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# Notes on the Sound Pattern of Old English

## Marking Conventions and Morpheme-Structure Rules

P. Tosio Sato

Presented below are interim results of an investigation on the sound system of Old English. Only consonants are taken up at this stage and their nature and distribution in the morphemes are described and accounted for. In the course of this investigation, validity and merits of Hallian theory of marking conventions will also be examined, and some suggestions for revision will be made.

1. Old English had 22 consonant segments, four liquids, and four glides, as listed in Table 1. [h] is a 'devoiced vowel', if we use the terminology of Daniel Jones,<sup>1</sup> and features unspecified in Table 1 (i.e., high, back, low, and round) are assigned according to the succeeding vowel. Not all segments listed in Table 1 are phonemically contrastive: the purpose of this paper is not to make a phonemic description of the language in question.<sup>2</sup>

2. It is, however, unnecessary to specify all features of the segments either as + or as - in the lexicon, for the following set of ordered marking conventions assign + or - to all features marked (specified as

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<sup>1</sup> Daniel Jones: *An Outline of English Phonetics*, 9th ed. (Cambridge, Heffer, 1960), p. 201.

<sup>2</sup> See Noam Chomsky: 'Some general properties of phonological rules', *Language* 43 (1967), 102-128.

	p	b	t	d	č	j	k	g	f	v	θ	ð	s	z	š	x	γ	m	n	ŋ	n	ŋ	l	l	r	r	w	w	y	h
voc	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
cons	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—		
son	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
cont	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
nasal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
cor	—	—	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
ant	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
back	—	—	—	—	—	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	○		
high	—	—	—	—	—	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	○		
low	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	○		
tense	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	—	—	—	—	—	—	—	—	+	—		
d. r.	—	—	—	—	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
str	—	—	—	—	+	+	—	—	+	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
lat	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
round	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	○		

Table 1. OE Consonants—I<sup>3</sup>

*m* in the matrix) or unmarked (specified as *u* in the matrix).<sup>4</sup> In these conventions, [*u* F] → [*α* F] means [*m* F] → [−*α* F] also.

*For consonants only*

(C1) [*u* nasal] → [− nasal]

<sup>3</sup> voc = vocalic, cons = consonantal, son = sonorant, cont = continuant, cor = coronal, ant = anterior, d.r. = delayed release, str = strident; lat = lateral.

<sup>4</sup> The set of conventions given here is a revised version of the one provided by Morris Halle at his class at M.I.T. on May 12, 1967. Halle may also have revised his conventions in the meantime. Because Chomsky-Halle: *The Sound Pattern of English* is still 'in print', however, I could not compare my version with his latest version.

(C2)  $[\text{u son}] \longrightarrow [-\text{son}] / \left[ \begin{array}{c} \text{u} \\ \text{m} \end{array} \right] \text{ nasal} \right] \quad ^5$

(C3)  $[\text{+ nasal}] \longrightarrow \left[ \begin{array}{c} +\text{son} \\ -\text{str} \\ +\text{cont} \end{array} \right]$

(C4)  $[\text{u low}] \longrightarrow [-\text{low}]$

(C5)  $[\text{+ low}] \longrightarrow [-\text{high}]$

(C6)  $[\text{u high}] \longrightarrow \left\{ \begin{array}{l} [-\text{high}] / \left\{ \begin{array}{c} \left[ \begin{array}{c} \text{u ant} \\ \text{u back} \end{array} \right] \\ \left[ \begin{array}{c} \text{m ant} \\ \text{m back} \end{array} \right] \end{array} \right\} \\ [+ \text{high}] / \left[ \begin{array}{c} \text{m ant} \end{array} \right] \end{array} \right\}$

(C7)  $[\text{u back}] \longrightarrow \left\{ \begin{array}{l} [-\text{back}] / \left[ \begin{array}{c} \text{u ant} \\ -\text{low} \end{array} \right] \\ [+ \text{back}] / \left\{ \begin{array}{c} \left[ \begin{array}{c} \text{m ant} \end{array} \right] \\ \left[ \begin{array}{c} \text{m low} \end{array} \right] \end{array} \right\} \end{array} \right\}$

(C8)  $[\text{u ant}] \longrightarrow \left\{ \begin{array}{l} [-\text{ant}] / \left[ \begin{array}{c} +\text{high} \\ -\text{back} \\ +\text{cor} \end{array} \right] \\ [+ \text{ant}] \end{array} \right\}$

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5 Halle's version is  $[\text{+ nasal}] \longrightarrow [-\text{son}]$ . I added  $[\text{u son}]$  to the input because tense (or unvoiced) nasals and tense liquids, which are  $[\text{+son}]$ , are also  $\left[ \begin{array}{c} -\text{voc} \\ +\text{cons} \end{array} \right]$ .

$$(C9) [u \ cor] \longrightarrow \left\{ \begin{array}{l} [\alpha \ cor] / \left\{ \begin{array}{l} \overline{-\alpha} \ back \\ -ant \end{array} \right\} \\ [+ \ cor] / \left\{ \begin{array}{l} \overline{+} \\ \overline{ant} \end{array} \right\} \end{array} \right\}$$

$$(C10) [u \ cont] \longrightarrow [- \ cont]^6$$

$$(C11) [+ \ cont] \longrightarrow [- \ d.r.]$$

$$(C12) [u \ d.r.] \longrightarrow \left\{ \begin{array}{l} [+ \ d.r.] / \left\{ \begin{array}{l} +cor \\ -ant \end{array} \right\} \\ [- \ d.r.] / \left\{ \begin{array}{l} \overline{-cor} \\ \overline{+ant} \end{array} \right\} \end{array} \right\}$$

$$(C13) [u \ str] \longrightarrow \left\{ \begin{array}{l} [\alpha \ str] / \left\{ \begin{array}{l} -cor \\ -ant \\ \alpha \ cont \end{array} \right\} \\ [-\alpha\beta \ str] / \left\{ \begin{array}{l} \overline{\alpha \ cont} \\ \overline{\beta \ d.r.} \\ \overline{\{-cor\}} \\ \overline{\{+ant\}} \end{array} \right\} \end{array} \right\}^7$$

$$(C14) [u \ tense] \longrightarrow [-\alpha \ tense] / \left[ \overline{\alpha \ nasal} \right]^8$$

$$(C15) [u \ lat] \longrightarrow [- \ lat]^8$$

6 Halle's version is  $[u \ cont] \longrightarrow \left\{ \begin{array}{l} [+ \ cont] / + \\ [- \ cont] \end{array} \right\} [+ \ cons] \right\}$ . The

first of the outputs is temporarily excluded here because it seems to be subject to revision. In English, as well as in numerous other languages, stops often come at this position as, e.g., *pleasure*, *tree*, *close*.

7 This is also a revised version of Halle's convention.

8 These conventions are not given by Halle but are added here to complete Table 2.

(C16)  $[\text{u round}] \longrightarrow [- \text{ round}]$ <sup>8</sup>

*For liquids only*

(L1)  $\begin{bmatrix} + \text{ voc} \\ + \text{ cons} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ son} \\ - \text{ nasal} \\ - \text{ d.r.} \\ - \text{ str} \end{bmatrix}$ <sup>9</sup>

(L2)  $[\text{u ant}] \longrightarrow [+ \text{ ant}]$

(L3)  $[\text{u cor}] \longrightarrow [+ \text{ cor}]$

(L4)  $[\text{u high}] \longrightarrow [- \text{ high}]$

(L5)  $[\text{u back}] \longrightarrow [- \text{ back}]$

(L6)  $[\text{u low}] \longrightarrow [- \text{ low}]$ <sup>8</sup>

(L7)  $[\text{u lat}] \longrightarrow [+ \text{ lat}]$

(L8)  $[\text{u cont}] \longrightarrow [- \text{ cont}]$

(L9)  $[\text{u tense}] \longrightarrow [- \text{ tense}]$ <sup>8</sup>

(L10)  $[\text{u round}] \longrightarrow [- \text{ round}]$ <sup>8</sup>

*For glides only*

(G1)  $\begin{bmatrix} - \text{ voc} \\ - \text{ cons} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ son} \\ - \text{ nasal} \\ - \text{ cor} \\ - \text{ ant} \\ - \text{ d.r.} \\ - \text{ str} \\ - \text{ lat} \end{bmatrix}$

(G2)  $[\text{u tense}] \longrightarrow [- \text{ tense}]$ <sup>8</sup>

(G3)  $[\text{u ow}] \longrightarrow [- \text{ low}]$

(G4)  $[\text{u high}] \longrightarrow [+ \text{ high}]$

<sup>9</sup>  $[- \text{ d.r.}]$  and  $[- \text{ str}]$  are added by the present writer.

(G5)  $[\text{u cont}] \longrightarrow [+\text{ cont}]$

(G6)  $[\text{u round}] \longrightarrow$   
 $[\alpha \text{ round}] / \left[ \begin{array}{c} \overline{\alpha \text{ back}} \\ \overline{\alpha \text{ high}} \end{array} \right]$

(G7)  $\left[ \begin{array}{c} \overline{-\text{ back}} \\ +\text{ tense} \end{array} \right] \longrightarrow \left[ \begin{array}{c} \alpha \text{ back} \\ \beta \text{ high} \\ \gamma \text{ low} \\ \delta \text{ round} \end{array} \right] / \cdots \left[ \begin{array}{c} \alpha \text{ back} \\ \beta \text{ high} \\ \gamma \text{ low} \\ \delta \text{ round} \end{array} \right]$ <sup>10</sup>

Thus, Table 1 may be rewritten as Table 2. These conventions are incorporated in the general theory of phonology, and has no bearing on the simplicity of a particular grammar. Only  $+$ ,  $-$ , and  $m$  have bearings on the 'cost' of the grammar: 'a system in which more features have only the entry  $u$  is preferable to a system in which fewer features have only the entry  $u$ , all other things being equal.'<sup>11</sup>

3. The marking conventions are used also as 'linking rules'. After each phonological rule is applied, the output is subject to application of all relevant marking conventions, unless otherwise specified, which increase the simplicity of the phonological component of particular grammars. Here are some examples:

**3.1. Initial Clusters.** Listed in Tables 3 and 4 are initial consonant clusters found in Joseph Bosworth and T. Northcote Toller's *An Anglo-Saxon Dictionary* (Oxford: Clarendon Press, 1964).

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10 This convention is added by the present writer. See n. 12 below.

11 Halle's Forum Lecture, 'Problems in Generative Phonology', given at the Linguistic Institute at the University of Michigan, July 18, 1967.

	p	b	t	d	č	j	k	g	f	v	θ	ð	s	z	š	x	γ	m	n	ŋ	ñ	ŋ	l	l	r	ɾ	w	ɾ	w	y	h
voc	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
cons	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	—			
son	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u		
cont	u	u	u	u	u	u	u	m	m	m	m	m	m	m	m	m	m	u	u	u	u	u	u	u	u	u	u	u			
nasal	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	m	m	m	m	m	m	u	u	u	u	u	u			
cor	m	m	u	u	u	u	u	m	m	u	u	u	u	u	u	u	m	u	u	u	u	u	u	u	u	u	u	u			
ant	u	u	u	m	m	m	m	u	u	u	u	u	m	m	u	u	m	m	u	u	u	u	u	u	u	u	u	u			
back	u	u	u	m	m	m	u	u	u	u	u	u	m	u	u	u	m	u	u	u	u	u	u	+	—	—	—				
high	u	u	u	m	m	m	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u			
low	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u			
tense	u	m	u	m	u	m	u	m	u	m	u	m	u	u	m	u	m	u	u	u	u	u	u	u	m	u	m				
d. r.	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u			
str	u	u	u	u	u	u	u	u	u	u	u	u	m	m	u	u	u	u	u	u	u	u	u	u	u	u	u	u			
lat	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	m	m	u	u	u				
round	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u			

Table 2. OE Consonants—II<sup>12</sup>

II	p	t	k	m	n	l	r	w
I	—	—	—	—	—	plega	prēost	—
p	—	—	—	—	—	—	—	—
t	—	—	—	—	—	—	trēow	twēgen
k	—	—	—	—	cniht	clēofan	cræft	cweðan
b	—	—	—	—	—	bliss	brōðor	—
d	—	—	—	—	—	—	dryhten	—
g	—	—	—	—	gnornung	glēaw	grund	—
f	—	—	—	—	—	flōd	fram	—
θ	—	—	—	—	—	—	þrowian	—
s	spell	stæf	Scottas	smolt	snican	slēan	—	swerian
š	—	—	—	—	—	—	scrin	—
w	—	—	—	—	—	—	sræc	—
h	—	—	—	—	hnappian	flāford	hræfn	hwæt

Table 3. Two Consonant Clusters<sup>13</sup>

		III	1	r
I-II				
sp		splottian	sprecan	
st		—	strang	

Table 4. Three Consonant Clusters

Of the segments constituting these clusters, many of the component features become predictable by OE phonological rules and marking conventions used as linking rules. The features that are necessary to be marked either +, - or *m* in the phonological matrices of the lexicon are therefore only those indicated in Table 5.

	p l	p r	b l	b r	f l	f r	t r	t w	d r	θ r	s l	s w	s n	s m	s p	s p r	s p l
voc												+	-		-		
cons	+++	+++	++	++	++	+	+	+	+	+	++	++	+	+	++	++	++
son																	
cont					m	m				m	m	m	m	m			
nasal													m	m			
cor	m	m	m	m	m	m								m	m	m	m
ant																	
back																	
high																	
low																	
tense					m	m				m							
d.r.																	
str											m						
lat		m		m			m	m		m	m						
round															m		

12 As mentioned in section 1, [h] is not always [- back], but this feature is adjusted by (G7).

13 /hn/ = [n<sub>o</sub>], /hl/ = [l<sub>o</sub>], /hr/ = [r<sub>o</sub>], /hw/ = [w<sub>o</sub>].

	s	t	s	t	r	s	k	š	r	k	l	k	r	k	w	k	n	g	l	g	r	g	n	w	r	h	n	h	l	h	r	h	w
voc	—					—				—												—	—	—	—	—	—	—	—	—	—		
cons	++	++	++	++	+	++	+	+	+	+	+	+	+	+	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
son																																	
cont							m																										
nas																	m					m				m							
cor																		m								m							
ant							m			m		m						m															
back																							+										
high																																	
low																																	
tense																		m				m											
d.r.																																	
str																																	
lat							m			m			m										m										
round																															m		

Table 5. Matricse of OE Clusters<sup>14</sup>

3.1.1. In the phonological matrices of OE lexicon, no initial consonant is specified as [- voc], and if any segment is specified as such, it is always a glide. Thus:

$$(1) \quad [u \text{ cons}] \longrightarrow [- \text{ cons}] / \$ \left[ \begin{array}{c} \text{---} \\ \text{---} \end{array} \right]$$

This rule is not a universal marking convention, but it belongs to the particular grammar of OE.

3.1.2. As is evident from (C1), (L1) and (G1), the nasality feature is

14 For clarity's sake, those features which are to be specified as *u* are left blank.

15 And also from Halle's (V8), which is a convention 'for vowels only', and which is omitted here because our main topic is consonant.

marked in all nasal segments and unmarked in all non-nasal segments. Thus:

$$(2) \llbracket u \text{ nasal} \rrbracket \longrightarrow \llbracket - \text{ nasal} \rrbracket$$

Note that this is simply a repetition of (C1) and (V8), and a partial repetition of (L1) and (G1). Why not, then, remove the conditions, 'for consonants only', 'for liquids only', etc., from some of the conventions and make them 'general conventions' which are independent of such categories? At any rate, it seems to me that rule (2) does not belong to the particular grammar of OE, but is of a much general nature.

3.1.3. We can hardly think of any language that has either a 'lateral

vowel', a 'lateral consonant' (i.e.,  $\begin{pmatrix} - \text{ voc} \\ + \text{ cons} \\ + \text{ lat} \\ \dots \end{pmatrix}$ ), or a 'lateral glide'. Therefore,

if we admit a set of such 'general marking conventions' as mentioned in the preceding section, then we can include (3) in this set.

$$(3) \llbracket m \text{ lat} \rrbracket \longrightarrow \begin{pmatrix} + \text{ voc} \\ + \text{ cons} \\ - \text{ lat} \end{pmatrix}$$

Here we must introduce the following 'meta-conventions':

I)  $\llbracket u F \rrbracket \longrightarrow \llbracket \alpha F \rrbracket$  also means  $\llbracket m F \rrbracket \longrightarrow \llbracket -\alpha F \rrbracket$

(This is already mentioned in section 2.)

II)  $\llbracket m F \rrbracket \longrightarrow \llbracket \alpha F \rrbracket$  does not mean  $\llbracket u F \rrbracket \longrightarrow \llbracket -\alpha F \rrbracket$

3.1.4. In OE, all nasal segments are consonants. Thus:

$$(4) \llbracket + \text{ nasal} \rrbracket \longrightarrow \begin{pmatrix} - \text{ voc} \\ + \text{ cons} \end{pmatrix}$$

As is evident from Table 2, the optimal nasal is  $\llbracket n \rrbracket$ . And after rule (4), all relevant marking conventions 'for consonants only' are applied, as linking rules, to assign all component features of  $\llbracket n \rrbracket$ , if all features except

nasality are left unmarked. If we mark the feature 'coronal' as well as 'nasal', then our conventions automatically assign all component features to the segment to make it [m]. Only [n] or [m] can occur at initial position after an initial consonant. In the pre-marking-convention theory, therefore, we had to have rule (5) to account for this restriction, which of course is not necessary in the present theory.

$$(5) [+ \text{ nasal}] \longrightarrow [+ \text{ ant}] / \# \left( \begin{array}{c} - \text{ voc} \\ + \text{ cons} \end{array} \right) \longrightarrow$$

3.1.5. Moreover, if the initial consonant preceding the nasal is not /s/, then it must be either /k/ or /g/, and the nasal in this case must be /n/. If we want to formulate these restrictions without recourse to the linking rules, it will become fairly complex. In the present theory, however, all we must have is rule (6).

$$(6) \left( \begin{array}{c} + \text{ cons} \\ \text{u cont} \end{array} \right) \longrightarrow [m \text{ ant}] / \# \longrightarrow [+ \text{ nas}]$$

If the output of this rule is marked for tenseness, then linking rules will make it /g/ after rule (7) is applied, and if it is not marked for tenseness, the linking rules will make it /k/. As for the succeeding nasal, all we have to do is leave all features except consonantality (specified as +) and nasality (specified as *m*) unmarked.

3.1.6. A segment that has a feature [+ cons] also has a feature [- voc] if it is between (I) a word-boundary or a consonant (in OE, /s/) and (II) a consonant, liquid, or a glide. Thus:

$$(7) [+ \text{ cons}] \longrightarrow [- \text{ voc}] / \# ( [+ \text{ cons}] ) \longrightarrow \left\{ \begin{array}{l} [+ \text{ cons}] \\ [- \text{ voc}] \end{array} \right\}$$

3.1.7. Only a vowel or /s/ occur initially before a stop consonant. Thus:

$$(8) [ \quad ] \longrightarrow \left( \begin{array}{c} + \text{ cont} \\ < + \text{ str} > \end{array} \right) / \# \left( \begin{array}{c} - \text{ cont} \\ < + \text{ cons} > \end{array} \right) [ \quad ]$$

Vowels are all continuant (which is marked by a convention). If it is a consonant, the linking rules applied after (7) have already changed it to [t], which is the optimal consonant. [+ str] is added in rule (8), therefore, to prevent it from becoming [θ]. The feature [- cont] of the second segment of the word does not have to be specified thus in the lexicon, for (C10) assigns it automatically if it is left unmarked.

3.1.8. A segment that has a feature [- voc] is a glide if it follows an initial consonant (except /s/) or a glide. Thus:

$$(9) \quad [- \text{voc}] \longrightarrow [- \text{cons}] / \# X \text{ ---}$$

where  $X = \text{any segment with a feature } [- \text{voc}]$ , but  $X \neq /s/$ .

3.1.9. A non-nasal consonantal segment is always a liquid if it stands immediately after an initial glide, an initial consonant except /s/, or after a group of two consonants occurring at the initial position (in this case, the consonant group must be /s/ plus a stop—see 3.1.7.). Thus;

$$(10) \quad \left[ \begin{array}{c} + \text{cons} \\ - \text{nasal} \end{array} \right] \longrightarrow [+ \text{voc}] / \# \left\{ \begin{array}{c} (+ \text{cons}) X \\ [- \text{voc}] \\ [- \text{cons}] \end{array} \right\} \text{ ---}$$

where  $X = \text{any segment with a feature } [- \text{voc}]$ , but  $X \neq /s/$ .

3.1.10. A liquid segment that comes after a dental stop or /θ/ is always /r/. This fact is accounted for by rule (11).

$$(11) \quad \left[ \begin{array}{c} + \text{voc} \\ + \text{cons} \end{array} \right] \longrightarrow [- \text{lat}] / \left[ \begin{array}{c} + \text{cor} \\ + \text{ant} \\ <+ \text{cont}> \\ <- \text{str}> \end{array} \right] \text{ ---}$$

However, rule (11) is redundant because the more general rule (3) in 3.1.3. has already assigned all features of /r/ to the input to (11). To

specify the /r/ in this position as [m lat] in the matrix (as we did in Table 5) does not sacrifice simplicity (for if we do not mark laterality, then we must specify the segment as [+ cons] in order to have rule (10) applied to this segment to make it  $\begin{pmatrix} + \text{voc} \\ + \text{cons} \end{pmatrix}$ ). Rather, it simplifies the grammar because, as mentioned above, it makes rule (11) redundant.

**3.1.11.** The only possible glide that occurs after an initial consonant or glide, or initially before /r/, is /w/. Thus:

$$(12) \quad \begin{pmatrix} - \text{voc} \\ - \text{cons} \end{pmatrix} \longrightarrow [+ \text{back}] / \# [- \text{voc}] \longrightarrow$$

**3.1.12.** Unless it is followed by an /r/ or a vowel, an initial glide is always /h/. If the segment that follows this initial /h/ is not a vowel, it must be either a nasal, a liquid or a /w/. The /h/ in this position drops after devoicing the following nasal, liquid, or /w/. Therefore, we have the following set of rules:

$$(13) \quad \begin{pmatrix} - \text{voc} \\ - \text{cons} \end{pmatrix} \longrightarrow [+ \text{tense}] / \# \longrightarrow \begin{cases} [- \text{voc}] \\ [+ \text{voc}] \\ [+ \text{cons}] \end{cases}$$

$$(14) \quad \begin{cases} [- \text{voc}] \\ [+ \text{cons}] \end{cases} \longrightarrow [+ \text{tense}] / \# \begin{pmatrix} - \text{voc} \\ - \text{cons} \\ + \text{tense} \end{pmatrix} \longrightarrow$$

$$(15) \quad \begin{pmatrix} - \text{voc} \\ - \text{cons} \\ + \text{tense} \end{pmatrix} \longrightarrow \phi / \# \longrightarrow \begin{cases} [- \text{voc}] \\ [+ \text{voc}] \\ [+ \text{cons}] \end{cases}$$

**3.1.13.** After these clusters must always come a vowel. Therefore:

$$(16) \quad \begin{pmatrix} + \text{voc} \\ - \text{cons} \end{pmatrix} / \# \begin{pmatrix} [+ \text{cons}] \\ [+ \text{cons}] \end{pmatrix} \begin{cases} \begin{pmatrix} \alpha \text{ voc} \\ \alpha \text{ cons} \end{pmatrix} \\ [+ \text{nasal}] \end{cases} \longrightarrow$$

### 3.2. Other Phonological Rules

3.2.1. Between voiced segments, /f/ → [v], /θ/ → [ð], /s/ → [z] (but not /š/ → [ž] or /x/ → [r]) as in *wulfas*, *seɔþan*, *nosu*. Thus:

$$(17) \left[ \begin{array}{l} + \text{cons} \\ + \text{cont} \\ + \text{ant} \end{array} \right] \rightarrow [- \text{tense}] / [+ \text{voiced}] \longrightarrow [+ \text{voiced}]$$

Note that in consonants, [u voiced] → [α voiced] /  $\overline{[-\alpha \text{tense}]}$ .<sup>16</sup>

3.2.2. /g/ → [r] medially between back vowels, between /l/ or /r/ and a back vowel, or finally after a back vowel or a back vowel followed by a consonant, as in *dagas*, *boga*, *hälga*, *beorgan*, *genög*, *burg*. Thus:

$$(18) \left[ \begin{array}{l} - \text{voc} \\ + \text{cons} \\ - \text{cor} \\ - \text{ant} \\ - \text{tense} \end{array} \right] \rightarrow [+ \text{cont}] / \left\{ \begin{array}{l} \left[ \begin{array}{l} + \text{voc} \\ - \text{cons} \\ + \text{back} \end{array} \right] \longrightarrow \left[ \begin{array}{l} + \text{voc} \\ - \text{cons} \\ + \text{back} \end{array} \right] \\ \left[ \begin{array}{l} + \text{voc} \\ + \text{cons} \end{array} \right] \longrightarrow \left[ \begin{array}{l} + \text{voc} \\ - \text{cons} \\ + \text{back} \end{array} \right] \end{array} \right\} \quad ((+ \text{cons}) \longrightarrow \$)$$

3.2.3. [x] does not occur in initial position, but no rule is necessary in OE grammar to account for this fact because if the feature 'anterior' is left unmarked, it is automatically marked '-' by convention (C8).

3.3.4. No voiced fricative comes at the initial position. But (C14) makes it unnecessary to make a special rule to assign [+ tense] to all fricatives in this position.

16 Halle does not give this convention, though.