast as being between syllables which contain *one*, and syllables which contain *two* moras. What then is a mora? We offer the following account:

(39) Assuming that long vowels are sequences:
a. The first vowel of a syllable is a mora.
b. The segment immediately following the first vowel, if it is in the same syllable as that vowel, may be a mora, subject to language-specific constraints.

The language-specific constraints are few in number. In the first case discussed, the constraint was that all moras must be [+syllabic], i.e. vowels: this generates the distinction between long and short in the stress rule. In certain languages, e.g. Lithuanian (v. Kiparsky 1973) and Kwakiutl (v. Bach 1975, Prince 1975b), the restriction is loosened so that any [+sonorant] segment can qualify under provision (39b). Finally, in Hebrew and PPGermanic, there is no restriction, and the second mora may be vowel or consonant: here the contrast is between light and heavy syllables. In this last case, whenever a consonantal mora comes to bear stress, a convention compels its realization on the neighboring tautosyllabic vocalic mora. (Such a convention is argued for in the domain of tone by Clements writing on Luganda, by Liberman on Vietnamese, and no doubt by many on Japanese.)

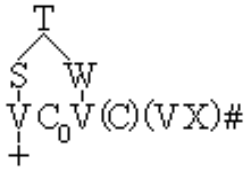
Observe that in this conception of 'mora' it is not the case that a syllable is *partitioned* into moras. A mora is a single segment, and mora-hood is structurally determined. A syllable looks like this

(40) a. $[_{Syl}$ ...m...]
b. $[_{Syl}$ ...m m...]

where '...' does not contain any vowels.

Aside from the internal content of a mora – its syllabicity or sonorance – there is a positional parameter that can be adjusted to language-specific requirements: the moraicity of word final consonants. In colloquial Arabic, for example, (ref. ??) the last syllable will receive stress if it is VCC or V̄C; evidently, in the word-final sequence VC#, the *C* does not count as a mora, although C counts in VCC# and word-internally. The condition is that a single consonant in the env. V— # cannot be a mora. Again, this constraint is widely attested; there seems to be free choice whether to regard VC# as 'heavy' or 'light'.

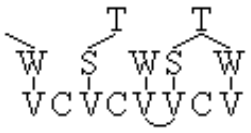
It is important to understand that any decision to use notions like *mora* or *syllable* directly in the descriptive formalism is independent of the metrical concept *per se*. We could employ the asyllabic segment-concatenating formalism of SPE to express the restrictions on patterning, yielding a formula like this for the case we have been considering:

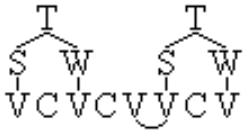
(41) 

In this system, of course, the PSI is still motivated. The alternating pattern gives evidence that phonological representations are organized into syllables and metrical structures; the question is whether the syllabic organization is directly accessed by the rule formalism, or whether it only play a role in constraining the application of rules.

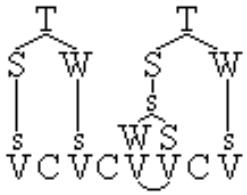
The question has, perhaps, at bottom, a certain interest. Limiting the template terminals to *mora* and *syllable* restricts 'substantively' the range of possible stress rules, allowing only a very impoverished formalism. Within the asyllabic notation there is a luxuriant exfoliation of devices, which growth is severely cut back by constraints on canonical rule form. For example, in (41), the C_0 could not be replaced by, say, *C* or *CC*; nor could the (*C*) term show up as (CC); nor could the (V X) term be (C X). These follow from the definition of *mora* and *syllable* in the one system; in the other they appear in the definition of rule form, constraining the use of zero-subscript, parentheses, variables, etc. This issue will crop up variously below.

The PSI can be installed in the theory as a constraint on the ultimate shape of metrical representations: namely, that in the final form of a word's tree, every syllable must be dominated by a node *s*. Looking at two possible preliminary scansions,

(42) a. 

b. 

it is readily apparent that only (42b) can be ramified into a proper tree (43).

(43) 

As this provides a simple and direct account of the PSI, we tentatively accept it as a constraint on metrical word trees.

Let us turn now to examples that display a richness of patterning characteristic of many stress systems. These examples will lead to a general conception of the relation between metrical trees and stressing possibilities, and beyond that, the relation between 'application' of stress and 'application' of intonational melodies.

The stress rule of Classical Latin, within the standard theory, appears as in (44):

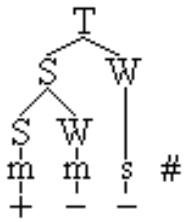
(44) $V \rightarrow [+stress] / -C_0 (V_{[-long]} (C)\ ) (V\ C_0)\ \#$

Rule (44) says that stress is antepenultimate if the penult is weak, penultimate otherwise if the word is bisyllabic or longer; and monosyllables bear stress too.

This translates easily into the mora-based theory sketches above: observing that the Latin mora is unrestricted, i.e. may be a consonant, we can say that stress falls as far from the end as possible, but may not be farther than one mora from the last syllable. In order to express this as a metrical *template*, we define a new symbol *s*, signifying either a mora or a sequence of tautosyllabic moras, whichever is the larger analysis possible.

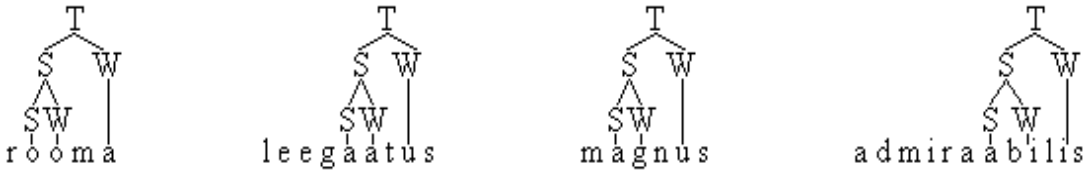
The full template for Classical Latin, expressing the greatest possible retreat from the end of the word, looks then like this:

(45)



The template is instantiated whole-hog in words like *Rōma*, *lēgātus*, *magnus*, *admirābilis*.

(46)



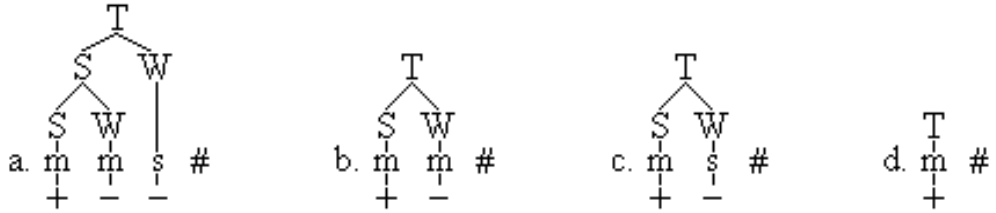
(Note that this is a 'preliminary scansion' and the syllable node has not been emplaced.)

But what of words containing fewer than two moras before their final syllable? They do not fit the template given, yet they are not denied stress: one says *tí-mor*, *tí-bi*, *bí-bit*, *rēs*.

(47)

The metrical pattern exhibited by these words is not point-for-point identical with that of the template (45), but is nonetheless quite similar to it. Indeed, the briefer pattern of the words in (47) may be derived by simply deleting a weak branch from the fuller tree of template (45).

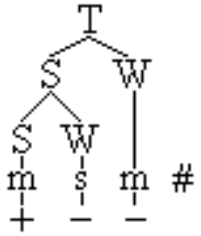
Applying this method of generating sub-patterns would give four trees for Latin.

(48) 

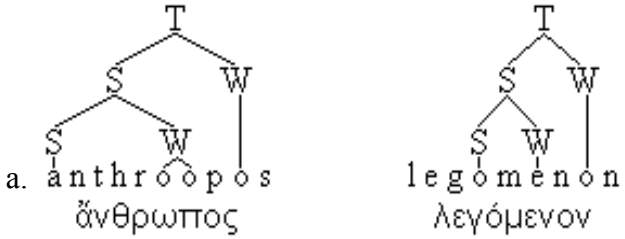
Note that when a node N_i is deleted, its sister N_j disappears with it. The material labeled N_j comes to be dominated by the immediate parents of N_i, N_j. Given the essentially relational character of the node-labels, this seems a natural interpretation fo the 'derived constituent structure' resulting from such a deletion.

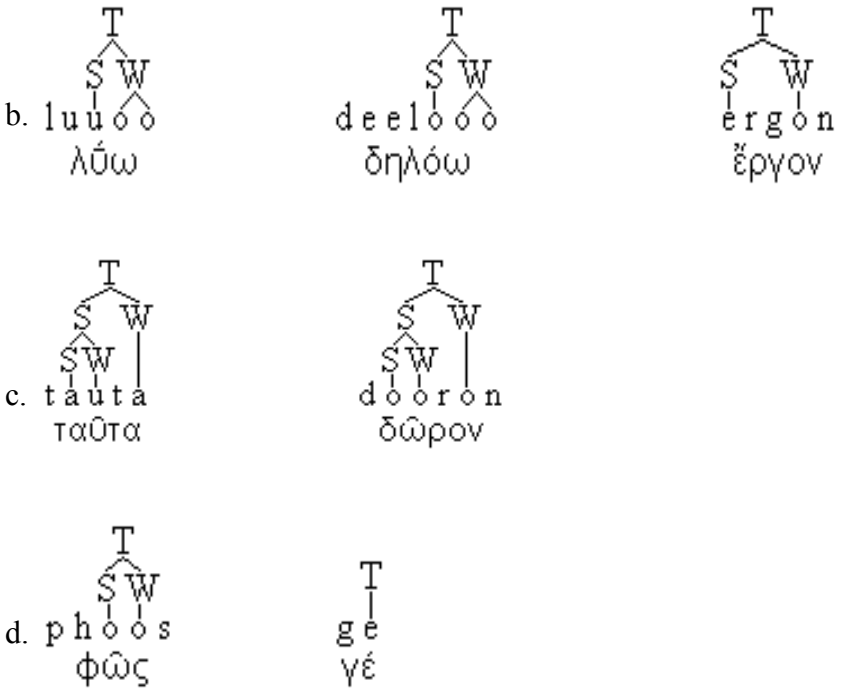
Observe further that tree (48c) comprehends (48b) as a special case, given the interpretation of *s* adopted above. The possibilities of Latin stress are therefore given by (48a), (48c), (48d), – this last comes into play only on one-mora words, such as they are. To determine the stressing of a Latin word, one selects from these the largest tree consistent with the exigencies of syllable structure.

The template governing the recessive accent of Classical Greek is very similar to that of Latin, consisting of the same elements arrayed in different order.

(49) 

In Greek, only a vowel can be a mora. Via W-deletion and the principle of always taking the largest pattern-option permitted, the following characteristic assignments of structure are generated:

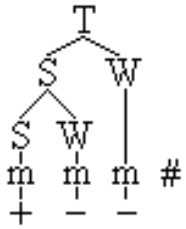
(50) a. 



The mora at S_T – the accented mora – is the point of inflection of the word's tone contour.

As a final simple example, consider the conditions under which stress is assigned in literary Arabic (this rule reflects the stress pattern that prevails in many mid-eastern dialects.) The last syllable is stressed if it contains a long vowel or ends in two consonants; therwise, the penultimate if it is similarly strong; otherwise, the antepenultimate. In terms of the system of representation advanced here, this pattern corresponds to the template

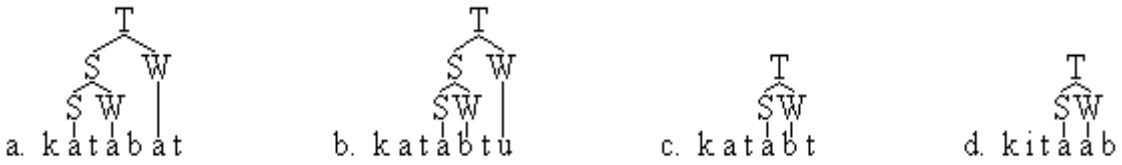
(51)



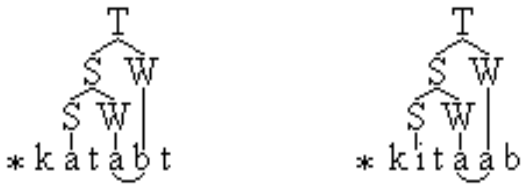
The arabic mora may be any segment whatsoever, the basic contrast being between heavy and light syllables; further, a consonant in the env. V — # is *not* a mora.

Given these stipulations, the template (51) licenses the following metrical analyses:

(52)



Observe that in (52 c, d), the PSI plays a crucial role in determining the correct patterning; without it, the full template (51) could be instantiated in these examples, giving the incorrect penultimate stress.

(53) 

Metrical parsings such as these violate the PSI because they assign the first mora of the final syllable to a metrical unit that does not contain its second mora. As a consequence, no node *s* can be inserted into the tree to dominate all and only the contents of the last syllable.

The theory of accent placement we have developed up to this point is founded on a small number of assumptions. The lowest level of metrical analysis is structurally defined by a *template*, a metrical tree whose terminals express restrictions on the kind of phonological material the bottom rank of *S*'s and *W*'s can dominate. These restrictions may be couched in a vocabulary consisting of (at least) *m* (for *mora*), *s* (*syllable* or *mora*), where the extension of these terms is subject to language-specific variation along a certain few parameters. The full range of basic metrical patterns is derived from the template by deletion of weak branches. A 'directionality' of patterning must be defined – which end of the word the parsing starts at – though this may be predictable from template structure, left-branching (S W) being leftward, and vice-versa. (Note that in the Latin, Greek, and Arabic examples, the template was represented as being anchored to the word boundary, the fate of the remaining syllables being left open, due to lack of information. The role of pattern repetition will be amply illustrated again when we consider English.) The Principle of Syllabic Integrity restricts both the placement of repeated units, as in the alternating stress example illustrated in (42), and the choice of (sub-) template, as in the Arabic stress case of (53). Finally, in scanning a new stretch of string, of the several possibilities offered by the set comprising the template and its *W*-deleted sub-templates, that one is chosen which is consistent with the *longest* substring.

This last provision subsumes the theory of disjunction, which is classically associated with the notation of parentheses. Metrical theory provides an explanation for why the property of disjunction is associated with stress rules: a substring is typically liable to several scansions *via* template and sub-templates, and the sole correct analysis must be chosen from a set of intrinsically incompatible alternatives. One tree only may stand in a fixed locus, and it will be the largest that can stand there. Segmental rules collapsed by parentheses do not effect similar incompatibilities.....

Acknowlegment 2006. Many thanks to Viktoria Lazar for preparing this version of the ms.