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Old English Deletion: the Foot and the Syllable

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1. Deletion in a Segmental Account

As part of a larger study of Old English phonology,[1] we present an i,u-Deletion rule in terms of syllables and supersyllables (or feet).

We will begin by giving the basic fact which the deletion rule must account for: e.g., the surface alternation u~Ø of the inflectional morph in the Nominative-Accusative Plural of neuter 'a-stem' nouns:

(1)	sing:	hof	pl:	hofu	'dwelling'
		wīf		wīf	'woman'
		word		word	'word'

The traditional description posits a unitary morph /u/ for the nt. N-A Pl, and claims that deletion of i,u may obtain only in the context $\bar{V}C\_$ or $\breve{V}CC\_$ [2]; i,u are protected in $\breve{V}C\_$. Thus the underlying forms are:

(2) sing: /hof+Ø/ →[hof] pl: /hof+u/ →[hofu]
/wīf+Ø/ →[wīf] /wīf+u/ →[wīf]
/word+Ø/→[word] /word+u/→[word]

Our deletion rule[3] may be tentatively given as:

(3) $\begin{bmatrix} +hi \\ +syll \end{bmatrix} \rightarrow Ø \; / \; \left\{ \begin{matrix} \bar{V} \\ \breve{V}C \end{matrix} \right\} C \; \_\_$

But notice that the context for deletion is complex in two regards: (a) it is a disjunctive, formally arbitrary list; (b) it requires that application of the rule be dependent upon the quantity $[-long]_4$ of a segment which is three segments from the focus bar.[4] Our dissatisfaction increases as we note that the language needs the same complex environment for an independent (non-collapsible) set of Glide rules -- the glide y assimilates to C after $\breve{V}C\_$ (e.g. /bed+y+Ø/→ bedd 'bed'); it syllabifies to i (later Lowered to e) after $\bar{V}C\_$ or $\breve{V}CC\_$ (e.g. /wīt+y+Ø/→ wīte 'punishment'; /end+y+Ø/→ende'end')

2. Deletion in a Syllabic Account

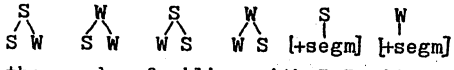
A more adequate description might avoid a purely segmental formulation, and give the deletion rule as: "high vowels delete if preceded by a heavy syllable + a consonant". We attempt to incorporate this rule into an extension of the traditional feature notation by claiming (a) that syllables may form part of the structural description or change of (a constrained subset of)

the rules of phonology; and (b) that a 'heavy' syllable is differentiated by the feature [-weak][5], a 'light' syllable by [+weak][6]. Then, in feature notation, the rule is:

(4) [+hi,+syllabic] → ∅ / [-weak] C __ [7]

But just what is this [-weak]? Following a suggestion of Paul Kiparsky[8], we extend the domain of metrical trees (of the type recently presented by Liberman and Prince (L&P in LI 1977 8.2)) to include domination of segments. In other words, we will build, first syllable trees, then incorporate these into foot or super-syllable trees (in some languages), then these into a word tree, then into phrase trees, etc. Just as in L&P, each node in the tree will be binary-branching (dominating S W or W S) -- with the difference, of course, that a node is unary branching over a segment; thus:

(5)



But the reader familiar with L&P will note a second difference: we talk of labeled root nodes, whereas L&P only label sister nodes, one as S and the other as W, so that root nodes are left unlabeled. By making our modification, we are able to define a level at which the topmost nodes are actually syllable nodes, labeled S for a heavy syllable and W for a light syllable. And our rule of i,u-Deletion is conditioned by just such a context: deletion after a heavy syllable + consonant. Further effects of our choice will be evident below.

3. Autonomy constraint on Tree rules

Immediately upon suggesting a strengthening of the phonological theory (to include metrical trees, and, in particular, to extend these to dominate segments) we were compelled to constrain our extension, by, e.g., including the nodes in a feature framework and restricting the types of branching. A number of important further constraints may be suggested[9]; one is of immediate concern to our solution of the Old English Deletion problem. Taking the definition of "tree rule" as "a phonological rule that refers to [±weak]", let us suggest (6):

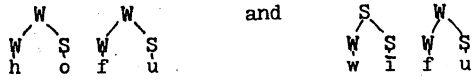
(6) Autonomy Constraint
In a tree rule, no purely segmental contexts are allowed.
(i.e., any unchanged segment must be explicitly dominated by some [±weak]).

An immediate example of a disallowed rule is our own (4)

"(4)" [+hi,+syllabic] → ∅ / [-weak] C __

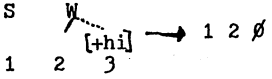
We must change this, so that C is dominated by some node. What change could we make? Well, the forms input to the Deletion rule include the disyllabics hofu and wīfu, with the structures in (7):[10]

(7)



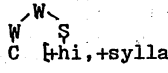
In the latter, u is deleted; we may minimally[11] change the rule to (8):

(8)



which suffices to distinguish hofu from wīfu, and does not incur the unneccessary expense of specifying that the complete SD uniquely represented by (8) is (9)[12]

(9)



But now the rule (8) makes the prediction that i and u don't delete from inside a [-weak], i.e., heavy, syllable. That is, that ī and ū don't delete (since they form nuclei of syllables 'heavy by nature'), nor do i and u delete when there is a consonant coda to their syllable. Consequently, i and u are protected before __C# [13] or __CC [14]. And indeed they are.

4. The S-B M constraint on Trees

We would like to suggest a further constraint on "tree-rules", one that also has immediate consequences for the OE Deletion rule. We may go back a moment and ask what formal consideration allowed us to say, in footnote 10, that the ho of hofu is unarguably syllabified as  instead of  ? We wish to proscribe

structures in which the syllabic nucleus is dominated by a lower W node than is some other segment in the syllable, and, more generally, we want to capture the widely-true observation that sonority increases from a syllable-initial (local) minimum, to the nucleus' maximum, down to a syllable-final (local) minimum.

First, we will generalize the sonority relation, in terms of which we formulate the requirement that the nucleus of a syllable be a segment higher on the sonority scale than any of the syllable's other segments. To a high level of accuracy, one can list the important universal aspects of this relation as in (10), with $\gtrdot_S$ meaning 'greater in sonority'.

(10) $\acute{V} \gtrdot_S \check{V} \gtrdot_S G \gtrdot_S L,N \gtrdot_S F \gtrdot_S$ obstruent stops [15]

Secondly, we need an easily defined generalization of the notion "not dominated by a lower W". We will use the "branch. number" (short form of "branching number")--given a segment s_i in a tree, its branch. number m_i is just the number of nodes one counts inclusively in going from the lowest W node above s_i up to the root node. (Always count the root node (whether W or S); thus any branch. number is greater than or equal to 1; one and only one segment in a tree has m=1).

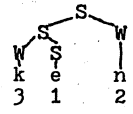
The proscription against S W over ho in hofu is via

(11) Disallow the formation of a tree with terminals s_i and s_k if both $s_i \gtrdot_S s_k$ and $m_i > m_k$

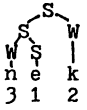
The labeling $\widehat{S\ W}$ is disallowed for ho in hofu because both the branch. number (m=2) and the sonority of the second segment are greater than that of another segment in the tree.

Now, (11) is a constraint on well-formed trees, in terms of sonority-branch. matching, but it isn't the correct constraint, because it would throw out one of the two trees in (12) as ill-formed in all languages.

(12a)



(12b)



Constraint (11) would disallow (12b) in all languages, because in that tree n has a higher sonority and branch. number than does k. And though it is indeed the case that in some languages ken is a possible syllable and nek is not, it is (a) not universally true and (b) the syllable kek would be no better, in such a language, than nek. Constraint (11) falsely claims that the coda depends on the choice of the syllable-initial consonant.

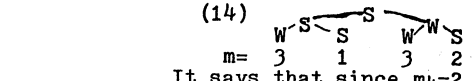
We might consider modifying (11) to compare only adjacent segments, but instead we suggest (13), wherein we do not compare two segments across a lower value m. Thus we don't compare k and n across the e, with m=1.

(13) Sonority-Branch Matching Constraint (S-B M)
Unless there's an intervening s_j with $m_j < m_k$, disallow formation of a tree with both $s_i \gtrless s_k$ and $m_i > m_k$.

5. OE Foot

What is the justification for the new constraint ? The answer comes from looking at a super-syllable level (for clearly, if the sonority of the syllable decreases monotonically from the nucleus, then (13) is needlessly more complex than a constraint comparing s_i and s_j only if they are adjacent). Constraint (13) makes predictions about the yield of a tree like (14):

(14)



It says that since $m_4=2 > m_2=1$, we can't have $s_4 \gtrless s_2$. Let us look into OE for some justification of (13).

To recapitulate earlier points, we have found that i,u delete after $\breve{V}C\_$ and $\breve{V}CC\_$, but that they are protected after $\breve{V}C\_$ or before $\_C\#$ or $\_CC$. Descriptively equivalent, but considerably more explanatory and cheaper, is our deletion rule (8):

"(8)" S W
[+hi] → 1 2 ∅
1 2 3

But more data show that improvement of (8) is required, for i,u also delete after #CVCVC_ , as in /werod+u/→ werod 'nt N-A Pl army'. Thus # W W W [+hi] is to be included in (8).

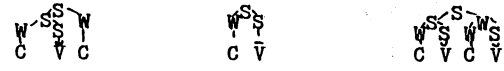
But deletion applies neither to hofu nor to the u of /cīcin+u/ 'nt N-A Pl chicken'. In both of these, the light syllable containing u is preceded by (S)W_.

The solution we suggest is that deletion applies only inside a topmost W, after our 'foot-formation' rule, applying left-to-right, consolidates two weak syllables W W into one strong foot, thus leaving the 'hofu' inside one strong foot, as also the 'cinu' of cīcinu. So in both hofu and cīcinu, the high vowels are protected, while in wīfu, wordu, and werodu, the u remains in a final weak syllable, and then deletes by (8).

Is there independent evidence for this move? Yes, in metrics,[16] a word with two light syllables WW acts just as if it contained a heavy syllable, and so metrical filters disallowing a post-tonic unstressed syllable (* ´x) do allow resolved stress over WW (´).

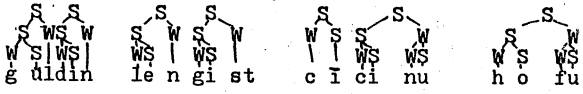
In our terms, metrical stress can fall only inside a [-weak] tree, of which there are three types:

(15)

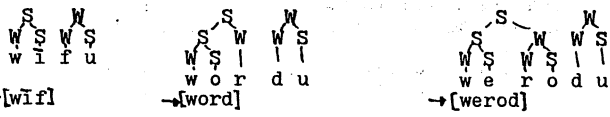


And, to return to the phonology: in our terms, i,u-Deletion occurs inside a topmost W, not inside a topmost S, and is ordered after the Foot-Formation rule. Thus:

(16) Protection environments:



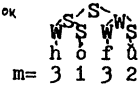
(17) Deletion environments



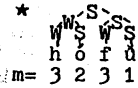
6. S-B M and OE Foot

Now, it may be clear, constraint (13) can say something of interest. For example, since $\acute{V} \gtrdot_S \grave{V}$ (by (10), and since, in OE, stress is on the first vowel of the stem, we see that the foot formed on hofu 'dwellings' must be (18a) instead of (18b), because in the latter, $s_2 \gtrdot_S s_4$ and $m_2=2 > m_4=1$.

(18a) ok



(18b) ★



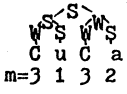
So the first thing constraint (13) tells us is that when W W forms a foot, the first W becomes a S.

A second, remarkable, prediction of (13) is dependent upon a second relation from the sonority scale (10). If a language makes use of a sonority relation between [+high] and [-high] vowels, it's always that [-hi] $\gtrdot_S$ [+hi] but not every language's phonology makes use of this relation (while every phonetics might). But the phonology of OE does distinguish [-hi] from [+hi] in about a fifth of its rules: e.g.,

(19) Glide Formation desyllabifies [+hi]; Syncope, Lower, Deletion are of [+hi] vowels; the canonical strong verb stem has e,a+ [+hi] or [-syll].

The conclusion is that OE has the relation [-hi]$>_S$ [+hi], and the prediction is that (20) is a bad foot:

(20)



since $s_4 >_S s_2$ and $m_4=2 > m_2=1$.

And in fact this is so. Consider the underlying[17] and surface forms of /hǣɔfud/[18] 'head,nt. a-stem'. Since the first syllable is heavy, Foot-Formation can never join the stem's fu to that first syllable. When fu is followed by _C# or _CC, it is protected; thus the NomS surfaces from /hǣɔfud+Ø/ as hǣɔfud . When fu is followed by Ci or Cu, a well-formed foot can be made (in which the second, non-nuclear vowel is no more sonorous than the first, nuclear vowel); thus the NPl is hǣɔfudu, and the DatPl is hǣɔfudum. But when the fu is followed by Ce, Cæ ,Co, or Ca, no foot can be formed, and fu is left as a topmost W tree, and hence its high vowel is subject to deletion; thus GenS /hǣɔfud+es/→ hǣɔfdes; DatS /hǣɔfud+e/→ hǣɔfde; GenPl /hǣɔfud+a/→ hǣɔfda.

7. Conclusion

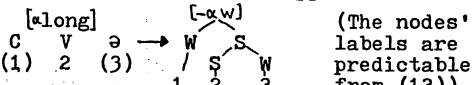
We have suggested removing the formulation of OE i,u-Deletion from the realm of segmental phonology, and describing it in terms of L&P's metrical trees, which we extend to dominate segments. We build up syllables and feet (as sketched above and, more fully, in Appendix I), and then use the same type of rules and constraints thereon to make word-trees, phrase-trees, etc.

We have constrained the theory by keeping L&P's binary branching over S W or W S; we regard S and W as features [-weak] and [+weak] on nodes. We suggest an autonomy constraint to reduce the interaction of segmental and tree rules; we define well-formed trees by the sonority-branch.matching constraint of (13) above, and thereby explain the remarkable facts of section 6.

Appendix I: O.E. Syllable Rules

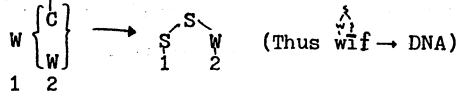
Our more complete phonology[1] includes three syllable-formation rules and three syllable-based Glide rules, along with (8) Deletion. Applying left to right, syllable heads are formed (CVə, Və, CV, or V)"; if the vowel is short, a coda consisting of C or CV is appended.

(21) Head rule [α long]



(The nodes' labels are predictable from (13))

(22) Coda rule (v.(13))



(Thus wīf → DNA)

Rules (21) and (22) are followed by (8) (in which term 1= [±w]), and then by three Glide rules.

(23a) Cy → 1 1 COND 1≠r.

e.g. bedy → bedd 'bed' but endy → DNA

(23b) [-cons] → [+syll] / _#

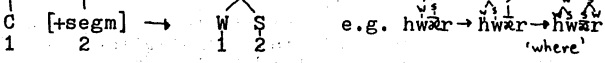
e.g. end+y → endi (→ende] 'end');
wīt+y → wīti (→[wīte] 'punishment');
her+y → heri (→[here] 'army')

(after each rule, (21-22) reapply, giving here).

(23c) y → ø /C__ e.g. wīt+y+u → wītu 'punishments'

Consonantal clusters do not become part of the syllable trees until after the rules of consonantal assimilation and deletion; the rule is (24) for syllable-initial CC clusters, followed by its mirror-image for syllable-final clusters.

(24)



Appendix II: Mod. English Stress

As further evidence for (13), the S-B M constraint, we examine another language with a level of foot between syllable and word. In Mod. English, our Foot rule (25) builds 2- or 3-syllable feet, and assigns [1stress] to the foot-initial vowel. (R→L, simultaneous application).

(25) [±w] ([±w]) [±w] ⟶ S S W W
1 2 3 1 2 3
[1stress]

Consider as input 'amerika', syllabified as four [+w] trees. (25), applying R→L, takes the last three syllables and forms a foot-tree, placing [1stress] on the antepenult 'me'. (25) does not apply to the remaining initial 'a', because at least two syllables are needed to form a foot. Thus əmérəkə is generated.

Consider 'arōma' as input. If, as in footnote 15, $\overset{x}{V} \gtrdot_S \overset{x}{V}$, then by (13), we can't form a three-syllable foot 'arōma', because medial ō, with m=3, is more sonorous than final ă, with m=2. So we try the two-term expansion of (25), leaving out term 2, and get 'rōma'. No stress is put on the initial a, so we generate ərōmə.

Thirdly, consider a word like 'salivate', which has (v. L&P:275) an underlying /sælīv+ēt/. Despite the long medial vowel, stress is not penultimate. This word is exemplary of a large class of exceptions, most of which end in -ate,-ary,i.e. with a long low vowel. How can we explain their antepenultimate stress? We remember, from (10) and footnote 15, that no (unstressed) vowel is more sonorous than a long low vowel, so in a word with an -ēt or -ēry suffix, any medial vowel is allowed in the three syllable foot.

It is possible to simplify (25) much further: (a) All tree-formation rules have two or three terms as input; if 3, then: ([+segm] [+segm] ([+segm]) --with obligatory nucleus-- or [±w] ([±w]) [±w] --with possibly optional middle syllable. The fact that (25) is applying to [±w]'s is predictable from the feature --[1stress] --that it works with; all that the SD must state is that (25) applies to 3, not 2, terms. (b) The labels on the nodes in (25) are predictable since, given that $\overset{x}{V} \gtrdot_S \overset{x}{V}$, it is impossible that the [1stress] V in term 1 be dominated by any nodes but S. (c) It appears that, if all tree-formation rules are R→L, as in M.E., the feature added by the rule (i.e., [1stress] in (25)) is always added to the leftmost term -- i.e., in a R→L language, the right-hand part of the SD serves as context. All we need state for the Foot rule is that the SD has 3 terms, and the SC includes [1stress]; we then get (25).

Footnotes

[1]to appear in 1978, by O'Neil & Sjoblom. (This study shows, e.g., that long vowels in OE are $\bar{V}$, and not VV.) We thank S.J. Keyser and P. Kiparsky for useful discussions; and NSF for Sjoblom's Graduate Fellowship. We are in debt to Kiparsky & O'Neil (1976) for a clear framework on which to build.

[2]see Section 2 for the notion "heavy syllable".

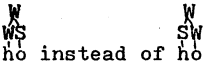
[3]by which i deletes in dēm+i→dēm 'judge!'; dēm+i+de→dēmde 'judged'.

[4]I.e., u is protected in $\bar{V}CC\_$. Thus wīt+y+u DNA (→[wītu] 'punishments').

[5,6]we may use S for [-weak]; W for [+weak].

[7]C= [-syllabic]. Note that [±syllabic] is defined for segments, not for # or nodes of trees; [±weak] is defined only for nodes.

[8]in class spring 1976. John McCarthy III's unpublished Phonology Generals paper (M.I.T. 1976) is the earliest paper we have seen using Kiparsky's suggestion (as well the notion, via Alan Prince, of assigning an integer value to the positional strength of a terminal. We call this the 'branch.number'; v.p. 4).

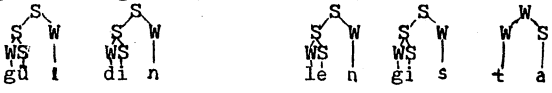
[9]as in Appendices I and II. 

[10]where, unarguably, ho is hó instead of hó. v. Section 4.

[11]using | to mean domination; ¦ for imm. domination. Nodes are undominated if not under ¦ or | ; a segment not under ¦ or | may or may not be dominated.

[12]A node imm. dominating ∅ is pruned, as is its sister, in SC.

[13,14]e.g. güldin→DNA (→[gŭlden] 'golden'); lengista→ DNA (→[lengesta] 'longest').



[15]and, for [αstress] vowels, $\bar{V} \gtrdot \breve{V}$ appears never to be violated; for [αstress, β long]: [-hi] ≻ [+hi]; [+lo] ≻ [-lo]; perhaps [+bk] ≻ [-bk]. v. Bell (1977) and J. Hooper (1977) for aspects of this scale.

[16]in the traditional, i.e., Sievers, school.

[17]These are 800 A.D. eWS forms. The rules differ in other stages.

[18]The schwa is not problematic: it belongs to the first syllable.

REFERENCES

Bell, Alan (1977) "Segment Organization Phenomena and their Explanations," unpublished paper; preliminary version for the Symposium on Segment Organization and the Syllable. Boulder, Colorado, Oct. 1977.

Hooper, Joan B. (1977) "Syllabic and Non-Syllabic Issues in Phonology," unpub. paper; preliminary version for the Symposium on ...the Syllable, Boulder, Oct. 1977.

Kahn,D. (1976) Syllable-Based Generalizations in English Phonology, unpub. Doctoral dissertation, M.I.T., Cambridge, Massachusetts.

Kiparsky, P. and W. O'Neil (1976) "The Phonology of Old English Inflections," Linguistic Inquiry 7, 527-557.

Liberman, M. and A. Prince (1977) "On Stress and Linguistic Rhythm," Linguistic Inquiry 8, 249-336.

Sjoblom, Todd (1977) "A New Phonology of Old English Inflections --or-- K&O KO'd", unpub. paper, M.I.T.