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Intrasyllabic Boundaries: A Violation of Strict Layer Hypothesis *

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0. Introduction

Since the second half of the 1980's, various phenomena have been captured in terms of the authentic units of prosody, or prosodic categories, [1] although they are apparently unrelated to these categories unlike stress, rhyme, poetic meter, and so on. The phenomena include vowel reduction (Rappaport (1984)), vowel deletion (Archangeli (1984), Keyser and O'Neil (1985)), reduplication (McCarthy and Prince (1986, 1989, forthcoming)), vowel lengthening (Haraguchi (1988)), epenthesis (Ito (1989)), compensatory lengthening (Hayes (1989a)), vowel shortening (Tanaka (1989)), hypocoristic formation (Poser (1984, 1990)), etc.. Indeed, it is surprising that each phonological or morphological phenomenon, though seemingly irrelevant, should be accounted for by the prosodic representation developed in each theory. However, no theory but Tanaka (1989) covers all of the phenomena, as is shown in the literature, which deserves to be called *prosodic theory*. [2]

The prosodic theory has mainly three general principles: *the Strict Layer Hypothesis, the Minimality Condition,* and *the Extraprosodicity Condition*. [3] These principles work on prosodic categories, and, as a consequence, any account of all the phenomena stated above (including stress, rhyme, and meter) should involve the principles, as is demonstrated particularly in Tanaka (1989).

This paper is concerned with stress of Yupik Eskimo and Chugach Alutiq, on which was first shed light by Halle (1990). In explaining the stress, Halle (1990) proposes a new rule inserting idiosyncratic constituent boundaries (henceforth, Boundary Insertion ') while our approach, on the basis of the framework in Tanaka (1989), only needs the first principle, namely, the Strict Layer Hypothesis presented in Hayes (1989b). This is very important from a recent theoretical point of view, because

the former analysis reduces the odd stress behavior of the two languages to a matter of *rule* whereas the latter to that of *representation*. Moreover, it will be argued that Halle's approach suffers from some empirical and theoretical problems.

The organization is as follows: in section 1, we will review the generalization of the stress occurrence and Halle's account in Yupik Eskimo (section 1.1) and Chugach Alutiq (section 1.2); section 2 will be devoted to arguing against the account, pointing out the serious problems with its Boundary Insertion; section 3 will present a more natural account, using the Strict Layer Hypothesis and not suffering from the problems; and in the final section, we will speculate on some consequences of our theory.

1. Boundary Insertion as an Avoidance of Intrasyllabic Foot Boundaries

1.1 The Stress Pattern of Yupik Eskimo

According to Halle (1990), Yupic Eskimo stress has three patterns illustrated here as (1)-(3). The first of these is the most basic one in which stress falls on even-numbered syllables, counting from left to right, except that the final syllable never bears stress: [5]

(1) ma lì gu tuq 'he goes along with'

u tèR ten rìl Nur ni 'ones who don't come home (loc.)'

pi sù tu Lì ni lù ni 'he apparently always hunted'

ma Lù su tù Li nì lu ni 'he apparently always hunted for sea animals'

Second, a syllable with a long or di-vocalic nucleus, and the one preceding it, always bear stress, regardless of whether or not they are even-numbered:

(2) qà yà: ni 'in his kayak'

qù: yur nìt ka: 'he smiled about it'

à: Rà Nì: ra:t 'oldsquaw ducks'

cì tùaR su tù Li nì lu ni 'he apparently always hunted beluga'

The final pattern of distribution is rather complex. A closed syllable is stressed when it matches any of the three conditions: it is in word initial position (as in (3a)); it is followed by a light syllable (as in (3b)); or it precedes a long syllable (as in (3c)).

(3) a. àN ya mì ni 'in his own boat'

qùs Nir Nàl Nur pàg taN qèR sug nàr quq 'there seems to be a big goat'

b. ca Nà tèn rì tua 'there is nothing wrong with me'

àt ràr lu ni '(he) going down'

c. ùl ùr nia 'he says it is slowly flooding'

It appears at first sight that these stress patterns are not related to one another. In fact, one specific foot type (say, right-dominant feet) might seem to be unable to explain the patterns uniformly. However, to capture the consistency inherent in the apparently complicated patterns, Halle assumes the following rules and parameter values in the framework of Halle and Vergnaud (1987):

(4) a. Stress-bearing Elements
Assign line 0 asterisks to all vowels in the rime.

b. Boundary Insertion (BI)
Assign left foot boundaries to syllables with long vowels or diphthongs.

c. Accent Rule (AR)
Assign line 1 asterisks to closed syllables in word-initial position or followed by a word-medial light syllable.

d. Line 0 Parameter Settings:
[+ BND, + HT, right-headed, left-to-right].

e. Constituent Construction and Head Location
Construct constituents on line 0 and mark heads on line 1.

f. Defooting
Defoot word-final foot at the end of an intonational phrase.

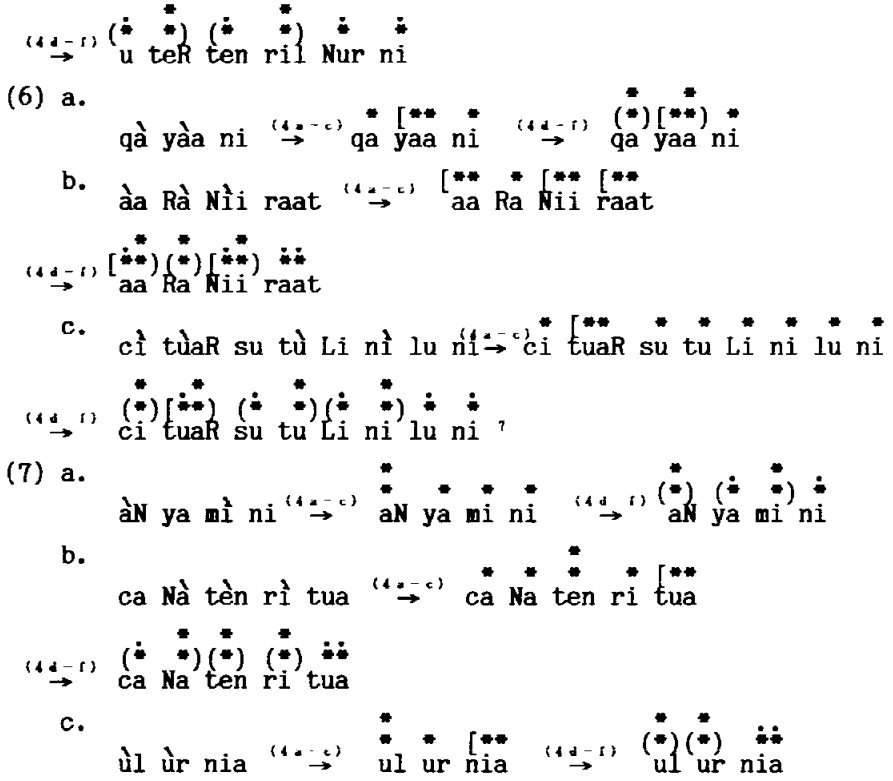
(4b) is a new rule by which either left or right idiosyncratic constituent boundaries are assigned, with the proviso that when constituents are constructed from left to right the inserted boundaries are left, whereas when constituents are constructed from right to left they are right. As the parameter settings in (4d) show, Yupik has the [left-to-right] specification of the directionality parameter, and therefore left boundaries are assigned if the language has the rule.

This rule is no more an unnatural one than the Accent Rule is; in fact, they appear to be, so to speak, the two sides of a thing. In general, a metrical constituent consists of asterisks (the head and the domain) and boundaries. If we take the Accent Rule to be an idiosyncratic rule assigning the head of a constituent, it is a natural consequence that there may exist an idiosyncratic rule which assigns the boundary of a constituent. That is why Halle (1990) devises what we call Boundary Insertion here.

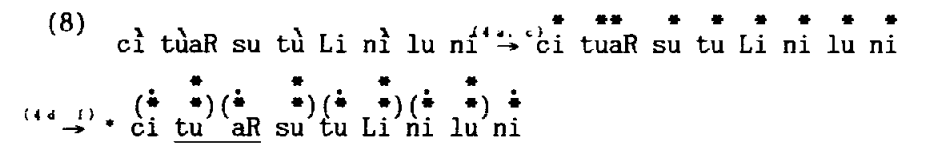
Given the rules and parameter settings seen above, the rather complex distribution of Yupik stress can be accounted for somewhat uniformly. Examples of derivations are given below, where the three patterns in (1)-(3) correspond to (5)-(7) respectively: [6]

(5) a. pi sù tu Lì ni lù ni $\xrightarrow{(4a-c)}$ * * * * * * *
pi su tu Li ni lu ni
$\xrightarrow{(4d-f)}$ (* *)(* *)(* *) *
pi su tu Li ni lu ni

b. u tèR ten rìl Nur ni $\xrightarrow{(4a-c)}$ * * * * * *
u teR ten ril Nur ni



Examining these derivations, we must realize how ingenious Halle's account of the stress occurences is. Note here that Boundary Insertion functions as a devise by which syllable-interal foot boundaries are avoided; that is, incorrect positions would be stressed if the rule did not apply, as the following example shows (cf. (6c)):



The ill-formedness may be assumed to be attributed to the intra-syllabic foot boundaries underlined above, and Boundary Insertion, as Halle defines it, plays a role to neatly avoid them.

1.2 Non-head-terminal Ternary Constituent in Chugach Alutiq

The next language to be discussed is the Chugach dialect of

Alutiq, whose stress facts are described by Rice (1988). Halle analyzes them from roughly the same point of view as those of Yupik. Consider the data illustrated in (9):

(9) a. ta qù ma lu nì 'apparently getting done'

a kù tar tu nìr tuq 'he stopped eating akutaq'

b. naà qu ma lù ku 'apparently reading it'

pi lù lià qa 'the fish pie I'm making'

c. èL tu àq 'my grandchild'

àg Nuà qu tàr tuà Na 'I'm going to dance'

As a first approximation, we can say that the language utilizes ternary feet, or amphibrachs, with their head in foot-medial position. This is particularly clear from (9a) since stress falls on the second and fifth moras from the beginning of the word. On the other hand, examples (9b) and (9c) show that every syllable with a long vowel or diphthong bears stress irrespective of its position and that closed syllables are stressed only word-initially as underlined. The two facts can be formally expressed by almost the same device as used in Yupik (cf. (4b) and (4c)). The whole schema of Halle's assumed rules and parameter settings for Chugach stress is therefore identical to those for Yupik stress, except for the foot type and the absence of defooting:

(10) a. Stress-bearing Elements
Assign line 0 asterisks to all vowels in the rime.

b. Boundary Insertion (BI)
Assign left foot boundaries to syllables with long vowels or diphthongs.

c. Accent Rule (AR)
Assign line 1 asterisks to closed syllables in word-initial position.

d. Line 0 Parameter Settings:
[+ BND, - HT, left-to-right].

e. Constituent Construction and Head Location
Construct constituents on line 0 and mark heads on line 1.

Again, stress-bearing elements are defined to be all vowels in the rime. It then follows that Halle takes Yupik and Chugach to be mora-counting languages, because they typically allow any number of stress-bearing elements to occur if they are vowels, while syllable-counting languages typically allow only a single stress-bearing element per syllable.

Now examine how well (10a-e) work in explaining the complicated stress patterns of the words in (9):

(11) a. ta qù ma lu nì $\xrightarrow{(10a-c)}$ ta qu ma lu ni

$\xrightarrow{(10d,e)}$ (ta qu ma)(lu ni)

a kù tar tu nìr tuq $\xrightarrow{(10a-c)}$ a ku tar tu nir tuq

$\xrightarrow{(10d,e)}$ (a ku tar)(tu nir tuq)

b. naà qu ma lù ku $\xrightarrow{(10a-c)}$ [naa qu ma lu ku

$\xrightarrow{(10d,e)}$ [naa qu)(ma lu ku)

pi lù lià qa $\xrightarrow{(10a-c)}$ pi lu [lia qa

$\xrightarrow{(10d,e)}$ (pi lu)[lia qa)

c. èL tu àq $\xrightarrow{(10a-c)}$ eL tu aq $\xrightarrow{(10d,e)}$ (eL tu)(aq)

àg Nuà qu tàr tuà Na $\xrightarrow{(10a-c)}$ ag [Nua qu tar [tua Na

$\xrightarrow{(10d,e)}$ (ag [Nua qu)(tar [tua Na)

It is to be noted here that Boundary Insertion (10b) prohibits the syllable-internal constituent boundaries in advance which would otherwise occur on *-lia-* in (11b) and on *-Nua-*, *-tua-* in (11c).

Incidentally, there has recently been a hot dispute over the headedness of a ternary constituent: the point to decide the issue is whether it is head-terminal or non-head-terminal. For instance, Haraguchi (1988) claims that ternary feet should be dactyls or anapests (namely, head-terminal) whereas Halle (1990) follows Halle and Vergnaud (1987) in assuming them to be only amphibrachs (i.e. non-head-terminal). It has been a tragedy that Cayuvava, a Bolivian language, was the sole candidate for a ternary-footed one, where either analysis seems to be possible. Chugach, however, may support the non-head-terminal nature of ternary feet in light of the stress facts seen above. In fact, Halle adduces some piece of evidence for that nature of the feet; that is, in Chugach, certain onset segments undergo fortition (i.e. complete lack of voicing with voiceless consonants, and preclosure) as described by Leer (1985), whose occurence can be predicted by amphibrachs constructed. This is exemplified in (12a), in which onset consonants with an apostrophe turn fortes, and it is sufficient to assume a rule like (12b) so as to account for their distribution:

(12) a. (* *) [**) (* *) (* *)
à li k'aà àn ci q'u kùt

b. Foot-initial consonants undergo fortition.

Of course, rule (12b), though not indicated, applies to all of the examples in (11) when the structural description is met. If this is the case, neither dactyls nor anapests seem to be unable to predict the phonological process straightforwardly, which implies that Cayuvava stress is approached better by non-head-terminal feet as well as Chugach.

In spite of the fairly ingenious cooperation of feet and fortition, there are some apparent exceptions to rule (12b), which are given below:

(13) a. (* * *)(*) (*) [** *)(*) [** *)
a kù t'a mèk àg Nuà q'u tàr t'ùa Na

b. (* *)(*) [** *)(*)
nàq L'u kù maà m'a qà

Relating to this problem, Halle suggests that there is a tendency in the language to avoide mono-moraic feet, except word-initially; indeed, when constituent construction results in them, the following remedy (14a) is appealed to:

(14) a. Refooting
* *)(*) → *)(* *) line 0

b. (* * *)(*) (* *) (* *)
a kù t'a mèk → a kù t'a mèk
(* *)(*) (*) (* *)
nàq L'u kù → nàq L'u kù

It is true that rule (14a) can explain the divergences in (13) from the predicted pattern, but it does not provide a principled account of why refooting *must* apply to the words in (13), or why mono-moraic feet *must* be inhibited in this language. In other words, what in the world prohibits unary feet and requires refooting to apply to a violation of the prohibition in a repair-strategic manner? We have to await an adequate answer until section 3.

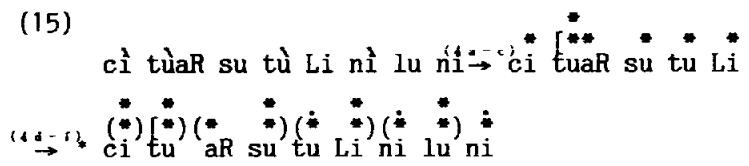
2. Some Empirical and Conceptual Problems with Halle's (1990) approach

We have thus far seen that Halle's approach with Boundary Insertion is quite appealing in that the rule is no less natural than the Accent Rule, that it excludes intrasyllabic foot boundaries which would otherwise occur, and that it makes possible to capture the intricate stress facts exhibited in Yupik Eskimo and Chugach Alutiq.

But we should point out that this approach, though successful to some extent, suffers from two empirical and four theoretical problems. First, empirically, (4a-f) generate some ill-formed pattern as they stand; that is, if they apply to the fol-

lowing word in Yupik *faithfully*, an unattested pattern is yielded:

(15)



The syllable *-tuaR-* includes a diphthong closed by a consonant, and is followed by a word-medial light syllable; therefore, both Boundary Insertion (4b) and Accent Rule (4c) should apply, as shown in the second stage of the derivation in (15). It is unknown why Halle does not invoke the Accent Rule with respect to this example (cf. (6c)), but the rule must apply, resulting in the unattested pattern, or it must tentatively stipulated that (4c) should not apply to CVVC. In either case, words with CVVC followed by a word-medial light syllable constitute a systematic exception to the approach.

The second empirical problem is that in the case of Yupik words with a long vowel, Halle's rules and parameters consistently assign stress to the second mora of that syllable, not the first. In the actual pattern, however, correct stress must fall on the first mora, as illustrated in (6a,b) (reproduced here as (16)):

(16) a.

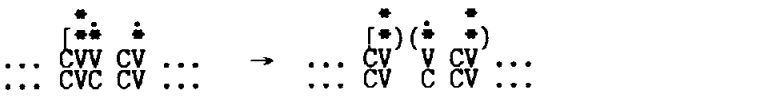
b.

Halle makes no comment on this point, but to generate the attested outputs, he needs an interpretive device by which stress is phonetically taken to fall on the syllable head (namely, the first mora) when it falls elsewhere in the syllable (although Yupik is considered to be a mora-counting language, where the second mora of a long vowel may in fact be stressed!). [8]

From a conceptual point of view, there also seem to arise several problems with Halle's account, or to be exact, with Boun-

dary Insertion. First, in languages where both Boundary Insertion and the Accent Rule apply to heavy syllables and where right-headed feet are constructed from left to right, syllable-internal constituent boundaries always occur, as shown below:

(17) AR (heavy syllables); BI (heavy syllables)

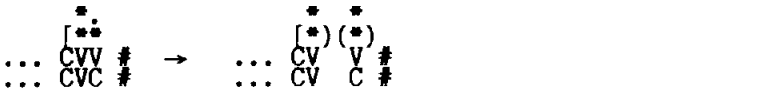


(right-dominant-footed languages)

The same argument also holds for languages where the two rules apply to long syllables or where they apply to closed syllables. This fact means that when line 1 asterisks and idiosyncratic boundaries are assigned to the same type of syllable, intrasyllabic foot boundaries always arise. In such a case, therefore, Boundary Insertion loses its original function: that is, it does not act any more as a prohibitor of a syllable split. [9]

Second, in just the same situation in which the target of Boundary Insertion coincides with that of the Accent Rule and where right-dominant feet are constructed from left to right, there occurs a configuration with two heads per syllable at the end of the word: [10]

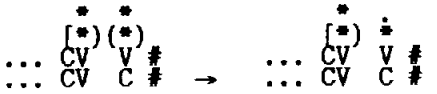
(18) AR (heavy syllables); BI (heavy syllables)



(right-dominant-footed languages)

This configuration raises a serious problem because, in general, a syllable may allow more than one stress-bearing element in it, but never allows more than one stressed element (i.e. constituent head) there; hence, stress deletion should be used to rule out the violation of the one-to-one correspondence between the syllable and the constituent head. But, even if deletion is resorted to, an intrasyllabic boundary remains intact, as illustrated in (19):

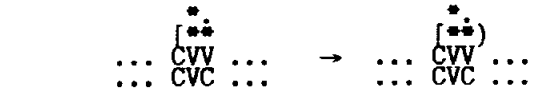
(19)



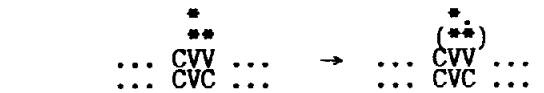
In short, regardless of the application of deletion, this approach encounters either the violation of the one-to-one correspondenece or the presence of intrasyllabic boundaries. [11]

The third conceptual problem is that when left-headed feet are constructed with the other requirements set the same as the two cases above, a redundancy procedure arises: that is, the Accent Rule and Boundary Insertion construct a left-dominant foot over CVV or CVC (as in (20a)), but either of these is sufficient to do the same effect (as in (20b) and (20c)):

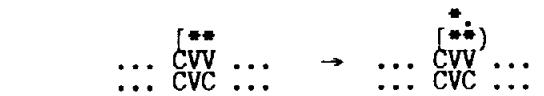
(20) a. AR (heavy syllables); BI (heavy syllables)



b. AR (heavy syllables)



c. BI (heavy syllables)



(left-dominant-footed languages)

This is due to the fact that the Accent Rule makes a specified syllable stressed while Boundary Insertion, strictly speaking, plays two roles: to avoid syllable-internal boundaries and, like the Accent Rule, to guarantee stress on a given syllable. Thus, when it comes to languages with left-dominant feet, both rules, though otherwise different, do the same function after all: they require that CVV or CVC be always stressed. To rule out the redundancy, it must be stipulated that in such languages, only one of these rules may apply. [12]

The three problems stated above are all restricted to the case where the Accent Rule and Boundary Insertion apply to the same type of syllable; in other words, we have hypothesized the

case in which the target syllable of the rules is both designated to be heavy, long, or closed. One might think that to exclude the intrasyllabic foot boundaries, the violation of the one-to-one correspondence, and the redundancy of the rules' function, we have only to devise a condition that each target of the rules should not be the same. Unfortunately, however, the three problems also do arise even when the targets are different from each other; that is, for example, when the Accent rule apply to closed syllables and Boundary Insertion to syllables with a long vowel or diphthong, both a line 1 asterisk and an idiosyncratic boundary are assigned to a superheavy syllable like CVVC:

(21) AR (closed syllables); BI (long syllables)

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        *
      [**
... CVVC ...
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Thus, when right-headed feet are constructed from left to right, the intrasyllabic boundaries occur or the violation of the one-to-one correspondence is yielded at the word edge, whereas when left-headed feet are constructed in the same manner, the redundancy arises.

Finally, Halle's (1990) invoked languages with respect to Boundary Insertion are the ones in which all vowels or rime phonemes are stress-bearing, such as Yupik, Chugach, and Cairene Arabic (see (4a) and (10a)). [13] In other words, it can be said that Boundary Insertion was effective only in the case of languages with more than one stress-bearing element in a syllable. This is obvious because it is impossible for a syllable split, or foot boundaries to occur within a syllable which has a single stress-bearing unit, and Boundary Insertion does not play any role in that case. Then, the analysis with Boundary Insertion should insure in a principled manner that the applicability of the rule depends mainly on line 0 asterisk assignment like (4a) and (10a) and that it may not apply to cases with a single stress-bearing element per syllable, or otherwise this rule would be said to be quite an arbitrary one.

To sum up, the problems exhibited thus far are once again

given in (22):

(22) a. Incorrectly assigned stress (15) — Empirical Problems
b. Incorrectly assigned stress (16) — Empirical Problems
c. Intrasyllabic boundaries (17) — Theoretical Problems
d. Syllables with two heads (18) — Theoretical Problems
e. Redundancy (20) — Theoretical Problems
f. Arbitrariness — Theoretical Problems

They arise partly because Boundary Insertion may sometimes not do its original effect and partly because it is arbitrary in nature, like the Accent Rule, in that it should be specified which language has the rule and, if it applies, which type of syllable becomes the target. In fact, we will demonstrate in section 3 that the reason for the occurrence of the problems is that Halle ascribed the avoidance of intrasyllabic foot boundaries to a matter of *idiosyncratic rule*, not to that of *phonological representation*.

3. Intrasyllabic Boundaries as a Violation of Prosodic Organization

3.1 Theoretical Background

Before accounting for the stress distribution of Yupik and Chugach, we will review and, if necessary, revise the framework advocated by Tanaka (1989). In particular, we will introduce the mechanisms of the construction of the prosodic hierarchy: rules and parameters, principles, and repair strategies in case of violation of the principles. First, we assume that prosodic structures are constructed over a phonological string by the following rule:

(23) *Prosodic Categories Assignment*
Assign α on the prosodic tier, α = a prosodic category.

This rule assigns moras (M), syllables (σ), feet (F), phonological words (PWd), etc. on each tier. In constructing the hierarchy, a certain prosodic category may be invisible to rule

(23), which varies across languages in accordance with the following parameter:

(24) *Extraprosodicity Parameter*
Inventory: M / σ / F / PWd / ϕ
Location: Left / Right

Here, ϕ is the value of languages with no extraprosodicity. Moreover, all the categories but the syllable also have parametric variation. Thus, a vowel that is the rime head is always a mora, but elsewhere what kind of segment can be a mora relies on the parameter in (25):

(25) *Mora Parameter*
Inventory: Onset/Rime/ϕ
Content: [+ syllabic]/[+ sonorant]/[+ consonantal]/
[+ coronal]/[no restriction]

A language must select a value from each of the subparameter: Inventory, which determines what position in the syllable the segment concerned should occupy, and Content, which determines what featural content it should have. When it chooses ϕ, no segment but a rime head vowel can be a mora. In all cases, moras are assigned to rime head vowels by default since they always count as mora, regardless of of the parameter in (25). Some examples are given below, where the left column indicates the values and the right the moras assigned to three types of syllable structure: [14]

(26) a. ϕ - - - - - - - - - $\overset{M}{CV}$ $\overset{M}{CVV}$ $\overset{M}{CVC}$

b. Rime • [+ syl] - - - - $\overset{M}{CV}$ $\overset{MM}{CVV}$ $\overset{M}{CVC}$

c. Rime • [+ cons] - - - $\overset{M}{CV}$ $\overset{M}{CVV}$ $\overset{MM}{CVC}$

d. Rime • [no res.] - - - $\overset{M}{CV}$ $\overset{MM}{CVV}$ $\overset{MM}{CVC}$

Moreover, what kind of foot a language should have is also parametrized in the following manner (here, the direction of assignment is unspecified; that is, except for the feet with 'R to L'

specification, all have the default value 'L to R'): [15]

(27) *Foot Parameter*

Inventory: $(\overset{*}{\dot{M}}\ \dot{M})$ / $(\dot{M}\ \overset{*}{\dot{M}})$ /

$(\dot{M}\ \overset{*}{\dot{M}}\ \dot{M})$ / $(\dot{M}\ \overset{*}{\dot{M}}\ \dot{M})$ (R to L) /

$(\overset{*}{\acute{\sigma}_\mu}\ \acute{\sigma}_\mu)$ / $(\acute{\sigma}_\mu\ \overset{*}{\acute{\sigma}_\mu})$ /

$(\overset{*}{\acute{\sigma}}\ \acute{\sigma})$ / $(\acute{\sigma}\ \overset{*}{\acute{\sigma}})$ (R to L) /

$(\overset{*}{\acute{\sigma}}\ \acute{\sigma}_\mu)$ (R to L) / $(\acute{\sigma}_\mu\ \overset{*}{\acute{\sigma}})$

$(\overset{*}{\acute{\sigma}}\ \acute{\sigma}_\mu \ldots \acute{\sigma}_\mu)$ / $(\acute{\sigma}_\mu \ldots \acute{\sigma}_\mu\ \overset{*}{\acute{\sigma}})$

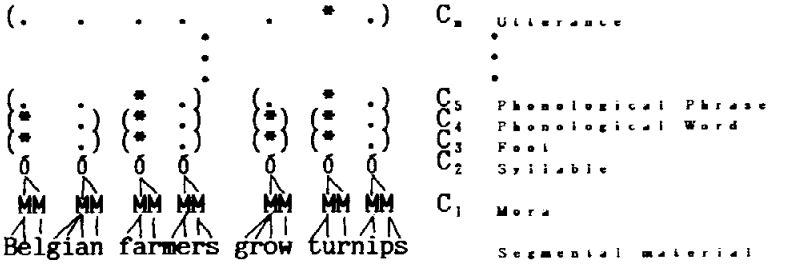
Tanaka (1989) does not include the feet on the second row, which gather three moras, and the ones on the third, which pair two light syllables; but the others are all attested as demonstrated in the literature. We can ill afford to illustrate the feet in (27) and the parameters of other prosodic categories, but for details, see Tanaka (1989).

Second, we assume two general principles imposed on the nature and behavior of prosodic categories: the Strict Layer Hypothesis and the Minimality Condition. On the one hand, the former is first formulated in Hayes (1989b), which is given in (28):

(28) *Strict Layer Hypothesis* (SLH)
The categories of the prosodic hierarchy may be ranked in a sequence C_1, C_2, ... C_n, such that
a. all segmental material is directly dominated by the category C_1.
b. for all categories C_i, $i \neq 1$, C_i directly dominates all and only constituents of the category C_{i-1}.

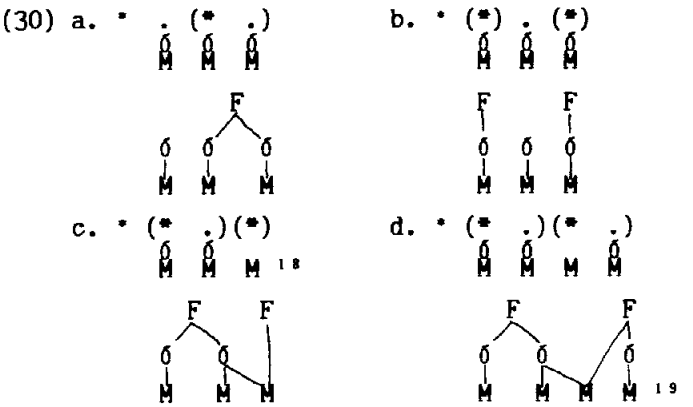
Thus, a well-formed organization of prosodic categories is shown as in (29). Examine how well the principle works:

(29)



Incidentally, our prosodic hierarchy is different from Hayes's. Hayes takes the terminal category C_1 as syllable because his inventory of prosodic categories does not contain mora, [16] while we follow Tanaka (1989) in assuming C_1 to be mora since it exhaustively dominates segments below it, as in (29), matching up to (28a). [17] Now, ill-formed examples are given hypothetically in (30), where (30a-d) violate (28b) (here, for comparison, we also use ordinary tree notations equivalent to ours so as to make clear dependency relation among categories):

(30)



[18] [19]

The ill-formedness of (30a,b) is due to the fact that foot does not dominate all syllables; that of (30c,d) should be attributed to the fact that foot directly dominates not only syllables but also moras. On the other hand, let us turn to the latter principle working on the well-formedness of prosodic categories, the Minimality Condition as formulated in (31) (Tanaka (1989)):

(31) ***Minimality Condition*** (MC)

$\min C_i = [C_{i-1}]^{ci}$

Informally, (31) reads "if C_i, $i \neq 1$, is a level i prosodic category expanding into several constituents of C_{i-1}, then the minimal form of C_i is C_{i-1}."; in other words, it requires that C_i contain at least one constituent of C_{i-1}. It therefore amounts to saying that, in general, min σ = $[M]^s$, min F = $[\sigma]^F$, min PWd = $[F]^{PWd}$, and so on, or that syllable, foot, and phonological word must include at least a mora, a syllable, and a foot, respectively. [20] However, some languages may have somewhat different requirements; for instance, in Khalkha Mongolian, Aguacatec Mayan, Yana, Chugach, and Cayuvava, min F = $[M\ M]^F$; in Creek and Warao, min F = $[\sigma\ \sigma]^F$; in Seneca, min F = $[\sigma_{\mu\mu}]^F$; [21] and in Kumi, min PWd = $[F\ F]^{PWd}$.

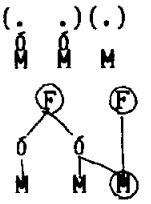
Finally, when there is a violation of any of the two principles just mentioned, one of the four rules to remedy it is appealed to, as illustrated in (32) (Tanaka (forthcoming)): [22]

(32) a. Postlexical Tier Deletion
b. Stress Deletion
c. Refooting
d. Defooting

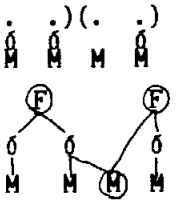
Rule (32a) deletes a prosodic tier postlexically when the Strict Layer Hypothesis is violated in a "single" manner, for example, in Winnebago, Old English, Cairene Arabic, Palestinian Arabic, and Southern Paiute. This violation seems to be relatively not serious, and is carried over in the postlexical stratum; Rule (32b) deletes the head of a constituent in case of violation of the Minimality Condition although another adjacent head (or stress clash) may often not exsist. Languges which have recourse to this remedy are Seneca, Khalkha Mongolian, Aguacatec Mayan, Yana, Creek, Warao, and Cayuvava; And finally, the strategies for the most serious contravention are rules (32c) and (32d). In fact, they apply if, in almost all cases, two of the three principles are violated at the same time: the Strict Layer Hypothesis and the Minimality Condition (see (30c)), and the Strict Layer Hypothesis and the Extraprosodicity Condition. The same also holds for a "double" violation of the Strict Layer Hy-

pothesis (30c,d), which is reproduced here as (33a,b): [23]

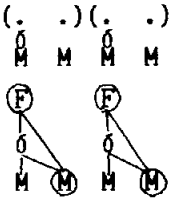
(33) a. Double Violation



b. Double Violation



c. Single Violation



(33a), which is a double violation as well as a violation of the Minimality Condition, triggers the application of Defooting in Palestinian Arabic and Old English, while (33b) and a violation of both the Strict Layer Hypothesis and the Extraprosodicity Condition trigger that of Refooting in Winnebago, Cairene Arabic, and Palestinian Arabic, and so on. To sum up, the relation between the type of violation and that of resolution is as in (34):

(34)	The Type of Violation	The Type of Resolution
a.	SLH "Single"	Postlexical Tier Deletion
b.	MC	Stress Deletion
c.	SLH "Double"	Refooting
	SLH and EC	
d.	SLH "Double" and MC	Defooting

In illustration of the rules' effect, now, consider the derivations of Palestinian stress, whose parameter values are as in (35):

(35) The Parameter Values for Palestinian Arabic Stress

a. Extraprosodicity - - - Foot • Right

b. Mora - - - - - - - - - - Rime • [no restriction]

c. Foot - - - - - - - - - - (* .)
M M

d. Phonological Word - - - $(\dot{F}_1\ \dot{F}_2\ \ldots\ \overset{*}{\dot{F}_n})$

(35a) means that the rightmost foot is extraprosodic; as (35b) shows, any segment in the rime can be a mora; The trochee in (35c) pairs two moras; and (35d) specifies that the language has a right-dominant phonological word which gathers feet. Derivations proceed as follows:

(36) a.

baarákato → baarakato → ba a raka to

→ * ba a raka to (by (34a)) → ba a raka to

b.

báarakat → baarakat → * ba a raka t (by (34d))

→ ba a rakat → * ba a rakat (by (34a))

→ ba a rakat [24]

c.

makáatib → makaatib → * maka ati b (by (34d))

→ * maka atib (by (34c)) → ma ka a tib

→ * ma ka a tib (by (34a)) → ma ka a tib

Here, we realize that the seriousness of the violations in (34) is ordered as (d) > (c) > (b) > (a), and hence that the violations are also resolved in that order (for examples of Defooting in Old English, see Tanaka (1990b, this volume)).

3.2 A More Plausible Account of Yupik and Chugach Stress

As we saw in section 2, problems with Halle's approach mainly results from the fact that Boundary Insertion is a rather arbitrary rule and, more importantly, that it may sometimes not function as a way of avoiding intrasyllabic boundaries. But to prohibit such boundaries, we need not resort to the arbitrary rule; that is, by making use of our foot inventory or the Strict Layer Hypothesis, the prohibition naturally obtains. An example of the use of the former is Yupik, and that of the latter is Chugach.

First, the rules and parameter values of Yupik stress are given below:

(37) The Parameters Values for Yupik Eskimo Stress

a. Mora - - - - Rime • [+ syllabic]
Rime • [no restriction]
(word-initially or before σ$_{\mu}$)

b. Foot - - - - (. *)
σ$_{\mu}$ σ$_{\mu}$

c. Destressing - Destress the foot at the end of an intonational phrase.

(37a) specifies that any vowel counts as mora and that any rime element counts as mora word-initially or before a light syllable; (37b) shows that this language has iambs which pair two light syllables, and that in the absence of specification of the directionality, it is L to R; and we assume unlike Halle (1990) that the final foot is destressed, not defooted; [25] The devices (37a-c), then, capture the distribution of Yupik stress quite straightforwardly as below:

(38) a.

pi sù tu Lì ni lù ni → pi su tu Li ni lu ni

(. *)(. *)(. *)<.>
σ$_{\mu}$ σ$_{\mu}$ σ$_{\mu}$ σ$_{\mu}$ σ$_{\mu}$ σ$_{\mu}$ σ$_{\mu}$

→ pi su tu Li ni lu ni

b.

u tèR ten rìl Nur ni → u teR ten ril Nur ni

(. *) (. *) <. .>
Ó Ó Ó Ó Ó Ó
→ u teR ten ril Nur ni

c.

(*)(*) <.>
Ó Ó Ó
qà yàa ni → qa yaa ni → qa yaa ni

d.

cì tùaR su tù Li nì lu ni

Ó Ó Ó Ó Ó Ó Ó Ó
→ ci tuaR su tu Li ni lu ni

(*)(*) (. *)(. *)<. .>
Ó Ó Ó Ó Ó Ó Ó Ó
→ ci tuaR su tu Li ni lu ni

e.

Ó Ó Ó Ó
qùu yur nìt kaa → quu yur nit kaa

(*) (. *) <.>
Ó Ó Ó Ó
→ quu yur nit kaa

f.

qùs Nir Nàl Nur pàg taN qèR sug nàr quq

Ó Ó Ó Ó Ó Ó Ó Ó Ó Ó
→ qus Nir Nal Nur pag taN qeR sug nar quq

(*) (. *) (. *) (. *) (. *) <.>
Ó Ó Ó Ó Ó Ó Ó Ó Ó Ó
→ qus Nir Nal Nur pag taN qeR sug nar quq

g.

Ó Ó Ó Ó Ó
ca Nà tèn rì tua → ca Na ten ri tua

(. *)(*) (*)<.>
Ó Ó Ó Ó Ó
→ ca Na ten ri tua

h.

(*)(*) <.>
Ó Ó Ó
ùl ùr nia → ul ur nia → ul ur nia

We should make two points here with respect to our system (37) as compared to Halle's approach. First, to capture the Yupik stress, we need no idiosyncratic rule like Boundary Insertion and the Accent Rule, both of which in turn need specifications as to what type of syllable structure they apply to: that is, our iambs which pair two light syllables always work as an avoidance of intrasyllabic boundaries, and always construct a unary

foot over a heavy syllable (particularly in (38c-h)). That is why we need neither of them. The fact that Yupik has the iambs pairing two lights implies that it is a syllable-counting language, not a mora-counting one. Hence, Halle was obliged to make use of Boundary Insertion because he analyzed the languge as mora-counting. Second, our Destressing is an idiosyncratic rule, but Halle also needs Defooting. It then follows that our analysis is fairly natural and straightforward, using mainly the parameters of mora and foot, which correspond roughly to Halle's line 0 asterisk assignment (4a) and line 0 parameter settings (4d). Idiosyncratic is Destressing only.

Second, we turn to Chugach stress, whose parameter values are indicated in (39):

(39) The Parameters Values for Chugach Alutiq Stress

a. Mora - - - Rime • [+ syllabic]
Rime • [no restriction] word-initially

b. Foot - - - $(\underset{\dot{M}}{.}\ \overset{*}{\underset{M}{.}}\ \underset{\dot{M}}{.})$

c. Fortition - Foot-initial consonants undergo fortition.

In this language, all vowels in the rime count as mora, with the proviso that in word-initial position, all rime segments constitute mora, as in (39a); (39b) indicates that Chugach has non-head-terminal ternary feet which gather three moras and that Chugach is a typical mora-counting language unlike Yupik because its feet gather not syllables but moras; and (39c) is the same rule as Halle assumes (i.e. (12b)). Just like all other languages, when there is a violation of the Strict Layer Hypothesis and/or the Minimality Condition, appropriate remedies must apply as stated in section 3.1. As for foot, the Minimality Condition generally requires that min F = $[\sigma]^F$, but in this language, min F = $[\dot{M}\ M]^F$ as in Khalkha Mongolian, Aguacatec Mayan, Yana, and Cayuvava. The derivaions in (40) show that any violation of the principles triggers Refooting and that correct stress is captured:

(40) a.

t'a qù ma l'u nì → t'a qu ma l'u ni

(. * .) (. *)

→ t'a qu ma l'u ni

b.

n'aà qu m'a lù ku → n'aa qu m'a lu ku

(.* .) (. * .)

→ n'aa qu m'a lu ku

c.

p'i lù l'ià qa → p'i lu l'ia qa

(. * .)(. *)

→ * p'i lu l'i a qa (by SLH "Double")

(. *) (. * .)

→ p'i lu l'i a qa

d.

èL t'uàq → eL t'uaq

(.* .)(*) (.*) (.*)

→ * eL t'u aq (by SLH "Double") → eL t'uaq

e.

àg Nuà q'u tàr t'uà Na → ag Nua q'u tar t'ua Na

(.* .)(. * .) (.* .)

→ * ag Nu a q'u tar t'ua Na (by SLH "Double")

(.*)(. * .)(*) (.* .)

→ * ag Nu a q'u tar t'ua Na (by MC) [26, 27]

(.*)(. *) (. *) (.* .)

→ ag Nu a q'u tar t'ua Na [28]

Here, we realize three improvements over Halle's analysis of Chugach stress. First, we need not assume an idiosyncratic refooting as formulated by Halle, i.e. * *)(*) → *)(* *). Our Refooting is not specific but general, triggered by a violation of the well-motivated principles, and such a remedy is also found in Winnebago, Cairene Arabic, and Palestinian Arabic. In

other words, our Refooting is one of the remedies in case of violation of the principles, and not a rule applying language-specifically. Second, Halle's approach does not give a principled account, formally, of why his formulated refooting applies in such an environment, but ours can. In general, languages with ternary or unbounded feet do not allow feet which contain smaller than two moras. This is the case with ternary-footed languages like Chugach and Cayuvava (see footnote 27), and unbounded-footed ones like Khalkha Mongolian, Aguacatec Mayan, and Yana. We formally expressed the fact as min F = $[M\ M]^F$, and that is why Refooting applies in Chugach when it is violated. Finally, we need a special specification of word-initial mora (i.e. (39a)) just as Halle assumes the Accent Rule specifying that it applies only to word-initial closed syllables. However, we do not have to resort to Boundary Insertion, an idiosyncratic rule whatsoever. What we call intrasyllabic foot boundaries here is the very violation of the Strict Layer Hypothersis because foot immediately dominates mora. More importantly, we reduce the avoidance of the boundaries to a matter of prosodic representation, not to that of idiosyncratic rule. Our analysis therefore seems to be theoretically favored over Halle's. An apparent problem with ours is that in the outputs of (40d,e), each initial syllable has stress on its coda consonant, not on its rime head vowel. We assume that this stress is phonetically interpreted as falling on the rime head vowel. One might think that the situation is the same as Halle's problem (16) pointed out in section 2, but it is radically different. Recall that Halle construes Yupik as a mora-counting language and that in such a language stress may often fall on the second mora or vowel in a syllable (for example, see Halle and Vergnaud's (1987) treatment of Cayuvava). It then follows that Yupik stress might also fall there, or Halle does not provide an account of why only Yupik stress cannot fall there in spite of the fact that the head of his foot is sometimes located on the second mora. In contrast, the phonetic interpretation seen in (40d,e) is a natural consequence of the fact that in any language, a consonant

cannot be stressed. If stress falls there, it phonetically shifts to the rime head vowel in the same syllable.

To sum up, we can enumerate the improvements of our approach to Yupik and Chugach, in the following way. First, it does not suffer from the six problems, empirical or theoretical, which are given in (22) of section 2. Second, we need not appeal to such idiosyncratic rules as Boundary Insertion and the Accent Rule, which in turn implies that we do not have to specify which type of syllable structure they apply to. We have only to specify the parameter values of mora and foot, which are roughly equivalent to Halle's line 0 asterisk assignment and parameter settings on line 0: other tasks are done by the principles and their related remedies. Third, our Refooting does not apply language-specifically, but is a general rule or a remedy to rule out a "double" violation of the Strict Layer Hypothesis (and/or the Minimality Condition). In addition to Chugach, it is seen in Winnebago, Cairene, and Palestinian. Other resolutions are Postlexical Tier Deletion in case of "single" violation of the Strict Layer Hypothesis (Winnebago, Old English, Cairene, Palestinian, and Southern Paiute); Stress Deletion in case of violation of the Minimality Condition (Seneca, Khalkha, Aguacatec, Yana, Creek, Warao, and Cayuvava); and Defooting in violation of both the Strict Layer Hypothesis and the Minimality Condition (Old English and Palestinian). Finally, we have demonstrated that syllable-internal foot boundaries are not licensed from the viewpoint of the well-formedness of the prosodic hierarchy or phonological representation. Their prohibition should not be the consequence of rule's application.

4. Some Consequences of the Theory

In section 3.1, we have introduced *Light-syllabic Trochee* $\overset{(* \ .)}{\sigma_{\mu} \ \sigma_{\mu}}$ and *Light syllabic Iamb* $\overset{(. \ *)}{\sigma_{\mu} \ \sigma_{\mu}}$ into our foot inventory. At first sight, they appear to be equivalent to *Moraic Trochee* $\overset{(* \ .)}{M \ M}$ and *Moraic Iamb* $\overset{(. \ *)}{M \ M}$ respectively, because a light syllable means the one with only a mora (i.e. $\sigma_{\mu} = [M]^{s}$); in fact, these feet are all the same in containing exactly two moras.

However, the former two and the latter two are not substitutable for each other because they have different consequences, which can be justified in the case of Yupik, Palestinian, Southern Paiute, and Old English. For example, Yupik stress is unanalyzable properly in terms of Moraic Iamb (cf. (38d,e)):

(41) Moraic Iamb

a.

qùu yur nìt kaa → quu yur nit kaa

(. *)(. *) <. .>
Ó Ó Ó Ó
M M M M M M
→ * qu u yur nit ka a

b.

àa Rà Nìi raat → aa Ra Nii raat

(. *)(. *)(. *)<.>
Ó Ó Ó Ó
M M M M M M M
→ * a a Ra Ni i ra at (by SLH "Double") [29]

(. *)(*)(. *)<. .>
Ó Ó Ó Ó
M M M M M M M
→ * a a Ra Ni i ra at

The problem here is that each syllable has stress not on its first but on its second vowel, which has already been pointed out in section 2. Next, in Palestinian, Light-syllabic Trochee generates unattested patterns when its stress is approached in place of Moraic Trochee (cf. (36)):

(42) Light-syllabic Trochee

a.

(*)(*)(*) (·*)(·*)<(·)>
Ó Ó Ó Ó Ó Ó Ó
báarakat → baarakat → baara kat → * baara kat
MM M̆M MM MM M̆ MM MM M̆ MM

b.

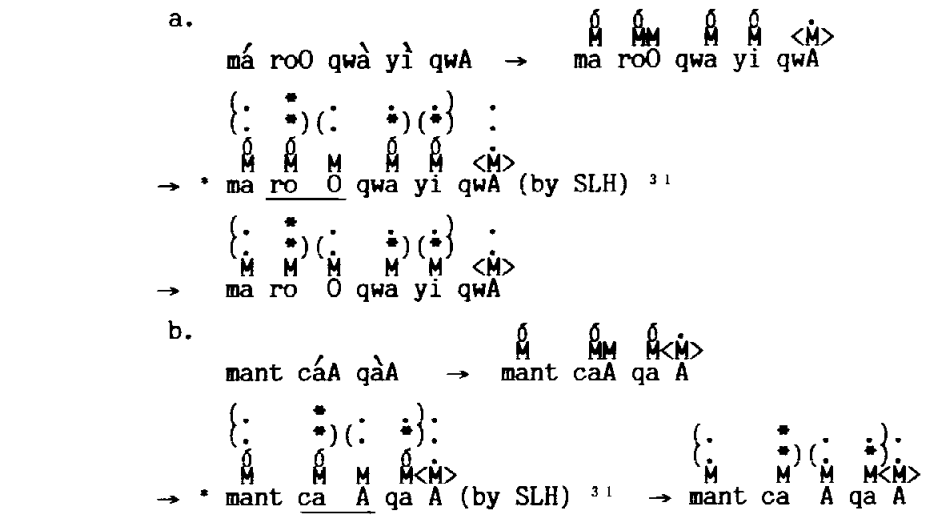
(*)(*)(*) (·*)(·*)<(·)>
Ó Ó Ó Ó Ó Ó Ó
qállamat → qallamat → qalla mat → * qalla mat
MM M̆M MM MM M̆ MM MM M̆ MM

It is true that Light-syllabic Trochee captures the stress patterns found in other data, but the examples above are not explained in any way, other things in (35) being equal. Third, in Southern Paiute, which seems to have Moraic Iamb, Light-syllabic Iamb cannot be used to account for its stress; that is, the situ-

ation is just the opposite in the case of Yupik: [30]

(43) Moraic Iamb

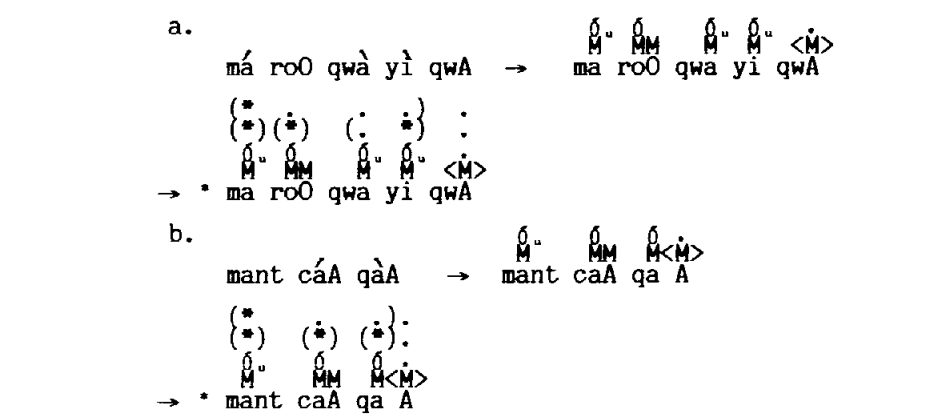
a.



b.

(44) Light-syllabic Iamb

a.



b.

The ill-formedness in (44) seems to be resolved by no means since the principles are not violated anywhere. Finally, like Palestinian, Old English stress is not accounted for by Light-syllabic Trochee in substitution for Moraic Trochee. For discussion, see Tanaka (1990b in this volume).

We have so far argued that Light-syllabic Trochee and Iamb are not substituted for Moraic Trochee and Iamb respectively. We must, at this point, confess that there are some languages in which the substitution is possible: Cairene and Winnebago, whose stress is analyzable in terms of either Moraic Trochee or

Light-syllabic Trochee.

In section 3.1, we have introduced, without discussion, Light-syllabic Trochee and Iamb into our foot inventory, but the non-substitutability observed in the four languages above shows that they are very distinct from Moraic Trochee and Iamb, and Yupik stress particularly provides us good evidence for introducing Light-syllabic Iamb. If Cairene and Winnebago turn out to have Light-syllabic Trochee, evidence will increase in favor of these feet, which awaits further research.

Footnotes

* This paper is a slightly revised version of the paper read at the conference of the Tsukuba Circle of Phonologists. I would like to thank Shosuke Haraguchi, Masao Okazaki, Takeru Honma, and Yukiko Kazumi for their valuable comments and suggestions on the earlier paper. All remaining inadequacies are due to the author.

[1] Prosodic categories constitute their own tiers in the prosodic hierarchy. They include mora (M), syllable (σ or S), foot (F), phonological word (PWd), phonological phrase (PPh), intonational phrase (IPh), and Utterance (Ut). Mora has not been represented by stress researchers in the prosodic hierarchy, but in Tanaka (1989) various arguments are exhibited in favor of mora as a prosodic category constituting its own tier.

[2] The prosodic theory like ours is different from the *metrical theory* like Halle and Vergnaud (1987), Hayes (1987), and Haraguchi (1988) in that the former explains phenomena in terms of prosodic constituents and the latter in terms of metrical constituents. Since the metrical constituents include neither mora nor syllable, the metrical theory does not cover, say, compensatory lengthening. The prosodic theory, therefore, has much wider coverage than the metrical theory. Specifically, it is subclassed into *prosodic phonology*, which is concerned with stress, meter, epenthesis, vowel reduction, vowel deletion, vowel lengthening, and vowel shortening, and *prosodic morphology*, which covers reduplication, hypocoristic formation, and so on.

[3] The Extraprosodicity Condition has been formulated in the following way (cf. Tanaka (1989)):

i) Extraprosodicity Condition
A prosodic category can be extraprosodic only if it is located at the edge of the phonological string.

For the formulations of the Strict Layer Hypothesis and the Minimality Condition, see section 3.1.

[4] The naming is our responsibility.

[5] Here and below, a voiceless /l/ is depicted as *L*; a velar nasal as *N*; a voiced uvular fricative as *ʁ*; and a voiceless uvular fricative as *R*.

[6] In what follows, round brackets mean the boundaries constructed by Constituent Construction while the square brackets are the boundaries inserted by Boundary Insertion.

[7] Halle derives the stress of the word as in (6c), but the actual derivation by (4) does not proceed in that way; in fact, the derivation raises a serious problem. See section 2.

[8] We will demonstrate in section 3 that Yupik is a syllable-counting language.

[9] Intrasyllabic boundaries also arise when right-headed feet are constructed *from right to left*. Of course, in that case, not left but right boundaries are assigned by Boundary Insertion:

ii) AR (heavy syllables); BI (heavy syllables)

```
        *                          *  *
    *  **]                      (*  *)(*]
... CV CVV ...   →   ... CV CV  V ...
... CV CVC ...       ... CV CV  C ...
```

(right-dominant-footed languages)

[10] In (18), a word boundary is represented as #.

[11] In word-initial position, the same configuration occurs with two heads per syllable when right-headed feet are constructed *from right to left*:

iii) AR (heavy syllables); BI (heavy syllables)

```
    *                  *  *
   **]                (*)(*]
# CVV ...   →   # CV  V ...
# CVC ...       # CV  C ...
```

(right-dominant-footed languages)

As stated earlier, whether the boundaries to be assigned are left or right depends solely on the directionality of foot construction.

[12] This is also the case with languages in which left-headed feet are constructed *from right to left:*

iv) a. AR (heavy syllables); BI (heavy syllables)

```
      *                    *
     **]                  (**]
... CVV ...    →     ... CVV ...
... CVC ...          ... CVC ...
```

b. AR (heavy syllables)

```
      *                    *
     **                   (**)
... CVV ...    →     ... CVV ...
... CVC ...          ... CVC ...
```

c. BI (heavy syllables)

```
      *                    *
     **]                  (**]
... CVV ...    →     ... CVV ...
... CVC ...          ... CVC ...
```

(left-dominant-footed languages)

All the three theoretical problems pointed out so far occur only when both the Accent Rule and Boundary Insertion apply in a language. To eliminate such a case, the following constraint would come to our mind, as Halle indeed does:

v) Idiosyncratic stress (line 1 asterisks) may not be assigned to syllables with more than one stress-bearing element.

Since Boundary Insertion may apply only to syllables with more than one stress-bearing element, v) implies that the Accent Rule and Boundary Insertion may not apply at the same time. However, we must say that the constraint is an ad hoc stipulation.

[13] In Cairene, not only vowels but also consonants are made stress-bearing; that is, all rime phonemes bear stress:

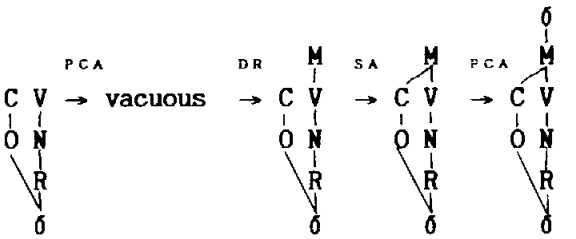
vi)

```
   ** * * * * **                    (*  *  *  *)
?adwiyatuhumaa 'their fighters' →   (**)(* *)(*)
                                    ?ad wiya tuhu<maa>
```

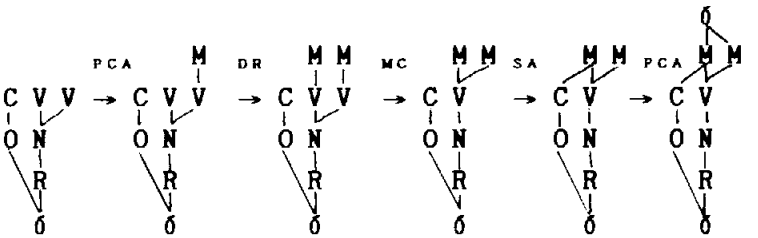
For details, see Halle and Vergnaud (1987) and Halle (1990).

[14] The actual derivations proceed as below, for example, in the case of languages with the value *Rime • [no restriction]* (here, PCA = Prosodic Categories Assignment; DR = Default Rule; SA = Stray Adjunction; and MC = Merging Convention):

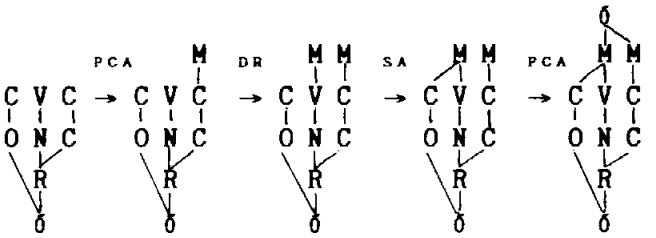
viii) a.



b.



c.

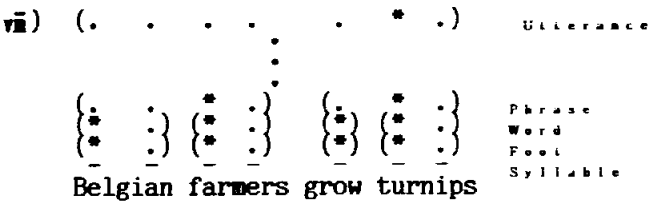


We assume the syllable plane indicated below the central line of phonemes as well as the stress plane (the prosodic hierarchy). Moras are assigned by Prosodic Categories Assignment in accordance with the Mora Parameter on the basis of the information of the syllable plane.

[15] Henceforth, the direction of construction is indicated as L to R (left to right) or R to L (right to left), and the syllable type as σ (any syllable), $\sigma_{\cdot}$ (light), or $\sigma_{\cdot\cdot}$ (heavy).

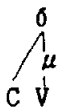
[16] Hayes's (1987) representation is illustrated as follows:

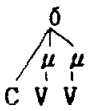
viii)



Belgian farmers grow turnips

A heavy syllable is depicted as - here. It is to be noted that this prosodic hierarchy, unlike ours, does not contain the mora tier. On the other hand, Hayes (1989a) represents mora as a sub-syllabic node which does not have its own prosodic tier, in the analysis of compensatory lengthening as in ix):

ix) a. 

b. 

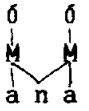
c. 

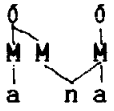
In the representation, the Strict Layer Hypothesis is not at work any more, or otherwise moras would not dominate all segmental material (the violation of (28a)) and each syllable would immediately dominate not only moras but also segments (the violation of (28b)). That is why Hayes does not regard mora as a prosodic category nor represents it in his prosodic hierarchy. Compare ix) with vii) in footnote 14.

[17] This implies that mora is a prosodic category. For further arguments in favor of mora as a prosodic category, see Tanaka (1989).

[18] (30c) violates the Minimality Condition as well because the foot contains no syllable. See (31).

[19] Geminates are "ambimoraic" and do not violate the Strict Layer Hypothesis. For instance, [anna] is represented as either x a) or x b), where a coda consonant counts as mora in the latter and does not in the former:

x) a. 

b. 

In either representation, moras directly dominates all segmental material and syllables all and only moras.

[20] This condition was initiated by McCarthy and Prince (1986), but the original one is quite different from ours. According to them, it generally obtains that min F = $[\delta_{\mu\mu}]^F$ and min δ = $[\delta_c]^S$. δ_c is a core syllable meaning CV or V. McCarthy and Prince do not take mora as a prosodic category, and hence the minimal form of syllable is a core syllable, not a mora.

[21] As noted in footnote 15, $\delta_{\mu\mu}$ indicates a heavy syllable.

[22] The situation is the same as such general principles as the Obligatory Contour Principle (McCarthy (1986), Yip (1988), and Odden (1988)) and the Stress Clash Hierarchy (Haraguchi (1988)): when there is a violation of the former principle, it is resolved by delinking (deletion), spreading (merging), movement, and so on whereas when there is a violation of the latter, either stress movement or stress deletion applies. But we must realize the crucial difference in applicability of the rules between the Obligatory Contour Principle and the Stress Clash Hierarchy on the one hand, and the Strict Layer Hypothesis and the Minimality Condition on the other. That is, what resolution applies is determined language-specifically in case of violation of the former two principles while in the case of the latter two, it relies on the way in which they are violated. See section 3.1.

[23] Whether a violation is single or double depends solely on the number of foot involved in the configuration: when two feet directly and indirectly dominantes a mora at the same time, the violation is double while when only a single foot immediately dominates a mora, it is single. It may be said that a double violation always contains syllable-internal foot boundaries.

[24] After the application of Postlexical Tier Deletion, there always occur violations of the Minimality Condition and the Strict Layer Hypothesis because C_i contains no constituent of C_{i-1} and directly dominates C_{i-2} when the tier of C_{i-1} is deleted. In this case, the syllable tier is deleted, and as a consequence, feet contain no syllable and directly dominate moras. However, these violations pose no problem and are licensed since the rule applies in the postlexical stratum: the principles are effective only in the lexical stratum.

[25] An idiosyncratically stress-deleting rule is referred to here as destressing, and the one triggered by some principle as stress deletion.

[26] The following way of refooting is also possible, but the resultant output is the same as the one in (40e):

x i) àg Nuà q'u tàr t'uà Na

(.* .)(. * .) (.* .)
Ó Ó Ó Ó Ó Ó
M M M M M MM M

→ * ag Nu a q'u tar t'ua Na (by SLH "Double")

(.*)(. * .)(. *.)(*)
Ó Ó Ó Ó Ó Ó
M M M M M MM M

→ * ag Nu a q'u tar t'ua Na (by MC)

(.*)(. *) (. *) (.* .)
Ó Ó Ó Ó Ó Ó
M M M M M MM M

→ ag Nu a q'u tar t'ua Na

[27] Although in this language, Refooting applies in violation of any principle, a violation of the Minimality Condition is resolved generally by Stress Deletion as (34b) shows. This is the case with Seneca, Khalkha, Aguacatec, Yana, Creek, Warao, and Cayuvava. For example, in Cayuvava with min F = [M M]^{s} again, the rule applies in the following manner:

x ii) The Parameter Values for Cayuvava Stress
- a. Extraprosodicity - - - M • Right
- b. Mora - - - - - - - - - - Rime • [+ syllabic]
- c. Foot - - - - - - - - - - (. * .) M M M (R to L)

x iii) a. càadiròboBurùruce 'ninety-nine'

Ó Ó Ó Ó Ó Ó Ó Ó.
MM M M M M M M<M>

→ caadiroboBururuce

(* .)(. * .)(. * .).
Ó Ó Ó Ó Ó Ó Ó Ó
M M M M M M M M<M>

→ ca a dirobo Bururuce

b. ikitàparerèpeha 'the water is clean'

Ó Ó Ó Ó Ó Ó Ó Ó.
M M M M M M M M<M>

→ ikitaparerepeha

(*)(. * .)(. * .).
Ó Ó Ó Ó Ó Ó Ó Ó
M M M M M M M M<M>

→ * i kitapa rerepeha (by MC)

<.>(. * .)(. * .).
Ó Ó Ó Ó Ó Ó Ó Ó
M M M M M M M M<M>

→ i kitapa rerepeha

In x ⅲ b), the foot on the initial syllable contains only a mora, which is a violation of the Minimality Condition. Then, Stress Deletion deletes the head of the foot, and as a result, it loses its genuine status as foot. The Minimality Condition is now satisfied, for it is not a foot any more. The foot in question is, as it were, made "extraprosodic", and does not violate the Extraprosodicity Condition since the extraprosodic foot is located at the edge of the phonological string (see footnote 3). Note here that the Clash Avoidance Principle does not trigger Stress Deletion, for there is no stress clash in x ⅲ b). Compare our approach to Cayuvava stress with the ones by Halle and Vergnaud (1987) and Haraguchi (1988).

[28] The outputs in (40c-e) result in a "single" violation of the Strict Layer Hypothesis, and hence each syllable tier is deleted by Postlexical Tier Deletion.

[29] The unary foot loses its genuine status after its head is deleted by Destressing (37c), so that it is not a violation of the Minimality Condition although it contains no syllable. The situation is the same as that of x ⅲ b) in footnote 27.

[30] The parameter values other than that of foot are shown below (Tanaka (1989)):

x ⅳ) a. Extraprosodicity - - - M • Right
b. Mora - - - - - - - - - - Rime • [+ syllabic]
c. Phonological Word - - - $(*_{\dot{F}_1}\ \dot{F}_2\ \ldots\ \dot{F}_n)$

[31] In general, a "double" violation of the Strict Layer Hypothesis triggers Refooting, as (34c) shows, but in this language, the violation is not taken to be so serious, triggering Postlexical Tier Deletion.

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