SOME OLD ENGLISH PHONOLOGICAL PROCESSES: A NONLINEAR ANALYSIS*

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This paper examines some problematical Old English phonological processes within a nonlinear framework that employs an intermediate C-V tier in syllable structure: 1) various injectivity and surjectivity relationships between segments and C-V units, 2) extrasyllabicity, 3) assimilation, compensatory lengthening and degemination, 4) reduplication, 5) long consonants, and 6) an appendix on ambisyllabicity and *s*-obstruent clusters.

In 1976 Kahn represented the syllable as a hierarchical unit with two tiers: the root (σ) node of the syllable and the terminal segments of the actual vowels, consonants, and glides that it dominates. Various expanded versions of it have since appeared, differing from each other in the number of the intermediate structures posited between the two basic tiers. Clements and Keyser (1981), for one, have introduced a third C-V tier[1] to mediate between the root tier and the terminal segmental tier. The elements of the C-V tier that make up the syllable are composed of C (for a nonsyllabic) and V (for a syllabic). Unlike others, they maintain that the C and V skeletal units are linked directly to a syllable node with no intervening consitutents such as onset, rime, and appendix, as postulated in Halle and Vergnaud (1980) and Harris (1983).[2] Thus, the syllable structure of a Luganda word *ono* 'this' can variously be represented as follows:

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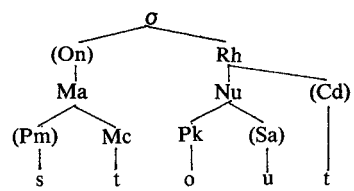
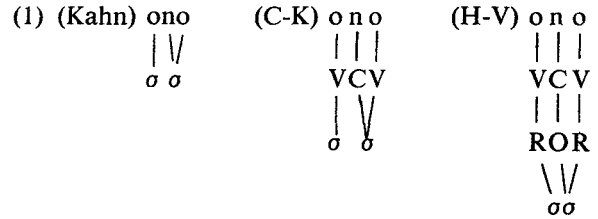
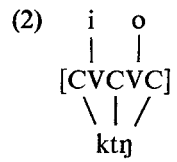
[1] C-V units are also known as skeleta, melody-bearing units, 'prosodic templates', and segments are also known as melody or phonemic units.

[2] Cairns and Feinstein (1982) break the onset further down into Ma (margin) and Ad (adjunct) and the rime into Pk (peak) and Sa (satellite) in a metrical theory without the C-V tier:

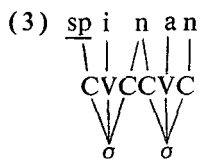




Others like Leben and McCarthy would furhter divide the segmental tier into two separate tiers: the consonantal tier and the vocalic tier, as shown in (2).



In a nonlinear framework, the underlying form of a word must be specified for all the tiers with respect to its segments, C-V positions and other intermediate constituents, if any. However, the branching relationships between the sekeletal C-V positions and the segmental phonemic units, for example, may not always be one-to-one; they may be one-to-many as for Old English alliterating *s*+ obstruent clusters (see also (55c)), with two segments mapped onto a single C-V unit, or many-to-one as for long vowels or consonants, or syllabic liquids or nasals, with a single segment associated with more than one C-V unit, as in (3) for OE *spinnan 'to spin'*.



Moreover, for the structure of a given form to be well-formed, all its tiers must be linked to one another by lines of association. For certain underlying and intermediate forms, therefore, units on one tier need not be linked to those on another tier (see 21b), nor all segments necessairly be attached to the root σ-node (18a). Since in a nonlinear framework various tiers are autonomous, hence independent of one another,[3] the structural description of phonological rules, as with other autosegmental phenomena, may refer to any one of these tiers of representation, without affecting the associated units on another tier.

[3] For example, a C-V unit would remain constant even after the segment previously associated with it has been deleted (22b).

One of the convincing arguments advanced for the C-V tier comes from analysis, for example, of Turkish and Finnish and Seri data.[4] These languages offer evidence of C-V units that are unassociated in underlying representations with segmental units. For example, in Turkish there is a class of vowel-final nouns (4c), which behave as if they were consonant-final, and there is no evidence as to what type of consonant segment might be assumed for it.[5] Now the rules of allomorphy to select the correct shape of the inflectional suffixes of these Turkish nouns crucially rely on whether the preceding morpheme ends in a C or a V.[6]

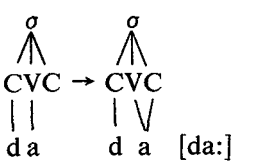
(4)	gloss	nom.sg.	nom.pl.	dat.sg.
a.	room	oda	odal*ar*	oday*a*
b.	cap	kep	kepl*er*	kep*e*
c.	mountain	da:	da:l*ar*	da*a*

The nouns in (4c) select the suffix allomorphs that occur only after consonant-final nouns. The underlying form of the word for 'mountain' is then given as (5) with the final consonant simply represented as a C-unit of the C-V tier which is not linked to any unit of the segmental tier.

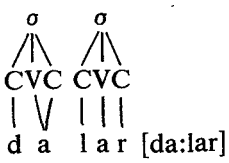
(5)

And then for the nom.sg. and pl. forms, a late rule would link the underspecified C to a preceding tautosyllabic vowel, yielding (6a) and (6b) respectively.

(6) a.



b.



For the dat.sg. form, the vowel initial allomorph is added to the underlying stem form (5) as it ends in a C, yielding (7), which is then resyllabified as (8).

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[4] For the Turkish and Finnish data, see Clements and Keyser, p.44f, and for the Seri data, see Marlett and Stemberger p.633 ff.

[5] In earlier segmental frameworks, an abstract segment for such an 'underspecified' or 'indeterminate' one was arbitrarily posited, which was then later deleted before it surfaces. In the CV phonology, no such abstract segment is said to be posited that does not occur at the surface, thus avoiding "the problem of having to mark an arbitrary choice as to the identity of the abstract underlying segment" (Clements and Keyser, p. 84).

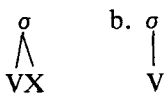
[6] The italicized post-consonantal dat.sg. and nom.pl. endings in *e* or *a* are determined by the principle of vowel harmony.

(7) 

(8) 

[daa]

The onset C of the second syllable of (8) will simply not surface by convention as it is unassociated. Note that the nom.sg. form (6a) is represented as a monosyllabic form with 3 units along the C-V tier, while the dative form (8) is represented as a bisyllabic form with 4 units. This analysis henceforth supports another evidence for the linguistic category 'mora', which should be defined in terms of the number of units of the C-V tier, not those of the segmental tier; thus, a heavy syllable is one in which a V element has a right sister (9a), i.e. having two moras, and a light syllable has none (9b), i.e., having one mora (Clements and Keyser p. 56).

(9) 

In this paper I will examine some problematical Old English phonological processes which I believe can best be accounted for within a nonlinear framework that employs an intermediate C-V tier in syllable structure: they are 1) various branching relationships between segments and C-V units, 2) extrasyllabicity, 3) assimilation, compensatory lengthening and degemination, 4) reduplication, and 5) long consonants, with an appendix on ambisyllabicity and *s*+[obstruent] clusters.

1. Branching relationships between the segmental tier and the C-V tier

1.1 An example of two segment units mapped onto a single C-V unit can be illustrated from OE prosody, where a so-called short 'diphthong' <æa> is scanned as equivalent to a short simple vowel <a> as shown in (10), while a so-called 'long' diphthong <ǣa> is scanned as equivalent to a long vowel <ǣ> as shown in (11) from "The Battle of Brunnanburh".[7]

(10) a. æafooran / ǣadwæardes (a D-type verse)

b. hamora / lāfum (A)

(11) a. nǣade ge / bǣded (A)

b. fǣge / feollon (A)

[7] In Old English alliterative poetry, the arsis (i.e., rhythmic stress) falls on a heavy syllable, i.e., a branching structure with two moras: VV(C), VC(C) or VCVC.

That this is so can be proved by the fact that when <æa> is compensatorily lengthened through the deletion of intervocalic *h* (27c), the resulting nucleus then comes to occupy two C-V units (27d). Hence, OE short 'diphthongs' should be analyzed as a bisegment mapped onto one single C-V unit as shown in (12a) and 'long' diphthongs as a sequence of two segments mapped onto two C-V units (12b).

(12) a. æa b. ǣa

V VV

Consequently a minimal pair like *gæst* 'guest' and *gæard* 'yard' exhibits a 'phonetic' difference at the segmental level (13a), while that of *gǣat* (<gēotan) and *gæat* 'gate' a 'phonemic' difference at the C-V level (13b).[8]

(13) a. gæst <æ> : gæard <æa> b. gæat <æa> : gǣat <ǣa>

V V V VV

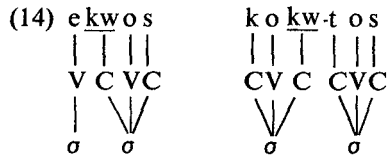
A similar analysis is made of the long stressed syllable in Finnish, which is scanned as a short stressed syllable; thus in the Finnish epic poem *Kalevala,* the long stressed syllable *keä-* of *keäjessä* occurs on the upbeat (i.e. *w*-position) in violation of the metrical rule which permits only short stressed syllables on the upbeat. The line involving the word, however, is said to be perfectly metrical as the underlying syllable of the word is short, at which point the metrical rule applies (Kiparsky 1968, p. 172 ff.).

Another example of bisegments being mapped onto one C-V unit can be drawn, this time, from Latin, where the labiovelars *qu* and *gu* are said to be "the only consonant clusters which fail to close a preceding syllable" (Steriade, p. 17), surfacing sometimes as simple velars as in *koktos* (kokwtos) <cocutus> 'cooked' by the rule kw →k / _____C, sometimes as velar + *u* sequence as in *ekwos* <equus> 'horse' — hence they are to be analyzed as (14).

[8] Historically speaking, OE short diphthongs were allophones of short vowels, and OE long diphthongs allophones of long vowels, just as OE [k] and [č], as evidenced in the following alliterations, were allophones of /k/, and OE [g] and [j] were allophones of /g/.

cuðe folme /čearu wæs geniewed.
godfremmendra /swelcum ǯifeðe biþ

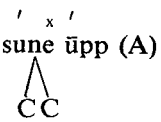
This means that the old Germanic poetic tradition was established long before these sounds became phonemic, i.e. when [k] and [c], [g] and [j] were still underlyingly /k/ and /g/ respectively, and diphthongs were likewise underlyingly simple vowels.

(14) 

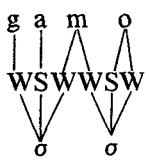
1.2 An example of two C-V units being associated with one segment unit can be illustrated from OE long (i.e., geminate) consonants (15), where the first C of the sequence CC closes the preceding syllable, making it heavy, as evidenced in the following OE verse scansion (15b). More on long consonants, see **5** below.

(15) a. 

<sunne> 'sun

b. 

In the same nonlinear vein, Leben analyzes <gammo> from Hausa with ambisyllabic *m*, as in (16).

(16) 

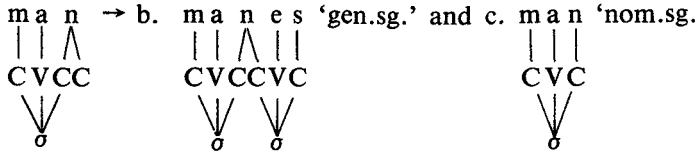
2. Extrasyllabicity

There are certain segments in the underlying representation of a word that are not linked to an σ-node. These segments are hence called extrasyllabic (i.e., floating). Such 'impossible' (i.e., unassociated) segments or clusters arise in underlying forms[9] either through morphological (or phonological) modifications of a root or through morpheme combinations. These extrasyllabic consonants are hence to be either deleted (17c) or associated with σ-nodes by being supported by an epenthetic vowel (18b) (20b) or the following vowel-initial syllable (18c) (19b), as in OE (17-18), French (19 on liaison) and Modern English examples (20).[10]

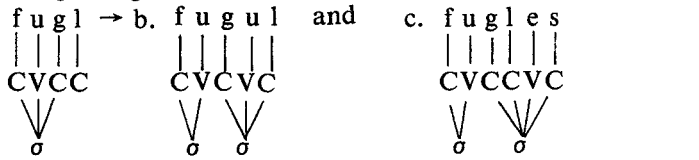
[9] Initial syllabification is performed at the underlying level, and then forms are constantly resyllabified during the course of a derivation so that the proper rules could apply: "The output of every rule is resyllabified according to the syllable structure rules examined up to that point in the derivation" (Clements and Keyser p.33).

[10] For Old English data, see Lowenstamm p.583, Kiparsky and O'Neil p.534; for the French and Modern English, see Clements and Keyser pp.29 and 78.

(17) man(n) 'man'

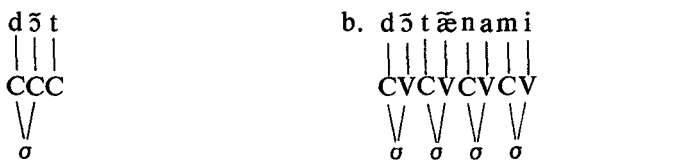


(18) 'nom.sg.': fugul 'bird', wæter 'water', and 'gen.sg.': fugles, wætres

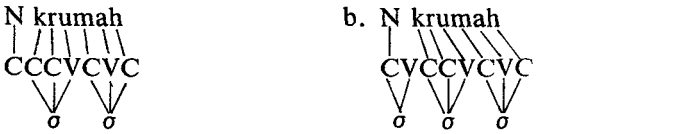


Between two possible underlying forms *wætr* and *wæter,* and *fugl* and *fugul* for the nominative singular, the former has been chosen because vowel epenthesis in the environment C ____ $\begin{bmatrix} +\text{son} \\ +\text{cons} \\ -\text{syll} \end{bmatrix}$ # is quite natural and universal whereas vowel deletion in the environment of C ____ C would be quite ad hoc.

(19) don(t) 'of which' dont un ami 'whose friend'



(20) a. N krumah b. N krumah



In the above OE examples, long consonants in (17), like the *gl* or *tr* clusters in (18), cannot occur word-finally. Therefore, the erstwhile floating extrasyllabic C, i.e. empty consonant position, gets anchored to the following syllable by a resyllabification convention, as shown in (17b) and (18c). If, on the other hand, an extrasyllabic position can't be associated with either the following onset or the preceding coda, then an epenthetic V-position is to be created by a resyllabification convention[11] immediately to its left on the C-V tier, yielding (18b); otherwise, the unassociatable extrasyllabic position gets deleted, as shown in (17c).

[11]See Marlett and Stemberger p. 619 for the convention as applied to Seri.

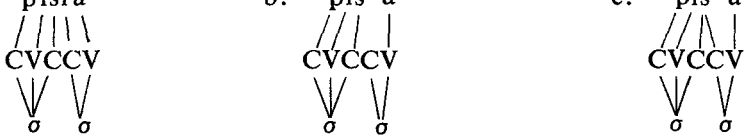
In (20), the initial sounds of the foreign names *Nkrumah, Dvorak,* etc. are pronounced as separate syllables with creation of a V-position to the left of *k* or *v* respectively of the underlying onsets, and then the inserted V-position is filled by universal autosegmental convention with an appropriate vowel segment /ə/ by a vowel epenthesis rule.

3. Assimilation, compensatory lengthening and degemination

3.1. Assimilation

Assimilation is a process of deletion of a segment, whose empty C slot is then reassociated as shown in (21) with the adjacent consonant on the segment tier: þ*issa* (<þis + ra 'gen.þl.' of þis) and þætte (<þæt#þe).

(21) a. þisra → b. þis a → c. þis a

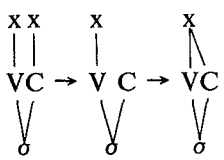


3.2 Compensatory lengthening and degemination

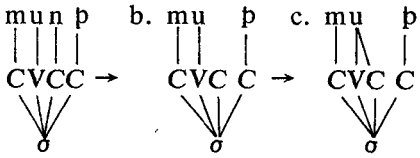
3.2.1. Compensatory lengthening

One of the arguments advanced for the introduction of the separate C-V tier in the theory of syllable structure comes from compensatory lengthening, where the C-V tier remains constant even if the segment erstwhile associated with it has been deleted and the resulting unassociated unit C on the C-V tier spreads automatically to the preceding accessible unit V on the segmental tier as shown in (23) by rule (22).

(22)



(23) a. mun þ b. mu þ c. mu þ 'mouth'



The infinitive form of one of the so-called contract verbs <slǣan>, whose principle inflected forms are given below, provides another example of compensatory lengthening.

(24) gloss	infinitive	3rd sg.	imperative	past sg.	past ppl.	pr. ppl.
'to strike'	slǣ an	sliehst	slæah	slōh	slagen	slǣande
(cf. 'to fall'	fæallan	fielst	fæall	fēoll	fæallen	fæallende)

Based on the imperative form, which exhibits the underlying stem form, the underlying infinitive form of the word, which consists of stem + *-an*, can be postulated as in (25), with initial syllabification at the morpheme level (26a) and the resyllabification at the word level (26b).

(25) slæah + an

(26) a. s l æa h + a n
CCVVC VC
σ σ

b. s l æa h a n
CCVV CVC
σ σ

If the stem vowel *æa* is taken to have two moras as posited in (26) following the statement in the traditional handbooks, then a wrong surface form (26f) would result from the following derivation: compensatory lengthening (26d) in conjunction with the deletion of intersonorant *h* (26c), followed by the deletion of the unstressed infinitive vowel *a* in hiatus (26e).

c. slæa an
CCVVCVC
σ σ

d. slæa an
CCVVCVC
σ σ

e. slæa an
CCVVCVC
σ σ

*f. slæa n
CCVVVC
σ

Now if an OE short 'diphthong' is analyzed as a short simple vowel, then the correct surface form would be derived from the following reanalysis (27).

(27) a. slæah + an
CC VC VC
σ σ

b. slæahan
CCVCVC
σ σ

c. slæa an
CCVCVC
σ σ

d. slæa an
CCVCVC
σ σ

e. sl æaan
CCVCVC
σ σ

f. slæan
CCVVC
σ

On the other hand, Kiparsky and O'Neil (1976, 536) as well as Keyser (1975, 382) maintain that the intersonorant *h* is deleted without simultaneous compensatory lengthening, implying that both <ǣa> and <æa> are to be interpreted phonemically as /æa/, which, however, is untenable in view of the evidence from OE verse scansion as shown in (10), where <æa> is scanned as ocupying one C-V slot with one mora, making the preceding syllable light, whereas <ǣa> is scanned as occupying two C-V slots with two moras, making the preceding syllable heavy. The differences between them cannot be accounted for in a theory lacking an intermediate C-V tier in syllable structure.

3.2.2. Degemination

OE geminate (i.e., long)consonants come from two main sources, one underly-

ing lexical (28) and the other derived (29). The derived sources are due mostly to either liquid lengthening (29a) or WGmc. *j*-lengthening (29b) or intermorphemic assimilation (29c).[12]

(28) fyllan 'to fill', sunne 'sun' (cf. sunu 'son'), æall 'all' (cf. ON allr)

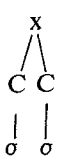
(29) a. æpla→ æppla 'apple' (gen.pl.); bitre → bittre 'bitterly', micle → miccle 'much'

b. sæt + jan (G. satjan) → sett + jan (cf. OS settian) → settan 'to set'

c. mētte (<mēt + de) '(he) met'; þissa <þis + ra 'gen.þl.'); þætte(<þæt#þe)

A geminate consonant appears as a CC sequence on the C-V tier mapped onto a single unit on the segmental tier, as shown in (30) — heterosyllabic in intersonorant positions word-medially (30a) but tautosyllabic word-finally (30b) at least in earliest Old English.

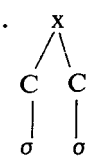
(30) a.



(segmental tier)

(C-V tier)

b.



And then at a very early stage in Old English, geminate consonants degeminated in the following environments: finally before word boundary (31a), as shown in (17c); medially in the environment of another consonant (31b), and also in low sentence stress (31c) (see Campbell §457).

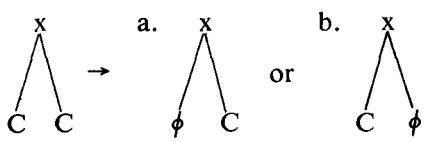
(31) a. mann# → man

b. offrian 'to offer' → ofrian; bittre → bitre; eorllic (<eorl + lic) → eorlic

c. þisses, þissum → þises (gen.sg.), þisum (dat.sg.)

Degemination process is the deletion of a skeleton, not a segment, position; hence, it does not trigger compensatory lengthening. Consequently it won't matter which one of the two (32) is to be chosen[13] for deletion of one of the two CC units associated with the branching segment.

(32)

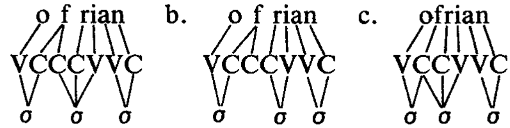


The degemination process for (31b) has been given in (17c) and that for (31b) and (31c) are given below in (33) and (34) respectively.

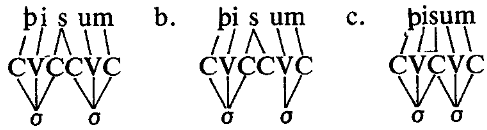
[12]See Kim 1972; for 'two' kinds of geminate consonants in OE, see Hogg 1982.

[13]See Steriade p. 142 for formulating compensatory lengthening without a skeleton.

(33) a. b. c.



(34) a. b. c.



In (33b) and (34b), the unassociated floating C will delete, resulting in (33c) and (34c) respectively, where the degeminated (hence, derived) segments *f* and *s* of *ofrian* and *þisum,* however, would not undergo the Intersonorant Fricative Voicing rule (35);[14] hence they would remain voiceless as in [o*f*rian] and [þisum].[15] Therefore, the degeminated *f* or *s* is to be analyzed as ambisyllabic as shown in (33c) and (34c).

(35) [−son], C, σ

$$\begin{array}{c}[-\text{son}]\\ |\\ C\\ |\\ \sigma\end{array} \rightarrow [+\text{voice}] \;/\; [+\text{son}] \;\_\_\_\_\; [+\text{son}]$$

A segment ia ambisyllabic if it is dominated by two σ-nodes, as shown below, where x represents a segment and C a skeleton.

(36) a. (see 34c) b. (see 15a)

[14](36) is equivalent to:

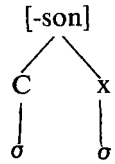
$$\begin{bmatrix}+\text{obst}\\ +\text{cont}\\ -\text{Deriv}\end{bmatrix} \rightarrow [+\text{voice}] \;/\; [+\text{son}] \;\_\_\; [+\text{son}]$$

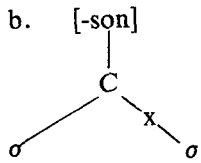
[15] See Hongg p.191: this is "indisputably the sign of a phonological geminate". Cf. the 'wanna' contraction rule, which applies only to the underlyingly continuous sequence *want to* as in (a), not to the derived sequence *want to* as in (b):

(a) Who do you *want to* love (<Do you *want to* love NP)
→ Who do you *wanna* love.

(b) Who do you *want to* win (<Do you *want* NP *to* win)
→ *Who do you *wanna* win.

The rule (35) says that the input [−son] is neither a geminate (37a) nor a single ambisyllabic consonant (37b), where x indicates that the input segment is dominated only by a single σ-node.

(37) a. 

b. 

næ*f*re [v], rī*s*an [s] o*f*rian [f], þi*s*um [s]
but cy*ss*an [s:]

4. Reduplicated verbs

In general, reduplication involves two processes. First a C-V skeleton is affixed to the stem, and then part of the stem melody is copied onto (i.e., spreads to) the added skeleton by a left-to-right association, for example. And any material, skeletal or melodic, left unassociated, will not surface.

The reduplicated material is in general a constituent of some sort—a syllable, a metrical foot, an entire morpheme, or even an onset or a rime, even though there are languages where reduplication involves a non-constituent such as only a phoneme (see Marantz 1982). Furthermore, some element of the reduplicating affix may be prespecified, as in Old English and Gothic, where the V of the added affix skeleta CV is fixed to /e/, spelled <aí> in Gothic. When a stem, however, begins with a vowel, then there would naturally be no reduplicated (see 43C below).

The analysis proposed here for the reduplicated past tense forms of Class VII strong verbs opts for a simple mapping of the morpheme melody of a verb directly onto its target skeletal template (C)CVCC, with the morpheme melody being represented on two separate tiers, one for the consonant melody and the other for the vowel melody /e/. The target skeletal template may be either CVCC or CCVCC for the seven attested OE forms: CVCC if the onset of the root of a verb (exp. *h*at-an) consists of one consonant phoneme only, including *s* + obstruent clusters (see Appendix (69)), in which case it alone would be copied onto two discontinous C clots as shown in (40) by Reduplication rule (38), where x is a consonant segment; CCVCC if the onset of the root of a verb (exp. *dr*æd-an) consists of two consonant phonemes, in which case the second, not the first phoneme—this is language specific—would similarly be copied as shown in (41).

(38) 

I believe that this 'direct' mapping analysis is straightforward, compared to the conventional, rather complicated 'contraction' analysis, which perhaps wrongfully assumes (see Prokosch p. 176ff.), on the basis of the Gothic counterparts, stress

shift from the root to the prefixed syllable and subsequent deletion of the destressed root vowel.

Traces of the old reduplicated past tense forms are still preserved in Old English, mostly in the Anglian dialects and also in poetry.

(39) a: for the CVCC target template:
heht (inf. hātan) (Go. haíhait)
leolc (inf. lācan)
leort (inf. lǣtan) (Go. laílot)
reord (inf. rǣdan)
speoft (ing. *spātan; see Appendix (69) for analysis)
beoftun (inf. bǣatan)

b: for the CCVCC target template:
(on)dreord (inf. (on)drǣdan)

The 'diphthongal' forms are all derived from the following underlying monophthongal forms by either (analogical) Breaking or velar Umlaut: *lelc, lelt* (>*lert* by dissimilation), *rerd, speft* (<*spept<spespt), *beftun* (<beptun<bebtun), and (on)*drerd*. A representative analysis of (39a) is given in (40) and that of (39b) in (41).

(40) heht: the root consonant melody *ht* (see inf. *hāt*-an, ppl. *hāt*-en)[16]

(consonant melody)
(target skeleton)
(affixed vowel melody)

(41) dreord (<drerd): the root consonant melody *drd* (see inf. *drǣd*-an, ppl. *drǣd*-en)

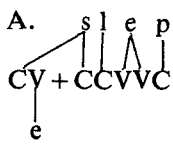
Campbell (§746) derives *drerd* from **dredrd,* which would then imply the following 'conventional' derivation: CCV(dre) + CCC(drd) → *dredrd* → ?*drerd*. However, this kind of derivation cannot be reconciled with the Gothic forms (see 43Ab), which points to the basic Germanic patterns, and also Linking Convention (see 69), according to which only one of the onset consonants except *s* + obstruent clusters is permitted for reduplication, namely the first of the two onset consonants in the

[16] In the Anglian dialects, the diphthong *eo* arising from Breaking had already been monophthongized ("smoothed")—hence *heht* from earlier *heoht* (Brunner §394 Anm.1.).

case of Gothic but the second of the two onset consonants in the case of Old English. Therefore, the choice of which one of the two onset consonants reduplicates is entirely language specific. Thus, in Sanskrit, when the basic stem begins with a continuant-stop cluster, the stop reduplicates, as in *st*uté~ *t*ustuve, *sk*and ~ *c*askand; on the other hand, when the stem begins with an obstruent + liquid cluster, the obstruent reduplicates, as in *sr*u ~ *s*usru, *pr*ach ~ *p*aprach. In Germanic versification and reduplication, an obstruent + *r* cluster is scanned or analyzed as two consonants, occupying two C slots, while an *s*-obstruent cluster is scanned or analyzed as a single consonant, occupying one C slot (43).

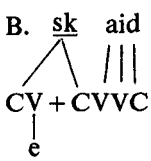
(42) A. a. laikan 'to leap': *l*aílaik
b. fraisan 'to tempt': *f*aífrais
grētan 'to weep': gaígrōt
c. slēpan 'to sleep': *s*aíslēp
B. skaidan 'to divide': *sk*aískai þ
(ga)staldan 'to possess': (ga)*st*aístaid
C. aukan 'to add': aíauk
(af)aikan 'to deny': (af)aíaik

(43) A.



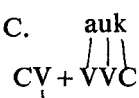
= seslēp <saíslēp>

B.



= skeskaiþ <skaískaiþ>

C.

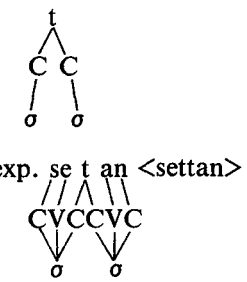


= eauk <aíauk>, where the initial unassociated C is deleted by convention.

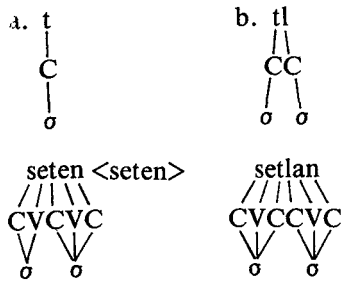
5. Long (= geminate) consonants

Long consonant in Old English is phonetically long—hence occupying two units of timing. Therefore, it is normally analyzed as a cluster of two consonants with respect to most rules like High Vowel Deletion (5.1.1); however, there are some rules such as Front Vowel Retraction (5.2.1), which requires analysis of long consonant as a single consonant. One way of capturing this dualistic nature of OE long consonant is to represent it as a single unit on the segmental tier mapped onto two skeletal consonant units on the C-V tier, as shown in (44)(= 15) and say that long consonants pattern with (45a) for certain rules but with (45b) for other rules.

(44)



(45)



Note that (44) and (45) are different yet are alike: (44) and (45a) have the identical melody segment /t/ but different skeleta, while (44) and (45b) have the identical skeleta CC but different melody segments.

5.1. Long consonant occupying two C-slots on the C-V tier

5.1.1. Post-root suffix vowel (*u, i*) deletion

When the stem syllable of a word is light (i.e., non-branching), monosyllabic neuters would retain the suffix vowel *u* in the nominative and accusative plural (46a) but delete it when the stem syllable is heavy (i.e. branching) (46b-d).

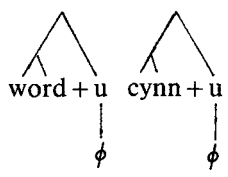
(46)	stem	plural	'gloss'
a.	scip–	scip-u	ships
b.	bān-	bān-ϕ	bones
c.	word-	word-ϕ	words
d.	cynn-	cynn-ϕ	kin(s)

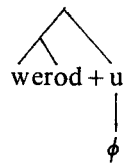
Likewise, when the stem of Weak verbs is short, it forms its past with the intervening affix vowel i (> e) (47a), which, however, syncopates for the verbs with long stems (47b-d).

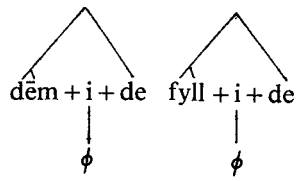
(47)	stem	past	'gloss'
a.	frem-	frem-i-de	(he) made
b.	dēm-	dēm-ϕ-de	judged
c.	cemb-	cemb-ϕ-de	combed
d.	fyll-	fyll-ϕ-de	filled

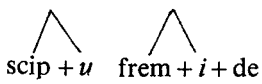
In both cases (46-47), the high vowel *u* or *i* gets deleted when it is preceded by a branching structure on its left and is itself dominated by a right branch (49) by the rule (48) stated on rime projection; the high vowels, however, are not deleted (50) as they don't meet the conditions (Halle and Vergnaud §5-4).

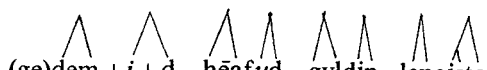
(48) [+ syl, +high] → ϕ /⩚

(49) a. 

b. 

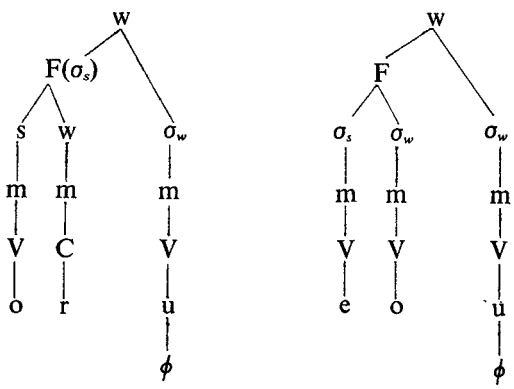
c. 

(50) a. 

b. 

Note that in (49) two light syllables (49b) are equated with one heavy syllable (49a),[17] since a heavy syllable is analyzed with two moras and a light syllable with one mora. Therefore (49) can be reanalyzed on mora projection (see Prince 1980, 528) as (51), where post-root unstressed high vowels are shown deleted in open syllables after two moras.

(51) a. word*u*, cynn*u* b. werod*u*

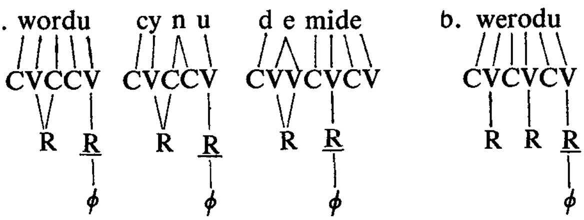


The rimes of a heavy syllable (51a) is therefore found to have an identical mora structure with the foot (51b). In (50b) the high vowels on the other hand don't get deleted even after branching structures with two moras simply because the high vowels themselves are not in open but closed syllable postitions. This difference between them can, however, be better accounted for by restating (49-50) this time as (52-53) with introduction of the additioal Rime (R) constituent, and say that in (52) post-root high suffix vowels have correctly been deleted because first they are immediately preceded by a root with two moras, with either a branching rime (52a) or two nonbranching rimes (52b) and second the rimes of the post-root suffix syllables are nonbranching with only one mora. In (53) post-root high suffix vowels are not deleted because in (53a) the root syllable is wrongfully nonbranching with only one

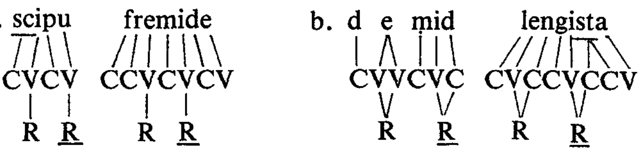
[17]just as in the Damascus Arabic and Classical Latin; see McCarthy 1979, 459.

mora and in (53b) the rime of the post-root suffix syllable containing high vowels is wrongfully branching with two moras. (On the ambisyllabic account of *st* in *lengista* in (53b), see Appendix 67).

(52)



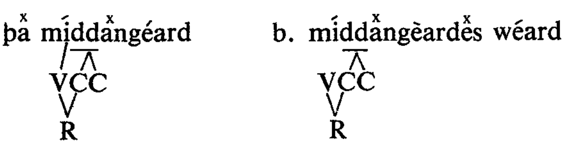
(53)



5.1.3. Stress rules

In Old English the ictus (i.e. the rhythmic stress) can occur only on a branching rime (i.e. heavy syllable). Hence the following verses (54) from the 'Cædmon's Hymn' and 'Daniel' (line 597) are scanned as a B and an E verse respectively, with the first ictus on the branching rime.

(54)



5.1.4. Other rules

In addition there are other rules which indicate that long consonants in OE pattern with clusters of two consonants, such as Breaking, which diphthongizes short vowels before certain clusters of two consonants including *ll* (exp. æld → æald 'old', æll → æall 'all'), or Intersonorant Fricative Voicing (35)(36) and Intersonorant *h*-Voicing (exp. seo*h*an → sēon but hlie*hh*an →*hlien).

5.2. Long consonant occupying a single melody segment on the segmental tier

5.2.1. Front Vowel Retraction[18]

The underlying a remains back before nasals but fronts to æ elsewhere; thus *man* →*mon* but *slahan* → *slæhan*→*slǣahan* → *slǣan* 'to slay'. This æ then gets retracted to *a* before a back vowel when the intervening consonant segment is either single

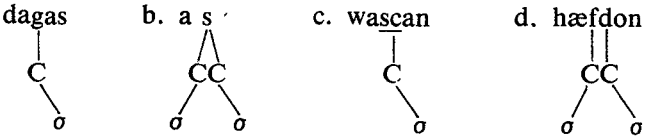
[18] See Campbell §158; Peinovich p.123.

(55a) or geminate (55b) or the *s*-clusters *sc* and *st* (55c) but not other clusters.[19]

(55) a. dagas (nom./acc.pl. of dæg), faran 'to go'
b. assa 'donkey', habban 'to have'
c. wascan 'to wash'
d. hæfdon (*hafdon) '(they) had'

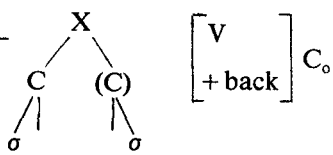
The C-V structures of the intervening segments in question can then be represented as (56).

(56) a. dagas b. a s c. wascan d. hæfdon



On the basis of (56), the rule for Front Vowel Retraction can be formulated as (57).

(57) æ → [+back] / —



where x ranges over single segments and s-clusters

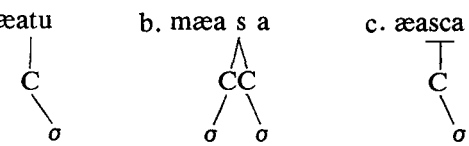
5.2.2. Velar Umlaut (i.e., back diphthongization)

Front vowels become diphthongs before back vowels when intervening consonants are either single (58a) or geminate (58b), or certain clusters consisting of *s* or *f* followed by another consonant (58c), especially in Northumbrian (see Campbell §206).

(58) a. fæatu (< fætu) 'vessels', weolor (< welor) 'lip'
b. mæassa (< mæssa) 'mass', ionna (< inna) 'womb'
c. æascan (< æsca 'ash'), (gonge)wæafran (<wæfran) 'spiders'

The C-V structures of the intervening segments in question can then be represented as (59). (On the treatment of *fr*-clusters, see Appendix (72).)

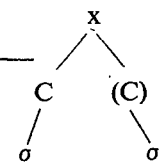
(59) a. fæatu b. mæa s a c. æasca



[19]See Wright §59, who, however, cites only one dubious example *brastlian* 'to crackle' for *st*-clusters and none for *sp*-clusters. On the analysis of *s*-clusters, see Appendix in this paper. Prof. Hogg (personal communication) cites *æspan*, an oblique case form of *æspe* 'aspen-tree', as an counter-example to the Retraction rule. However, I believe, the oblique form can be explained as analogical with the base nom.sg. form *æspe*.

On the basis of (59), the rule for Velar Umlaut can then be formulated as (60).

(60) $\phi \rightarrow \begin{bmatrix} V \\ +\text{back} \end{bmatrix} / \begin{bmatrix} V \\ +\text{back} \end{bmatrix} \_\_\_\_ \begin{bmatrix} V \\ +\text{back} \end{bmatrix} C_0$



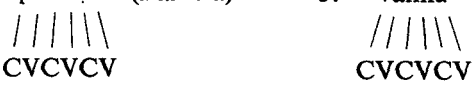
where x ranges over single segments and s-clusters (and possibly 'weak' clusters)

Appendix: Ambisyllabicity and *s*-clusters

1. Ambisyllabicity

The syllable structure, which is defined at the C-V level, of the following two words in (61) is the same but their stress patterns are different—one with antepenultimate stress for (61a) and the other with penultimate stress for (61b).

(61) a. pámeḷa (Pamela) b. vaníla (vanilla)

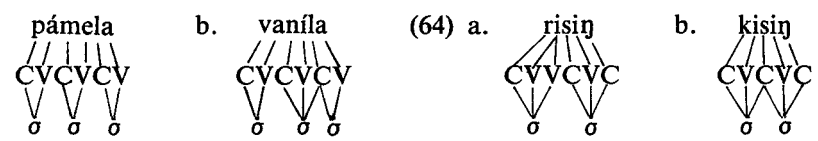


Similarly, the post-vocalic segment *s*'s in (62) are mapped onto one C-slot, yet the one in (62a) is voiced while the other in (62b) is not.

(62) a. rīsing b. kissing

One way to account for their difference would be to consider the intervocalic melody segments in the *b*-forms of (61-62) as ambisyllabic dominated by two σ-nodes of the form (36a), and then represent (61-62) as (63-64) respectively.

(63) a. pámela b. vaníla (64) a. risiŋ b. kisiŋ

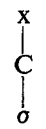


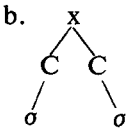
The segments in question in the *b*-forms of (63-64) are now shown in closed syllable positions, which explains the penultimate stress for (63b) (see Clements and Keyser p.18) and the absence of Intersonorant Fricative Voicing (35) in (64b).

2. On *s*-obstruent clusters

s-obstruent clusters in Old English seem to behave somewhat erratically; thus, even though they are analyzed as patterning with clusters of two consonants with

respect to some rules, they also pattern with single consonants with respect to some other rules. One way to capture the apparently dualistic nature of the *s*-obstruent clusters would be to consider them as bisegments mapped onto one *C*-slot position (65a) for some rules but two heterosyllabic C-slot positions (65b) for some other rules.

(65) a. 

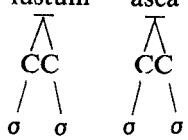
b. 

The rules which require the analysis of *s*-obstruent clusters as occupying two C-slot positions are OE scansion rules (66), (absence of) High Vowel Deletion (67), for example, and the rules which require their analysis as occupying one C-slot position are Alliteration (68), Reduplication (69), Vowel Shortening (70), Middle English Open Syllable Lengthening (71), and Modern English Stress Rules (72).

2.1. *s*-obstruent clusters occupying two C-slot positions

Medial *s*-clusters are analyzed as clusters of two consonants for the following two rules, with the *s* of the cluster closing the preceding syllable, making it heavy with two moras. (Even in Modern English *s*-obstruent clusters are said to be heterosyllabic word-medially, which implies that they can't qualify for the Onset rule.[20]

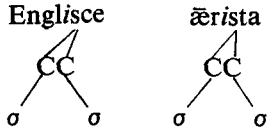
(66) Hēre wās ōn / lustum āscā / þrȳge



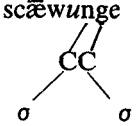
(Judith 161 b) (A-verse) 162a (A), 242a (B)) The Wanderer 99b (A), Beowulf 1772a)

(67) (see Campbell §352)

a. Englisce ærista (>æresta)



b. scæwunge



Therefore in (66) the verses are correctly scanned as A, and in (67) the post-root high vowel *i* or *u* is correctly not deleted (see 50b and 53b).

2.2. *s*-obstruent clusters occupying one C-slot position

2.2.1. Alliteration

In Old English verse, *s* alliterates with initial *s* of the clusters such as *sl, sw* as

[20]See Steriade p.90, but cf. (75b) below.

shown in (68a), but it may not alliterate with initial *s* of *sk, sp,* or *st,* since *sk* alliterates only with *sk,* and *st* only with *st,* and *sp* only with *sp,* as shown in (68b).

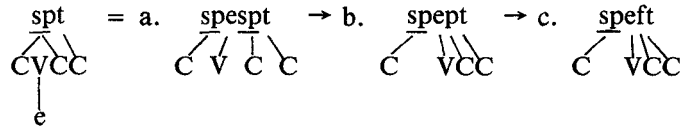
(68) a. ȝe-slōgon æt sæcce / sweorde ecgum
b. *st*rǣt wǣs *st*ānfāg / *st*īg wīsode

If so, the differences between (68a) and (68b) can be accounted for by treating a syllable-initial *s*-obstruent cluster simply as a bisegment mapped onto a single C-unit.[21] Consequently in Old English as well as in Modern English, a morpheme can be said to begin with not more than two onset CC slots, the first one of which is dominated by [-syll] and the second optional one by (+ son).[22]

2.2.2. Reduplication

The target skeletal template of *speft* (inf. spātan)has been posited as CVCC (see 39a), with initial *sp* occupying a single C slot, as analyzed below (see the corresponding Gothic form (42B)).

(69) spt = a. spespt → b. spept → c. speft



For the analogous change of sp→p/—C, see the Latin example (14), and for the analogous change of [+obst] → [+cont] before voicelss stops in *pt→ ft,* see *þonkte* → þonhte → *þōhte* '(he) thought' and *beoftun* (39a) derived from *bebt* → *bept* →*beft.*

The analysis given in (69) is then in accordance with Linking Convention B, which permits no multiple attachment of phonemes to CV slots or of CV slots to phonemes, i.e. only one member of an initial cluster is to be copied (Marantz, pp. 446 and 448 fn.9) since an initial *s*-obstruent cluster is here analyzed as one complex phoneme, not two in Germanic.

2.2.3. Vowel Shortening

In late Old English, vowels were lengthened before the consonant groups *mb, nd, ld, rd, rð* but shortened in closed syllables before other consonant groups; thus *sōfte* → *softe* 'soft', *kēpte* → *kepte*; *mētte* → *mette,* etc. However, before *st*-clusters in closed syllables as in word-final positions, long vowels did not undergo shortening, as evidenced in their Modern English reflexes in (70).

[21] Wagner, p.178. For a similar view but with different analyses, see Selkirk 1982, p.347; Wagner, p.177, Ewen p.47ff.

[22] In an early Middle English alliterative poem, Layman's *Brut,* written 1189-1207, new alliterating groups, *br, tr, gr* appear. It is no accident that they are 'weak' clusters albeit immediately preceded by stressed syllables—hence can perhaps be interpreted as bisegments dominated by a single C-node (see (75) below).

(70) crīst 'Christ', prēst 'priest', brēst → Modern Scottish English [brīst] (see Jones p.127).

Therefore, the *st*-clusters in (70) can be analyzed as bisegments mapped onto one C-slot.

2.2.4. Open Syllable Lengthening

Accented root vowels are lengthened in open syllables if the intervening consonants are either single consonants (71a) or *s*-clusters (71b) but not geminate consonants or other clusters (71c).

(71) a. (OE) nama → (ME) nāme 'name,' wicu → wēke 'week'
b. ȝestes → ȝēstes 'gen.sg. of ȝest 'yeast', haste → hāste 'haste' (Jespersen, p.113)
c. ebba 'ebb', frogga 'frog', micle 'much'

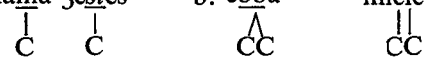
2.2.5. Stress Rules

The following words receive antepenultimate stress instead of penultimate stress:

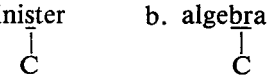
(72) a. mínister, sínister
b. álgebra, vértebra

From the above various rules, it could therefore be concluded that the *s*-clusters, and 'weak' clusters (72b), albeit immediately preceded by accented syllables, can be represented as bisegments mapped onto one C-slot as shown in (66a), where x ranges over single consonants, *s*-clusters, and 'weak' clusters, and then represent (71-72) as (73-74) respectively.

(73) a. nama ȝestes b. ebba micle

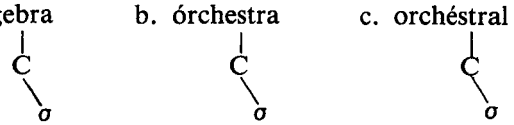


(74) a. minister b. algebra



It should, however, be noted parenthetically that if stress rules are to be based on the open/closed penult principle, i.e. the open vs. closed syllable of the pre-ultimate syllable (see Kahn p.86 and also Steriade p.84), then not only *algebra* with a weak cluster *br* but also *orchestra* and *orchestral* would naturally be stressed on the antepenultimate syllable as their penult syllables are open.

(75) a. álgebra b. órchestra c. orchéstral



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