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Old English as a Mora-counting Language: Stress and its Relation to High Vowel Deletion *

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0. An Overview of the Basic Data

It seems to have been thought among stress-researchers that Old English stress is quite simple: except for prefixal forms, its stress generally falls on the first syllable from the beginning of words. Hence, even pioneering studies on stress, which have presented a revolutionary framework and accounted for stress of vast varieties of languages, are not concerned with Old English stress, probably, as a trivial matter or something (Hayes (1981, 1987), Halle and Vergnaud (1987), and Haraguchi (1988)). It is true that such a simple stress is rather uninteresting and that Keyser and O'Neil (1985) analyze the language as left-dominant- and unbounded-footed, which in turn implies that it has no secondary stress. The language, however, does have secondary stress according to Suphi (1988) and Okazaki (1989) and, more luckily, its behavior is very odd and so fairly interesting. [1] Okazaki generalizes it on the basis of various arguments, as in (1):

(1) a. Primary stress falls on the initial syllable of a word.
b. Secondary stress falls on the penultimate syllable of a word when it is preceded by one heavy syllable or two light syllables.

Examples to justify the generalization are given below, where in (2a) the penult is preceded by one heavy or two lights and in (2b) it is preceded by only one light or nothing; and (2c) shows that the penult also has secondary stress if preceded by two heavies: [2]

(2) a. hángòde blíndnèsse síngènde (one closed)
háalìgne hláafòrdes léornère (one long)

	máDelòde	áeDelìnga	grýrelìcu	(two lights)
b.	lúfode	cýninga	wérodum	(one light)
	háalig	stréngest	wérod	(nothing)
c.	háalignèsse			(two heavies)

Then, our task is, first of all, to capture this unusual stress distribution. Especially, we must give a principled account of why the penult has stress if preceded by one heavy, two lights, or two heavies, or why these three count as the same thing with respect to stress assignment.

Moreover, since Keyser and O'Neil (1985), it has been agreed that Old English stress, or strictly, its foot is closely related to its segmental rule called high vowel deletion. This phenomenon is seen, for example, in (3) (they are taken from the literature):

(3) a.	/wordu/	→	[word]	/stefnu/	→	[stefn]
	/heeri/	→	[heer]	/laaru/	→	[laar]
b.	/werudu/	→	[werud]	/monigu/	→	[monig]
c.	/lofu/	→	* [lof]	/heri/	→	* [her]

With respect to the relation between the feet and the rule, Keyser and O'Neil claim that Old English has two metrical planes: one is the stress plane in which left-dominant, unbounded feet are constructed as stated above, and the other is the vowel deletion plane in which right-dominant, quantity-sensitive, bounded feet are constructed from left to right. Then, high vowel deletion is, as their argument goes, formulated with reference to the feet in the vowel deletion plane; in other words, this rule is related to the feet in the vowel deletion plane, not those in the stress plane. But, at this moment, we must ask whether the two metrical planes are really needed to capture the relation between feet and high vowel deletion. That is because we can observe that the behavior of the deleted vowel is exactly the same as that of the secondary stress: the vowel to be deleted is preceded by one heavy syllable or two light syllables. If so,

there is a good possibility of explaining the phenomenon exhibited in (3) with a single metrical plane (i.e. the stress plane).

In sum, we can raise the following questions as to the prosody of Old English: [3, 4]

(4) a. To what extent can we provide a natural and straightforward account of the quite odd behavior of Old English stress?
b. Why are the three syllable structures (i.e. one heavy, two lights, and two heavies) are taken as equivalent?
c. How can we capture the environmental similarity of the occurrence of secondary stress and high vowel deletion?
d. How many metrical planes are necessary for the account of Old English prosody?

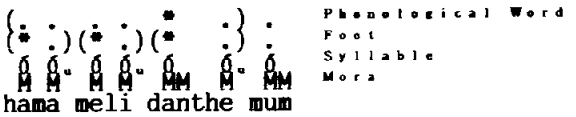
These questions naturally come to our mind when we look at the observations made earlier. It then follows that a better theory must give a plausible answer to each of them. In what follows, we will compare three approaches to the Old English prosody, including a hypothetical one, and seek for a better theory from the viewpoint of the questions posed in (4). In section 1, we will present an account in the framework of Tanaka (1989, 1990a contained in this volume) on the assumption that Old English is a mora-counting language; section 2 will exhibit two other approaches in the framework of Halle and Vergnaud (1987): one is made in Okazaki (1989), and the other is a hypothetical one; and finally, in section 3, we will reconsider the obtained results, and conclude that the language is mora-counting.

1. Old English as a Mora-counting Language

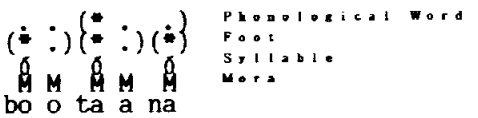
When we say "mora-counting" or "syllable-counting", what in the world is a language counting? In other words, what are the elements counted by a language when we use the term "counting"? It seems that phonologists have so far used the notion or term intuitively but that we must define it in a strict manner. In

general, a phonological counting device is taken to be a prosodic category like mora, syllable, foot, phonological word, and so on. For example, consider the prosodic hierarchies in (5):

(5) a. English *hàmamèlidánthemum*



b. Winnebago *bootáana* 'he hit him'



Here, each prosodic constituent counts the constituents below it when it is assigned: a syllable counts moras; a foot counts syllables (in English) or moras (in Winnebago); and a phonological word counts feet. Note, however, that there is no language known as "foot-counting" or "phonological-word-counting" and that the elements a language is usually said to count seem to be either syllables or moras. That is why we say that "in such and such a language, stress falls on the first (second, third, even-numbered, or odd-numbered) *syllable*(*s*) or *mora*(*s*)". Then, why is the usual counting limited to either of them? We claim that what a language counts in stress assignment corresponds exactly to what a foot counts in the language: English has a foot called *Quantitative Trochee*, or $(\overset{*}{\acute{\sigma}}\ \dot{\sigma})$, which counts and pairs syllables whereas Winnebago has a foot called *Moraic Trochee*, or $(\overset{*}{\acute{M}}\ \dot{M})$, which counts and pairs moras. This claim parallels the fact that the former language is known as syllable-counting and the latter as mora-counting. It thus follows that whether a language is syllable- or mora-counting depends entirely on what its foot counts, or on what are its stress-bearing elements. [5]

Now let us turn to our account of Old English prosody. As for stress, the language has the following parameter values:

(6) The Parameter Values for Old English Stress

a. Extraprosodicity - - - $\acute{\sigma}$ • Right

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

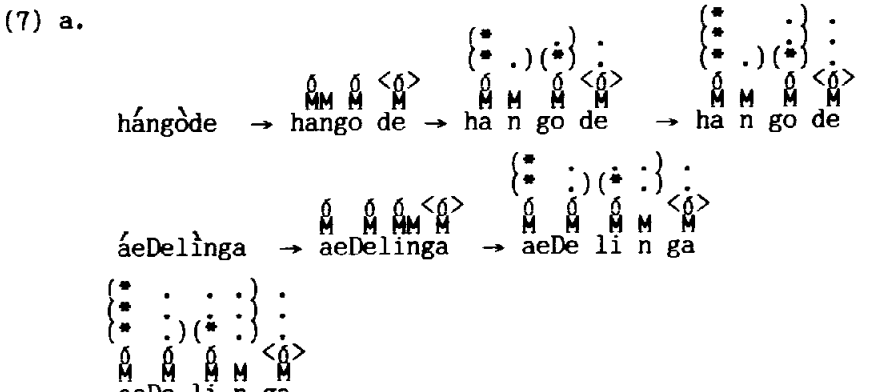
c. Foot - - - - - - - - - - $(\overset{*}{M}\ \dot{M})$

d. Superfoot - - - - - - - $(\overset{*}{F}\ \dot{F})$

e. Phonological Word - - - $(\overset{*}{F_1}\ \dot{F}_2\ \ldots\ \dot{F}_n)$

(6a) shows that in constructing the prosodic hierarchy, the rightmost syllable is invisible to the construction, and (6b-e) are the types of prosodic categories specified: mora is assigned to any segment in the rime; foot pairs two moras from left to right, with the left one strong; superfoot pairs two feet from left to right, with the left one strong; and phonological word gathers superfeet, with the leftmost one strong. [6] This system accont for the seemingly complicated patterns in (2) in a straightforward manner:

(7) a.



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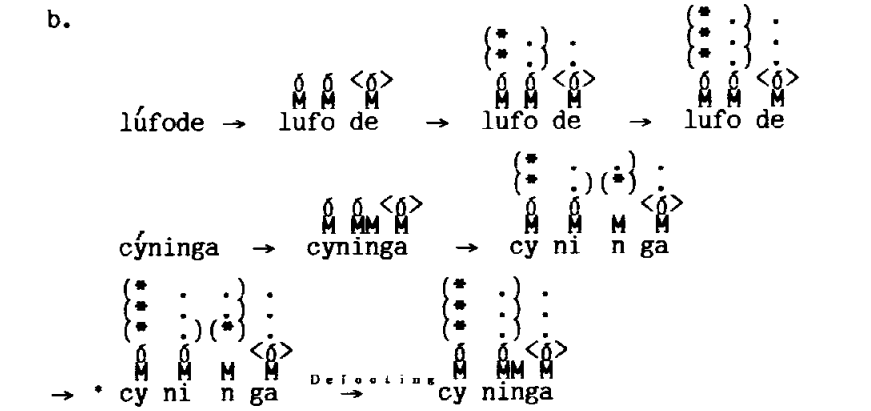
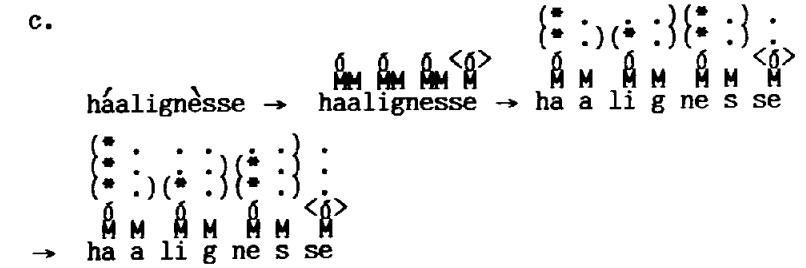


c.



In the derivation of *cýninga* in (7b), Defooting must apply, but we need not assume that this language has the rule. In other words, it is not a language-particular rule but one of the resolutions in case of violation of a set of principles working on the prosodic organization: when the Strict Layer Hypothesis is violated, Postlexical Tier Deletion applies as in Winnebago, Cairene Arabic, Palestinian Arabic, and Southern Paiute; when the Minimality Condition is violated, Stress Deletion applies as in Seneca, Khalkha Mongolian, Aguacatec Mayan, Yana, Creek, Warao, and Cayuvava; when the Strict Layer Hypothesis and/or the Extraprosodicity Condition are violated, Refooting applies as in Winnebago, Cairene, Palestinian, and Chugach Alutiq; and when both the Strict Layer Hypothesis and the Minimality Condition are violated, Defooting applies as in Palestinian (examples and further details of the principles and the resolutions are discussed in Tanaka (1990a in this volume)). We then claim that the fourth stage of the derivation of *cyninga* violates the Strict Layer Hypothesis and the Minimality Condition because a foot immediately dominates a mora and, at the same time, does not contain any syllable at all, and therefore that Defooting applies to exclude the violation. [7] It thus follows that we can give a fairly natural account of Old English stress, which implies an answer to question (4a).

Now, it is obvious that one heavy, two lights, and two heavies have the same status with respect to secondary stress: they all constitute a *binary* foot. The penultimate syllable of *hangode*, *aeDelinga*, and *haalignesse* is preceded by a binary foot or superfoot, and that is why another foot or superfoot can be located there and hence secondary stress is marked. However, one

light syllable never constitutes a binary foot and is not equivalent to one heavy syllable, two light syllables, and two heavy syllables. This is our answer to question (4b).

Let us turn to our account of high vowel deletion. First, the words in (3) have the following prosodic structures in accordance with the parameters given earlier:

(8) a. [heer] b. [monig] c. [lofu]

Then, high vowel deletion can be formulated as in (9) (Tanaka (1989)):

(9) High Vowel Deletion

$$V\ [+\text{ high}] \rightarrow \phi \ / \ (\underset{M}{*}\ \underset{M}{\cdot})\ \underset{|}{M}\ \_$$

This formulation means that a high vowel, which is short and not closed by a consonant, is deleted when preceded by a binary foot. Rule (9) neatly deletes the final vowel in (8a,b) as is expected, but not the one in (8c) since it is preceded by a unary foot. All the data given in (3) are accounted for by (9), which, more importantly, reflects the fact that the deletion applies in exactly the same environment as the assignment of secondary stress: the deleted vowel and the secondary stress are both positioned after a binary foot. That is why high vowel deletion appears to occur after one heavy or two lights just as secondary stress does, and an answer to (4c) is obtained. [8] One might also ask why a high vowel may be deleted after a binary foot but not a unary one and why such a segmental rule interplays with the prosodic unit although the two are apparently unrelated. We suggest that Old English has the Minimality Condition to the effect that min PWd = [M M]^{PWd}: a word must include at least two moras. After the construction of a binary foot including two moras, it already guarantees the condition and deletion is allowed to apply, but otherwise the condition would be violated if dele-

tion applied (see (8c)). It thus follows that we can also explain the interaction between foot and high vowel deletion in a principled way.

Our answer to question (4d) is self-evident. Only one prosodic plane is sufficient to explain stress and deletion and to answer (4a-c). We will show in the next section that the other approaches to be discussed need two metrical planes anyhow.

Recall here that Old English has a foot pairing two moras, or Moraic Trochee. Languages with this foot are Winnebago, Cairene Arabic, and Palestinian Arabic, which are all known as mora-counting languages. Previous analyses have treated Old English as a syllable-counting language such as Sievers (1885, 1893), Campbell (1959), Keyser (1969), Halle and Keyser (1971), and Keyser and O'Neil (1985), but have not answered the questions in (4). In what follows, we will take into account two candidates to answer the questions in the metrical framework and examine whether Old English is mora-counting or syllable-counting.

2. Approaches in Halle and Vergnaud's (1987) Framework

2.1 Okazaki (1989)

In addition to generalizing Old English stress in a uniform manner, Okazaki (1989) proposes an interesting account of it, postulating two metrical planes: one is for stress assignment and the other is for deletion. (10) and (11) are the parameter values for each metrical plane:

(10) The Parameter Values for the Stress Plane
  a. Stress-bearing elements: vowels of rime heads.
  b. Line 0: [+ HT, + BND, left, right-to-left].
  c. Line 1: [+ HT, - BND, left].

(11) The Parameter Values for the Deletion Plane
  a. Stress-bearing elements: vowels of rime heads.
  b. Accent Rule: heavy syllable.
  c. Line 0: [+ HT, + BND, right, left-to-right].

Note here that stress-bearing elements are regarded as rime head vowels and that a syllable has only a single stress-bearing ele-

ment in it. This implies that Old English is taken as syllable-counting. After constructing metrical constituents in each plane, the following rules of deletion apply:

(12) Clash Deletion

* → . / * __ * Line 1 Deletion Plane

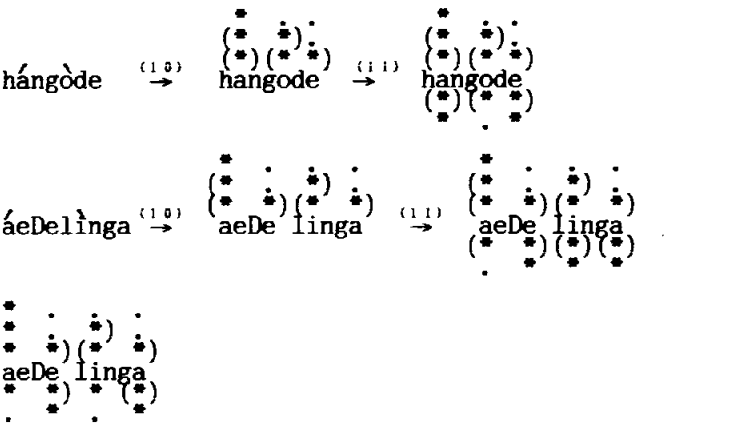
(13) Stress Deletion

* → . / (* *) Line 1 / (* *) Line 0 Stress Plane

(* *) Line 0 / (* *) Line 1 Deletion Plane

Rule (12) deletes the center of three sequential asterisks in the deletion plane; and rule (13) also deletes a clash in the stress plane, in light of the information on the constituent in the deletion plane. Given (10)-(13), all the stress distributions are captured correctly as below:

(14) a.



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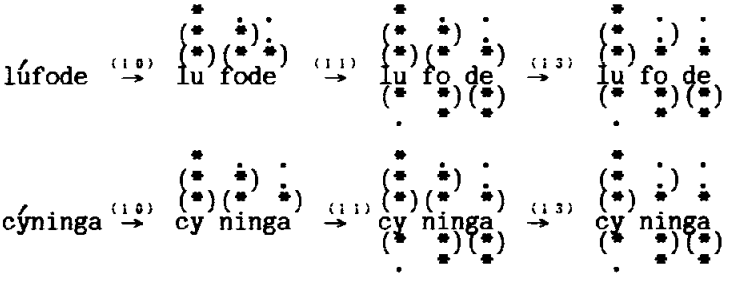

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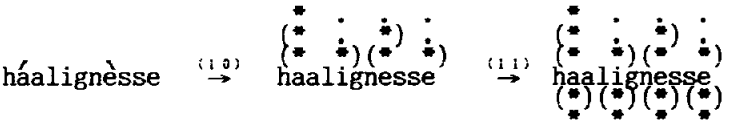
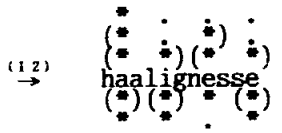
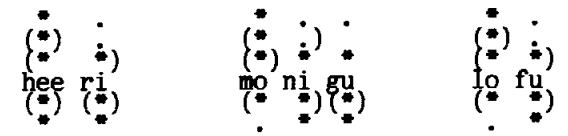




One of the advantages of Okazaki's approach is that it can also account for high vowel deletion if the deletion plane is made use of: the deletion plane functions not only as deleting incorrectly assigned secondary stress as we have seen but also as deleting high vowels in an appropriate way. Consider the metrical structures of the following words:

(15) a. [heer] b. [monig] c. [lofu]



Since the vowels to be deleted are preceded by either a unary or a binary foot, the following formulation is possible, following Keyser and O'Neil (1985): [9]

(16) High Vowel Deletion

$$V \rightarrow \phi \;/\; F\,[\;\underline{\quad}^{R}\;]$$

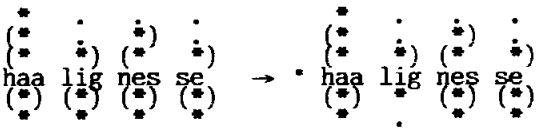
$$V: [+\text{high}]$$

Informally, a high vowel which is short and not closed is deleted if preceded by any foot in the deletion plane. This rule deletes the high vowels in (15a,b), but not the one in (15c) because it is not positioned after a foot at all, capturing the contrast correctly.

Now, let us examine this approach in terms of the questions in (4). First, as to (4a), we must say that this account of Old English stress is not so straightforward and natural as ours since it should assume two language-specific rules: Clash Deletion and Stress Deletion. A better way will do the task of explaining stress not by stress deletion but by constituent construction only. We must indeed postulate Defooting, but it is triggered by some principles, and applies to any environment if

the violation occurs, while the two rules are not triggered by any general principle, say, the Clash Avoidance Principle in the sense of Haraguchi (1988) although they substantially eliminate a clash. If Stress Deletion applied to any environment with a clash, triggered by such a principle, they would incorrectly delete secondary stress on *hángòde*. Moreover, Clash Deletion should specify not only its deletion environment but also its direction of application [right-to-left]: if it applied from left to right, the constituent head would be deleted not on *-nes-* but on *-lig-*:

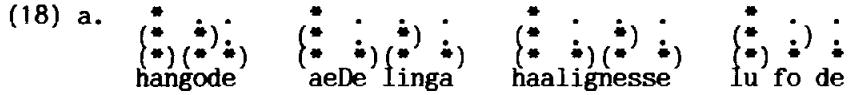
(17)



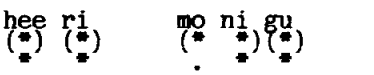
We can then conclude that Stress Deletion and Clash Deletion should stipulate the deletion environment or the directionality and that they are idiosyncratic and not triggered by the Clash Avoidance Principle. Second, we may ask at the moment why Clash Deletion is assumed in this approach though the occurrence of stress is never sensitive to the rule: the secondary stress of *aeDelinga* in (14a) and *haalignesse* in (14c) can be explained even if Clash Deletion does not apply to them. It seems that the rule is necessary to answer question (4b). As is seen in (14), the penultimate syllable is not given the head of a constituent in the deletion plane when preceded by one heavy, two lights, or two heavies (as in (14a,c)), but it is if preceded by only one light (as in (14b)). That is why one heavy, two lights, and two heavies constitute a class with respect to secondary stress. But this reasoning has two inherent problems: one is that if Clash Deletion were not assumed, the equivalency of the three would not be captured since the penult would have the constituent head in the deletion plane after two lights or two heavies as in *aeDelinga* and *haalignesse*; and the other is that even if Clash Deletion is assumed, the equivalency is captured only negatively, because it should be said that the penult *does not* have the constituent head in the deletion plane when prece-

ded by the three. [10] In contrast, in our account discussed in section 1, we can simply say in a positive manner that the three have a binary foot, without assuming such an idiosyncratic rule. Third, let us examine this approach in terms of (4c). Okazaki's utilized feet seem to be able to capture the intuition that both the penult with secondary stress and the deleted high vowel are preceded by one heavy syllable or two light syllables (or two heavies). Consider the final outputs generated by his stress system once again:

(18) a.



b.



It appears that the deleted high vowel is preceded by a foot in the deletion plane while the secondary stress, *if it exists*, is also preceded by a foot in the stress plane (*lufode* has no secondary stress, and is not problematic). The feet in both planes, though constructed by different parameter values ((12) and (13)), correspond to one heavy, two lights, and two heavies, which implies that the occurrence of secondary stress and high vowel deletion has similarity in environment. However, the bare fact leads one to think that the task should be done in a single metrical plane because the similarity of the two is attributed to the similarity of the feet in each metrical plane. In fact, the feet in the two planes are exactly the same in nature, which is formally expressed by our approach given in section 1 (Answering (4d) is evident, and so omitted).

2.2 Another Possible Analysis

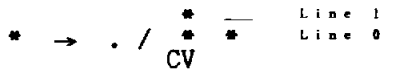
The final analysis to be examined is a hypothetical one in the framework of Halle and Vergnaud (1987). It appears at first sight to be very simple, but will turn out to be problematic. [11] First, the occurrence of stress is predicted by the parameter values in (19), which are the same as assumed in Okazaki, i.e.

(10):

(19) The Parameter Values for the Stress Plane
  a. Stress-bearing elements: vowels of rime heads.
  b. Line 0: [+ HT, + BND, left, right-to-left].
  c. Line 1: [+ HT, - BND, left]

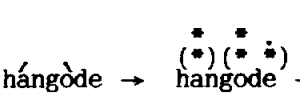
As seen in the derivations illustrated in (14b), all the deleted secondary stresses are the ones preceded by a light syllable, and therefore we may assume that instead of postulating the deletion plane and Stress Deletion like Okazaki, the following rule is sufficient to the task:

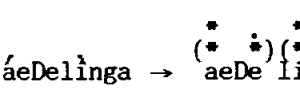
(20) Clash Deletion



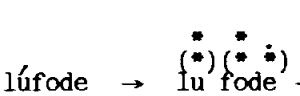
For instance, all the words we have seen are assigned stress properly in the following manner:

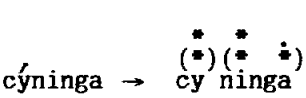
(21) a.



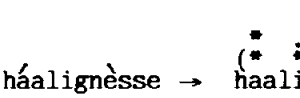


b.





c.



Since Clash Deletion (20) applies only when the deleted asterisk of a clash follows a light syllable, the examples in (21b) undergo the rule.

In spite of its apparent elegancy, this analysis with the above parameter settings, as it stands, cannot predict the contrast as below:

(22) a. [heer] b. [monig] c. [lofu]

As a consequence, it must also make use of Okazaki's deletion plane and its constituents generated by (11). Then, High Vowel Deletion (16) as formulated by Keyser and O'Neil captures the contrast and deletes the high vowels only in (22a,b) correctly. This situation is all the same as that in (15).

However, some problems with the analysis arise when we reconsider it in light of questions (4a-d). First, it appears to be fairly elegant and straightforward at least with respect to the account of stress. But Clash Deletion (20) suffers from highly serious defects. The rule is idiosyncratic and not triggered by any general principle: if the Clash Avoidance Principle were at work, any grid might be deleted irrespective of whether or not it is preceded by a light syllable. Furthermore, as is pointed out by Okazaki, this rule falls into *segmentalism* in the sense of McCarthy and Prince (1986) and Tanaka (1989); that is, it is not to be seen why the deleted grid should follow CV and not CVV, CVC nor CVCV. [12] Segmental phenomena may often be given a principled account in prosodic terms (e.g. high vowel deletion or see footnote 3), but prosodic phenomena like stress is not in segmental terms. [13] We thus propose that any prosodic theory be subject to the following constraint:

(23) The One-way Constraint on Prosody
No rule of prosody can refer to the CV tier in its environment of application.

If this is the case, not only Clash Deletion but also the Accent Rule and Boundary Insertion violate the constraint and hence are problematic. That is because the Accent Rule assigns stress to CVV and/or CVC (see (11b) or Halle and Vergnaud (1987)) and Boundary Insertion assigns boundaries on line 0 to CVV and/or CVC. [14] The validity of (23) indeed awaits further research, but in either case, Clash Deletion inhibits the elegancy of this appraoch.

Second, the answer to question (4b) is that the utilized feet do not allow us to capture the class of one heavy, two lights, and two heavies: since this analysis takes Old English to be syllable-counting, one light and one heavy constitute a unary foot, and two lights and two heavies a binary foot. Moreover, Okazaki's way of capturing the class cannot be made use of, for Clash Deletion (12), which is distinct from (20), is not assumed here. However, if (12) is adopted, the equivalency of one heavy, two lights, and two heavies is explained like Okazaki. In that case, this approach must assume two rules (12) and (20), which decreases the elegancy even more. Third, this account of Old English prosody, after all, utilizes two metrical planes, and can seize the intuition that secondary stress and high vowel deletion is similar in the sense that both are observed after one heavy and two lights. But again, as pointed out in the previous section, the similarity should be ascribed not to the similarity of the feet in the stress plane and the deletion plane but to the identity of those feet represented in a single plane. This is the answers to (4c,d).

3. Summary

We have so far compared three approaches to Old English prosody in terms of the questions in (4) and argued that it is provided with a better account by the approach regarding the language as mora-counting. In short, questions (4a-d) are answered by each analysis in the following way:

(24) Tanaka's Answers

a. Defooting is assumed as well as the usual parameter settings, but it is one of the four rules triggered by violations of the general principles. So it belongs to the usual system.

b. They all constitute a binary foot, which is a positive conception.

c. They both occur after a binary foot. Why High

Vowel Deletion applies after a binary foot can also be accounted for.

d. Only one.

(25) Okazaki's Answers

a. Clash Deletion (12) and Stress Deletion (13) are assumed as well as the usual parameter settings. They are language-particular rules, which need specifications of the environment and the directionality.

b. None of them are followed by the constituent head in the deletion plane, which is a negative conception.

c. They both are followed by a foot in the stress plane and the deletion plane. Why High Vowel deletion applies after a foot is not accounted for.

d. Two.

(26) A Possible Alternative's Answers

a. Clash Deletion (12) and Clash Deletion (20) are assumed as well as the usual parameter settings. They are language-particular rules, which need specifications of the environment and the directionality.

b. None of them are followed by the constituent heade in the deletion plane, which is a negative conception.

c. They both are followed by a foot in the stress plane and the deletion plane. Why High Vowel deletion applies after a foot is not accounted for.

d. Two.

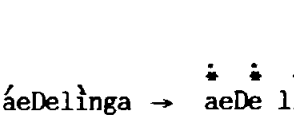
In our approach, only a light syllable constitutes a unary foot while one heavy syllable and two light syllables constitute a binary foot, which means that Old English is a mora-counting language; and in the stress plane represented by the other two approaches, one light syllable and one heavy syllable are given a unary foot while two light and two heavy syllables are given a binary foot, which implies that the language is a syllable-

counting one. As seen in (24)-(26), a more adequate account is obtained if we take it as mora-counting.

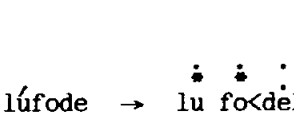
One might guess that our approach can be translated into a version in the framework of Halle and Vergnaud. A possible way to do so seems to be as in (27):

(27) a. Stress-bearing elements: all rime phonemes.
b. Extrametricality: the final syllable.
c. Line 0: [+ HT, + BND, left, left-to-right].
d Line 1: [+ HT, + BND, left, left-to-right].
e. Line 2: [+ HT, - BND, left]

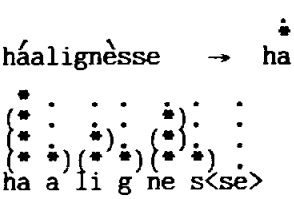
(28) a.



b.

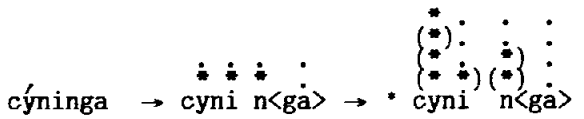


c.



But, unfortunately, this amounts to assigning secondary stress to *cyninga* incorrectly:

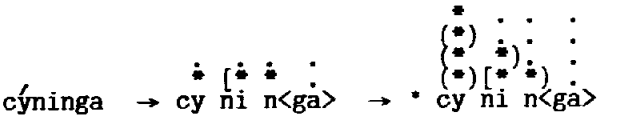
(29)



Since Halle and Vergnaud's framework does not postulate neither the Strict Layer Hypothesis nor the Minimality Condition, the ill-formed derivation is not ruled out; in fact, even if they adopt the principles, they do not work well because Halle and Vergnaud's representation is radically different from ours. Or

otherwise, the task would be done by Boundary Insertion to the effect that the left boundary is assigned to heavy syllables (Halle (1990)), but secondary stress is incorrectly assigned once again:

(30)



It follows then that Clash Deletion (20) must be assumed in any case in their framework, as well as Boundary Insertion suffering from various kinds of problems (see Tanaka (1990a in this volume)).

Footnotes

* I would like to express my deepest gratitude to the following people: Shosuke Haraguchi, Masao Okazaki, Takeru Honma, Shinsuke Homma, and Yukiko Kazumi. They all kindly and carefully gave me suggestions and comments on the present topic, reading an earlier version of the paper. I alone am to blame for all remaining errors.

[1] We must add that there is a long-drawn controversy over the existence of secondary stress in Old English (Sievers (1885, 1893), Campbell (1959), Keyser (1969), Halle and Keyser (1971), Suphi (1988), and Okazaki (1989)). We follow with Okazaki (1989) in assuming that the language does have secondary stress, since he adduces various evidence for it by examining meters and the previous studies.

[2] In what follows, a voiced interdental fricative is depicted as *D*.

[3] By the term "prosody", we mean the phenomena which are properly accounted for in terms of prosodic categories such as mora (M), syllable (S or σ = any syllable and σ_{μ} = a light one), foot (F), phonological word (PWd), phonological phrase (PPh), and so on. In addition to stress and high vowel deletion, such segmental phenomena are included as vowel reduction (Rappaport (1984)), vowel deletion (Archangeli (1984)), reduplication (Mc-

Carthy and Prince (1986, 1989, forthcoming)), vowel lengthening (Haraguchi (1988)), epenthesis (Ito (1989)), compensatory lengthening (Hayes (1989a)), vowel shortening (Tanaka (1989)), and hypocoristic formation (Poser (1984, 1990)).

[4] Questions (4a) and (4b) are also raised by Okazaki (1989).

[5] In Halle and Vergnaud's term, it depends on what number of line 0 elements are aligned per syllable. If a language has only one line 0 element per syllable, it is seen as syllable-counting; and if it has more than one line 0 element per syllable, it is mora-counting. As a result, in the former language stress-bearing elements are vowels of the rime head, while in the latter they are all vowels or all phonemes in the rime.

[6] For details of the parameters of prosodic categories and extraprosodicity, see Tanaka (1989) or Tanaka (1990a in this volume).

[7] Informerly, the Strict Layer Hypothesis requires that a prosodic category should directly dominate all and only constituents of the category ranked immediately below it; therefore, foot directly dominates syllables but not moras. The Minimality Condition requires that a prosodic category should contain at least one constituent of the category ranked immediately below it; thus, foot contain at least one syllable. Further details and arguments are discussed in Tanaka (1990a in this volume).

[8] A high vowel after two heavy syllables is also expected to be deleted, but we have no examples.

[9] The metrical structures proposed by Keyser and O'Neil to account for high vowel deletion are substantialy equivalent to those constructed by (11), although they are not aiming to delete secondary stress. In fact, they think that Old English has no secondary stress, for they use an unbounded foot in the stress plane, as stated earlier.

[10] In addition to this way of seizing the class stated in Okazaki (1989), another way is possible: secondary stress, *if it exists*, is preceded by a foot consisting of one heavy, two lights, or two heavies (as in (14a,c)). That is why they all constitute a class. The foot consisting of one light does not

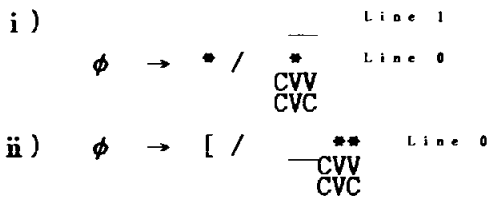
belong to the class because the words *lufode* and *cyninga* in (14b) have no secondary stress. But even the way must also assume Clash Deletion (12), which was devised only for the purpose of capturing the class.

[11] Okazaki also takes an example of the analysis cited here, and criticizes it.

[12] One might think that Clash Deletion (20) refers not to segments but to *syllables* in the statement of its condition. However, this framework does not represent syllables but only segments below foot. So what is referred to is segments.

[13] Tanaka (1989) argues against segmentalism observed in other fields such as extrametricality, compensatory lengthening, reduplication, vowel shortening, and high vowel deletion.

[14] It may be unclear why the two rules refer to the CV tier in their environments. The point is made clearer if we rewrite the two rules in the following format:



Now, we see that both of these rules refer to the CV tier in their environments.

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