LEXICAL REDUNDANCY IN GOTHIC, LATIN, AND GREEK

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by
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I. LEXICAL REDUNDANCY

The morpheme structure (MS) rule, which was introduced into generative phonology by Morris Halle (1959), represented the first attempt to formalize lexical redundancy within a distinctive feature system of phonology. It was reasoned that anything which could be predicted by a general rule was otherwise redundant and should be stated once in the grammar of a language, rather than repeated at every occurrence of the matter involved. The morpheme structure rules were considerably revised and clarified by Stanley (1967). It is Stanley's concept of lexical redundancy which was accepted without revision by Chomsky and Halle (1968) and forms the theoretical basis for the present work.

The morpheme is the unit of language in which the fundamental union of sound and meaning is made, that is, a semantic meaning is paired off with a phonological representation. Because of this, phonological shape is assigned first to the morpheme, which is stored as such in the dictionary of the language. The morphemes are assigned last in the phrase structure of a generated sentence. With the dictionary representation already added, the sentence undergoes the transformational cycle and then is considered output of the syntactic component and, after the readjustment rules, input to the phonological component. For this reason Stanley made a necessary distinction between phonological rules (P-rules) and morpheme structure rules (MS-rules). MS-rules describe the lexical redundancy already inherent within individual morphemes of a language and are therefore to be included in the lexicon. MS-rules describe the permissible phonological structure within individual morphemes, whereas P-rules describe permissible phonological structure
The essential differences between P-rules and MS-rules are these: 1) P-rules change features, whereas MS-rules only add redundant features. 2) P-rules are at least partially ordered and the order is often crucial to the output, whereas MS-rules are unordered and considered to apply simultaneously. In other words, order is not seen to affect the results of the MS-rules. 3) P-rules map the output of the syntactic level onto the phonetic level and apply across morphemes, whereas the MS-rules apply in the lexicon and within individual morphemes.

Preferring to keep the term "rule" for only those formulae which change features, i.e. P-rules, Stanley conceives of MS-formulae as "conditions," which do not change features, but state that if X is so, then Y must follow.

(1) If: \[
\begin{array}{c}
\text{nas} \\
\text{voc}
\end{array}
\]
Then: \[
\begin{array}{c}
\text{grv} \\
\text{dif}
\end{array}
\]

The "then" part merely adds redundant features. The phonological part of the morpheme is viewed as a matrix with columns representing segments, and rows describing features. In this sense the if-then condition represents a "disjoint matrix," which places a restriction on the possible occurrence of features within segments. In Condition (1), which describes the assimilation of nasals to a following stop, if a matrix in the lexicon has the configuration described in the "if" part, then it must also have the configuration in the "then" part. Of all the mathematically possible matrices, only those matrices which comply with Condition (1) are accepted. If a matrix complies with the "if" part
of (1) and does not comply with the "then" part, it is rejected as an inadmissible phonological matrix of that language.

Stanley points out that redundancy can be of two kinds: redundancy within a segment and redundancy with regard to sequences of segments. The former are described by "segment structure conditions" and have the form given in (2) below. The latter are described by "segment sequence conditions" and have the form in (1) above.

\[
\begin{align*}
(2) & \quad \text{If:} & 4\text{n}s \\
& & 4\text{voc} \\
& \downarrow & \\
& \text{Then:} & 4\text{voi}
\end{align*}
\]

Condition (2) states that resonants are redundantly voiced. The "then" half of both "segment structure" and "segment sequence" conditions contains redundant information which is omitted in the dictionary listing of each morpheme.

The segment structure conditions, such as (2) above, not only set aside the redundant features within a segment but also define the set of segmental phonemes which occur in the language. In other words, a complete set of segment structure conditions defines all the possible segments in the language. Similarly, a complete set of segment sequence conditions, in the form of (1) above, while setting aside the redundant features within a morpheme, also set aside the set of possible morphemes which can occur in the language (Stanley 1967:397-401).

In addition to conditions of the above mentioned if-then variety, Stanley augments the descriptive power of the HS-conditions by introducing conditions of the additional formats: the "positive" condition and the
"negative" conditions. The positive condition is used only for describing syllable structure (ibid. p. 432). It is not in an if-then format but simply a statement in the form corresponding to the "if" part alone, which pertains to all morphemes in the language. For instance, if all the syllables in a language were of the shape (C)V(C), then this information could be stated in a positive condition (Stanley 1968:524).

\[(3) \text{ POS: } ( \{ -\text{voc} \} ) [\text{voc}] ( \{ -\text{voc} \} ) \]

For a more complete discussion of the justification for positive conditions see Stanley (1967:431f).

Negative conditions, on the other hand, describe phonological feature matrices which are not allowed in a language. The example Stanley gives is the description of voicing and aspiration assimilation in Proto-Indoeuropean obstruents. The end result is a negative condition of the form:

\[(4) \text{ NEG: } \left[ \begin{array}{l} \alpha_{\text{voi}} \\ \beta_{\text{asp}} \end{array} \right] \left[ \begin{array}{l} \beta_{\text{voi}} \\ \alpha_{\text{asp}} \end{array} \right] \]

(Stanley 1967:433)

Indo-European had morphemes of the variety besh, bhedh, ped, bhed, pet, bet, but morphemes of the type pedh, ped, bhet, pheth are not allowed and are specifically excluded by the negative condition (4), a situation which cannot be handled by NS-conditions of the if-then variety. In other words, negative conditions are reserved for certain cases which cannot be dealt with in the if-then format.

Stanley (1967) is very careful to restrict the use of positive conditions to syllable structure, because all information which can be set forth in a positive condition can also be set forth in an if-then
condition. It so happens that a positive condition can describe syllable structure more simply than an if-then condition can. Likewise, Stanley realizes that negative conditions need further justification if they are to be included along with if-then conditions in describing lexical redundancy (Stanley 1967:433). This imposed limitation on positive conditions and the reservation about negative conditions arises from the fact that there is a tremendous overlap in the explanatory power of the positive and negative conditions with the explanatory power of the if-then condition. This is because the if-then condition is by its very format both a prediction and a prohibition; it has both positive and negative aspects which correspond to positive and negative conditions. An if-then condition describes all the matrices which can occur after the "if" part of the condition. Without the use of parentheses or alpha features only one matrix is described, and more than one are described if parentheses and alpha features are used. On the other hand, the if-then condition prohibits all matrices which do not comply with the "then" part. In other words, all the matrices generated by an if-then condition are, in a sense, positive conditions. This is why Stanley (1967) restricted positive conditions to describing syllable structure. Furthermore, the matrices prohibited by an if-then condition could just as well be described by negative conditions. For example, in Greek there is an if-then condition which says that if a dental occurs before an η, it must be voiceless:
However, the same restriction can be described equally as well by a negative condition which states that the cluster $\text{dl}$ is prohibited:

\[
\text{(6)} \quad \text{NEG: } \quad \begin{array}{c}
\text{[4cns]} \\
\text{-son} \\
\text{-grv} \\
\text{[4voi]}
\end{array} \quad \begin{array}{c}
\text{[4cns]} \\
\text{+son} \\
\text{-nas} \\
\text{+con}
\end{array}
\]

What then is the reason for selecting one format over the other? When more than one feature is redundant, the if-then condition is capable of more economy in presentation, and it is to be preferred. Also, the negative condition does not set aside redundant features as does the if-then condition, and so once again the if-then condition is to be preferred. Consider, for example, the following if-then condition concerning clusters of nasals, which occur in Gothic, Greek, and Latin:

\[
\text{(7)} \quad \begin{array}{c}
\text{[4nas]} \\
\text{+dif} \\
\text{+grv}
\end{array} \quad \begin{array}{c}
\text{[4nas]} \\
\text{+dif} \\
\text{+grv}
\end{array}
\]

Condition (7) states that before an $\text{m}$ the only nasal which can occur is is another $\text{m}$. Thus Condition (7) has the effect of generating $\text{mm}$ and prohibiting $\text{nm}$ and $\text{nn}$. This same information could be conveyed by two negative conditions (8) and (9):
We see that the if-then condition is more economical when more than one feature is redundant. We are able to collapse the negative conditions (8) and (9) into a single if-then condition (7). This will not always be so, for it is not so in the negative condition (4) which Stanley gives concerning voicing and aspiration assimilation in Indo-European, but it will be so whenever if-then and negative conditions overlap. For each if-then condition there will be one or more corresponding negative conditions, depending on how many features are redundant in the "then" part of the if-then condition. This fact will prove useful later, when we seek to compare specific points in Greek, Gothic, and Latin. Because of its greater generality, the if-then condition sometimes obscures these specific points. For illustrative purposes, then, we will want on occasion to be able to switch to the corresponding negative aspect of an if-then condition. Before this could be done, however, it has been necessary to demonstrate that the negative condition overlaps with the if-then condition, and, when only one feature is involved, is equivalent to it.

Occasionally, two if-then conditions will have the same negative counterpart. When they do, they are complements of each other. Let us return to Condition (5) which stated that before a dental had to be voiceless. To arrive at this redundancy we focused on the first segment
of the two-segment cluster. If we had focused on the second segment, we would have the following if-then condition:

\[(10) \begin{bmatrix} +\text{cns} \\ +\text{son} \\ -\text{grv} \\ +\text{voi} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cns} \\ +\text{son} \\ -\text{nas} \end{bmatrix} -\text{con} \]

After a θ in Greek, the only nonnasal resonant which can occur is ρ. This Condition (10) is the complement of (5) above. Both Conditions must be in the lexicon to explain redundancies in morphemes beginning with thl and dr and other similar clusters. The negative aspect of (10), though, is Condition (6), the same as it was for Condition (5). When this happens, the complementarity of two if-then conditions is assured.

Thinking of segment sequence conditions in complements is of value perhaps only as a part of an overall discovery procedure. In many instances the complementary conditions, or a set of complementary conditions, will generate the same results. In Greek, for instance, the following clusters of two resonants are permitted within a morpheme: ll, rm, mn, mn, mn, step. This can be visualized two ways: either the second segment is focused on and the resonant before it is generated, or vice versa. In the following table of Greek resonant clusters we can think of the resonants in column (B) as the resonants in focus, and write MS-conditions to generate what can follow in column (C), or we can write another set of MS-conditions to generate what resonant can precede in column (A).
Correspondingly, the set of conditions (12.1-4) yield the same results as the conditions (13.1-3).

<table>
<thead>
<tr>
<th>(11)</th>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r, a )</td>
<td>( m )</td>
<td>( m, n )</td>
<td></td>
</tr>
<tr>
<td>( m, n, r )</td>
<td>( n )</td>
<td>( n )</td>
<td></td>
</tr>
<tr>
<td>( r )</td>
<td>( r )</td>
<td>( m, n, r )</td>
<td></td>
</tr>
<tr>
<td>( 1 )</td>
<td>( 1 )</td>
<td>( 1 )</td>
<td></td>
</tr>
</tbody>
</table>

(12.1) \[ \begin{align*} +nas & \quad +cns \quad +son \quad +grv \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ +nas & \quad +cns & \quad +grv \\ \end{align*} \]

(12.2) \[ \begin{align*} +nas & \quad +cns \quad +son \\ \quad -grv \\ \downarrow \quad \downarrow \\ +nas & \quad +cns \quad -grv \\ \end{align*} \]

(12.3) \[ \begin{align*} +cns & \quad +son \quad -nas \quad -con \\ \quad +son \\ \quad \downarrow \quad \downarrow \\ +cns & \quad +son \quad -con \\ \end{align*} \]

(12.4) \[ \begin{align*} +cns & \quad +son \quad -nas \quad +con \\ \quad +son \\ \quad \downarrow \quad \downarrow \\ +cns & \quad +son \quad -nas \quad +con \\ \end{align*} \]

(13.1) \[ \begin{align*} +cns & \quad +son \quad -nas \\ \quad +grv \\ \quad \downarrow \quad \downarrow \\ +cns & \quad +grv \quad -grv \\ \end{align*} \]
(13.2) 
\[
\begin{array}{c}
\text{+cons} \\
\text{+son} \\
\text{-grv} \\
\downarrow \\
\text{-con}
\end{array}
\]

(13.3) 
\[
\begin{array}{c}
\text{+cons} \\
\text{+son} \\
\text{-nas} \\
\downarrow \\
\text{acon}
\end{array}
\]

\[
\begin{array}{c}
\text{-nas} \\
\text{acon}
\end{array}
\]

The two sets of conditions are complementary, and they yield the same results, namely, the resonant clusters in Greek listed above. Consequently, only one of the sets need be included in the lexicon.

Complementary conditions, however, will not always yield the same results. The complementary conditions (5) and (10) above did not attain the same results, and both conditions were found necessary for inclusion in the lexicon. Nor will two sets of complementary conditions always yield the same results. In Latin, for example, the following medial nonstrident consonant clusters are allowed: **pp, pt, tt, kk, kt**. This can be visualized in the following table. As in (11) above we can focus on the stops in column (B) and write **MS-conditions** to generate what stops can follow in column (C), or we can write a different set of conditions to generate what stops can precede in column (A).

<table>
<thead>
<tr>
<th>(14)</th>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p</td>
<td>p</td>
<td>p,t</td>
</tr>
<tr>
<td></td>
<td>k</td>
<td>k</td>
<td>k,t</td>
</tr>
<tr>
<td>p,t,k</td>
<td>t</td>
<td>t</td>
<td></td>
</tr>
</tbody>
</table>

The results would be the following two sets of **MS-conditions** respectively.
It is precisely in such instances where thinking of conditions in terms of complements is profitable. We see that it was not possible to write a MS-condition in (16) parallel to (15.3), because all three stops could precede \( t \). Consequently, the only redundancy which could be captured is in what step follows \( t \), (15.3). On the other hand, (15.1-2) overlap with (16.1-2), but not entirely. (15.1) is able to describe one redundant feature in the medial clusters pp, pt, and (15.2) is able to
describe one redundant feature in the medial clusters \( kk, kt \). Where
geminate clusters are concerned, though, (16.1-2) are able to predict
two redundant features, whereas (15.1-2) could only predict one
redundant feature in the cluster. We see, then, that in order to
describe the maximum redundancy in Latin consonant clusters we must
include all the complementary conditions in (15) and (16) in the lexicon.
We can and should, however, collapse (16.1) and (16.2) with the use of
an alpha feature for diffuseness. We have shown how the use of
complementary conditions as a discovery procedure could lead to the same
results, as in (12) and (13), in which case one set of complementary
conditions need not be included in the lexicon, or it could lead to the
discovery of additional redundancies, as in (15) and (16), all of which
should be included in the set of MS-conditions in the lexicon.

There is one further way in which viewing each condition together
with its complement may be of value. Occasionally, the researcher will
discover that two complementary conditions can be collapsed into one
condition. For instance, in Latin initially before a stop the only
consonant which can occur is an \( s \). In addition, another sequential
restraint exists which states that after an initial \( s \), the only
consonant which can occur is a stop. The realization that these two
conditions are complements of each other enables one to collapse them
into a single MS-condition:

\[
\begin{align*}
(17) \quad \# & \quad [\text{\textasciitilde} \text{cns} - \text{son}] & \quad [\text{\textasciitilde} \text{cns} - \text{son}] \\
& \quad \downarrow & \quad \downarrow \\
& \quad [\text{\textasciitilde} \text{str}] & \quad [\text{-con}] 
\end{align*}
\]
"Languages differ with respect to the sounds they use and the sound sequences they permit in words. Thus each language places certain conditions on the form of phonetic matrices and hence on the configurations of pluses and minuses...that may appear as entries in the classificatory matrices of the lexicon." (Chomsky and Halle 1968:381). It is the purpose of this work to demonstrate that NS-conditions, with all the facets described above, provide a means to describe the relationship between languages. This can be done by pointing out which conditions related languages share, which conditions they do not share, and how shared conditions differ. This will be done in Chapter Five of this work.

Certain conditions such as (2) above can be seen to be universal conditions, which, as matters of convention, apply to all languages possessing resonants. Many of these conditions will be obviated by the acceptance of uniform marking conditions. Conditions such as (1), describing the assimilation of nasals to following stops, although they are not universal, are so general that they should not be used to demonstrate language relationships. Only conditions which are language-specific can and will be used to demonstrate language relationships. We will present the lexical redundancy conditions of Gothic, Latin, and Greek, which will be arrived at independently for each language; then they will be examined in the fifth chapter for identical and overlapping NS-conditions.
THE FEATURES

Segment (seg). For the purposes of analysis the linear flow of sound is divided into discrete units. These units are then subdivided into segments and boundaries. A segment will be marked [seg], and a boundary will be marked [seg]. Since all features below are features of segments, we will regard the occurrence of any of these features to presuppose the feature [seg]. This allows us by convention to omit the feature [seg] from all segments. In writing MS-conditions we are confronted with only one type of boundary, morpheme boundary. [seg] will be used to designate only morpheme boundary. When [seg] occurs at the beginning of a MS-condition, it will mean "morpheme initial." When [seg] occurs at the beginning of a MS-condition, it will mean "medially."

Consonantal (cns). "Consonantal sounds are produced with a radical obstruction in the midsagittal region of the vocal tract; nonconsonantal sounds are produced without such an obstruction (Chomsky and Halle 1968: 302).

Sonorant (son). Following the example of Voyles (1967:640) the feature sonorant is used instead of the feature vocalic. "Sonorants are sounds produced with a vocal tract cavity configuration in which spontaneous voicing is possible (Chomsky and Halle 1968:302)." This feature groups vowels, nasals, and liquids into one class, whereas Chomsky and Halle (p. 303) consider nasals to be nonvocalic. Although their definitions are accepted without modification, Chomsky and Halle are not rigidly followed on the matter of choice of features, because they seemed to provide an unnecessary proliferation of features, the superfluous ones of which would only have to be eliminated in the segment structure condi-
tions.

**Grave** (grv). The feature grave, when applied to vowels, refers to back vowels. The absence of gravity indicates front and low vowels. When applied to consonants, the feature grave corresponds to peripheral consonants: labials and velars.

**Diffuse** (dif). When applied to vowels, diffuse characterizes high vowels. The absence of diffuseness refers to mid and low vowels. Applied to consonants, the feature diffuse refers to front consonants and corresponds to what Chomsky and Halle (1968:307) refer to as "anterior." Chomsky and Halle were not followed here, because "anterior" was restricted to consonants alone.

**Nasal** (nas). "Nasal sounds are produced with a lowered velum which allows the air to escape through the nose (Chomsky and Halle 1968:316)." This feature, by convention, will apply only to resonants.

**Continuant** (con). "In the production of continuant sounds, the primary constriction in the vowel tract is not narrowed to the point where the air flow past the constriction is blocked (Chomsky and Halle 1968:317)." In continuancy, however, following Harms (1968:33), nasals are considered noncontinuant. This leaves open the possibility of nasalized continuants and nasalized noncontinuants.

**Voiced** (voi). Voiced sounds are those during which the vocal cords vibrate. In voiceless sounds, the vocal cords do not vibrate.

**Long** (lng). The duration of long sounds is significantly longer than non-long sounds. By convention length applies only to vowels. In comparing Gothic to Latin and Greek we will not be concerned whether Gothic vowels portrayed a tense/lax distinction instead of a long/short distinction. To facilitate comparison we shall assume that the distinc-
tion is one of length.

**Compact** (com). Compactness, by convention, is characteristic only of vowels, and corresponds to the lowest significant level of vowel height.

**Flat** (flt). "Flatness is produced by a secondary articulation that increases the volume of the oral cavity; e. g. lip rounding... (Harms 1968:31)." This feature is used to mark labiovelars.

**Tense** (tns). Tenseness applies only to the aspiration of consonants, which occurs in Greek.

**Strident** (str). "Strident sounds are marked acoustically by greater noisiness than their nonstrident counterparts (Chomsky and Halle 1968:329)." By convention strident applies only to continuants.

Because of the need to distinguish sibilants from other continuants, stridency will be further restricted to apply only to sibilants.

Contrary to common usage then (Chomsky and Halle 1968:177) the segment & will be considered [−str].

The presence or absence of the above features is represented in the phonological matrices by a plus or minus respectively.

The four basic types of segments are characterized by the presence or absence of only the two features consonantal and sonorant. Obstruents are considered [+cns] [-son]. Vowels are considered [+son]. Resonants are [+son].

Glides are [-cns] [-son].
II. GOTHIC

Segment Structure Conditions:

To conserve space the segment structure conditions will be presented horizontally from left to right, but they will still be thought of in their if-then format.

(1) \[ +\text{son} \rightarrow +\text{voi} \]

Vowels and resonants are redundantly voiced.

(2) \[ -\text{cns} \quad +\text{son} \rightarrow +\text{con} \]

Vowels are redundantly continuant.

(3) \[ -\text{cns} \quad +\text{son} \quad +\text{grv} \rightarrow -\text{com} \]

Back vowels are noncompact.

(4) \[ -\text{cns} \quad +\text{son} \quad +\text{dif} \rightarrow -\text{com} \]

High vowels are noncompact.

(5) \[ +\text{com} \rightarrow [-\text{cns} \quad +\text{son} \quad -\text{grv} \quad -\text{dif}] \]

Low segments are redundantly nonback and nonhigh vowels.
### Possible Segments in Gothic

|   | p | t | k | k' | f | b | h | w | b | d | g | g' | s | r | l | m | n | ñ | e | i | o | u | iu | i | ia | a | au | u | j | w |
| ons | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| son | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| grv | + | - | + | + | - | + | + | + | - | + | + | + | - | - | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| dif | + | + | - | + | + | - | + | + | + | + | + | - | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| nas |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| con | - | - | - | + | + | - | - | + | - | + | - | + | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| voi | - | - | - | - | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| lng |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| oom |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| flt | - | - | - | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| str | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
(6) \[ \text{nas} \rightarrow \text{cons} \]

Nasal segments are noncontinuant resonants.

(7) \[ \text{cons} \rightarrow \text{dif} \]

Nongrave consonants and resonants are redundantly diffuse.

(8) \[ \text{str} \rightarrow \text{cons} \]

Strident segments are redundantly continuant, nongrave consonants.

(9) \[ \text{con} \rightarrow \text{str} \]

Noncontinuants are nonstrident.

(10) \[ \text{cons} \rightarrow \text{dif} \]

Glides are diffuse in Gothic.

(11) \[ \text{flt} \rightarrow \text{cons} \]

Flat segments must be velar consonants.

(12) \[ \text{cons} \rightarrow \text{flt} \]

Nonvelar consonants must be nonflat.
Segment Sequence Conditions:

Since segment sequence conditions involve more than one segment, we will resume a vertical presentation of the if-then conditions. Rather than positing unfamiliar underlying morphemes, we will present the examples of sequence conditions in their easily recognizable standard written forms. That is, most examples will be words as they are normally written. It is cautioned here that the examples being offered are the individual morphemes (usually only one per example) which underlie the sample word, and not the word itself.

\( (13.1) \quad \begin{array}{c}
\text{cns} \\
\text{son} \\
\text{grv}
\end{array} \quad \begin{array}{c}
\text{cns} \\
\text{son} \\
\text{nas}
\end{array} \quad \begin{array}{c}
\text{con}
\end{array}
\)

Before an \( \text{̔} \) voiceless dentals are generated and voiced dentals are prohibited. Examples are: plahan, ma\( \text{̔} \), sleps, hunsl, sit\( \text{̔} \), fairweis\( \text{̔} \).

\( (13.2) \quad \begin{array}{c}
\text{seg}
\end{array} \quad \begin{array}{c}
\text{cns} \\
\text{son} \\
\text{grv}
\end{array} \quad \begin{array}{c}
\text{cns} \\
\text{son} \\
\text{nas}
\end{array} \quad \begin{array}{c}
\text{con}
\end{array}
\)

When initial this cluster of dental plus the resonant \( \text{̔} \) is also redundantly continuant. Examples are the same as above: plahan, sleps.

\( (14) \quad \begin{array}{c}
\text{cns} \\
\text{son} \\
\text{grv} \\
\text{voi}
\end{array} \quad \begin{array}{c}
\text{cns} \\
\text{son}
\end{array} \quad \begin{array}{c}
\text{nas} \\
\text{con}
\end{array}
\)
After a voiced dental stop the only resonant permitted is \( r \). This condition is the complement to the preceding Condition (13). Examples are: driusan, sadrein, fodor.

\[
\begin{array}{c}
\text{(15) } \text{NEG:} \\
\text{str} \quad \text{cns} \\
\quad +\text{son} \\
\quad -\text{grv} \\
\quad -\text{con} \\
\quad -\text{nas}
\end{array}
\]

After a strident consonant the only resonant not permitted is \( r \). Condition (15) thus prohibits the cluster \( gr \), but allows \( sl \), \( sm \), and \( sn \). Examples are: sleps, smals, smaga, anabums, razn, gasaizlep.

\[
\begin{array}{c}
\text{(16.1) } \text{-seg} \\
\text{cns} \\
\quad \text{-son} \\
\quad \text{str} \\
\quad \text{odif} \\
\quad \text{grv} \\
\quad \text{dvoi} \\
\quad \text{nas}
\end{array}
\]

Initially the only clusters of nonstrident consonant plus nasal resonant which are permitted are \( bn \), \( kn \), and \( hn \). Examples are: bnaun, knops, hnaius.

Medially the situation for consonant plus nasal is more complex. The following table shows the clusters of consonant plus nasal which do and do not occur medially in Gothic. Clusters preceded by an asterisk do not occur.

\[
\begin{array}{cccccc}
\text{bn} & \ast\text{dn} & \text{gn} & \ast\text{bm} & \ast\text{dm} & \text{gn} \\
\text{pn} & \ast\text{tn} & \text{kn} & \ast\text{pm} & \ast\text{tn} & \ast\text{km} \\
\ast\text{fn} & \text{pn} & \text{hn} & \ast\text{fn} & \text{pn} & \text{hn}
\end{array}
\]

Table 1.
The situation before n in Table 1 can be described by the following negative condition (16.2). The situation before m in Table 1 is described by the two if-then conditions (16.3) and (16.4).

(16.2) \[ \text{NEG: } \begin{array}{c} \text{seg} \\ \text{cons} \\ \text{nas} \\ -\text{con} \\ -\text{son} \\ +\text{dif} \\ +\text{grv} \\ -\text{grv} \end{array} \]

Noninitially labial continuants and dental stops do not occur whereas labial stops and dental continuants as well as all velars do occur before a nasal n. Examples are: afdbn, wepna, laugnjan, rahnjan, taiknjan, haipno.

(16.3) \[ \begin{array}{c} \text{seg} \\ \text{cons} \\ \text{nas} \\ -\text{con} \\ -\text{grv} \\ +\text{dif} \end{array} \]

Noninitially a dental before an m must be p, as in maipna.

(16.4) \[ \begin{array}{c} \text{seg} \\ \text{cons} \\ \text{nas} \\ -\text{con} \\ -\text{grv} \\ +\text{dif} \end{array} \]

Noninitially a velar before an m must be k or h. Examples are: bagms, ahma.
(17) \[ \text{nas} \rightarrow \text{cns} \]
\[ \downarrow \]
\[ \text{grv} \]
\[ \text{dif} \]

Nasals are assimilated to a following obstruent. Examples are: anda, blinds, finf, dumbs, aggilus (gg-ng).

(18) \[ \text{cns} \]
\[ \downarrow \]
\[ \text{dif} \]

Noninitially after a labial consonant a following consonant must be diffuse. This has the effect that, except for geminate consonants, the second consonant must be a dental. Because of Condition (21) below, which limits initial consonant clusters, it is not necessary to mark "noninitial" in this condition and the following conditions (19) and (20). Examples are: haifst, aftana, abba, rabbei, aiffa.

(19) \[ \text{cns} \]
\[ \downarrow \]
\[ \text{grv} \]
\[ \text{str} \]

Noninitially after a nonstrident dental consonant only another nonstrident dental can occur. This results in allowing only the geminatedentals. Examples are: skattja, aippan, daddjan.
Noninitially after a velar consonant a consonant must not be a labial. This has the effect that, except for geminate velars, the second segment must be a dental. Examples are: ahtau, gehugdai, ahs, sakkum, saggws, triggws.

If two consonants occur initially in a morpheme, the first must be an s, and the second must be a voiceless obstruent. Examples are: sparwa, stautan, skafts.

Medially before a labial or a velar segment the first segment must also be a labial or a velar respectively. Thus geminate labials and velars are generated. Examples are: abba, aiffapa, saggws, sakkum.
Noninitially before a labial or a velar consonant must be a continuant. Examples are: aftana, nahts.

Clusters of dentals are assimilated in continuancy. These are only geminates because of (19) above and are assimilated in voice because of (24) below. Examples are: daddjan, skattja, aippau.

Clusters of consonants are assimilated in voice. Examples are: abba, aftana, aippapa, skattja, aippau, gahugdai, sakkum, triggus, nahts.

\[ \text{NEG:} \quad \text{nas} \quad \text{cns} \]

After an \( m \) the only resonant not permitted in Gothic is \( l \). Other resonants after an \( m \) are permitted. Examples are: stamms, namnjan, gatimrjo.
After an \( n \) the only resonant permitted is another \( n \). This allows, then, only the geminate \( n \). Examples are: brinno, gimnan.

After an \( r \) only noncontinuant resonants are generated. This in effect prohibits only the cluster \( nr \). Examples are: haurn, arma, fairra.

After an \( l \) an \( r \) is not permitted in Gothic.

After an \( l \) an \( n \) is not permitted in Gothic. The effect of (28.1-2) is to prohibit clusters of \( ln \) and \( lr \), but to permit \( m \) and \( l \) after an \( l \). Examples are: hilms, wulla.
Before two consonants or before a resonant plus a consonant, a vowel must be short. This condition, however, does not exclude the possibility of a long vowel before a cluster of consonant plus resonant. Examples are: briggan, huggrjan, gaggan, kintus, grunduwaddjus, fimf, filhan, alds, andanumts, fisks, waihts, rasta, trausti, krusts, födr.

\[(30)\] \text{NEG:} \begin{bmatrix} \text{-cons} \\ \text{+son} \\ \text{+son} \end{bmatrix}

Diphthongs are not permitted in Gothic. This is still a disputable point, but there is no evidence within Gothic to regard ai and au as anything but monophthongs.

\[(31)\] \begin{bmatrix} \text{-cons} \\ \text{+son} \\ \text{-com} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+nas} \\ \text{+son} \end{bmatrix}

Mid vowels are not permitted before a nasal plus a consonant, whereas high and low vowels are permitted. Examples are: kintus, andanumts, grunduwaddjus, fimf, alds, briggan, gaggan, huggrjan.

\[(32.1)\] \begin{bmatrix} \text{-cons} \\ \text{+son} \\ \text{-com} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+cons} \\ \text{+son} \\ \text{-nas} \\ \text{+con} \end{bmatrix}

Mid vowels are not permitted before a nasal plus a consonant or resonant, whereas high vowels are generated. Likewise, there is no restriction on low vowels in this position. Examples are: hilpan, filhan, hilm, alds, wulla, tulgus, wulfs.
High vowels are prohibited from occurring before an r plus a consonant or resonant. Examples are: stairno, airpa, airkns, fairra, arbi, gards, baurgs, waurd. The overwhelming evidence supports the lack of high vowels before r regardless of what follows, but Moulton (1948:80) prefers the seeming exceptions to such a condition, hiri, hirjats, and the prefix ur-. These exceptions, although few, have been met by adding the further environment [+-cons] to Condition (32.2). The combined result of (31) and (32) is to permit only two vowel heights before a resonant plus a consonant or resonant.

A segment after a glide in Gothic must be either a resonant or a vowel. Examples are: vlits, wrikan, wair, awiliub, jai, ajukiup.

Medially if a resonant occurs before a glide, the resonant must be non-grave and the glide must be y. Examples are: balwjan, arwjo, manwjan.
If a consonant occurs before a glide, the consonant must be a dental and the glide must be y. Examples are: dwals, fidwor, twefl, jwahan, swairhro, izwar. Conditions (33.2-3) effectively limit the glide j to occurrence initially and intervocally. Across morpheme boundaries j, too, occurs quite frequently after a resonant or a consonant (fiskjan, fulljan, etc.), but never within a morpheme. The alternations of w~u and j~i are matters for the phonological component and cannot be handled within the framework of MS-conditions.

Before a voiceless velar continuant high vowels are not permitted, whereas mid and low vowels are permitted. Examples are: faihu, saih/an, jahan, ah/a, dauhtar.

After an initial resonant, or after a resonant preceded by one or two consonants in morpheme-initial position, the next segment must be a vowel.
This condition effectively prohibits initial clusters of two resonants.

Examples are: land, magan, niba, reiki, slahan, smals, smaga, streiks.
III. LATIN

Segment Structure Conditions:

To conserve space the segment structure conditions will be presented horizontally from left to right, but they will still be thought of in their if-then format.

(1) \[
\begin{array}{c}
\xrightarrow{\text{son}} \\
\text{son}
\end{array}
\rightarrow
\begin{array}{c}
\xrightarrow{\text{vol}} \\
\text{vol}
\end{array}
\]

Vowels and resonants are redundantly voiced.

(2) \[
\begin{array}{c}
\xrightarrow{\text{cns}} \\
\text{cns}
\end{array}
\rightarrow
\begin{array}{c}
\text{con}
\end{array}
\]

Vowels are redundantly continuant.

(3) \[
\begin{array}{cc}
\xrightarrow{\text{cns}} & \\
\text{cns} & \text{con}
\end{array}
\rightarrow
\begin{array}{c}
\text{con}
\end{array}
\]

Back vowels are noncompact.

(4) \[
\begin{array}{cc}
\xrightarrow{\text{cns}} & \\
\text{cns} & \text{con}
\end{array}
\rightarrow
\begin{array}{c}
\text{con}
\end{array}
\]

High vowels are noncompact.

(5) \[
\begin{array}{c}
\xrightarrow{\text{com}} \\
\text{com}
\end{array}
\rightarrow
\begin{array}{cc}
\xrightarrow{\text{cns}} & \\
\text{cns} & \text{con}
\end{array}
\]

Low segments are redundantly nonback and nonhigh vowels.
Nasal segments are noncontinuant resonants.

Nongrave consonants and resonants are redundantly diffuse.

Strident segments are redundantly continuant, nongrave, voiceless consonants.

Noncontinuants are nonstrident.

A nonstrident continuant in Latin must be a voiceless labial.

Flat segments must be noncontinuous velar consonants.
Nonvelar consonants must be non-flat.

Segment Sequence Conditions:

Since segment sequence conditions involve more than one segment, we will resume a vertical presentation of the if-then conditions. Rather than positing unfamiliar underlying morphemes, we will present the illustrations of sequence conditions in their easily recognizable standard written forms. That is, most examples will be words as they are normally written. It is cautioned here that the examples being offered are the individual morphemes (usually only one per word) which underlie the sample word and not the word itself.

\[ (13) \quad \begin{array}{c}
\begin{array}{c}
\text{\textit{\small{cns}}} \\
\text{-son}
\end{array} \\
\downarrow
\end{array} \begin{array}{c}
\begin{array}{c}
\text{\textit{\small{nas}}} \\
\text{\textit{\small{con}}}
\end{array}
\end{array} \]

Dentals are prohibited before an \( \text{\textit{\small{l}}} \), whereas labials and velars are generated. Examples are: flagro, plus, blandus, clamo, glomero.

\[ (14) \quad \begin{array}{c}
\begin{array}{c}
\text{\textit{\small{cns}}} \\
\text{-son}
\end{array} \\
\downarrow
\end{array} \begin{array}{c}
\begin{array}{c}
\text{\textit{\small{nas}}} \\
\text{\textit{\small{con}}}
\end{array}
\end{array} \]

After a dental stop the only resonant permitted is an \( \text{\textit{\small{r}}} \). Examples are: traaho, Hadrianus.
Resonants are not permitted after an $g$. The cluster $sm$ does exist in several Greek loanwords such as Smyrna, smēris, smilax, smaragdus, but as far as native Latin morphemes are concerned this cluster is not permitted.

The only cluster of nonstrident consonant plus resonant permitted in Latin is $gn$. In early Latin this cluster is permitted initially, but lost during the historical period. Examples are: gnosco, ignis.

A nasal resonant assimilates in gravity and diffuseness to a following obstruent. Examples are: abundantia, ambulo, anxius. This condition is so widespread that it is tempting to posit it as a universal, but it cannot be considered a universal for several reasons: 1) The nasals do not assimilate to each other in Latin, as seen in columna, somnio, alumnus, amnis, etc. 2) In some languages the assimilation of nasals may be regressive, as in Old Icel. Gunnr compared with OHG gund-, and Latin quando becoming Sicilian $kwannu$. 3) In some languages there are early
instances of non-assimilation, as in Lith. šimtas.

(18) \[
\begin{array}{c}
[+\text{cns}] \\
[+\text{son}] \\
[\text{dif}] \\
\end{array}
\quad \quad \quad \\
\downarrow
\quad \quad \quad \\
\begin{array}{c}
[+\text{cns}] \\
[\text{dif}] \\
\end{array}
\]

Noninitially after a labial consonant a following consonant must be diffuse. This has the effect that, except for geminate consonants, the second consonant must be a dental. Because of Condition (21) below, which limits initial consonant clusters, it is not necessary to mark "noninitial" in this condition and the following conditions (19) and (20). Examples are: neptis, ruptio, aptus, Appius, mappa.

(19) \[
\begin{array}{c}
[+\text{cns}] \\
[+\text{son}] \\
[\text{grv}] \\
[\text{str}] \\
\end{array}
\quad \quad \quad \\
\downarrow
\quad \quad \quad \\
\begin{array}{c}
[+\text{cns}] \\
[\text{son}] \\
[\text{grv}] \\
[\text{str}] \\
\end{array}
\]

Noninitially after a nonstrident dental consonant the only consonant which can occur is another nonstrident dental. This results in allowing only the geminate ſť. Examples are: mitto, gutta, littera.

(20) \[
\begin{array}{c}
[+\text{cns}] \\
[+\text{son}] \\
[\text{grv}] \\
[\text{dif}] \\
\end{array}
\quad \quad \quad \\
\downarrow
\quad \quad \quad \\
\begin{array}{c}
[+\text{cns}] \\
[\text{son}] \\
[\text{dgrv}] \\
[\text{dif}] \\
\end{array}
\]

Noninitially after a velar consonant a consonant cannot be a labial. This has the effect that, except for geminate velars, the second segment must be a dental. Examples are: nocto, acta, flaccus.
If two consonants appear initially in a morpheme, the first consonant must be s and the second consonant must be an obstruent. Voicelessness is predicted by the more general Condition (24) below. Examples are: spargo, stella, scando.

Medially before a labial or a velar segment the first segment must also be a labial or a velar respectively. Thus geminate labials and velars are generated. Examples are: lippus, Appius, flaccus.

Clusters of nonstrident continuants are prohibited. In other words, s does not form consonant clusters.
Clusters of voiced consonants are prohibited in Latin. The one exception is the rare word *gibbus*. Condition (24) cannot be collapsed with the preceding (23) because (24) is more general than (23) in that it applies to clusters of strident consonants as well.

\[
\begin{array}{c}
+\text{nas} \\
+\text{grv}
\end{array}
\begin{array}{c}
+\text{cns} \\
+\text{son}
\end{array}
\Downarrow
\begin{array}{c}
+\text{nas}
\end{array}
\]

After the resonant \( m \) a nonnasal resonant is prohibited. Thus the clusters \( ml \) and \( mr \) are prohibited and \( mm \) and \( mn \) are generated. Examples are: *flamma*, *alumnus*.

\[
\begin{array}{c}
+\text{nas} \\
-\text{grv}
\end{array}
\begin{array}{c}
+\text{cns} \\
+\text{son}
\end{array}
\Downarrow
\begin{array}{c}
+\text{nas} \\
-\text{grv}
\end{array}
\]

After the resonant \( n \) the only other resonant which can occur is another \( n \). This allows, then, only the geminate \( nn \). Examples are: *hinnio*, *annus*.

\[
\begin{array}{c}
+\text{cns} \\
+\text{son} \\
-\text{nas} \\
-\text{con}
\end{array}
\Downarrow
\begin{array}{c}
-\text{con}
\end{array}
\]

After the resonant \( r \) all resonants are generated except \( l \). Examples are: *curro*, *firma*, *urna*. 
(28) \[
\neg \begin{array}{c}
+\text{cns} \\
+\text{son} \\
-\text{nas} \\
+\text{con}
\end{array} 
\quad \begin{array}{c}
+\text{cns} \\
+\text{son} \\
-\text{nas} \\
-\text{con}
\end{array}
\]

After the resonant 1 the resonant r is prohibited, whereas other clusters of 1 plus resonant are permitted. Examples are: stella, alma, balneum.

(25) (26) (27) (28)

\[
\begin{array}{c}
*\text{ml} \\
*\text{nl} \\
*\text{rl} \\
11
\end{array} 
\quad \begin{array}{c}
*\text{mr} \\
*\text{nr} \\
rr \\
*1r
\end{array} 
\quad \begin{array}{c}
\text{nn} \\
*\text{nm} \\
\text{rm} \\
\text{lm}
\end{array} 
\quad \begin{array}{c}
\text{nn} \\
\text{nm} \\
\text{rn} \\
\text{ln}
\end{array}
\]

Table 1.

The preceding Table 1 shows visually the results of the preceding Conditions (25-8). The asterisk marks nonoccurring clusters. The conditions were presented to predict redundant features in the second segment, but they could equally as well have been written to predict the redundant features of the first segment. In other words, we could have chosen either of the complementary conditions with the same results.

(29) \[
\begin{array}{c}
-\text{cns} \\
+\text{son} \\
\downarrow \\
-\text{lng}
\end{array} 
\quad \begin{array}{c}
+\text{cns} \\
\text{cns} \\
-\text{son}
\end{array}
\]

A vowel must be short before two consonants or before a resonant plus a consonant. This condition, however, does not exclude the possibility of a vowel being long before a cluster of consonant plus resonant.

Examples are: aptus, stella, altus, litro, libra.
The diphthongs permitted in Latin are eu, oe, au, ae. Examples are: heu, poena, claudo, caedo.

Front mid vowels are prohibited from occurring before the velar nasal. Other vowels do occur before a velar nasal. Examples are: lingua, anxius, longus, hunc.

Back mid vowels are prohibited from occurring before the resonant l plus a consonant, whereas other vowels are permitted. Although the change of q to u took place earlier, spellings such as volt, volnus, etc., are found as late as the first century before Christ (Buck 1933:83). Because of the rounding effect of Latin l, front vowels are very rare in this position, too. Examples are: Celtus, alter, cultus.
Initially and medially a glide must be followed by a vowel, and medially a glide must also be preceded by either a vowel or a resonant. Examples are: homo, venio, jacio, nihil, avis, servo, solvo.

Medially in Latin if a resonant occurs before a glide, the resonant must be a liquid and the glide must be \( \mathbf{w} \). Examples are: servo, solvo.

After an initial resonant, or after a resonant preceded by one or two consonants in morpheme-initial position, the next segment must be a vowel. This condition effectively prohibits initial clusters of two resonants. Examples are: laeso, moneo, non, radix, traho, strepo.
IV. GREEK

The Greek we shall treat here is Attic of approximately 350 B. C. By this period earlier /ɛ/ represented by the diphthong ei, had merged with /i/, and the asymmetry of the long vowel system of the 5th Century (Allen 1968:74) had been replaced by a system which is more readily comparable to the systems of Gothic and Latin. One further advantage of treating this period rather than an earlier period is that the treatment of zeta is also clearer; by the 4th Century we may regard zeta as /z/ (Allen 1968:53-56) rather than a cluster of /zd/ and/or /dz/.

Segment Structure Conditions:

To conserve space the segment structure conditions will be presented horizontally from left to right, but they will still be thought of in their if-then format.

(1) \[ +\text{son} \rightarrow +\text{voi} \]

Vowels and resonants are redundantly voiced.

(2) \[ -\text{cns} +\text{son} \rightarrow +\text{con} \]

Vowels are redundantly continuant.

(3) \[ -\text{cns} +\text{son} +\text{grv} \rightarrow -\text{com} \]

Back vowels are noncompact.

(4) \[ -\text{cns} +\text{son} +\text{dif} \rightarrow -\text{com} \]
|     | p | t | k | b | d | g | ph | th | kh | s | r | l | m | n | g | i | e | å | ö | u | i | o | å | e | o | u | o | å | e | o | å |
|  ons| + | + | + | + | + | + | + | + | + | + | + | + | + | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  son| - | - | - | - | - | - | - | - | - | + | - | + | + | + | + | + | + | + | + | + | + | + | + | - | - | - | - | - | - | - | - |
|  grv| + | + | + | + | - | - | - | - | - | - | - | - | - | + | - | + | + | + | + | + | + | + | - | + | + | + | + | + | + | + | + |
|  dif| + | + | - | - | - | - | + | + | + | + | + | + | - | + | - | - | - | + | + | - | + | + | - | + | - | + | + | + | + | + | + |
|  nas| - | - | - | - | - | - | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  tns| - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  voi| - | - | - | + | + | + | + | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
|  lbg| - | - | - | - | - | - | - | - | + | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
|  oom| - | - | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  oon| - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  str| + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

POSSIBLE SEGMENTS IN GREEK
High vowels are noncompact.

\[ \begin{array}{c}
(5) \quad [\text{com}] \quad \rightarrow \\
& [\text{cns} \\
& +son \\
& -grv \\
& -dif]
\end{array} \]

Low segments are redundantly nonback and nonhigh vowels.

\[ \begin{array}{c}
(6) \quad [\text{nas}] \\
& \rightarrow \\
& [\text{cns} \\
& +son \\
& -con]
\end{array} \]

Nasal segments are noncontinuant resonants.

\[ \begin{array}{c}
(7) \quad [\text{cns} \\
& -grv] \\
& \rightarrow \\
& [\text{dif}]
\end{array} \]

Nongrave consonants and resonants are redundantly diffuse.

\[ \begin{array}{c}
(8) \quad [\text{str}] \\
& \rightarrow \\
& [\text{cns} \\
& -son \\
& -grv \\
& +con]
\end{array} \]

Strident segments are redundantly continuant, nongrave consonants.

\[ \begin{array}{c}
(9) \quad [\text{con}] \\
& \rightarrow \\
& [\text{str}]
\end{array} \]

Noncontinuants are nonstrident.

\[ \begin{array}{c}
(10) \quad [\text{cns} \\
& -son \\
& -str] \\
& \rightarrow \\
& [\text{con}]
\end{array} \]

Nonstrident consonants are redundantly noncontinuant.

\[ \begin{array}{c}
(11) \quad [\text{tms}] \\
& \rightarrow \\
& [\text{cns} \\
& -son \\
& -voi]
\end{array} \]
Tense segments are voiceless consonants.

\[
(12) \quad \begin{bmatrix} +\text{cns} \\ -\text{son} \\ +\text{voi} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{ns} \end{bmatrix}
\]

Voiced consonants are nontense.

**Segment Sequence Conditions:**

Since segment sequence conditions involve more than one segment, we will resume a vertical presentation of the if-then conditions. Rather than positing unfamiliar underlying morphemes, we will present the examples of sequence conditions in their easily recognizable standard written form. That is, most examples will be words as they are normally written. It is cautioned here that the examples being offered are the individual morphemes (usually one per example) which underlie the sample word, and not the word itself.

\[
(13) \quad \begin{bmatrix} +\text{cns} \\ -\text{son} \\ -\text{grv} \end{bmatrix} \quad \begin{bmatrix} +\text{cns} \\ +\text{son} \\ +\text{con} \end{bmatrix}
\]

Before a \( \_ \) voiceless dentals are generated and voiced dentals are prohibited. Examples are: \( \Theta \lambda \acute{\iota} \omega \), \( \tilde{\Theta} \lambda \eta \rho \omicron \nu \).

\[
(14) \quad \begin{bmatrix} +\text{cns} \\ -\text{son} \\ -\text{grv} \\ +\text{voi} \end{bmatrix} \quad \begin{bmatrix} +\text{cns} \\ +\text{son} \\ -\text{nas} \end{bmatrix}
\]

After a voiced dental stop the only resonant permitted is \( \tilde{\imath} \). This condi-
tion is the complement to the preceding Condition (13). Examples are: ἔσπαρα, ἕσπαρα.

(15) \[ \text{NEG: } \begin{bmatrix} +\text{str} \\ +\text{cons} \\ +\text{son} \\ -\text{grv} \end{bmatrix} \]

After a the only resonant permitted is \( m \). This condition prohibits the clusters \( sm, sl, sr \) and generates \( sm \). Examples are: ὑσμήχω, ὑσμίνη.

(16.1) \[ \begin{bmatrix} +\text{cons} \\ -\text{son} \\ -\text{str} \\ -\text{grv} \end{bmatrix} \]

A nasal after a nonstrident consonant must be an \( n \). I am considering τμήνω (cf. τέμω) and δμῶς (cf. δαμῶς) and ἔλαιος (cf. ἐλαιός) to be derived from the underlying morphemes tem-, dam-, and tal respectively. Across morpheme boundaries, of course, clusters of consonant plus \( m \) are frequent. Examples are: πνοή, ὑπνος, φνεί, Δάφνη, δάκνω, κτίση, χναῶς, ἓχνος, γνός, ἦγνος.

(16.2) \[ \text{NEG: } \begin{bmatrix} -\text{seg} \\ +\text{cons} \\ -\text{son} \\ +\text{nas} \\ -\text{grv} \end{bmatrix} \]

Initially the clusters \( bn \) and \( tn \) are not permitted in Greek.

(16.3) \[ \text{NEG: } \begin{bmatrix} +\text{seg} \\ +\text{cons} \\ +\text{grv} \\ +\text{dif} \\ +\text{voi} \end{bmatrix} \]

Medially the ban on \( tn \) is lifted, as in ἐγνος, and only \( bn \) is prohibited.
(17) \[ \text{nas} \quad \text{cons} \quad \text{grv} \quad \text{dif} \]

A nasal resonant assimilates in gravity and diffuseness to a following obstruent. Examples are: ἀντί, δένδρον, μανθάνω, ἀγγέλω, ἐγγύος, ὄνκος, τυγχάνως, ὄμφαλος, λαμπάς, λαμβάνω.

(18) \[ \text{cons} \quad \text{grv} \quad \text{dif} \]

Initially and medially after a labial consonant a following consonant must be diffuse. This has the effect that, except for medial geminate consonants, the second consonant must always be a dental. Initial geminates are eliminated by (21.1) below. Examples are: πτέρυξ, ἐπτα, ἵππος, ἐβδομος, θάνω, φυκή, δίφα.

(19) \[ \text{seg} \quad \text{cons} \quad \text{grv} \quad \text{str} \]

Medially after a nonstrident dental the only consonant which can occur is another nonstrident dental. Examples are: θάλαττα, γλωττα, ἀγκος, ἄττα.
After a velar a consonant must be a dental or another velar, that is, it cannot be a labial. This has the effect that, except for medial geminate velars, the second consonant must be a dental. Initial geminates are eliminated by the following (21.1). Examples are: κτείνως, τίκτως, δύσος, ξέθες, δικθά, ἀκκός, ξανθός, βρόξος.

\[(21.1) \quad \begin{array}{c}
[-\text{seg}] \\
\downarrow \\
[-\text{con}] \\
\end{array} \quad \begin{array}{c}
[-\text{son}] \\
\downarrow \\
[+\text{grv}] \\
[+\text{str}] \\
\end{array} \quad \begin{array}{c}
[-\text{son}] \\
[+\text{grv}] \\
\end{array} \quad \begin{array}{c}
[-\text{son}] \\
\end{array} \quad \begin{array}{c}
[-\text{son}] \\
\end{array} \quad \begin{array}{c}
[-\text{con}] \\
\end{array}\]

A consonant occurring initially before a labial or a velar consonant must be strident, and the labial or velar must be noncontinuant. Examples are: σπόρας, σβέννυς, σφάγιον, σκότος, σκέδον. There is a partial overlap with Conditions (18) and (20) above in that they, too, prohibit initial clusters of labial plus velar and velar plus labial. Condition (21.1) is needed, though, to prohibit initial clusters of geminate velars and labials. The overlap could be eliminated by marking (18) and (20) to apply only medially, but this would deprive them of their greater generality.

\[(21.2) \quad \begin{array}{c}
[-\text{seg}] \\
\downarrow \\
[-\text{con}] \\
\end{array} \quad \begin{array}{c}
[-\text{son}] \\
\downarrow \\
[-\text{grv}] \\
[+\text{str}] \\
\end{array} \quad \begin{array}{c}
[-\text{son}] \\
\end{array} \quad \begin{array}{c}
[-\text{son}] \\
\end{array} \quad \begin{array}{c}
[-\text{grv}] \\
\end{array} \quad \begin{array}{c}
[+\text{str}] \\
[-\text{con}] \\
\end{array}\]

If two dentals occur initially, the first must be strident. There is no overlap with (19) above, since (19) is necessarily marked to apply only medially. Condition (21.2) prohibits an initial cluster of geminate dentals. The combined purpose, then, of Conditions (21.1) and (21.2) is to
prohibit initial clusters of geminate consonants. Examples are: στάδιον, σθένω.

(21.3) \[
\begin{array}{c}
\text{[-seg]} \\
\text{[-son]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[-son]} \\
\text{[-son]} \\
\text{[-con]} \\
\text{[-con]} \\
\text{[-con]} \\
\text{[-con]} \\
\text{[-con]} \\
\end{array}
\]

After an initial labial or an initial velar a consonant must be a dental. Examples are: χθόνιος, φθάνω, κτείνω, πτέρνε, ψελών, ξεκ.

(22) \[
\begin{array}{c}
\text{[+seg]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\end{array}
\]

Noninitially in a cluster of two consonants if the first consonant is nonstrident and the second consonant is a labial or a velar, then the first consonant must likewise be a labial or a velar respectively. Condition (22) generates the geminates pp and kk. Other than geminates, the second segment must be a dental. Condition (22) overlaps with (18) and (20) above. The only motivation for including (22) in addition to (18) and (20) is that (22) is more specific and is able to predict two redundant features, whereas (18) and (20) can only predict one redundant feature. Examples are: ἔπτωσ, ἀ κ χ ι ω.

(23) \[
\begin{array}{c}
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\text{[+cns]} \\
\end{array}
\]

Clusters of consonants are assimilated in voice. Examples are: ἐδομος,
If two resonants occur initially, they must be **mm**. Examples are: 

μνίον, μνάμα.

After an **m** nasal resonants are generated and liquids are prohibited.

Examples are: ὀμνουμι, γάμμα, ἄμμος.

After an **n** the only other resonant which can occur is another **n**.

Examples are: ἐννοεί, ἄγνωνεθος.

After an **r** the other resonants which can occur are **m**, **n**, and **r**.
Examples are: ὕρνες, ἐρρῆν, Ἐρμῆς, ἐρρᾶ.

(28) \[
\begin{array}{c}
\text{[+cns]} \\
\text{[+son]} \\
\text{[-nas]} \\
\text{[+con]}
\end{array}
\quad \begin{array}{c}
\text{[+cns]} \\
\text{[+son]} \\
\text{[-nas]} \\
\text{[+con]}
\end{array}
\]

After an \( \lambda \) the only resonant which can occur is another \( \lambda \). Examples are: βόλλω, μιλλω. The cluster \( \lambda m \), although very common across morpheme boundaries, is prohibited within a morpheme.

(29) \[
\begin{array}{c}
\text{[-cns]} \\
\text{[+son]}
\end{array}
\quad \begin{array}{c}
\text{[+cns]} \\
\text{[-son]}
\end{array}
\quad \begin{array}{c}
\text{[+cns]} \\
\text{[-son]}
\end{array}
\quad \begin{array}{c}
\text{[-lng]}
\end{array}
\]

A vowel before two consonants or before a resonant plus a consonant is short.

(30) \[
\begin{array}{c}
\text{[-cns]} \\
\text{[+son]} \\
\text{[<-com>]}
\end{array}
\quad \begin{array}{c}
\text{[-cns]} \\
\text{[+son]} \\
\text{[<agr>]} \\
\text{[<agr>]}
\end{array}
\quad \begin{array}{c}
\text{[-dif]} \\
\text{[<-agr>]} \\
\text{[<-dif>]} \\
\text{[+dif]}
\end{array}
\]

We are considering a stage of Greek in which the "spurious" diphthongs \( ei \) and \( ou \) have already merged with the long vowels \( i \) and \( u \) respectively, leaving only four possible diphthongs, \( eu, oi, ai, au \). Examples are: ἐὖ, ρεῦσ, δίκος, δαίμων, αὐριον.
A vowel must follow and, if noninitial, must also precede a glide. In other words, glides occur initially before a vowel and intervocalically.

Examples are: ἰδ'λλως, ὑδ'ς, ἰδ'λος ἀὐς, ἕμερα (rough breathing = h).
V. THE COMPARISON

In respect to lexical redundancy there are several ways in which related languages can differ: they can differ 1) in the inventory of distinctive features, 2) in the inventory of possible segmental phonemes, 3) in the presence, or absence, of identical morpheme structure conditions, and 4) in the feature configuration of shared morpheme structure conditions. These differences reflect the ways in which related languages, here Gothic, Latin, and Greek, have changed, both in their split from a common source and in their independent development.

A change in the inventory of features can occur when one feature has changed in acoustic or articulatory quality to the point where it is best described by another feature. The change can be in either the number of features or in the selection of features. If, for example, as in the development from Classical Greek to Modern Greek, aspirated stops become continuants,

\[\text{(1) } [\text{tns}] \rightarrow [\text{con}]\]

then there is a change in the inventory of a language's features depending on whether the second feature already exists in the language and whether the first feature continues to exist. If the first feature continues to exist and the second feature already exists in the language, then there is no change in the inventory. If, as in Condition (1) above, the second feature did not formerly exist in the language and the first feature changes in every instance across the board, then there is no change in the number of features, but rather a change in the selection of features; that is, \([\text{con}]\) has replaced \([\text{tns}]\). A decrease in the number of features
occurs when the first feature changes in every instance to one or more features already in the language. An increase in the number of features occurs when the first feature does not change in every instance, but when it does change, it changes to one or more features not formerly in the language.

The inventory of possible segments can change in both number and selection of segments, when a feature appears or ceases to appear in a segment in a particular configuration of other features.

The presence of identical MS-conditions in related languages merely indicates that no features have been lost, added, or replaced. The absence, however, of an identical MS-condition in a group of related languages reflects a matter of degree in the fourth category mentioned above, i.e. differences in feature configuration of shared MS-conditions. We must discuss, then, how MS-conditions change and are lost.

King (1969) lists four fundamental ways in which phonological changes are manifest: 1) rule addition, 2) rule loss, 3) rule re-ordering, and 4) rule simplification. As discussed in Chapter One, MS-conditions are unordered. We are at an advantage, then, in dealing with lexical redundancy because we have a control case in which the factor of "ordering" is eliminated. As we describe the differences between related languages in terms of how they have changed in regard to morpheme and segment structure, we can eliminate any possibility of re-ordering.

According to King (1969:58-63) rule simplification is manifest by the suppression (i.e. loss) of a feature, resulting in greater generality. He illustrates this in an example drawn from Becker (1967: 112-113). In comparing Alsatian with other German dialects, Becker
posits the following two P-rules:

\[(2.1) \quad [\text{obstruent}] \rightarrow [\text{-voice}] / \_\_\_\_\_\#\]

\[(2.2) \quad [\text{continuant}] \rightarrow [\text{-voice}] / \_\_\_\_\#\]

Rule (2.2) is more restrictive, since it applies only to fricatives.
Rule (2.1) is more general in that the feature [\text{-continuant}] has been suppressed and final devoicing applies to all obstruents.

In regarding rule loss, it is not clear from King (1969) how a rule is lost. One suggestion, however, is made by Chafe (1968). Very briefly, Chafe views language change as adding rules to the grammar which may or may not affect or interfere with the input of rules already present in the language. Over a period of time so many rules may be added to the grammar, which interfere with the input of a much earlier rule, that the earlier rule is so completely buried under and interfered with that it loses all its effectiveness and just drops out of the grammar, that is, it is no longer recoverable in synchronic analysis. For example, if there were a rule (A) in a language's grammar which applied to aspirates, and a rule (B) was added which eliminated aspirates, then the effectiveness of rule (A) would be totally interfered with and lost.

Following our discussion of rule simplification by feature loss, rules (and conditions) could be "lost" in another way: enough features could be suppressed, resulting in so great a state of generality in the recoverable rule, that the earlier rule could be considered "lost". For instance, we can see such "rule loss" if we examine the MS-conditions in Greek, Latin, and Gothic regarding initial clusters of g plus resonant.

In Gothic the cluster \text{gr} is prohibited initially. In Greek the clusters
$sl$, $sr$, and $sm$ are prohibited initially. In Latin all initial clusters of $g$ plus resonant are prohibited. These restrictions can be captured in the following three negative conditions:

Gothic (3.1) \[ \text{NEG: } [+\text{str}] \quad [+\text{cns} \quad +\text{son} \quad -\text{grv} \quad -\text{con} \quad -\text{nas}] \]

Greek (3.2) \[ \text{NEG: } [+\text{str}] \quad [+\text{cns} \quad +\text{son} \quad -\text{grv}] \]

Latin (3.3) \[ \text{NEG: } [+\text{str}] \quad [+\text{cns} \quad +\text{son}] \]

In Greek (3.2) two features which are present in Gothic (3.1) have been suppressed, yielding a more general condition which prohibits all grave resonants after $g$. In Latin still another feature has been suppressed giving the most general condition of all. Gothic (3.1) and Greek (3.2) can be re-formulated as if-then conditions:

Gothic (4.1) \[ [+\text{str}] \quad [+\text{cns} \quad +\text{son}] \quad \downarrow \quad [+\text{cns} \quad +\text{son} \quad -\text{con}] \]

Greek (4.2) \[ [+\text{str}] \quad [+\text{cns} \quad +\text{son} \quad -\text{nas} \quad +\text{grv} \quad -\text{dif}] \]

Latin (3.3) cannot be re-formulated as an if-then condition, because any if-then condition concerning clusters of $g$ plus resonant which may have
existed in Latin has been lost. All the features in the "then" part were suppressed so that the condition had no application and was lost, only to be recovered as a negative condition. If we look only at the negative conditions, we see that what we regarded as "rule loss" in the if-then formulation is reflected in the negative formulation as an instance of greatest generality.

In sum, we have attempted to show that rule (or condition) loss can be the result of feature suppression. The if-then condition is lost when enough features have been suppressed that the original condition has no application (i.e., all the features in the "then" part of an if-then condition have been suppressed). Because if-then conditions can also be viewed negatively, we are able to recover the condition at the height of generality, that is, that no such formulation exists at all.

It should be cautioned that in a synchronic comparison of related languages, there is no way to decide if a feature has been suppressed in one language or added to the other. In each stage we see feature suppression, resulting in rule simplification and greater generality, and finally, in Latin, rule loss.

Having discussed the ways in which NS-conditions may differ in related languages, let us turn now to a systematic comparison of the redundancy rules presented in Chapters Two, Three, and Four.

**Segment Structure Conditions:**

All three languages share the identical segment structure conditions (1-7) and (9). The need for some of these shared segment structure conditions would be obviated by a universal set of marking conditions, but as yet, such a universal set is not available. It is not at all sur-
prising, though, that related languages would share a great many of the same conditions. The differences in segment structure conditions among the three languages will reflect the differences in the inventory of features and in the inventory of possible segments.

Greek and Gothic (8) \[ \ast_{\text{str}} \rightarrow \ast_{\text{cns}} \]
-son
-\text{grv}
-\text{con}

Latin (8) \[ \ast_{\text{str}} \rightarrow \ast_{\text{cns}} \]
-son
-\text{grv}
-\text{con}
-\text{voi}

Greek and Gothic share Condition (8) and differ from Latin in that they permit both a voiced and a voiceless sibilant, whereas Latin allows only a voiceless sibilant. This is reflected in Condition (8) by the absence of the feature \([-\text{voi}]\) in Greek and Gothic. Latin, on the other hand, due to the presence of the feature \([-\text{voi}]\), has a more restricted condition.

Gothic (10) \[ \ast_{\text{cns}} \rightarrow \ast_{\text{dif}} \]

Glides in Gothic must be diffuse. Gothic (10) thus limits the glides in Gothic to \(j\) and \(\nu\), whereas in Latin and Greek \(j\), \(\nu\), as well as \(h\) ("rough breathing" in Greek) are considered glides. We have considered the letter \(h\) in Gothic to represent a velar continuant consonant. An alternate view is presented by Moulton (1954:6-8) in which he considers \(h\) in Gothic to be a "glottal spirant." Moulton's evidence rests mainly on the following two facts: First, \(h\) and \(g\) contrast after a vowel and before \(t\), \(s\), and word boundary, whereas the contrast of \(h\) with \(g\) and \(d\) with \(b\) is lifted before
t, s, and word boundary. This indicates, according to Houlton, that the opposition of g to h might be different from the opposition b to f and d to p. Second, Wulfila used k in Greek loanwords to represent the Greek letter chi, which is taken to represent a velar fricative in the Greek of Wulfila’s time. If h, Houlton reasons, had been a velar continuant, Wulfila would have used h to represent chi. We, however, group h with the other velar continuants in Gothic rather than with the glides, because 1) as Houlton says (p. 7, fn. 18) the “proto-type” for h was velar, and 2) h patterns as do the other velar consonants, particularly in initial position before n, which neither of the glides j or w do.

\[
\text{Latin (10)} \quad \begin{cases} \text{+cns} \\ \text{-son} \\ \text{+con} \\ \text{-str} \end{cases} \rightarrow \begin{cases} \text{+grv} \\ \text{+dif} \\ \text{-voi} \end{cases}
\]

\[
\text{Greek (10)} \quad \begin{cases} \text{+cns} \\ \text{-son} \\ \text{-str} \end{cases} \rightarrow \begin{cases} \text{-con} \end{cases}
\]

In Latin the only nonstrident continuant permitted is f. In Greek nonstrident continuants are not allowed. We have not presented a MS-condition for continuants in Gothic, because the matter of voiced continuant consonants is far from resolved. Certainly, in Gothic there is a complete series of voiceless continuants (f, p, h) and perhaps voiced continuants, too, in complementary distribution with voiced noncontinuants. But regardless of whether the voiced consonants b, d, g are continuants or noncontinuants, or continuants in certain positions and noncontinuants in others, the distinctive feature of this series is [+voi], and the feature plus or minus continuancy is redundant in all environments and can be omitted in the dictionary representation of each morpheme. Indeed, it is
most certainly the fact that continuancy is redundant in the voiced series of consonants that allows that series to develop continuant and noncontinuant allophones.

Without precise knowledge of the phonetic nature of the voiced consonants in all environments, it is impossible to write the MS-conditions assigning the feature continuancy to them. Nevertheless, it is tempting to write two conditions anyway, based on the best hypotheses available, that is, on those found in Moulton (1954). We could write one condition making voiced consonants [−con] after a vowel, and a second condition making them [−con] elsewhere. Or, we could assume that the underlying segments are [−con] and require a later phonological rule to make them [−con] after vowels. Whichever solution we chose, continuancy would be redundant in all environments, and, in this respect, Gothic agrees exactly with Latin and Greek, in which continuancy is also redundant in all environments. We have just stated what two MS-conditions we would write if we took the first solution. Let us now take the latter solution and assume that underlying voiced consonants are noncontinuant and that voiced continuants are derived later by a P-rule. We could posit, then, the following MS-condition for Gothic:

Gothic (10.1)  

\[
\begin{array}{c}
\text{[+cns]} \\
\text{[−son]} \\
\text{[+con]} \\
\text{[−str]} \\
\downarrow \\
\text{[−voi]} \\
\end{array}
\]

We could then contrast this condition with its counterparts in Latin and Greek:
Latin (10) differs from Gothic (10,1) only by the presence of the two features \([+\text{grv}]\) and \([+\text{dif}]\). Greek, though, lacks all three features and prohibits all continuants.

Gothic (11) \([+\text{flt}]\) \(\rightarrow\) \([^\text{cns}\]
-\text{son}
\(+\text{grv}\)
-\text{dif}\)

Latin (11) \([+\text{flt}]\) \(\rightarrow\) \([^\text{cns}\]
-\text{son}
\(+\text{grv}\)
-\text{dif}
-\text{con}\)

Gothic and Latin are alike in that both languages possess labiovelars. In this respect they differ from Greek, which has no labiovelars. Correspondingly, Greek does not have the feature \([\text{flt}]\) and lacks any condition which corresponds to Gothic and Latin (11). Gothic (11) and Latin (11) differ in only one feature: Latin has the feature \([-\text{con}]\). The difference does not exceed the context of Grimm’s law, according to which voiceless stops become continuants. With this added knowledge, we can state in reference to Gothic (11) that Gothic has suppressed the feature \([-\text{con}]\).

Gothic & Latin (12) \([^\text{cns}\]
-\text{son}
\(+\text{dif}\)\) \(\rightarrow\) \([-\text{flt}]\)
Gothic and Latin share the identical condition (12), which, like preceding Gothic & Latin (11), deals with labiovelars. Once again, since Greek has altogether lost the feature [tlf], it has lost any condition corresponding to Gothic & Latin (12).

\[
\text{Greek (11)} \quad \begin{array}{c}
\underline{\text{[+tns]}} \\
\underline{\text{[+cns]}}
\end{array} \rightarrow \begin{array}{c}
\underline{\text{[-son]}} \\
\underline{\text{[-voi]}}
\end{array}
\]

\[
\text{Greek (12)} \quad \begin{array}{c}
\underline{\text{[+cns]}} \\
\underline{\text{[-son]}} \\
\underline{\text{[+voi]}}
\end{array} \rightarrow \begin{array}{c}
\underline{\text{[-tns]}}
\end{array}
\]

Latin and Gothic, on the other hand, have lost the feature [tns] and have no conditions corresponding to Greek (11) and (12).

**Segment Sequence Conditions:**

All three languages share the identical segment sequence conditions (17-20), (22), (26-27), and (29). It is not surprising that related languages share a number of the same segment sequence conditions. Many of the other conditions are very similar, too, differing by the presence or absence of only a few features. The differences in segment sequence conditions among the three languages will reflect differences in the sets of "possible morphemes."

A comparative list has been provided in the Appendix of the possible two-segment clusters of consonants and resonants which occur within a single morpheme. Clusters of consonant plus glide and of vowel plus consonant have been omitted from the Appendix. Likewise, clusters of more than two segments have been omitted from the Appendix, but they adhere to the same restrictions and are consequently generated by the
same MS-conditions as two-segment clusters. Finally, the frequency of
the clusters has not been taken into account. If the cluster appears,
regardless of how rarely, it is included in the list. The medial cluster
-bb-, for example, is extremely rare in Latin, but it does occur in
gibbus and so is included in the list. The list in the Appendix is
ordered in the same way as the following segment sequence conditions so
that it may be of easy reference in comparing the results of the follow-
ing segment sequence conditions with the conditions themselves. Clusters
are presented in the following order: 1) clusters of consonant plus
resonant, 2) clusters of consonant plus consonant, 3) clusters of
resonant plus resonant, and 4) clusters of resonant plus consonant.

Greek & Gothic (13)  \[
\begin{align*}
  &{\text{+cns}} \\
  \text{-son} &{\text{-grv}} \downarrow \\
  \text{-voi} &{\text{+cns}} \\
  \text{+son} &{\text{-nas}} \\
  \text{-con} &{\text{+con}}
\end{align*}
\]

Latin (13)  \[
\begin{align*}
  &{\text{+cns}} \\
  \text{-son} &{\text{-grv}} \downarrow \\
  \text{-voi} &{\text{+cns}} \\
  \text{+son} &{\text{-nas}} \\
  \text{-con} &{\text{+con}}
\end{align*}
\]

Before an ʃ Greek and Gothic do not allow a voiced dental. Latin, on the
other hand, prohibits all dentals before an ʃ. The difference between
Latin (13) and Greek & Gothic (13) can best be seen by switching the
preceding if-then conditions to their negative counterparts:

Greek & Gothic (13°)  NEG:  \[
\begin{align*}
  &{\text{+cns}} \\
  \text{-son} &{\text{+cns}} \\
  \text{-grv} &{\text{-nas}} \\
  \text{+voi} &{\text{+cns}} \\
  \text{+con} &{\text{+con}}
\end{align*}
\]
Latin (13°)  NEG: 

\[ \begin{array}{c}
\text{+cns} \\
\text{-son} \\
\text{-grv} \\
\text{+con} \\
\end{array} \begin{array}{c}
\text{+cns} \\
\text{-son} \\
\text{+nas} \\
\text{+con} \\
\end{array} \]

What appeared to be a more complicated situation in comparing Greek & Gothic (13) to Latin (13) is seen in (13°) to be a matter of the presence or absence of a single feature, that is, the feature [+voi]. By suppressing the feature [+voi] Latin has generalized the restriction before \( \_ \) to include all dentals.

Gothic (14) 

\[ \begin{array}{c}
\text{+cns} \\
\text{-son} \\
\text{-grv} \\
\text{+voi} \\
\end{array} \]

\[ \begin{array}{c}
\text{+cns} \\
\text{-son} \\
\text{-nas} \\
\text{-con} \\
\end{array} \]

Latin (14) 

\[ \begin{array}{c}
\text{+cns} \\
\text{-son} \\
\text{-grv} \\
\text{+voi} \\
\end{array} \]

\[ \begin{array}{c}
\text{+cns} \\
\text{-son} \\
\text{-nas} \\
\text{-con} \\
\end{array} \]

Greek (14) 

\[ \begin{array}{c}
\text{+cns} \\
\text{-son} \\
\text{-grv} \\
\text{+voi} \\
\end{array} \]

\[ \begin{array}{c}
\text{+cns} \\
\text{-son} \\
\text{-nas} \\
\text{-con} \\
\end{array} \]

The conditions in (14) are the complements to the preceding conditions in (13). If \( d \) does not occur before \( l \) in Gothic and Greek, what resonants do occur after \( d \)? In Latin if dentals do not occur before \( l \), what resonants do occur after dentals? In Greek we must allow for an \( n \) and an \( r \) after \( d \), while in Gothic and Latin the only resonant which can occur after the
first segment is r. As in Latin (13), the feature [-voi] is again suppressed in Latin (14). Otherwise, Latin (14) and Gothic (14) are identical.

For clusters of s followed by a resonant we have posited the following negative conditions in the three languages:

Gothic (15)  NEG: [+str]  [+cns]  [+son]
             [-grv]  [-con]  [-nas]

Greek (15)  NEG: [+str]  [+cns]  [+son]
              [-grv]

Latin (15)  NEG: [+str]  [+cns]  [+son]

All three languages share the prohibition against the cluster sr, which is the only effect of Gothic (15). By suppressing the features [-con] and [-nas] Greek has simplified the condition and generalized it to prohibit all nongrave resonants after s. Latin has suppressed still another feature and generalized the condition to the point that clusters of s plus resonant are prohibited altogether. Gothic and Greek (15) could have been presented in their corresponding if-then format as follows:

Gothic (15')  [+str]  [+cns]  [+son]  [+nas]
              [-dif]  [-acon]
The if-then presentation would set aside the redundant features for Gothic and Greek, but it would conceal the relationship between the Gothic and Greek conditions, which is manifest in the negative presentation. For Latin, though, no such if-then condition is possible, because clearly there is a prohibition in Latin against clusters of $g$ plus resonant, and any Latin condition which may have pertained to such clusters has been lost.

The NS-conditions for clusters of consonant plus nasal, which are presented in (16) for each language, are at such variance among the three languages that straightforward comparison of the conditions does not reveal very much. A slight comparison can be effected, however, by comparing some general aspects of the conditions in each language.

1) Clusters of nonstrident consonant plus $m$ are not permitted initially in any of the three languages, and are not permitted medially in Greek and Latin within a morpheme. 2) In Gothic and Latin initial clusters of $gn$ are prohibited. 3) Greek and Gothic allow clusters of sibilant plus nasal. 4) Gothic allows a contrast between $m$ and $n$ after $g$ and medially after nonlabial consonants, which is not allowed in Greek. 5) Except for medial $gn$, Latin has virtually eliminated clusters of consonant plus nasal.
In Gothic and Latin if two consonants occur initially, the first must be s and the second must be a stop. In Greek, however, initial kt and pt, as well as ks and ps, are permitted. Greek has two conditions (21.1-2) corresponding to Gothic and Latin (21), depending on whether or not the second segment is plus or minus grave. To compare them we must split Gothic and Latin (21) into two conditions which correspond to the two Greek conditions:
We know that Gothic and Latin (21.1) and (21.2) are equivalent to earlier Gothic and Latin (21), because the two conditions would immediately collapse into Gothic and Latin (21). The first thing we notice is that Gothic and Latin (21.1) is identical to Greek (21.1), so we turn our attention to (21.2). The difference between Gothic and Latin (21.2) and Greek (21.2) is the presence or absence of the feature [-grv] in the first segment. We assume, then, either that Gothic and Latin have suppressed the feature [-grv], or that Greek has added the feature [-grv]. We cannot tell from a synchronic approach to these three languages whether the feature has been added to one language or lost in the others. The presence of the feature [-grv] in the Greek Condition (21.2), however, leaves open the possibility of having a plus grave initial consonant before a minus grave consonant and of having an additional condition for which there is no equivalent in Gothic and Latin:

\[
\text{Greek (21.3)} \quad [-\text{seg}] \quad [+\text{cns}] \quad [+\text{cns}] \\
\quad [-\text{son}] \quad [-\text{son}] \\
\quad [+\text{grv}] \quad \downarrow \\
\quad [-\text{grv}]
\]

Greek (21.3) permits initial clusters of labial or velar plus dental, which are prohibited by Gothic and Latin (21).

\[
\text{Latin (23)} \quad [+\text{cns}] \quad [+\text{cns}] \\
\quad [-\text{son}] \quad [-\text{son}] \\
\quad [-\text{str}] \\
\quad \downarrow \\
\quad [-\text{con}] \\
\quad \downarrow \\
\quad [-\text{con}]
\]
Nonstrident continuant consonants do not exist in Greek. They were excluded from occurrence by the Greek segment structure Condition (10), which, for convenience, we repeat here:

Since nonstrident continuants do not exist in Greek, a segment sequence condition concerning continuity in consonant clusters, which might correspond to Gothic and Latin (23), would be completely unmotivated within the lexicon of Greek. The situation concerning continuity in nonstrident consonant clusters in Greek, however, is identical to that described in Latin (23). Henceforth, then, in contrasting Latin (23) to Gothic (23.1-2) we will consider the Greek to be in complete agreement with Latin (23).

In order to facilitate a parallel description we must make an otherwise unmotivated split in Latin (23) to make it correspond to the two
conditions in Gothic (23.1-2), which is done on the basis of whether the first consonant is plus or minus grave.

\[
\text{Latin (23.1)} \quad \begin{array}{c}
\begin{array}{c}
+\text{cns} \\
-\text{son} \\
+\text{grv} \\
-\text{con}
\end{array} \\
\downarrow
\begin{array}{c}
-\text{cns} \\
-\text{son} \\
-\text{con}
\end{array}
\end{array}
\]

\[
\text{Latin (23.2)} \quad \begin{array}{c}
\begin{array}{c}
+\text{cns} \\
-\text{son} \\
-\text{grv} \\
-\text{str} \\
-\text{con}
\end{array} \\
\downarrow
\begin{array}{c}
-\text{cns} \\
-\text{son} \\
-\text{con}
\end{array}
\end{array}
\]

We know that Latin (23.1) and (23.2) are equivalent to Latin (23) because they should and do collapse right back into Latin (23). If we examine Gothic (23.1) and Latin (23.1) we see that a simple change in feature value has occurred in Gothic before a \( t \). The difference between Latin (23.1) and Gothic (23.1) is that Gothic added the phonological rule that noncontinuant labials and velars became continuant before a voiceless dental:

\[
(P-1) \quad [ \text{-con} ] \rightarrow [ \text{+con} ] / [ \begin{array}{c}
+\text{cns} \\
-\text{son} \\
+\text{grv} \\
-\text{voi}
\end{array} ] [ \begin{array}{c}
+\text{cns} \\
-\text{son} \\
-\text{grv}
\end{array} ]
\]

In comparing Latin (23.2) to Gothic (23.2) it is not clear from what is presented exactly what happened historically in Gothic. We can tell only that the cluster of nonstrident dentals must be plus or minus continuant, and whichever it is, it must, like Latin (23.2), be the same value in both segments.
Greek (23) &
Gothic (24)

[ +cns ]
[ -son ]

[ -voi ]

Latin (24)

[ +cns ]
[ -son ]

[ -voi ]

Clusters of consonants in Greek, Gothic, and Latin are assimilated in voice, but in Latin they are further restricted to [-voi].

In Greek the only initial cluster of resonants which can occur is mn. In Gothic and Latin clusters of initial resonants are prohibited by the negative condition:

Latin & Gothic (24°) NEG: [ -seg ] [ +cns ] [ +cns ]
[ +son ] [ +nas ] [ -dif ]
[ +grv ] [ -grv ]

This negative condition, however, is not motivated as such in the individual lexicons of Latin and Gothic. Initial clusters of resonants are prohibited in Latin by Latin Condition (34) and in Gothic by Gothic Condition (35). Latin and Gothic (24°), which is only posited here to contrast with Greek (24), is actually one of the negative aspects of Latin (34) and Gothic (35).
To compare Latin (25) and Greek (25), which are if-then conditions, with Gothic (25), which was presented most simply as a negative condition, we must switch one or the other format, so that the corresponding condition appears in the same format in all three languages. An if-then format does not prove very revealing in this instance, so we will switch Latin and Greek (25) to its negative aspect.

Latin & Greek (25) \[\text{NEG: } [+\text{nas} \quad +\text{cns}] \quad [+\text{son} \quad -\text{nas}]\]

Gothic (25) \[\text{NEG: } [+\text{nas} \quad +\text{cns}] \quad [+\text{son} \quad -\text{nas} \quad -\text{con}]\]

The difference between Latin and Greek (25) and Gothic (25) is the presence or absence of the feature \[+\text{con}\] in the second segment. Of the clusters \[m\] plus resonant Gothic does not permit \[ml\]. By suppressing the feature \[-\text{con}\] Greek and Latin have generalized the condition to exclude all clusters of \[m\] plus liquid.

In order to facilitate a comparison of resonant clusters beginning with \[l\], we must switch the Greek Condition (28) to its corresponding negative aspects, which are posited below as Greek (28.1) and (28.2).

Greek & Gothic (28.1) \[\text{NEG: } [+\text{cns}] \quad [+\text{cns}]\]
Latin (28) \[ [+\text{son} \quad -\text{nas} \quad -\text{con}] \quad [+\text{son} \quad -\text{nas} \quad -\text{con}]\]

Of the clusters \[l\] plus resonant all three languages prohibit \[lr\]. Greek and Gothic, though, further prohibit one of the possible clusters of \[l\] plus nasal.
Gothic (28.2) NEG: \[
\begin{bmatrix}
+\text{cns} \\
+\text{son} \\
-\text{nas} \\
+\text{con}
\end{bmatrix}
\begin{bmatrix}
+\text{cns} \\
+\text{son} \\
+\text{nas} \\
-\text{grv}
\end{bmatrix}
\]

Greek (28.2) NEG: \[
\begin{bmatrix}
+\text{cns} \\
+\text{son} \\
-\text{nas} \\
+\text{con}
\end{bmatrix}
\begin{bmatrix}
+\text{cns} \\
+\text{son} \\
+\text{nas}
\end{bmatrix}
\]

Greek prohibits clusters of \( l \) plus nasal, although the cluster \( ln \) is common enough across morpheme boundaries. Gothic (28.2) and Greek (28.2) differ only in the presence or absence of \( -\text{grv} \) in the second segment.

Gothic (30) NEG: \[
\begin{bmatrix}
-\text{cns} \\
+\text{son}
\end{bmatrix}
\begin{bmatrix}
-\text{cns} \\
+\text{son}
\end{bmatrix}
\]

Latin (30) \[
\begin{bmatrix}
-\text{cns} \\
+\text{son}
\end{bmatrix}
\begin{bmatrix}
-\text{cns} \\
+\text{son}
\end{bmatrix}
\]

\[\downarrow\]

\[
\begin{bmatrix}
-\text{dif} \\
\langle -\text{grv} \rangle
\end{bmatrix}
\begin{bmatrix}
-\text{com} \\
\langle -\text{dif} \rangle
\end{bmatrix}
\]

Greek (30) \[
\begin{bmatrix}
-\text{cns} \\
+\text{son}
\end{bmatrix}
\begin{bmatrix}
-\text{cns} \\
+\text{son}
\end{bmatrix}
\]

\[\downarrow\]

\[
\begin{bmatrix}
-\text{dif} \\
\langle -\text{grv} \rangle
\end{bmatrix}
\begin{bmatrix}
\end{bmatrix}
\]

Both Latin and Greek have four diphthongs. (The diphthong \( u1 \) is of secondary origin and occurs only across morpheme boundaries.) The only difference between the four diphthongs is that Greek has \( ai \) and \( oi \) where Latin has \( ae \) and \( oe \). By comparing Greek (30) and Latin (30) we can extract the phonological rule (P-2) which Latin has added to its grammar.
(P-2) \[+\text{dif}\] \rightarrow \[+\text{dif}\] / \[+\text{cns}\] \[+\text{son}\] \[+\text{grv}\] \[+\text{com}\]

Except for the addition of (P-2) Latin (30) and Greek (30) are identical. Gothic, on the other hand, has lost all diphthongs and only the negative condition Gothic (30) is recoverable.

For the moment let us set aside our synchronic analysis and discuss how the diphthongs of these three languages developed from Indo-European. Six short diphthongs are commonly posited for Indo-European: ai, au, eu, ei, oi, ou. These diphthongs are generated by the following NS-condition for Indo-European:

\[
\text{PIE (1)} \quad \begin{array}{cc}
\{\text{cns}\} & \{\text{cns}\} \\
\{\text{son}\} & \{\text{son}\}
\end{array}
\]

\[
\begin{array}{c}
\downarrow \\
\{\text{-dif}\} & \{+\text{dif}\}
\end{array}
\]

Latin and Greek then added the phonological rule (P-3).

(P-3) \[+\text{dif}\] \rightarrow \[+\text{dif}\] / \[+\text{cns}\] \[+\text{son}\] \[+\text{grv}\] \[+\text{com}\] \[+\text{grv}\]

This P-rule, which effectively changes ei to ii and ou to uu, is accompanied by the subsequent merger of ii and uu with i and u respectively. The change of ei to i and ou to u took place in Latin during the historical period, as witnessed in early Latin deico and domno for dıco and dıco (Buck 1933:86-88). In Greek, however, there appears to have been a time lag between the development of ou to u, which took place before the 5th Century B. C., and ei to i, which took
place during the middle of the 4th Century B.C. (Allen 1968:74).

Diachronically, then, for Greek we would separate the two rules which were collapsed into (P-3) by the use of an alpha feature. The change brought about by (P-3) is reflected in the morpheme structure of Latin and Greek by the addition to their lexicons of the Condition Latin and Greek (30.1).

\[
\begin{array}{c}
\text{Latin & Greek (30.1)} \\
\begin{array}{c}
\text{+son} \\
\text{-dif} \\
\text{-com} \\
\text{+son} \\
\text{+dif}
\end{array}
\end{array}
\]

Latin and Greek (30.1) prohibits ai and au. In turn, Greek (30.1) collapses with Indo-European (1) to form Greek (30). After Latin (30.1) and Indo-European (1) have collapsed, Latin adds (P-2), discussed above, to form Latin (30).

We know that at some stage Gothic possessed the two diphthongs ai and au. We can arrive at this stage simply by adding the feature \(+\text{con}\) to the "then" part of the first segment of Indo-European (1). The result is Gothic (30.1).

\[
\begin{array}{c}
\text{Gothic (30.1)} \\
\begin{array}{c}
\text{+son} \\
\text{+son} \\
\text{+com} \\
\text{+dif}
\end{array}
\end{array}
\]

If ai and au were taken to represent diphthongs, Gothic (30.1) would replace Gothic (30) in the lexicon of Gothic. However, since there is no evidence within Gothic to regard ai and au as anything except monophthongs, we assume that Gothic suppressed all the features in the "then"
part of Gothic (30.1), and the condition had no further application, that is, it was lost and is recoverable only in the negative format posited in Gothic (30).

\[
\begin{align*}
\text{Latin (31)} & \quad [-\text{cns}] \\
 & \quad \downarrow \\
 & \quad [+\text{nas}] \\
 & \quad \downarrow \\
 & \quad [+\text{cns}]
\end{align*}
\]

\[
\begin{align*}
\text{Gothic (31)} & \quad [-\text{cns}] \\
 & \quad \downarrow \\
 & \quad [+\text{nas}] \\
 & \quad \downarrow \\
 & \quad [+\text{cns}]
\end{align*}
\]

In Gothic, mid vowels are not allowed before a nasal plus consonant within a morpheme. In Latin, front mid vowels are not allowed before velar nasal plus consonant. The difference between the two conditions is the presence of \([-\text{grv}]\) in the first segment and \([-\text{dif}]\) in the second segment of Latin (31) and their absence in Gothic (31). We know, though, that back mid vowels are very rare in this position in Latin, and that \(o\) became \(u\) before most instances of velar nasal plus consonant other than \(ng\). For a discussion of this see Buck (1933:82f). Except for the glaring exception in \textit{longus} and \textit{spongia}, we would be tempted to remove the feature \([-\text{grv}]\) from Latin (31). Greek, on the other hand, has no restriction on the vowels which can occur before the cluster of nasal plus consonant. Examples are: \textit{Ἰνδός}, \textit{δένδρον}, \textit{ἄνδρων}, \textit{σπονδή}, \textit{Ὀλύμπια}, \textit{Θριγκός}, \textit{ἐγγός}, \textit{ἀγγέλλως}, \textit{ὄγκος}, \textit{τυχάνω}. 

In Gothic, mid vowels are not allowed before an /l/ plus consonant or resonant. In Latin, parallel to the preceding Latin (31), this same restriction applies only to front vowels before nasal plus consonant.

Latin (32) differs from Gothic (32.1) only by the presence of the feature [+grv] in the first segment and [−son] in the third segment.

Back mid vowels, too, generally do not occur in Latin before a cluster of /l/ plus resonant, except before geminate /ll/. For a discussion see Buck (ibid.). Greek has no restrictions on vowels before a cluster of /l/ plus consonant or resonant. Examples are: στῆμα, ἐλθα, κάλμης, ὄπης, σύλλογ

In Gothic, high vowels are prohibited before a cluster of /r/ plus resonant or consonant. No such restriction on vowels exists in Latin or Greek.

Examples are: circa, firma, virgo, tergo, ferre, artus, arca, portus, corpus, furca, urna; κύρκος, πέρσας, ἀρθόν, ὄρνις, ὄρνος, ὄργα, πυρρόσ.
Gothic (33.1) \([\text{-cns}] [\text{+seg}] \Rightarrow [\text{+son}]\)

Latin (33.1) \((\text{seg}) [\text{-cns}] [\text{-son}] [\text{+seg}] \Rightarrow [\text{-cns}] [\text{+son}]\)

Greek (31) \((\text{seg}) [\text{-cns}] [\text{-son}] [\text{+seg}] \Rightarrow [\text{-cns}] [\text{+son}]\)

Gothic (33.1) demonstrates the one factor all three languages share in common, that is, a glide must be followed by a sonorant segment. In Gothic this means a resonant or a vowel. In Latin and Greek the addition of \([\text{-cns}]\) to the last segment restricts what may follow a glide to a vowel.

The major difference pertaining to glides among the three languages concerns what can occur before the glide. In Latin if a segment precedes a glide, that is, if the glide is not morpheme-initial, it must be a resonant or a vowel. In Greek a segment before a glide is further restricted; it must be a vowel. In Gothic, however, no such restrictions exist; not only can vowels and resonants occur before a glide, but certain consonants as well.
Medially in Gothic and Latin a resonant can occur before a glide, and when it does, the resonant must be nongrave and the glide must be \( \gamma \).

In Latin because of the presence of the feature \([-\text{nas}]\) the occurrence of a resonant before a glide is further restricted to nonnasal resonants. Examples are: marwjan, arwjo, balwjan; servo, volvo.

In addition, Gothic differs from Greek and Latin in another major point: in morpheme-initial position a glide may be preceded by a consonant.

When a consonant does precede a glide in Gothic, the consonant must be a dental and the glide must be \( \gamma \). Examples are: dwals, tweifl, \( \text{þ} \)wahan, swe.
High vowels are not permitted before h in Gothic. Greek and Latin lack an equivalent to this condition, because velar continuants do not exist in either language. (In both Greek and Latin h is considered a glide.)

\[
\begin{array}{c}
\text{Gothic (35)} & [\neg \text{seg}] & ( + \text{str} ) & ( + \text{cns} ) & ( + \text{cns} ) & ( + \text{seg} ) \\
\text{Latin (34)} & [\neg \text{son}] & \downarrow \\
                  & [\neg \text{cns}] & + \text{son}
\end{array}
\]

In Gothic and Latin a resonant which is not preceded by a vowel must be followed by a vowel. This condition cannot be stated for Greek because of the initial cluster mn. It would be true for Greek, if one of the two segments before the resonant were made obligatory.
VI. CONCLUSION

We have proceeded with the advance knowledge that Gothic, Latin, and Greek were genetically related languages. The material presented here does not in any way constitute proof of a genetic relationship. Genetic relationship was established in the nineteenth century on the basis of systematic sound correspondences within cognate words in each language. If we had also examined the morpheme structure of additional totally unrelated languages, Ewe and Quechua for example, we might have been able to hypothesize a genetic, and certainly a typological relationship, for Gothic, Greek, and Latin, because they shared an uncommonly large number of MS-conditions which were not shared by Ewe and Quechua. But we have not attempted to do so.

It would also be interesting to show the degree of relationship of the MS-components of Gothic, Latin, and Greek. In order to do this we must devise some metric or parameter which can be used to measure "relatedness" in MS-conditions. In the first column on the left in the following Table we have listed all the MS-conditions presented for the three languages. After each condition is a row containing pluses, minuses, or zeroes, which indicate the status of that condition in each language. The presence of a plus in the column under each language indicates that the language has the condition listed in the first column on the left. A minus under the language indicates that the language has the condition, but differs from the other two languages in the formulation of the condition. A zero in the column under the language indicates that no such condition is present in the language. If we total the number of identical values (plus, minus, or zero) that each language shares with the
other two, this provides us with a metric which, though very crude, is yet indicative of the degree of relationship between the MS-components of the three possible pairs of languages. One peculiarity of this metric is that if two languages do not have an MS-condition which is present in the third language, as for instance Latin and Gothic do not have Greek Conditions (11-12), then the absence of that condition is counted as a similarity between the two languages. This seems fully justified, because a condition present in one language but absent in the other two does in fact increase the distance between the MS-component of the one language and the MS-components of the other two.

When we total the identical values, we find that out of 46 MS-conditions Latin and Gothic have the same value for 36 conditions; Latin and Greek have the same value for 31 conditions; Gothic and Greek have the same value for 27 conditions. We deduce, then, that the MS-components of Latin and Gothic are more similar to each other than either is to the MS-component of Greek.

If we total only the number of identical MS-conditions shared by each pair of languages, that is, just counting pluses and not counting minuses and zeroes, we find that Gothic and Latin share 23 identical MS-conditions, Latin and Greek share 21 identical conditions, and Gothic and Greek share 22 identical conditions. The difference of one condition for each pair cannot be very significant.

If we total the number of shared but not necessarily identical conditions in each pair of languages, that is, counting pluses and minuses without regard to value and not counting zeroes, we find that Gothic and Latin share 37 identical and similar MS-conditions, Latin and Greek share 33 conditions, and Gothic and Greek share 32 conditions. Gothic and
<table>
<thead>
<tr>
<th>MS-Cconditions</th>
<th>Gothic</th>
<th>Latin</th>
<th>Greek</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Nos. refer to Chap. V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A11 (1)</td>
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<td>+</td>
<td>+</td>
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<td>A11 (2)</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>+</td>
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<td>-</td>
<td>+</td>
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<td>+</td>
<td>+</td>
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<tr>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>La-Gr (10), Go (10.1)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
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Totals: 46 Conditions
Latin share four more conditions than the next highest pair. We deduce from this figure also that the MS-components of Gothic and Latin are more similar to each other than either is to the MS-component of Greek.

Whether by totaling identical MS-conditions, or by totaling shared MS-conditions, or by counting identical values for the MS-conditions, in all three methods of reckoning the three possible pairs, we find the MS-components of Gothic and Latin to be most similar. We are not attempting to maintain that, because Gothic and Latin share more MS-conditions with each other than either does with Greek, Gothic and Latin are therefore more closely related languages. The MS-component is too small a part of the overall grammar to justify our making such a far-reaching statement. We are stating only that the MS-components of Gothic and Latin appear to be more closely related to each other than to the MS-component of Greek.

We have shown that because of the overlap in explanatory power between if-then conditions and negative conditions it is possible to switch formats without affecting the output of the condition. If-then conditions are preferable because they mark off which features are redundant and can be omitted from the dictionary representation of the morpheme. However, quite often the negative condition is more specific, particularly when a single cluster is not allowed in a group of similar clusters. For example, if \( dl \) is the only cluster of consonant plus liquid which is not allowed, it is easier and clearer to write a negative condition prohibiting \( dl \) than it is to write an if-then condition generating all other clusters of consonant plus liquid.

In discussing the ways in which MS-conditions can change, we have also pointed out that changes in the morpheme structure of a language
cannot be the result of re-ordering, for the simple fact that MS-conditions are unordered.

We have attempted to show that a MS-condition in its if-then format can be lost by suppressing all the features in the "then" part of the condition, and that a condition lost in this manner can be "recovered" in its most general form, that is, as a negative condition.

Segment sequence conditions can be thought of as complements. In a sequence of two segments, an if-then condition describing the redundant features of the first segment will be a complement to the condition describing the redundant features of the second segment, and this complementarity can be further demonstrated in that the complementary if-then conditions will share some of the same corresponding negative conditions. Thinking of conditions in complements is useful sometimes in discovering additional conditions, in describing a maximum number of redundant features, and occasionally in collapsing two complementary if-then conditions into one if-then condition.

We have also indicated that certain sound changes, such as Gothic voiced stops becoming continuants in certain positions, may arise from the fact that the latter feature is redundant in all environments.

Finally, we have shown that lexical redundancy conditions, as formulated by Stanley (1967), provide a means to explicate the relationship of different languages in terms of their morpheme structure. As such, redundancy conditions are a useful addition to comparative methodology.
## APPENDIX

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