A NATURAL HISTORY OF COMPLETE
CONSONANTAL ASSIMILATIONS

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PUBLICATIONS


FIELD OF STUDY

Major Field: Linguistics

Phonological Theory. Professors David L. Stampe and Arnold M. Zwicky

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0.6. Background and Theoretical Orientation.

My purpose in writing this dissertation is to try to explain a variety of phonological phenomena which have been classed as complete consonantal assimilations. This study is one of a number of phonological investigations within the conceptual framework of natural phonology (Stampe 1972b). Such investigations have dealt with either of the two basic kinds of phonological processes. Studies in context-free processes are best represented by Stampe (1972a) and Miller (1972), both of whom show that context-free processes in simple vowels and diphthongs are to be explained by the nature of the sounds themselves. Recent studies in context-sensitive processes--synoope (Zwicky 1972b), nasal assimilation (Zuckerman 1972), palatalisation (Neel 1973), and vowel nasalization (Schourup 1973a, 1973b)--have demonstrated that these processes too are to be explained largely on the basis of the function of the processes themselves and by the character of the sounds which are affected by them.

Investigations like those mentioned in the previous paragraph result from taking seriously a notion which has been around for many years, the notion of ease of articulation. Stampe states this in the following way (1972b:1):

1
A phonological process is a mental operation that applies in speech to substitute, for a class of sounds or sound sequences presenting a specific common difficulty to the speech capacity of the individual, an alternative class identical but lacking the difficult property.

Grammont writes with similar intent when he says (1933:176).

La loi du moindre effort. Il est certain que cette loi joue un grande rôle dans l'évolution des langues, et qu'en particulier tous les phénomènes d'assimilation, à quelque degré et sous quelle forme que ce soit, lui soit, lui sont dus. Mais si elle était seule à régir l'évolution phonétique des langues, tous les mots arriveraient assez vite à ce réduire à une seule syllabe, voire à un seul phonème.
Elle a contre elle la loi du plus grand effort, ou plutôt du besoin de clarté, qui commande toutes les différenciations et tous les renforcements.

The latter part of Grammont's statement involves the other major force at work in the development of phonological systems, the need to maintain distinctiveness. The results of the interaction of these two opposed forces in the development of children's language has been particularly well stated by Stampe (1969).

It is precisely in the earliest stage of language development in the child that ease of articulation dominates the phonological system to the extent of reducing everything to a kind of verbal pantomim, consisting of a simple consonant-vowel sequence. This notion of ease of articulation as reformulated by Stampe will play an especially important role in the characterization of complete consonantal assimilations,
particularly the way in which such processes apply and are extended in a hierarchical fashion.

As might be obvious from the foregoing statements, much of the work in my study of complete consonantal assimilations involves the reduction of phonology to a kind of phonetic teleology. Such a reduction is, however, limited by the seeming paradox that, even though many phonological processes can be shown to serve the requirements of the vocal tract, they are at the same time essentially mental processes. There are also a number of important ways in which nonphonological conditions constrain the operation of phonological processes, as will be shown with respect to complete consonantal assimilations in chapter four of this work.

Many of the observations made in the present study are not new, as a perusal of older literature on the subject makes quite clear. One such observation in particular, which is of central importance was made in the late nineteenth century by Sievers (1901:277):

Entsprechendes hat man auch noch zwischen partieller und totaler Assimilation unterschieden. Letztere tritt um so leichter ein, je mehr Vokaler die beiden Nachbarlauts bereits mit einander gemein haben. Es wird z. B. *adna* unter denselben Bedingungen zu *amna* mit totaler Assimilation, wie *toma* zu *toma* oder *abna* zu *abna* mit partieller, weil *d* und *g* neben der Stimme auch noch den dentalen Verschluss gemeinsam haben, so dass nur die verschiedene Stellung des Gaumensegels sie Oberhaupt unterscheidet.—No weiter auseinanderliegende Lauten vollkommen assimiliert werden, sind nach dem allgemeinen Gesetz der Allähnlichkeit des
Much of the work in the first three chapters of this dissertation involves clarifying and examining the important consequences of the observation that complete assimilations occur most easily when the two sounds involved are already nearly identical. As will be shown below, such a claim is not really as simple as it first seems.

A more recent and somewhat different version of the observation concerning similarity vis-à-vis complete assimilation is found in Kenstowicz (1979:107-8):

...It is reasonable to assume that assimilation is of a continuous nature in which one segment becomes more and more similar to another to the limiting case of complete identity. Furthermore, it seems that clear cases of complete assimilation arise only when the two continuous segments are already similar to begin with. For example, the assimilation rule alluded to above, which turns dental stops to continuants, also applies before dental continuants. Thus, beside the 3 past and infinitive forms meto and meti of the verb meaning 'throw' we find the 1 future mesker from /met-er-1u/. Here we can say that the root final /t/ is completely assimilated to the following /s/, but only by virtue of the fact that the /t/ and /s/ already share a fair number of features in common. Finally, it seems reasonable to assume that a hierarchy is involved in assimilation such that complete assimilation implies partial assimilation, but not vice versa.

Similarity as a condition for complete assimilation proves, as is claimed in the two quotations above, and as is demonstrated
below, to be an extremely important notion; however, as will be shown such a constraint needs to be modified, when what I shall call true single process complete assimilations are involved.

0.1. Definition of Complete Consonantal Assimilation.

Before proceeding any further I would like to describe just what is meant by complete consonantal assimilation. Such a description is necessary because the term complete assimilation has been used in a variety of ways. Under the notion complete consonantal assimilation I include the phonological process(es) which convert a sequence \( C_1 C_2 \) (where there is a difference of at least one feature between the two segments) to a sequence of identical sounds.\(^1\) Thus, derivations, either historical or synchronic, which involve the development of \( C_1 C_2 \) sequences to \( C_1 C_1 \) (complete progressive assimilation), \( C_0 C_2 \) (complete regressive assimilation), or \( C_3 C_3 \) (complete coalescence, where \( C_3 \) is a segment made up of features from both \( C_1 \) and \( C_2 \), are the subject matter of my work.

Since I am most interested in elucidating the nature of the process, I have limited the data to reasonably unambiguous
cases of complete consonantal assimilation. This was done by stringently restricting the data to cases where there is some real evidence of a geminate or long consonant arising from the application of phonological processes at least one of which must be assimilatory in nature.² By this restriction I mean

²I add the final clause of this constraint to exclude cases where a $C_1$ $C_2$ sequence is converted to a $C_2$ $C_2$ sequence by non-assimilatory processes. Such a process would be final $V$-filling devocing which would convert, for example, an underlying $dt$ sequence to $ct$ but not by assimilation (note that the same rule would convert $dyo$ to $td$).

to exclude questionable synchronic derivations which involve first completely assimilating two unlike segments and then simplifying the resulting cluster by a rule of degemination. Such derivations are argued for on the basis of the free ride principle which involves designing the phonological descriptions of a language not necessarily in the most natural, straightforward manner but rather in a way which makes the most economical use of demonstrably needed rules. Zwicky (1970) has discussed the problem of economy and the free ride principle as it relates to complete assimilations. In this paper he demonstrates that such argumentation (specifically that found in Chomsky and Halle 1968) cannot be justified for at least some dialects of English. Disregarding some counter claims based on dialect differences, Zwicky’s argument is sound, based on the data both
from his own dialect and that described in Chomsky-Halle; and I feel that it provides sufficient reason for restricting the data in the way I have just outlined.

One further remark about the subject matter under investigation is necessary. I have specifically stated that the notion complete consonantal assimilation has to do with phonological processes. This may seem redundant; however, I used the modifier advisedly. As I shall show in Chapter 4, some complete assimilations are no longer natural phonological processes at all but are rather to be described as having some other motivation—in many cases morphological in much the same way that Modern German umlaut is a morphological process.

0.2. Sources of Data.

The data on which the claims made in this work are based come from a variety of sources: casual speech (optional sandhi phenomena triggered by a casual speech style),\(^3\) regular

\(^3\)For a discussion of casual and fast speech phenomena and the theoretical significance of these notions see Iversen (1972a) and Dressler (1972).

non-optimal external sandhi, internal assimilations resulting from inflectional and derivational processes; and historical developments involving both word internal changes and those occurring across morpheme boundaries. I have attempted to use
data from languages representing different language families in order to make my statements as generally valid as possible. Although only relatively few languages are examined in depth in the following chapters, the appendix contains similar data and their sources from a number of other languages. In all nearly one hundred descriptions of languages and dialects of individual languages have been consulted. Naturally those examples which are discussed in greatest depth are for the most part from languages with which I have become relatively well acquainted.

3.3. The Body of the Work and the Arrangement of Chapters.

One important task, which I mention and discuss at length in chapter three, is to distinguish between correspondences of either historical or synchronic derivations which arise from a single process of complete assimilation and those correspondences which arise in some other fashion. Of the latter, two different situations obtain. Either the complete assimilations arise by 'ancient' as a subset of some larger assimilatory process, e.g., a voicing assimilation rule, or they are the result of a number of processes whose cumulative effect is a complete assimilation. The former processes are the subject of chapter one. I treat the latter in chapter two where a further division of type is shown to be necessary. Cumulative processes
resulting in complete assimilations may all be assimilatory in nature, e.g. a voicing assimilation rule plus a manner changing rule, or they may involve a combination of assimilatory and non-assimilatory processes as seems to be the case in the historical development of Greek sonorant clusters in some dialects (below, pp. 38–50).

I discuss single process complete consonantal assimilations in chapter three. Such processes turn out to be relatively rare in the languages of the world. It is, however, precisely these processes which show how complete consonantal assimilation is to be interpreted within the framework of natural phonology as a single phonological process with identifiable phonetic constraints. I point out in this chapter that the notion of hierarchy of application and extension of phonological processes—an important one within natural phonology—can also be seen in complete consonantal assimilation.

Chapter four deals primarily with non-phonological factors which must be considered in any thorough study of complete assimilation. In particular the notion of strength, or conversely that of weakness as it relates to my subject is examined and it is shown that theories which attempt to explain strength/weakness on purely phonetic or abstract phonological grounds are not tenable. Indeed, a number of non-phonological (non-phonetic) factors play important roles in determining the relative strength or weakness of segments. Furthermore,
it will be shown that some processes which began as genuine phonological assimilations have become in the course of time morphological and no longer can be considered to be genuine phonological processes but require making the important distinction between process and rule—an as yet poorly understood distinction.

In chapter five I attempt to draw conclusions from the preceding chapters. In particular, I explicate what I call the principle of similarity which relates the claims made in the two quotations from Sievers and Konstowicz (see pp. 3-4 above) to the data considered in Chapters 1 and 2 and shows how the claims must be modified in the case of true single process assimilations. Furthermore I list a number of methodological problems arising from the study particularly with respect to the surveying of languages to obtain data on language universals, to the need for more in depth work on individual languages, and to the need for a stronger more explicit theory which allows for the distinction between natural phonological processes which are universal and related to innate (biologically determined) mechanisms and phonological rules which are necessarily non-universal and learned. This conclusion, as is so often the case, asks more questions than it answers. My only hope is that the contribution of this study at least clarifies to some extent what questions we should be asking and how we should be asking them.
CHAPTER I
SINGLE STEP FORTUITOUS ASSIMILATIONS

1.0.

In this chapter I wish to discuss a class of assimilatory phenomena which meet the constraints set out in the introduction but which do so in a completely fortuitous fashion. These complete assimilations occur as a subset of members of a more general rule of assimilation. Such a situation arises when a simple, single feature assimilation rule affects two segments which differ to begin with only in respect to the feature changed by the assimilation rule. An example of an assimilation of this type would be the application of a voicing assimilation rule to consonant clusters where the two segments differ by only the voicing feature. I know of no language which restricts the application of a voicing assimilation rule to just those instances where the segment whose voicing coefficient is to be changed differs from its neighboring segment by just the value of that feature coefficient. On the other hand, there are many languages in which a general rule of voice assimilation fortuitously accomplishes complete assimilations. Another example of such an assimilation process involving a single feature change which fortuitously includes complete assimilation are the examples cited in the Sievers quotation.
(above, pp. 3-4). Here the general rule is one which assimilates voiced stops to homorganic nasals in a nasal environment. When the nasal environment is a nasal which is itself homorganic to the voiced stop, as in the case of anna, the result is a complete assimilation to anna; however, when—as in the case of ange and ange—the nasal environment is a nasal not homorganic to the stop to be assimilated, the result is partial assimilation to ange and ange respectively.

In order to illustrate the type of complete assimilation described above, I would like to consider in detail two examples, one from English and one from Yakit. Each example includes sound correspondences which are fortuitously complete assimilations and which cannot be considered to be a single complete consonantal assimilation process, i.e. the rule cannot be formalized as simply:

\[
C_1 C_2 \rightarrow C_2 C_2 \quad \text{or} \quad C_1 C_1
\]

but rather must be formalized as

\[
\{\text{feature} \} \{\text{feature} \} \rightarrow \{\text{feature} \} \{\text{feature} \}
\]

or

\[
\{\text{feature} \} \{\text{feature} \} \rightarrow \{\text{feature} \} \{\text{feature} \}
\]

1.1.

One of the best sources of data concerning natural phonological processes is found in the phonological changes
which occur in rapid and/or casual speech styles. English rapid speech offers an example of an assimilatory process which in turn serves to illustrate a more general fact about marked sequences of segments. The following facts have been discussed, independently it seems, by Gismon (1960, 1970) and Bailey (1969, 1970). Consider the following data from Gismon (1970: 294-5):

\[ t \rightarrow p \text{ before } p, b, m, \text{ e.g., } \text{that pen, that boy, that man becomes that pen, that boy, that man.} \]

\[ t \rightarrow k \text{ before } k, g, \text{ e.g., that cup, that girl become that cup, that girl.} \]

\[ s \rightarrow š \text{ before } p, b, m, \text{ e.g. good pen, good boy, good man become good pen, good boy, good man.} \]

\[ s \rightarrow g \text{ before } k, g, \text{ e.g. good concert, good girl become good concert, good girl.} \]

\[ n \rightarrow ñ \text{ before } p, b, m, \text{ e.g. ten players, ten boys, ten men become ten players, ten boys, ten men.} \]

\[ n \rightarrow ñ \text{ before } k, g, \text{ e.g. ten cups, ten girls become ten cups, ten girls. (There is of course no complete assimilation of } n \text{ to } ñ \text{ before } g \text{ since there are no initial } ñ \text{'s in English.)} \]

Some assimilations affect both \( s \) \( t \), and \( ñ \) before nonalveolar segments, e.g. Don't be late, he won't come, We found both, become Donp be late, he zork come, he founb both.
s - š before palatal, e.g. this shop, this year
become this shop, this year.

There are a number of important things to notice about this assimilatory process. First the order alveolar-non-alveolar (Bailey prefers apical-non-apical) is crucial. Forms such as keet track for keep track or bat track for pack track do not occur. Second, and-for the purposes of this discussion--more important, this assimilation process is a straightforward position of articulation assimilation, not a complete assimilatory process as is demonstrated by e.g. good pen not good pen, shop boy, not shab boy. Where complete assimilations arise the segments in question were identical except for the single position feature which was changed by the rule (Gimson 1970:296).

In both of Bailey's squibs he considered only forms in English which resulted in complete assimilations. He did not consider what happens to forms like that boy, that man, etc. This omission was not, however, crucial to Bailey's argument, since he was interested in showing that this assimilatory tendency was to be subsumed under a larger tendency toward unmarking clusters, such clusters of apical plus non-apical segments having been shown to have a relatively marked status.
in language.¹

¹In addition to Bailey's examples of marking by metathesis in Greek and assimilation in English fast speech (in Yakut) a regular exceptionless assimilation of ts and tp clusters to ks and pp occurs (Hsu 1962:58).

More information of importance about this assimilatory process can be provided by looking at the situation involving the alveolar segment s followed by a nas alveolar segment. Notice that s assimilates only to a following palatal sound, resulting in the substitution of ż for s. Nothing happens if the segment following s is labial (sp, sh remain unchanged) or velar (sk, sg are also stable). The reason for this restriction on the assimilation of s seems to follow from the highly restricted nature of this assimilation process. The process affects the feature of articulatory position only. In order for s to assimilate to a labial or velar position of articulation its distinctive similarity would have to be lost as well as the position feature alveolar. A change of such magnitude is not within the scope of this assimilation process. That such a constraint is in effect is even more aptly demonstrated by the behavior of l. The alveolar lateral does not assimilate at all in casual speech, which is not surprising in view of the foregoing data. In order for a lateral to change position (other than by a light l-dark l alternation), it must undergo
a change not only in position, but in manner features as well.

In Gibson's first article he speculates as to the possible reasons for the assimilatory process under discussion (1970:9-10). Indeed the very title of the article hints at a possible reason ("The instability of alveolar articulations").

As to the possible reason for this instability, Gibson says:

It is difficult to account for this apparent alveolar instability on articulatory or systematic grounds. It is possible that the tongue articulation of, for instance, /t, d, n/ is more readily adjustable than the bilabial closure characteristic of /g, b, m/. but one might equally expect changes of /s, z, n/ to /t, d, n/. The alveolar stop series is, of course, being medial, exposed to a double attraction from the bilabial and the velar series. (The strong vocalic transition characteristic of the velar series may also be a factor in inhibiting their modification.) /s, z/, however, occurring midway between the dental and palato-alveolar series, assimilate only in the direction of /ʃ, ʃ/. From a functional standpoint, it is true that the alveolar phonemes occupy a high place in the order of frequency of occurrence in English; so that the "functional load" may be said to be relatively great at the word level. But this high frequency of occurrence may, in fact, contribute to their instability in word final position within the continuum, as compared with the less common terminal consonants, when it is a question of the neutralisation of redundant oppositions.

Gibson leaves open the question as to why these assimilations take place. By 1970, however, he had—perhaps through the influence of a reply to his 1960 article (Allen 1960)—
apparently decided in favor of the 'functional load' explanation. Gimson (1970:295) states:

...it is to be noted that the alveolars have a relatively high frequency of word final occurrence, especially when inflectional, and are particularly apt to undergo neutralization as redundant oppositions in connected speech.

I think, however, that Bailey is probably closer to recognizing the real state of affairs when he points out that there is genuine evidence that clusters of apical, nonapical segments are universally marked and have a tendency in many languages to become unmarked, even by the relatively drastic process of metathesis. Indeed rather than functional load being the basic factor responsible for the weakness of final alveolars in English, the language-universal phonological properties of such articulations might well underlie the fact that alveolar articulations have such a high frequency of occurrence in English.

Simply stating that a sequence of segments is marked, and basing such a statement on evidence from the behavior of such sequences in a number of languages, is only the first important step. There remains the question of why such a sequence is marked, what natural process underlies this markedness. I think the answer to this question can be found by considering some relatively straightforward facts about the articulation of the sounds in question. Bailey
uses the term *apical* for the sounds Gibson identified with the position feature alveolar; and the clue to the solution of this problem is in the identification of the *active* articulator, the apex, or at least the front portion, of the tongue. Both bilabial and dorsovelar articulations involve comparatively larger articulatory gestures than articulations involving the tongue tip. Dorsovelar articulations involve the use of the extrinsic tongue muscles, and are relatively more sluggish than the tongue tip articulations which are controlled by the intrinsic muscles of the tongue. One reason for this relatively more sluggish movement involved in the dorsovelar articulation is that the whole body of the tongue is moved, whereas in the apical articulation controlled by the intrinsic muscles only the tongue tip needs to move. In a sense, this relationship of dorsovelar articulations to apical alveolar ones is analogous to the relationship between vowels and consonants where the larger more sluggish vowel articulations tend to dominate the relatively finer articulations of consonants involving the tongue as an articulator (Ozman 1965).

Bilabial articulations, involving both lip muscles and jaw muscles are also relatively slower and more sluggish articulatory gestures than apical ones; and, at the present time, it seems most reasonable to assume that the instability of alveolar bilabial sequences is related to that of alveolar-velar sequences. Indeed early investigations of these articulations
by experimental phoneticists offer substantial evidence for these claims (Kaiser 1954, Edgins and Stetson 1937).

In Stetson's study (pp. 92-94) data is summarised which shows that tongue tip articulation is faster than back of the tongue articulation which in turn is faster than lip articulation.

Posner (1961:37) interpreted this difference in speech as a difference in ease of articulation:

The consonants that are articulated with the tip of the tongue (dental and alveolars) are ceteris paribus easier to pronounce than the others; most difficult are those articulated by movements of the lips. "Difficulty" here seems to be correlated with the speed at which the muscles controlling the articulatory organs can move: owing to the effect of the facial nerve, the lips move more slowly than the back of the tongue, which in turn moves more slowly than the tip of the tongue.

The result is that ceteris paribus dental consonants are shorter in duration than the velar, palatal, and labial consonants, and the effort of pronunciation is consequently reduced.

At first glance it would seem that the assimilation processes I have been considering involve eliminating an easier articulation in favor of a more difficult one. Such a change would hardly seem to be in the service of ease of articulation, which I have claimed is the raison d'être of assimilation rules in general. This paradox is, however, only an apparent one.

The articulatory difficulty involved here is not one of alveolar versus velar or bilabial per se but rather one of sequencing these articulations. The difficulty arises by
having to produce the easier tongue-tip gesture before the more
difficult slower articulatory gesture can be started. Such a
difficulty does not exist when the tongue tip articulation
follows the velar or bilabial articulation.\textsuperscript{2}

\textsuperscript{2}It should be remembered that assimilation is only the
most common way of resolving this difficult sequence. A more
drastic resolution is reversing the sequence through metathesis.

1.2.

The assimilation phenomenon described in the preceding
paragraph was one which involved assimilating the position of
articulation of an alveolar segment to that of a following
nonalveolar one. In the course of doing this a number of complete
assimilations were fortuitously accomplished. I would now like
to consider data from a radically different language which
involves a manner of articulation assimilation. Despite the
differences, the assimilations show similar fortuitous complete
assimilations.

The language in question is Yakut, a Turkic language of
Siberia. Most grammatical relations in this language are
expressed through suffixation. In the case of the plural of
nouns, the suffix showing plurality is -\lambda l\lambda (where \lambda represents
a vowel subject to regular harmonic alternations which are of no
significance to the point in question. I have chosen the plural suffix to illustrate the following assimilatory phenomena; there are, however, a number of other suffixes having \( \text{\textasciitilde l} \) as the initial segment. All of these \( \text{\textasciitilde l} \)-initial suffixes show the same assimilations. The initial segment of the plural ending remains \( \text{\textasciitilde l} \) only when suffixed to a stem ending in a vowel, a diphthong, or \( \text{\textasciitilde l} \) itself. When suffixed to stems ending in other segments, the \( \text{\textasciitilde l} \) of the plural regularly assimilates in the following way (Krueger 1963:4-5).

a. \( \text{\textasciitilde l} + t/C \) where \( C \) is a voiceless obstruent; there are no stem-final voiced obstruents:

<table>
<thead>
<tr>
<th>at</th>
<th>'horse'</th>
<th>attar</th>
<th>'horses'</th>
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<td>balik</td>
<td>'fish'</td>
<td>ballatar</td>
<td>'fishes'</td>
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<tr>
<td>tuyr</td>
<td>'what thing'</td>
<td>tuyratar</td>
<td>'what things'</td>
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<td>iskasp</td>
<td>'cabinet'</td>
<td>iskaspatar</td>
<td>'cabinets'</td>
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<td>musp</td>
<td>'horn'</td>
<td>muspatar</td>
<td>'horns'</td>
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b. \( \text{\textasciitilde l} + d/C \) where \( C \) is \( r \) or \( y \)

<table>
<thead>
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<th>ubayar</th>
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<td>atlip</td>
<td>'stallion'</td>
<td>atlipatar</td>
<td>'stallions'</td>
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c. \( \text{\textasciitilde l} + n/C \) where \( C \) is a nasal

<table>
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<td>'ford'</td>
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</tbody>
</table>
Notice that the / assimilates with respect to a single feature in each case. In no instance is the alveolar point of articulation lost. As was the case in the English examples the only complete assimilations are in those cases where the neighboring segment was already minimally different. Elsewhere the assimilation is partial.

1.3.

In this chapter I have discussed the simplest class of complete consonantal assimilations, the fortuitous ones. In these cases the teleology of the assimilatory process was not complete assimilation at all, but rather the elimination of a specific difficulty in the articulation of a sequence of segments. In some cases the elimination of a specific difficulty resulted in a complete assimilation. The next class of complete assimilations to be discussed is somewhat more complex, involving, as it does, the combining of a number of processes to produce a complete assimilation.
CHAPTER II

COMPLETE ASSIMILATIONS INVOLVING SEVERAL RULES

2.0.

In the preceding chapter I discussed a number of examples of complete assimilations which tend to confirm the claim that complete assimilations occur when the two segments involved differ only minimally. In the present chapter I wish to consider a number of complete assimilations which also offer confirming evidence for the similarity constraint but in a slightly more complex and involved fashion. These assimilations meet the definition of the introduction, i.e. sequences of unlike consonants become sequences of identical consonants through the operation of at least one assimilatory rule. However, unlike the complete assimilations of the previous chapter, those under present consideration involve a combination of more than one phonological process before complete assimilation is achieved. These combinatory complete assimilations involve the application of two or more assimilatory rules or the application of assimilatory rule(s) and nonassimilatory rules. Both types of combinatory assimilations are the subject of the following paragraphs.

2.1. Combinations of more than one assimilatory rule—Finnish gradation.

23
The data from Finnish which I wish to consider are from the well-known phenomenon of consonant gradation. Gradation involves the weakening of stops when such stops are word initial and at the head of a short closed syllable. The following forms (from Skousen 1972:10-11) illustrate the alterations arising through consonant gradation:

Short stops:

a. When preceded by a nasal the stop is weakened to a nasal:
   mp + mn  kampa 'comb' kampam (ess. sg.) kampaa (gen. sg.)
   nt + nn  ranta 'teeth' rantan rannan
   nk + nn  sa(n)ko 'bucket' sa(n)kono, sa(n)kon

b. When preceded by a labial the dental stop is weakened to an identical liquid:
   it + ll  silta 'bridge' siltan silla
   rt + rr  virta 'stream' virtan virran

c. Otherwise, p is weakened to v:
   p + v  halpa 'cheap' halpan halvan
   t is weakened to d (in the dialects t is weakened to a glide or a null segment, depending on the environment, or to r, or to l):
   t + d  rato 'dirt' ratona radon
   and k is weakened to a glide or a null segment depending on the environment:
In recent years a number of accounts of this phenomenon have been made within the framework of generative phonology (McCawley 1963, Karttunen 1970, Skousen 1971). Each of these accounts has attempted to explain Finnish consonant gradation on the basis of phonetically conditioned phonological rules.

In a more recent paper Skousen (1972) has argued that the consonant alternations presumed under gradation are no longer the result of a productive phonological rule but rather are learned as alternations conditioned by the use of specific suffixes. Skousen's evidence for this claim, if not overwhelming, is at least extremely thought-provoking and deserving of careful consideration. Whatever the status of gradation as a phonological rule in present-day Finnish, there can be no doubt that historically these alternations came about as a result of phonetic conditioning.

With the foregoing hedges as to the present-day status of gradation in mind, I should now like to consider these examples.
of this gradation which involve complete assimilations, specifically
the following:

\[
\begin{align*}
mp &\rightarrow m3 \\
zt &\rightarrow nn \\
sk &\rightarrow ng \\
rz &\rightarrow rz \\
lz &\rightarrow ll
\end{align*}
\]

Historically these alternations are the product of the combination
of a number of processes. First, there is ample reason for
assuming that all occurrences of \( \eta \) on the surface are derived
from an underlying \(/n/\) (Karstens 1970:70-71). Thus surface \( \eta \)
as in [\( \text{tanko} \)] would be derived from underlying \(/\text{tanka}/\). The rule
of nasal assimilation operates independently of consonant gradation
and must apply before it.

When the conditions for consonant gradation are met, phonetically
motivated changes are brought about. Of the many interpretations
of the individual steps involved in the conversion of underlying
\(/mp/, /zt/, /sk/, /rz/, /lt/, to \{m3\}, \{nt\}, \{ng\}, \{rz\}, and \{ll\}\)
respectively, that of Skousen (1970) seems most plausible.

Gradation of nonvocate steps involves weakening then to
homorganic voiced fricatives. Thus, \( p \rightarrow b, t \rightarrow d \) and \( k \rightarrow g \).

There seems to be no evidence which would suggest that
the spirantization and voicing could be separated. Skousen
(1971:73-79) cites ample evidence for this interpretation over
that which would weaken \( p, t, k \) to \( b, d, g \) and these changes \( b, d, g \)
in a variety of ways.
The operation of this rule would produce the intermediate stages 
\( n^2, n^6, n^7, n^8, n^9, n^{10} \) from \( n^2, n^6, n^7, n^8, n^9, n^{10} \), respectively.

At this stage the following rule applies (Skousen 1971:75):

\[
\begin{array}{c}
+\text{cons} \\
+\text{son} \\
\end{array}
\begin{array}{c}
+\text{cons} \\
+\text{son} \\
\end{array}
\]

1 2 + 1 1

condition: 1 and 2 are homorganic

Skousen argues that this rule is both a phonological rule in its
application to its output of gradation and a morpheme structure
condition. The existence of such rules with double functions is
not at all surprising and is in fact predicted by the theory of
natural phonology espoused by Stampe (1972) where it is specifically
claimed that so-called morpheme structure conditions and
phonological rules have essentially the same ontological status
and are not to be treated as essentially different entities within
the phonological component. However this may be, the interesting
thing about this rule for present consideration is the way it
relates to the process of complete assimilation. The rule of
progressive consonant assimilation is the last in a series of
phonetic processes which convert sequences of unlike consonants
into sequences of like consonants. Each step changes the
underlying segment to one which is more similar to its neighbor
until the complete assimilation is achieved. The rules as they
apply in ordered sequence are:
(1) Nasal assimilation
(2) Weakening (gradation)
(3) Sonorant assimilation

It is important to note that in those cases where the segments are too unlike the complete assimilation is never achieved. The clusters rp, rk, lp, lk are not completely assimilated, since there is no rule (like the rule of nasal assimilation) which naturally adjusts the liquids r and l to make them homorganic to p and x. In chapter one (p.15), I showed that the rule of assimilation of position of apical + nonapical clusters was limited in the case of the apical sibilant s to the change $s \rightarrow f$ because of the need to preserve the distinctive sibilance of the s; in a like manner, it would seem, is the prohibition of the shift of r, l from their alveolar position of articulation to be interpreted. Once again, a constraint requiring similarity can be seen operating to limit possible complete assimilations.

2.2. Latin Prefix Assimilations.

A particularly vexing problem of Latin historical phonology involves the assimilation of prepositional prefixes in compound words. I should like to consider particularly the assimilations (or lack of same) in the compounds with ab-, aus-, and in-.

The reason that these compounds present a problem is that the evidence for an individual assimilation is often confused and
even contradictory. Concerning the situation in the Classical language Buck and Hale say the following (1966:24):

When assimilation takes place in compounds, the changes are nearly all such as have just been mentioned. But assimilation is often absent, owing to the influences of the separate form of the word which is the first member of the compound. This is the same principle of Reconstruction that often prevents the regular vowel changes in the second member of compounds... The greatest variation is seen in the so-called prepositional compounds, that is, compounds with adverbial prefixes, most of which occur separately as prepositions. For certain combinations assimilation predominates from the earliest period; in others only the unassimilated form is in use until a late period. So, for example, spellings like accipitā, attineō are more common at all periods than adcipio, addineō, and, though the latter forms are sometimes found in imperial times, it is doubtful if the recompounding affected anything but the spelling.

It is further pointed out that the spellings afferē, adīgnō, conlocō, 'prevailed to the almost total exclusion' of afferē, adīgnō, and collectē. From this the authors conclude that the pronunciations must also have mirrored the spelling and ad- and con- were so pronounced in these words.

The general rules given for Classical Latin are the following (Buck and Hale 25).

a. ad-

Assimilates before t, c ēkl, and p, e.g.

attineō, accipitē, apparēō (in verbs other than appellē, appārēō, and apparēō, the unassimilated ad- appears frequently before
roots with initial p).

Remains unchanged before b, m, q (e.g., g, f, s, n, e.g. adhibē, admissē, admissēō, admissēōr (but often admissēōr, admissēōrē, admissēō, admissēōrē).

Often does not assimilate before l, r, e.g. adlūh, allegō, allegō, however, preference for the assimilated form is shown in allegō, allūtus, arripīō, arripīō.

b. cons-

Not assimilated before t, d, c, l, g, t, f, and v.

Assimilated to cons- before p, b, m.

Preferably not assimilated before 1 (except colisēō).

Preferably assimilated before f, e.g. corrumpē, corrumpē.

c. in-

Not assimilated before t, d, c, g, q, n, f, v.

Assimilated to in- before p, b, m.

Remained unassimilated until very late before l, r.

The facts as reported by Vääränen (1963:62-68) for Vulgar Latin are somewhat confusing:

L'assimilation totale se fait généralement dans les composés avec ad-: -cādo, -cipō, -tārē, -ferō, -pīca, -pīco, -tīrēō, etc.
et avec con- : -labor, -libo, -loguer, -laudo, -laboro, -ripio, -rupo, etc., bien que les formes non assimilées soient fréquentes, voire prédominantes, par ex. pour officio, Alforton (noe) et adfert, et souvent précédées par les grammariens latins.... Leurs (the grammarians') règles sont souvent fantaisistes et contradictoires, par ex. colligo, collaco, mais conlabbro, conlaudo, etc. D'une manière générale, les grammariens donnent préférence aux formes assimilées. Mais un témoignage plus sûr est fourni par les inscriptions. Plus leur allure est désinvolte (graffiti, tablettes d'excavation), et plus souvent les préfixes ad-, con-, in-, etc., sont assimilés à la consonne initial du radical. Au contraire, les manuscrits des textes littéraires, même "vulgaires", accusent un accroissement des formes non assimilées vers la fin de l'Antiquité.

The situation with regard to the assimilation of the final segments of the prefixes ad-, con-, and in- can be summarized in the following fashion: Classical Latin, the conservative literary dialect, shows a tendency toward complete assimilation of these segments to the initial consonant of the root, while those sources which reflect the living, spoken language, i.e., graffiti, inscriptions, etc., show this same tendency carried through much more completely and regularly. Moreover, if one looks ahead to the development of that dialect of Vulgar Latin which was to become Modern Italian, the complete assimilation process can be seen to have become completely regular and, with respect to ad-, an exception-free process (Roßle 1943:39ff.).

To doubt the phenomena of recomposition plays a major role in determining the confusing character of these assimilations
and their seeming hit and miss application, particularly in the literary language. There is, however, more to this phenomenon than such an explanation covers. First of all, some assimilations show up earlier and seem to be much more regular and exception-free than others. Other assimilations do not occur until much later. I think that a probable answer to this problem, and one which is fully as important as any notion of recomposition, is to be found in the nature of the assimilatory processes in question. Whereas, in Italian the process of assimilation, at least in the case of ad + c, must be viewed as a single general process which assimilates the stop to any following consonant, such is not the case in Latin.²

²I will have more to say about the assimilation rule in Modern Italian in chapter four. The question of the rule's status will be discussed—i.e., whether the rule is a rule of phonological assimilation, whether it has become morphologized, or whether it is any longer an assimilation rule at all.

In the extended passage from Bick and Halle cited above, it is mentioned that one of the earliest assimilations preserved in writing was attēnus. Even though there is evidence of recomposition sporadically in the late innumeral period, such recomposition, according to the authors, doubtfully affected anything but spelling. In reality a much stronger position could be taken. One of the oldest phonological rules of Latin, inherited from the Indo-European, is one which requires
that obstruent clusters have the same voicing feature for each segment. This rule works regressively, requiring the first obstruent to agree in the voicing feature with that which follows (Sommer 1966:213-6). That the voicing assimilation rule remains a particularly strong one is not to be doubted; indeed following Allen (1965:22), it can be said:

It is in fact uncertain to what extent in educated speech the analogical spellings (i.e., the recompositions—J.W.H.) may also have been reflected in pronunciation. What is virtually certain is that, even when this happened, the b or d will have been devoiced to (p) or (tß) before a voiceless sound.

Thus, given the existence of the voice assimilation rule, which was operative from the very earliest stage of Latin, there would always have been a complete assimilation of *sd + t* to *st*—along with *stk* and *stn*, *stc*, *stc* from *sd + s*, *sd + z*, *sd + f* and *sd + g*. Such an assimilation is another example of the phenomenon discussed in Chapter 1, a fortuitous complete assimilation.

The equally prevalent *sceplo* is possibly to be explained by the operation of both the voicing rule and some form of the rule discussed in chapter one which assimilates marked clusters of alveolar-non-alveolar sequences. That the assimilation of the *sd + c* sequences is more regular than that of *sd + g* would follow from the fact that within the operation of this unmarking process, clusters involving sequences of apico-alveolars followed by palatals or dorsovelars are more difficult
than alveolar-bilabial sequences involving as they do the same active articulator.

Another rule which existed in Latin from a very early time is one which assimilated the sequences -al-, -ad-, -a1-, -an- to -il- (cf. Buck and Halle 24). There is no reason not to assume that the assimilations ad- i 1, con- i 1, and in- i 1 to all- coll- and ill- were related to this early development of morpheme internal clusters. There is also an independently motivated phonological rule which assimilated a dental stop to a following s, e.g. meusul from met-sul, clausul from clausul.

*ovutul < *clausul.

In other words, there are a number of individual rules of assimilation which can explain individual cases of prefix assimilation. It is my conjecture (and at this point only a conjecture) that prefix assimilation occurred originally as a result of the application of one or more of these rules, in some cases the application being optional. This, however, particularly in the spoken language was enough to establish a tendency which became regularized as a general rule of complete assimilation. It is the operation of this general rule of complete assimilation which predominates in the language of the inscriptions and graffiti and later in the development of Italian. If this conjecture is correct we have here an example of a general phonological process developing out of a number of fragmentary ones.
2.2.1. Recursus: A Later Italian Development.

Not directly related to the foregoing section on prefix assimilation, but nonetheless interesting in the same general context is a development in certain southern dialects of Italian. This development shows two important aspects of phonological development. One is the notion of central importance to this thesis, that sounds which are more similar to one another tend to assimilate completely more readily than those which are not so similar in feature makeup. The other important point illustrated by these data is that, whenever possible, complete assimilation should be viewed as a combination of several single-feature assimilatory processes. This fact about such processes is of importance in showing the chronology of individual developments. The data are the following (from Knolfs 418-27):

a. -mb-, -nd-, -ng- remain unchanged in Tuscan and most other dialects of middle and upper Italy.
   e.g., Tuscan mondo, jomme, rotondo, cantando, mondola, vendere, manba, colomba, sambuco, piombo, lumbo, fuljado, rainjleg, pescjleg, lutjleg, sasojleg.

b. In Southern Italy and Sicily the development of -nd-, -mb-, and -ng- was to -nn-, -mn-, and -ng- respectively,
c. -*π*, -*μ*, -*ν* (ǥkl) remain unchanged in Tuscan and most dialects of upper Italy.

e.g., Tuscan cento, pianta, cento, tempo, canto, mondo, unico.

d. In the South, -*κ*, -*σ*, -*η* become -*ν*, -*θ*, and -*γ*, i.e., there is a rule of progressive voicing in nasal + obstructant clusters.

e.g., Southern Umbrian bianco, canta, canto.

Neapolitan mondo, canto, angela.

These data illustrate the following features:

1. Only the clusters with identical voicing assimilate completely (more similar ꝩ > ꝩ while less similar ꝩ does not > ꝩ).

2. The rule of regressive manner assimilation operated and ceased to function before the progressive voicing rule became operative. (Hence Lat. grando > granno but Lat. vestus > venedo not vennos).
It should be further noted that a rule assimilating nasals to the position of a following obstruent is also operative and is prior (both diachronically and synchronically) to the assimilation rule.

2.3. Complete Assimilations Involving Resonants and Sibilants.

At this point I should like to consider a number of assimilatory phenomena which convert sequences of resonants and sibilants to sequences of identical segments. Departing from the procedure in previous sections, I will treat here data from several languages and will not restrict the discussion to a single assimilatory phenomenon from a single language. There is, however, one set of assimilatory correspondences which are of particular interest at this juncture and which will, I hope, be illuminated by looking at data from some other languages. The language in question is Ancient Greek, and the assimilations are those which convert sequences of -ηη-, -ππ-, -ττ-, -λλ-, -θθ-, -ζζ-, -υυ-, -ωω-, -αι-, to ηη, ππ, ττ, λλ, θθ, ιι, υυ, οο, οο, ιι, respectively. This assimilation is regular in the Lesbian and Thessalian dialects of Ancient Greece, whereas in other dialects, e.g., Attic, the development is to a long vowel plus a single resonant in most cases. This dialect split, which is also represented by developments of resonant and glide sequences, is one of the more striking aspects of the evolution of the early Greek language and its dialects. I hope to show that interesting
and important insights into the solution of this problem in ancient Greek can be gained by looking at data from other languages either not related at all to Greek or only remotely related.

3.3.1. The Greek Data.

In the Attic-Ionic dialects of Greek the loss of an original s in medial clusters with resonants is accompanied by a corresponding lengthening of the vowel preceding the cluster. 3

3 It is important to note that the correspondences in question all involve original, i.e., IE., s. The secondary s, which developed from t in certain environments, e.g. ti, underwent entirely different developments.

In Lesbian and Thessalian the same clusters develop into long resonant clusters when s disappear. The following forms illustrate this development:

(1) -sr- clusters.

*a) Lesbian and b) Attic 'an'

*seilakē 'moon':

a. Lesbian "seilakē" b. Doric "seilakē" Attic "seilakē"

A > S is a regular change in Attic-Ionic.

*selvans 'gracious':

a. Lesbian "selvans" b. Homeric "hilæs"

(good examples of s + r are lacking).
(2) -Ra- clusters.

*akrina 'judged' > a. Lesbian *skrina
   b. Attic *skrina

*akenna 'distributed' > a. Lesbian *enenna
   b. Attic *enenna (esternal)

*ostella 'sent' > a. Lesbian *stella
   b. Attic *steila (estelial)

*espibera 'destroyed' > a. Lesbian *spibera
   b. Attic *spisteira

These data are taken from Kiparsky (1967:620), but they can be
found in any standard reference, e.g., Grammont, Lejeune, Bick.

On the basis of these forms alone it would seem that in the case
of Lesbian and Thessalian one would have to posit two assimilatory
rules, one which progressively assimilates -Ra- to -Rh- and one
which regressively assimilates -Rh- to -Ra-. In the case of the
dialects which show the development of a long vowel the situation
is less plausible. The development of YR to VR is not implausible
from a phonetic point of view, but the development of VRs to YR
has considerably less plausibility.

There are three possible ways to approach this problem:

First, and least satisfying, is in effect to ignore the problem
entirely, and simply to state the correspondences with their
dialectal peculiarities. Such a 'safe' way out is fine as long
as it is made clear that such statements are statements of
correspondences only and make no pretense of describing historical processes. A second way of approaching the problem is to assume that the developments in Lesbian and Thessalian are regular and that the Attic-Ionic long vowel resonant sequence is the result of simplifying a long resonant and compensatory lengthening of the vowel. Such a solution is proposed by Cowgill (1959). The third solution involves no rule of progressive assimilation of -Ah- clusters but rather a metathesis rule, a rule s → h, and either a rule VHr → HR (Attic-Ionic) or VHR → VHr (Lesbian, Thessalian). This solution with minor variations is proposed by Grammont (1947), Lefèvre (1948), and Kiparsky (1967). For reasons which will follow, the third solution, with some important modifications, is the best that the present state of our knowledge allows.

Before stating in detail the individual steps which explain the development of -VHR-, -VHR- clusters, I must qualify the statement. The data are compromised to an extent, in that while -VHR- clusters involving nasals show almost without exception the correspondences described above, those clusters involving the liquids -VHR- and -VHR- develop regularly to Lesbian VHR. VHR and Attic H, H only when the s is the s of the sigmatic aspirates. Elsewhere the clusters -LR-, -RR- either remain unchanged or much later develop to -LH-, -RR-, particularly in Attic, the dialect which develops long vowels in the situation under present discussion. Thus, it would seem that the historical
Phonetic developments have become (by the time the data is available) to some extent morphologically restricted (cf. Malakouti-Drechman 1972).

I would like to argue that the following well-motivated phonetic processes are responsible for the development of the / developing sequences in question:

4 I cannot overestimate my indebtedness to Malakouti-Drechman's help in working out the solution of this problem.

\[ a. \quad s \rightarrow h / \{ V_R \} \]
\[ \quad \quad \quad \quad R_{V} \]

\[ b. \quad h \rightarrow h / V_{_m} \]

\[ c. \quad V_{Rh} \rightarrow V_R \]

\[ d. \quad V_{rh} + a. \quad \tilde{V}_{R} \]
\[ \quad \quad \quad b. \quad V_{RH} \]
\[ \quad \quad \quad V_{HR} + a. \quad \tilde{V}_{R} \]
\[ \quad \quad \quad b. \quad V_{HR} \]

Rule (a) is well attested in other environments. Kiparsky (1967:620-1) justifies extending the rule \( s \rightarrow h \) to the environment given in (a) above in the following way.

This \( Cs - hJ \) is patent in initial position...

*sarpis > hárpo 'grass'. Intervocally, \( s \)...

...became \( h \) and dropped e.g. *neomai > *nehomai > pëomal 'return'. That there really was an intermediate stage \( h \) is shown by the appearance of this \( h \) in initial position in originally vowel-initial words like *iseros > *iberos > iberos 'holy'... It is reasonable, therefore, to assume that the loss of...s in sonorant clusters did not take place directly either, but here, as elsewhere, via the intermediate stage \( h \).
Additional forces for the argument that the rule s + h is operative in the clusters under discussion comes from the fact that an assimilation rule \( Vh \rightarrow \tilde{V} \) or \( BR + HR \) is much more plausible on phonetic grounds than \( Va \rightarrow \tilde{V} \) or \( BR + HR \). However, the really clinching argument for this change as well as the need for the metathesis rule and a rule which voices \( s \) comes from recent work by Malikouzi-Drechan on the development of derived long vowels in Greek. In a recent paper and in numerous personal communications Malikouzi-Drechan has demonstrated that the development in some dialects of a tenser, more closed long vowel derived from \( VaR \) and \( VhR \) clusters can be directly traced to the raising effect of a voiceless \( h \) on a preceding vowel. If this explanation of the distribution of long derived vowels in the various Greek dialects is correct, and there seems to be no convincing reason not to accept it, then not only is rule (a) well motivated but so is the metathesis rule (c) and the h-voicing rule (b). The following derivations (Malikouzi-Drechan 1972:handout) show the individual steps and the dialectal variations based on the different applications of rule (c).

Long vowel from \( R \) with \( s \).

**Rules**

1. s + h before \( V \) or \( R \) not preceded by a step.

2. h metathesizes with \( h \).

\( \theta e s l o i \) omi\( w o m a \)\( o s t e l a s \)\( p h e r e s e n \)

\( \theta e s l o i \) omi\( v o l o m a \)\( o s t e l a s \)\( p h e r e s e n \)

\( e s t o h l a \)
3. $h \rightarrow \{\text{voice}\} \ (y)$  
   kheptioo omm (w)tobnt estehla
   next to hm/v弱点

4. V raising by h  
   perseh

5. assimilation of Vb, 
   Vh, loss of h in 
   Vb
   kheplioo omm (w)tobnt estehla perseh

   Dialect variation
   h voicing generalized
   perseh

   h voicing lost  kheplioo omm estehla

Thus far this rather involved discussion of resonant clusters has
been more pertinent to an explanation of the development of long
vowels in Vh, Ph clusters, e.g. Ionic, Attic, while the problem
which was originally posed concerned the development in Lesbian and
Thessalian of Vh and Vh to Vh. Note, however, that the same
facts argued for above also explain very plausibly the consonantal
assimilations. No longer is it necessary to consider that there are
two rules of assimilation, one progressive, the other regressive.
There is a single rule of regressive assimilation of h, either voiced
or voiceless, to a following resonant.

2.1.1. Excursus A. Casual Speech Assimilations in South American
Spanish.

There is striking synchronic phonetic evidence for the
development of -rh- to -rr- from present day dialects of Spanish
spoken in Buenos Aires and Chile. The Porteño dialect of the greater
Buenos Aires area shows the following sandhi phenomena (Malmberg 1950:159-64, Beys 1963): as a followed by a voiced consonant first weakens to h. At this point there are different developments attested. Malmberg cites the following regular development (163):

-\text{hm}., -\text{hn}., -\text{hl}., -\text{hm}, -\text{hn}, -\text{hl}.

e.g. los níh\text{nos} [lO\text{h}n\text{i}\text{no}h]

\text{les madres} [l\text{a}\text{h}\text{m}\text{adre}h]

\text{estamos libres} [e\text{\text{\text{h}ta}m\text{\text{\text{h}libre}e}h}]

Optionally h becomes nasalized giving

[mismo] from ní\text{mo}

[l\text{a}\text{m}\text{adre}h] from les madres

The complete assimilation of $\text{g} \pm 1$ to $\text{l}$ does not occur in Portedo, according to Malmberg, but Lens (1946:134) notes that in Chilean, in addition to the assimilation of h to a nasal as above, the aspirate also assimilates to an l, e.g. los lib\text{ros} [lO\text{hlibro}h].

The data given in Beys 1963 indicate that a voiced aspirate h develops before voiced sounds. A further assimilation of \text{h} to \text{n} would give a geminate \text{mn}. These data serve to show that the developments claimed for Ancient Greek, whereby double resonants are derived from s plus a resonant, certainly do have phonetic plausibility, especially with regard to the individual steps which were postulated.
2.3.1.2. Excursus B. Greek Resonant * y Clusters.

Although the subject of Greek resonant and y clusters is not properly a part of a discussion of resonant and sibilant clusters, I should like to consider this class of consonantal clusters for several reasons. First, these clusters also share in the development of the dialect split between Attic, etc., and Lesbian and Thessalian. Second, Kiparsky's 1967 article cited above is an attempt to explain the development of resonant-y clusters as part of the development of resonant-s clusters. And finally these resonant-y clusters also provide evidence for the main thesis of this chapter, i.e., that many correspondences which show complete assimilation can only be explained by assuming a relatively complex development involving several individual processes (not all necessarily assimilatory in nature).

The crucial data here are the following forms:

- Attic, Ionic etc.: allos
- Lesbian, Thessalian: allo

*alvos

- Attic, Ionic etc.: phatos
- Lesbian, Thessalian: phaine

*phavos 'shov'

- Attic, Ionic etc.: polvo
- Lesbian, Thessalian: poira

*mur-ya 'lot'

- Attic, Ionic etc.: krip
- Lesbian, Thessalian: krimn

*krivos 'judge'
Attic, Ionic, etc. ὑπὲρζον
Lesbian, Thessalian ὑπὲρζον

*ὑπὲρνοι 'destroy'

Attic, Ionic, etc. ὀλοπορναι
Lesbian, Thessalian ὀλοπορναι

*ὀλοπορνον 'lament'

I would like to begin the discussion with a brief recapitulation of Kiparsky's arguments for treating resonant-y clusters just like resonant-s clusters.

A. Kiparsky (1967:622-6)

1. η and θ are precisely the segments which become θ in certain environments. (See quotation above, p. 622).

2. θ shows a metathesis with certain other sonorant segments, specifically υ (*δαυς < *δαυς < δαυς; *ἐμαυς < *ἐμαυς). Also η and θ when the vowel immediately preceding was a or o (see ραινον αντα above).

3. The development of resonant-y clusters where θ did not metathesise shows the same dialectal split as resonant-s clusters.

4. On the basis of this data the following rules explain the particular developments:

a. γ → h (environment)

b. γ → h (environment)

c. w[glide] → Y glide θ (where both γ and h are glides)
At first glance Kiparsky's analysis is most appealing, treating, as it does, well established changes (which were formerly considered to be unrelated for the most part) as parts of the same basic development. Unfortunately there are at least two problems in Kiparsky's analysis which vitiate to a significant extent much of what he claims to have shown. First, there are 'some complexities regarding -ίω-' which he chooses to 'sidestep' (1967:620, note 4). Second, the rule which he posits for ṭ + h is most peculiar. Consider the latter of these problematic parts of the analysis:

The rule which changes ṭ to h is constrained in the following ways:

τ + h if: 1. the following sonorant is a vowel.

2. the preceding sonorant is not a glide.

3. the vowel before the preceding sonorant must be nonglave or diffuse (cannot be a or o).

It might be argued reasonably that conditions one and two are reasonable, but I would argue that the third condition lacks over remote phonetic plausibility, especially when there is a perfectly plausible explanation for the strange evolution of the resonant-γ clusters (see below pp. 48-51).
The former problematic area, a major sin of omission, is the 'sidestepping' of the fact that the development of *al-yos in both the dialect groups in question is to al-yos. Again, there is a reasonable phonetic explanation for this fact although accepting it means abandoning an essential part of Kiparsky's analysis, the mechanical metathesis of U-Ry clusters (a sub-part of rule c above). Surely, however, this is to be preferred to totally ignoring any contradictory part of the data.

2. An alternative to Kiparsky's solution.

The following proposal shares features of a number of previous analyses, notably those of Grammont (1948:111-15), Lejeune (1947:13-5), Cowgill (1969); however, I owe most again to Malikouli-Drachman (1972 personal communication). In the case of the clusters -ry- and -ny- it is reasonable to assume that both r and n became palatalized to r' and n'. Greek, however, did not preserve palatalized consonants and such segments became depalatalized at an early time. (Grammont 1948: 100 and 110). Before depalatalization of r' and n' the transition glide between the vowels a and o, the two least palatal vowels, and the following palatal consonants became phonemized while the following y glide was absorbed with the results -ay-, -ay-, -er-, and -ay-. The transition glide between the vowels i, e, u and the following palatalized consonant did not phonemize, a reasonable assumption. Grammont, Lejeune and Cowgill posit a complete assimilation of y to the preceding palatalized
resonant and a subsequent development of geminate resonants to single resonants with compensatory lengthening in the case of Attic, Ionic, etc., while the geminates were preserved in Lesbian-thessalian. With Valikoutis-Uranchan, I accept a different analysis. First -מ- and מ- did not involve complete assimilation to מ- and מ- as posited by Grammont et al.; rather, before depalatalization the following situation obtained: original מ- and מ- had become מ- via מ- and מ-.

while original מ- and מ- became מ-. At this point a rule similar to the one proposed by Kiparsky (but without its ad hoc constraints) spirantizes and devoices מ- which becomes ה. Depalatalization occurs producing מ from מ-. Then ה metathesizes just as does the מ derived from מ, and the subsequent evolution is that which was described above.

We are left with the problem of מ- clusters. If this analysis is to be preferred to that of Kiparsky, which was strongly criticized specifically on account of its having sidestepped the complexities of מ- clusters, then a treatment of such clusters should fit into the preceding analysis in some natural fashion. With respect to susceptibility to palatalization, מ is the most easily palatalized of all segments and conversely it is the most resistant to depalatalization (Grammont:1948:115). I propose that מ assimilate to palatal מ and that instead of glide absorption and phonemicization of the transition glide, the מ cluster
remained and became depalatalized after other developments had taken place, preserving ʎ in all dialects except Cypriot where "alyos" does become ɔllos (cf. Grammont 1948:115-16).

The following derivation illustrates the developments just discussed (Malikouï-Brockman 1972: handout).

1. Consonants palatalize before ʎ
   allos  phaino  kteño

2. ʎ assimilates to ʎ
   allos  phano  kteño

3. palatal absorption and glide development (with preceding a/o)
   ʎ in is /v

4. ʎ assimilates and unvoices ʎ  kteño

5. Depalatalization
   allos  phaino  kteño

6. Metathesis
   kteño

7. Assimilation
   a. kteño
   e. kteño

2.3.2.

The preceding paragraphs set down in considerable detail the most plausible development of resonant, ʎ clusters in Ancient Greek. It is evident that any solution to this problem involves, in the case of the Lesbian and Thessalian dialects, a number of processes all of which contributed ultimately to producing a complete assimilation. If other correspondences showing a cluster
of resonant plus a becoming geminate are considered, a similar stepwise assimilation must be posited. This is of course not to say that all -Vgs- clusters, for example, have the same evolutionary history as Ancient Greek. The individual overall phonologies of each language must be considered, as well as the physical articulatory makeup of the individual segments. Consider for example the following from Grimmert (1933:132):

En pahl -gr- et -rg- sont tous deux devenus -ss-, parce que l'g est plus tendu que l'g, l' pahl est analoge à l' français, postalvulaire et peu tendu: vassa gr. vārga, asu- gr. ἀργα- Mais en irlandais les conditions sont tout autres: l'g y est alvéolaire et ou; il sonore l'g, qu'il soit placé avant ou après, puis se l'assimile totalement: irl. arrach 'príntempo', cf. gr. σαράσ 'príntemps', situazioni vasaré 'été'; carr 'char', gallo-lat. carrum, cf. latin currum de *cursum.

If this statement is correct, and I believe it is, then the actual physical feature content of individual segments may determine in which direction the assimilation will progress.

There is, however, more to the situation that the Grimmert remarks indicate. In the history of the development of Latin there is one stage where clusters of -rs-, -ls- become fr, and ll respectively, e.g. *sr-so and *vel-se > furrus and vella.

At a later stage any -gr- cluster (deriving from an earlier -ṛṛ-, e.g. dorsum < dorsum, or loans or new compounds) become Vulgar Latin -gs-, e.g. possessum, tussum < persicum, dorsum (cf. former 1948:244). There is no indication that the pronunciation of s changed in any significant way during this period of time, so
an explanation other than one like Grammont's must be found

The earlier of the two assimilations -\textit{pr}-, -\textit{lr}- = -\textit{rr}-,
-\textit{ll}- occur very early and affect all -\textit{pr}-, -\textit{lr}- clusters inherited
from Indo-European. This takes place at the same time that
intervocalic s become voiced to \textit{s} and subsequently became \textit{r},
the well known phenomenon of rhotacism (Sommer 1991).

Following Hamp (1973:29c) I assume that the intervocalic
environment for voicing of \textit{s} was extended to include all resonants,
so that the clusters -la\textit{V}- and -ra\textit{V}- become -la\textit{V}- and -ra\textit{V}-.

From this then are two possibilities: either the complete
rhotacism process is carried through in this environment,
producing -ra\textit{V}- and -la\textit{V}- followed by -ra\textit{V}- -la\textit{V}- or -rr-,
-\textit{la}- both assimilated directly to -rr- and -\textit{ll}-. Regardless
of which of these solutions is correct, it is important to note
that the assimilation proceeded stepwise until the two segments
were similar enough to assimilate completely.

The question which remains is, if \textit{r} and \textit{s} do not show any
change in feature makeup, then why, at a later date, did -rr-
become -\textit{rr}- rather than -\textit{rr}-? The answer is to be found, I
believe, in the history of the rhotacism rule itself. Rhotacism
generally completed its voicing of \textit{s} in resonant environments
in the fourth century B.C. (Intemann, 1968:886). Later s < \textit{ss}
e.g. \textit{qua}s < \textit{caus}s was not voiced even in the most favorable
environment, intervocically. Thus the rule which made \textit{s} more
similar to r through voicing was no longer operative. Moreover, in the latter Latin period there was a tendency to assimilate the initial consonant of a consonant cluster without regard to phonetic similarity, a kind of assimilation which no longer has to do with relatively phonological weakness of individual segments, but has as its raison d'être a more abstract condition on syllable structure (see chapter four).

2.4. Final remarks on Combinatory Assimilations.

In this chapter I have cited evidence to show that many correspondences which meet the general requirements for complete assimilations do so by a combination of individual phonological processes which in general only minimally affect individual segments. The more closely I have examined complete assimilation the more I have become convinced that most, if not all, purely phonological assimilations are to be interpreted in this way, with the exception of those fortuitous assimilations treated in chapter one—and even these can be subsumed under the material covered in this chapter, as indeed they will be in chapter five, where the 'principle of similarity' is elucidated.
CHAPTER III
SOME PUTATIVE SINGLE PROCESS COMPLETE ASSIMILATIONS

3.6.

In chapter nine of the *Sound Pattern of English* (Chomsky and Halle 1968:428) the authors make the following statement regarding assimilation:

...If assimilation were a special process which was available for use whenever necessary, it could be restricted so as to affect only the same features in different segments, or it could be further constrained to affect particular features or sets of features in particular environments. Thus, nasals seem to be quite prone to assimilate the point of articulation of a succeeding consonant, while the continuants are apparently all but immune to such assimilation. It would seem plausible to establish a hierarchy of assimilation processes ranging from complete assimilation of all features to assimilation of only a single feature. Processes such as palatalization and velarization would be characterized as assimilations which affect the features "high" and "back". (Emphasis mine--JMU)

The hope expressed in this quotation of incorporating natural phonetic tendencies of segments and classes of segments vis-à-vis the way such segments participate in (or resist) assimilation into a kind of hierarchy of assimilation processes ranging from complete assimilation of all features to assimilation of only a single feature is perhaps laudable in its effort to arrange phonological phenomena in a coherent fashion; however, I feel that such a hope is destined, from the outset, never to be realized, because it has as a necessary premise a false notion of what complete
assimilation is. I take Chomsky and Halle to mean that there exists a phonological rule of the following kind:

\[
(a) \quad \begin{bmatrix}
\text{C} \\
\text{SP1} \\
\text{SP2} \\
\text{SP3} \\
\text{SP4}
\end{bmatrix} \rightarrow \begin{bmatrix}
\text{C} \\
\text{vP1} \\
\text{vP2} \\
\text{vP3} \\
\text{vP4}
\end{bmatrix}
\]

Such a rule would convert any consonant C₁ to any neighboring consonant C₂ (note that (a) could have been regressive as well as progressive). A more restricted view of such a process of complete consonantal assimilation would be to specify that one segment, e.g. d, would assimilate completely to any following consonant:

\[
(b) \quad d \rightarrow \begin{bmatrix}
\text{opos} \\
\text{Smanner} \\
\text{vvoice}
\end{bmatrix} \rightarrow \begin{bmatrix}
\text{opos} \\
\text{Smanner} \\
\text{vvoice}
\end{bmatrix}
\]

Rule (b) is one way of expressing what happens in the assimilation of the Latin prefix ad- to following verb stem (above pp. 22-24). The question at hand is whether or not a rule like (a) or (b) is a phonological process with phonetic motivation in the same way that a rule which changes a single feature is, e.g. nasal position assimilation, voice assimilation of obstruct clusters, etc. In other words, can the correspondences which meet the working definition of complete assimilation ever be the result of a single process which is totally explicable in phonetic terms.³

³Obviously the correspondences of chapter one, the fortuitous assimilations, are excluded from such 'single process' assimilations, since in these cases complete assimilation is accomplished by the changing of a single feature.
By far the greatest number of complete consonant assimilations I have found which are also plausible from the point of view of phonetic motivation have been due to assimilatory processes like those discussed in chapters one and two. I now consider three of the best candidates for single-process multi-feature assimilations which I have found. The examples come from Finnish, Greek, and Colloquial Arabic.

3.1.0. Finnish final aspiration.

A number of Finnish morphemes have as a final segment what has been described variously as final aspiration (Karinen 1964:39, Karttunen 1970:25-30), Schlüsselbuch or Auslautverschluß (Hakulinen 1957:30), or glottal stop (Collinder 1957:6). This segment has a clear historical origin in a number of sources, including Proto Finnish *-k#, *n#, *-i#, *-n# (Hakulinen 1957:30-31). Frequently this segment is not pronounced in pause, before vowels, and before

h. j. Concerning its (non) pronunciation Hakulinen (31-32) says:

Der Schlüsselbuch ist in der modernen Umgangssprache kein läst; in den obigen Beispielen (und bei Bedarf auch sonst in diesem Buch) hat sein Gehören nur etymologische und keinerlei phonetische Bedeutung. Aber statt des 'Hauchens' kann, besonders bei sorgfältiger Aussprache und bei Sprechern aus bestimmten Dialektgebieten, ein Kehlkopfklirr oder wenigstens eine Art Kehlkopfverschluß resp. Stimmbläderverengung in den Fall eintreten, d. s. unmittelbar vokalischer Anlaut darauf folgt, z. B.:

tule] itte 'homs selbst'...
This optionally deletable 'semi-segment' is, according to Collinder [6], 'rather faint' or 'lacking in the pronunciation of many speakers'. Indeed there is no orthographic representation of the segment whatever. When, however, these morphemes which occur with optional final glottal constriction are followed immediately by a word beginning with a consonant, that consonant is geminated even in those dialects where the glottal constriction is not evident prevocally or in pause (Collinder: 6).

Even such speakers as do not distinguish between *saenko maksi* (mays I pay?) and *sakko maksi* (cany I have liver?), usually make a difference between *sakko maksi* TKIIT8 and *saenko maksi* TKB. (Kilari is a place advt 'there'.---JHL)

The process by which initial consonants of words following those morphemes with final glottal closure are doubled is a feature of external sanchi and is quite productive in those dialects where it appears. The problem here is whether an analysis of Finnish properly includes a phonological rule of the following kind:

\[(a) \ ? \rightarrow C / \_\_\_\_\_\_\_ C\]

[I use ? as a symbol for the glottal closure.

C can be any permissible initial consonant, e.g. p, t, k, s, m, n, r, l, v, j, h, with some dialectal constraints (cf. Jokonen 36ff.)]
One crucial factor which must be considered is the status of (7). None of the sources claim phonemic or underlying status for the glottal closure as such. Karttunen argues, on purely systematic grounds, for positing /k/ as the underlying segment (25-30).

Her argument takes the following form: underlying words are strings of fully specified phonemes. Therefore, final glottal closure cannot be an archiphoneme (as in Karm 1964).Having ruled out an archiphoneme, Karttunen then eliminates glottal stop as a possibility since it would add another segment to the inventory of underlying phonemes; moreover, this segment would be limited in its distribution to final position. Of the independently established inventory of phonemes, three—/p/, /k/, and /h/—are limited in distribution to nominal position. Of these three, historical evidence points to either h or k, but since all stems with aspiration behave alike there is no reason to posit both as underlying (7).

Indeed, Karttunen winds up her argument by stating the following (29-30):

From a phonological point of view, a final consonant is a useful means of accounting for the paradigm and its resemblance to that of words with final consonants. But granting that this choice is systematically motivated rather than psychologically motivated, is there any justification for choosing one of them? If there were an instance of k or h or p clearly alternating with aspiration, then it would do to regard all cases as having that particular consonant, since they all behave alike.... since neither phonetic alternation of any specific consonant with aspiration nor any rule forces a choice, and markingness principles do not clearly
choose between h and k, aspiration in existing vocabulary henceforth will be taken to have an underlying /h/, but no sequential constraints will prevent /h/ from occurring in this position.

Having thus postulated an underlying /h/ for the final aspiration, Karttunen can thus account for the distribution of ß and the associated process of complete assimilation by positing a rule

\[ \text{k} \rightarrow \? / \begin{cases} \text{âta} \\ \text{(part sg.)} \end{cases} \]

Then rule a operates converting ß to a following c.

The fact of the matter is that the phenomena under discussion—assimilation associated with final glottal closure—is restricted paradigmatically to an extreme degree. There are a number of sound stems which end in short vowels in the weak grade and which show weak grade consonantion. It is important to note that if gradation is a live, phonetically motivated process then the existence of such weak grade vowel final stems argues for the existence of some underlying consonant which closes the syllable, bringing about gradation. There would then have to be some phonological rule which assimilated this segment to a following consonant under the right conditions. These cause a doubling of the initial -t- of the paritive ending -ta. So verb stems have final glottal closure; however, a few verbal suffixes do. These suffixes include the first infinitive, the negative, and the second
person singular imperative. It is in conjunction with these word-final suffixes that the productive external sanathi gemination takes place. Moreover, in many instances outside of the highly restricted domain of these specific paradigms there is no final glottal closure or gemination where it is to be expected etymologically.

On the basis of the primarily paradigmatic constraints on the appearances of final glottal consonants, as well as the lack of strong evidence for determining what segment, if any, underlies glottal closure, it seems to me that there is motivation for claiming that the whole phenomenon in present day Finnish has considerably more plausibility (or psychological reality) as a rule which associates gemination with specific morphemes. That is to say that this rule, productive though it is, is the morphologized residue of a former live phonological process much as the velar softening rule of English is.²

²See the passages in Kiparsky (1972, 1973), Harris (forthcoming), Zwicky (1970, 1972a) and below (chapter four) for some discussion of the distinction between phonological and morphological processes and the problems concerned with determining how, when, and if a phonological process has become morphologized.

It is possible, however, regardless of the status of the glottal closure assimilation in present-day Finnish, to look at the problem as an historical one. What about the processes which were the ancestors of this phenomenon. As was stated
above, the segments which became glottal closure were *n, *t, *h, *k in final position and in the case of *n and *t it was limited to only some instances in final position (Nakuiinen 31-32). It was after the development of the glottalic consonant of indeterminate nature that the assimilation process began taking place. Consider the following rule:

\[
\begin{align*}
(c) & \quad C \quad [\text{+glottal}] \quad \begin{array}{c}
\text{opal.} \\
\text{manner}
\end{array} \\
\begin{array}{c}
\text{voice}
\end{array} \quad / \quad C \\
\begin{array}{c}
\text{opal.} \\
\text{manner}
\end{array} \\
\begin{array}{c}
\text{voice}
\end{array}
\end{align*}
\]

If this is posited as a phonological rule operative in the history of Finnish and the residue of which is preserved as a morphological process in present day Finnish, what is its status as a rule of complete assimilation? Does it have phonetic plausibility? Are there other instances of such a process in other languages? The answers to these questions as well as the larger question posed at the beginning of this chapter will perhaps be clearer if the Finnish problem is set aside for a while and some other data are considered.

3.1.1. Glottalic consonant assimilations.

There are a number of unrelated languages which have processes very similar to rule (3.1.0.c) above. Among these are Southern Palute, Mandal, and Ancient Greek. One of these, Ancient Greek, has been discussed at some length in chapter two of this paper.
Note that the assimilation in this specific instance involved h and a following resonant, m, n, r, or l. The restriction limiting the assimilation to following resonants is at least partially due to the fact that h only occurred before resonants, a result of a number of processes which were described in chapter two (above pp. 38-43).

There are three sets of morpheme types in Southern Paiute, an American language, one of which shows striking similarity to the Finnish suffixes which cause gemination of a following consonant. The language was described in detail by Sapir (1930) and the particular phenomenon under consideration was also discussed by the same author in 'The Psychological Reality of Thommes' (1933:42-51). Sapir claims that there are stems that cause either spirantization, nasalization, or gemination of the initial consonant of a suffixed element. Referring to these morphemes Sapir says (1930:63):

...all stems and many suffixes appear in either two, or more often, three forms according to the nature of the preceding stem or suffix...the deciding factor is the nature of the preceding stem or suffix, which, as far as a descriptive analysis of Paiute is concerned, must be credited, as a part of its inner form, with an inherent spirantizing, geminating, or nasalizing power (respectively indicated, where necessary, as -s, -s, -n). Thus the same adjectival verb suffix appears in spirantal form in *nma'-ya 'to be red', geminated in *n'be-a-q-a-ya 'to be gray', and nasalized in *n'be-a-' to be smooth'; the stems may be respectively indicated as *nma-s, *nbe-a-s, *nbe-a-n. On the other hand, the element -ya, -s-a-,
- qa- is consistently spirantizing (schematic form -qa-), e.g. in participial *wâga-rî-, *dîkâwâga-rî-, *wîkâwâga-rî-. The participial -rî- is itself capable of appearing in geminated (-trî-) and nasalised (-ntî-) forms as well under the appropriate circumstances... Thus for purposes of derivation and composition one needs to know always whether a given stem or suffix is one that spirantizes, geminates, or nasalizes.

In this passage Sapir proposes a solution much like the one which I suggested was at least plausible for an analysis of modern Finnish. However, in the case of Southern Palute these spirantizing, geminating and nasalizing stems and suffixes do not seem to be particularly well motivated as there is a reasonable phonological explanation for these processes. Sapir's analysis of these processes has been the subject of considerable discussion, e.g. McCawley (1967), Harms (1966) and Rogers (1965). Although different proposals have been made regarding the solution to the kinds of alternations which Sapir attributes to inherent spirantizing geminating and nasalizing characteristic of morphemes all of them agree in rejecting Sapir's solution and seeking a phonologically motivated explanation. The particular process of immediate interest is the 'geminanting morpheme.'

In order to reach a reasonable solution to the problem a few more facts are needed. There is an important alternation between the geminating suffixes which actually show gemination and geminating suffixes which show a voiceless vowel and so gemination of the following suffix. This alternation is a direct result of stress placement. Schematically the following situation obtains.
pæ.s + pa → pahpa

but

pa.s + pæ → papa

Thus, whereas the examples quoted above, qu’tca-g-a: 'to be gray' shows gemination with stress on the vowel immediately preceding the geminate, a form like tu-s- 'foot' used as a prefix and unaccented gives ta’pdeg-wi: 'to jump' with a voiceless vowel.

I feel that the best explanation of these data is one entertained by Harms (1966:229) but subsequently rejected by him on the grounds of feature economy. The following underlying form is postulated for the 'geminating morphemes' (again idealized forms are used):

CVh-

The alternation

\[
C \quad V \quad [\text{voice}] \quad \overleftarrow{C} \quad C \quad V \quad [\text{voiced}] \quad \overrightarrow{CC}
\]

is explained by the two following assimilation rules.

(a) \[V \quad h \quad C \quad [\text{-stress}]\]

\[1 \quad 2 \quad 3 \quad \rightarrow 1 \quad [\text{-voice}] \quad \phi \quad 3\]

(b) \[V \quad h \quad C \quad [\text{+stress}]\]

\[1 \quad 2 \quad 3 \quad \rightarrow 1 \quad 3 \quad 3\]

Both these rules involve an assimilation of the glottal consonant h to either an immediately preceding vowel or a following
constant depending on the placement of stress. Such rules seem plausible on two counts. First, there are similar rules in other languages, and second, the phonetic makeup of the glottal consonants /h/ and /?/ make them both easily assimilable segments to both vowels and consonants. Before justifying the second of my two claims I would like to briefly consider one more language which involves a complete assimilation of a glottalic segment to a neighboring segment.

The data from Mandalic are taken from Malone (1971 and 1972). Mandalic exhibits a metathesis rule similar to that of Greek described in chapter two. By this rule a laryngeal (i.e. glottal) glide /h/ or /?/ metathesizes with an immediately preceding consonant if the laryngeal is the third radical. Then the following three possibilities obtain (Malone 1971:407):

1. A postvocalic laryngeal glide totally assimilates to an immediately following consonant, i.e. VHC > VOC

2. A preconsonantal laryngeal glide totally assimilates to an immediately preceding vowel, i.e. VRC > VOC.

3. Either assimilation is optional where H = h.

In Malone (1972:472) the rule is formalized in the following way:

(1) /V/-vocalic /V/-consonantal /V/-high tone

1 2 3 1 1 3
Malouf explains the formalism as follows:

(a) \( V_1, V_2 \rightarrow V \) preconsantally or preconclusively;
(b) \( P_1, P_2, P_3, P_4 \rightarrow P \) generally, but \( P \) when either the immediately preceding consonant is the next preceding vocalism is geminates. When the conditions of both (a) and (b) are met for a given string, e.g. \( VP \), it is not clear what dictates which will apply (cf. Malouf 1971: §3.41) ... Both (a) and (b) obligatorily apply to \( h \), except a first or second radical \( h \) and optionally apply to any other \( h \).

These rules of metathesis of a laryngeal glide and a subsequent assimilation either to a preceding vowel or a following consonant are remarkably like those postulated by Kiparsky (1967), except that in the case of Mandia the choice of vowel assimilation or consonant assimilation is determined by factors which are not clear, with instances of both showing up in the same dialect, while in Ancient Greek there is a clean split with one dialect group showing assimilation of \( h \) to a vowel and the other showing assimilation of \( h \) to a following consonant. In the case of Greek there is at least a hint of why such a split has occurred. Malouf-Bachman (personal communication) has suggested that there was a general tendency in the dialects showing assimilation to the vowel to develop open syllables while the other dialects show the opposite tendency toward closed syllables. Thus, if the conjecture proves justified, a syllable shaping constraint
could be seen dominating the direction and very nature of an assimilation rule. 3 Of immediate interest, however, is the fact

3 For a further discussion of the role of syllable shaping rules on assimilation see below (chapter four).

that both Mandaric and Greek show the assimilation of a glottal segment to either a vowel or a consonant.

One other example of the assimilation of h to a following consonant was cited in chapter two (above p. 41ff). South American dialects of Spanish, specifically those of Chile and Buenos Aires, Argentina show a weakening of s to h and a subsequent assimilation of h to a following consonant.

Thus it can be seen that processes involving the complete assimilation of a glottal consonant to either a vowel or a consonant are not rare either in historical derivations or in synchronic analyses. It would seem reasonable, even if it is not possible to interpret present-day Finnish as having such a rule, to claim that the phenomenon of glottal assimilation in Finnish involves a historical development which includes a process that completely assimilates a glottal segment to a following consonant. The question of the status of such a rule remains. Is such a rule a genuine example of complete assimilation which operates in one step rather than a number of individual ones?

The answer, it seems, is yes.
An examination of the phonetic nature of both h and glottal stop, as well as the Finnish 'glottal closure'—if this cannot be said to be either h or glottal stop—shows why of all possible segments it is precisely these glottalic ones which have the capability of such complete assimilation. Since the articulation of the glottalic segments is at the glottis and does not involve the real articulators, which determine the primary features of every other segment both vowel and consonant, these same supra-glottal articulators are free to assume the position and 'set' for either a following segment in anticipation, or a preceding segment through hiatus. Of glottal stop Smalley says (1964:103-4):

In producing the glottal stop the vocal cords are briefly closed, and air pressure from the lungs builds up behind them. The sudden opening of the glottis releases the air. Note that in a glottal stop the air stream is cut off at the larynx, below all the articulators. This means that for the duration of this stop the position of the articulators is irrelevant to the sound. The position is governed by the preceding and/or following sounds.

Similarly h allows the supra-glottal articulators to assume the position of a neighboring segment. Indeed, in many descriptions e.g. Smalley (392), Heffner (150-151), Abercrombie (58-59), h is said to be a voiceless copy of a neighboring vowel. It is precisely the chameleon-like character of these glottal segments—either assuming the articulation of a neighboring segment or patterning like a glide or a true consonant—which is responsible for the considerable disagreement among recent phonetic accounts of the feature makeup of these segments, e.g. Chomsky-Halle (1968)
Ladefoged (1972) and Keane (1972). However, despite these
disputed analyses, the description of the glottalic consonants
(vis à vis the freedom of the supraglottal articulators to assume
nearly any position) cited above are valid, and it is the validity
of these descriptions that explains the assimilability of the
glottalic segments. Schane, in a recent paper on natural phono-
logical rules reminds us of the fact that natural assimilation
rules often involve the assimilation of primary features from a
neighboring sound (1972:219-20). Thus the assimilation of vowel
colorings by consonants, producing the secondary articulations of
palatalization, labialization, and velarization in the consonants
involves the assimilation of a primary articulatory feature of the
vowel (or glide), its color, by a segment for which coloring is
a non primary mode of articulation. In a like manner vowel
nasalization in a nasal environment is to be explained as an
assimilation or assumption of the feature of nasality which is primary
for consonants by a vowel for which nasality is a secondary feature.
It seems to me that the behavior of the glottal segments, which
have as primary features none of the supraglottal articulatory
features, corresponds precisely to this type of natural assimilation
rule. Note that the glottalic segments are the only ones which
qualify in respect to total freedom in the supraglottal tract.
Thus it would seem that with respect to glottal stop and h at least
a rule like (v) of 3.0 is possible; and that, to a limited extent
any way, there are rules which involve major changes in place and
manner of articulation in one process, although it should be noted that the process if viewed properly does not involve switching many features but rather adding a number of unspecified features and actually switching very few.

3.2. Greek apocope and assimilation.

The phenomenon of apocope involves the deletion (literally 'cutting off') of a final short vowel before an initial consonant. Apocope normally occurs only when two words stand in close grammatical relation with one another, e.g. the prepositions ana, para, and kata used as separate words or as the first element in compounds often underwent apocope to e.g. para, kata, producing consonant clusters which in the case of para and kata further underwent assimilation. In the case of para the development was perfectly regular (Smyth 1936:27).

Apocope is generally restricted to Homeric Greek in literary texts, but it is also found in the inscriptions.

\[
\begin{align*}
\text{a. (1) } & n \rightarrow m / \_ \_ \_ \_ \_ \\
& \{ p \} \\
& \{ p^a \} \\
& \{ p^b \} \\
\text{b. (2) } & n \rightarrow \eta / \_ \_ \_ \_ \_ \\
& \{ \eta \} \\
& \{ \eta^a \} \\
& \{ \eta^b \} \\
\text{c. (3) } & n \rightarrow n / \_ \_ \_ m
\end{align*}
\]
(4) \( n + \{t\} \rightarrow \{t\} \)

(5) \( n + d / \rightarrow S \) (with 'compensatory lengthening' of the vowel).

The rules for assimilation of \( n \) are all evident in the development of other -\( nC \)- clusters where apocope is not present, i.e. internal sandhi with \( n \)-final prefixes like \( nyn- \). There is no need for any 'special' assimilation rule associated with \( n \) in apocopated forms. There is also obviously no single rule of assimilation, but rather a rule of position assimilation and a rule of seniority assimilation.

In the case of the apocopated preposition \( kat \) the assimilation (to a following consonant) is complete (except before dental \( b \), \( gh \) clusters not being permitted). Thus forms like the following are found from Smyth 24 and Cunliffe):

b. \( kōpelo \)
   \( kōlipo \) 'threw down'
   \( kōksefonen \) 'left behind'
   \( kēd af \)
   \( kēd vunai \) 'entering into'
   \( kēp pekten \) 'through the plain'
   \( kēg pīnə \) 'on the knee'
   \( kēr rōn \) 'in the stream'
   \( kəmporo \) 'fate ridden' (Cunliffe: 211)
   \( kənkoqaaq \) contr. aor. pple 'had' (Cunliffe: 211)
   (rare assimilation)
Through the operation of apocope a number of consonant clusters arise which are to be found nowhere else in Greek. Specifically clusters of dental stops plus sonantal stops arise only in this way (Lajeune 1947:61). It would be possible to write a rule in a generative phonology of Hellenic Greek of the following kind:

\[
c. \quad t + \begin{array}{c}
   \text{opp} \\
   \text{manner}
\end{array} \\
\frac{1}{2}
\begin{array}{c}
   \text{opp} \\
   \text{manner}
\end{array}
\]

\((\text{\textit{t}} = \text{either a morpheme boundary or a close grammatical}}
\]
construction such as exists between a preposition and its object.)

Rule c describes very well what happens, however, it explains absolutely nothing. Indeed, the situation here is much like that discussed with respect to the Latin prefix g- in chapter two (pp. 28-34). There are a number of individual single process rules which cover most of the individual steps in the complete assimilation of t to a following consonant and which, furthermore, have an independent existence in the language. Thus, as in Latin, a Greek rule inherited from the parent language, which assimilates the first of a sequence of stops to the voice value of the second stop.

\[
d. \quad \text{Stop} + \begin{array}{c}
   \text{[voice]}
\end{array} \\
\frac{1}{2}
\begin{array}{c}
   \text{[voice]}
\end{array}
\]

\((\text{Cf. Lajeune 99})\)
I have noted in chapter one and discussed in some detail the instability of dental–plus–sonantal clusters. The same instability exists in Greek. In the earliest stage of common Greek the instability was resolved by the relatively radical means of metathesis. Thus *-tp- and *-tk- became -pt- and -tk- respectively, e.g. *ti-tk- > *tiptk and *hvi-ape > *hvti-ape *tptc cf. Lat. quirpe < quidpe. It seems perfectly feasible to assume that such instability could be resolved by a position assimilation rule like (s).

\[
e. \quad \text{stop} \quad \left[ \begin{array}{c} \text{dental} \\
\text{alabal} \\
\text{vellar}
\end{array} \right] \rightarrow \left[ \begin{array}{c}
\text{alabal} \\
\text{vellar}
\end{array} \right]
\]

That such an instability is resolved by assimilation rather than by metathesis might well be due to the fact that the t which is assimilated in the case of the apocopated pat- is a part of a weakly stressed proclitic morpheme whereas many of the metathesized forms were root internal clusters. It has often been demonstrated that even natural phonetically motivated processes are restricted in many cases to occurring either with specific morphological classes of words (Zwicky 1972a, 1972b) or at specific boundaries either between morphemes or words or both (McCawley 1967, Zwicky 1972a, cf. also chapter four below).

There is also a phonetic motivation for the assimilation of the final segment of pat- to a following nasal by way of d. This is a well attested process whereby a less sonorant segment
tends to assimilate to a more sonorant one along a specific hierarchy ranging from obstruent stops which are the least sonorant to liquids and glides which are most sonorant (cf. below 84-86). Indeed there is an example of precisely this kind of assimilation having occurred in Greek [Lajoune 1947:66 note and 133].

\[ \text{meša-ša} \quad \text{meša-ša} \quad \text{meša-ša} \quad \text{meša-ša} \quad \text{\textquoteleft base or supporting element\textquoteright} \]

These individual assimilation rules coupled with the weakness associated with the weakly stressed proclitic are probably both responsible for the development of the complete assimilation of t to a following consonant. At any rate it is obvious that this particular phenomenon cannot qualify as an indisputable example of a single step phonological process of the type described by Chomsky and Halle—at least with a view to explaining the assimilatory tendencies involved. Even if c is permissible as a rule describing the phenomenon this rule cannot qualify as one to be placed in the hierarchy Chomsky and Halle hope to establish.

3.3. The Arabic definite article.

The dialects of Arabic spoken in Syria (Cowell 1964), Morocco (Barrell 1962), Iraq (Erwin 1963), and Egypt—especially dialect (Khalafallah 1969) and Cairo dialect (abdoul-Fetauh 1969 and Mitchell 1962) all have a morpheme which serves as a marker of definiteness and is prefixed to nouns. Although the dialects differ in some respects as to the exact phonetic form of the
prefix (7,\text{-} in 6\text{fi}\text{-}\text{dil}, 6\text{-} in \text{Iraqi}), in all cases the final segment of the prefix is \text{-}l-. This \text{l} shows an interesting pattern of distribution depending upon the initial segment of the noun to which the article is prefixed. All the dialects mentioned above show a complete assimilation of \text{-}l- to the initial consonant of the root, if that consonant is a dental, alveolar, or palatal. Elsewhere the \text{l} remains unassimilated. Thus, for example, the following forms are found in Iraqi (Evlin 214-15):

<table>
<thead>
<tr>
<th>Noun</th>
<th>1-form</th>
</tr>
</thead>
<tbody>
<tr>
<td>yakti</td>
<td>1-yakti 'the foot'</td>
</tr>
<tr>
<td>baat</td>
<td>1-baat 'the house'</td>
</tr>
<tr>
<td>yulik</td>
<td>1-yulik 'the milk'</td>
</tr>
<tr>
<td>yoor</td>
<td>1-yoor 'the horses'</td>
</tr>
<tr>
<td>inab</td>
<td>1-inab 'the grapes'</td>
</tr>
<tr>
<td>yada</td>
<td>1-yada 'the lunch'</td>
</tr>
<tr>
<td>fikra</td>
<td>1-fikra 'the idea'</td>
</tr>
<tr>
<td>qisim</td>
<td>1-qisim 'the part'</td>
</tr>
<tr>
<td>kaatib</td>
<td>1-kaatib 'the clerk'</td>
</tr>
<tr>
<td>moox</td>
<td>1-mooy 'the bananas'</td>
</tr>
<tr>
<td>ba-va</td>
<td>1-ba-va 'the air'</td>
</tr>
<tr>
<td>wakit</td>
<td>1-wakit 'the time'</td>
</tr>
<tr>
<td>room</td>
<td>1-room 'the day'</td>
</tr>
<tr>
<td>pasag</td>
<td>1-pasag 'the bus'</td>
</tr>
<tr>
<td>guzin</td>
<td>1-guzin 'the cotton'</td>
</tr>
</tbody>
</table>
b. Assimilated

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>əmmən</td>
<td>'rice'</td>
</tr>
<tr>
<td>əqəb</td>
<td>'shirt'</td>
</tr>
<tr>
<td>ənənta</td>
<td>'suitcase'</td>
</tr>
<tr>
<td>əd-nənta</td>
<td>'the suitcase'</td>
</tr>
<tr>
<td>əd-dinər</td>
<td>'the dinner'</td>
</tr>
<tr>
<td>əz-dinər</td>
<td>'the dinner'</td>
</tr>
<tr>
<td>əz-sibbaan</td>
<td>'the flies'</td>
</tr>
<tr>
<td>əz-rukkaab</td>
<td>'the passengers'</td>
</tr>
<tr>
<td>əz-sibid</td>
<td>'the butter'</td>
</tr>
<tr>
<td>əz-sana</td>
<td>'the year'</td>
</tr>
<tr>
<td>əz-ənər</td>
<td>'the month'</td>
</tr>
<tr>
<td>əz-guura</td>
<td>'the picture'</td>
</tr>
<tr>
<td>ə-z-sabuut</td>
<td>'the officer'</td>
</tr>
<tr>
<td>ə-z-sabuut</td>
<td>'the officer'</td>
</tr>
<tr>
<td>bəbə</td>
<td>'ball'</td>
</tr>
<tr>
<td>bəbə</td>
<td>'ball'</td>
</tr>
<tr>
<td>leela</td>
<td>'night'</td>
</tr>
<tr>
<td>l-leela</td>
<td>'the night'</td>
</tr>
<tr>
<td>naaár</td>
<td>'fire'</td>
</tr>
<tr>
<td>n-naaár</td>
<td>'the fire'</td>
</tr>
<tr>
<td>əsakvu</td>
<td>'hammer'</td>
</tr>
<tr>
<td>ə-sakvu</td>
<td>'the hammer'</td>
</tr>
</tbody>
</table>

In the Cairo dialect the complete assimilation is extended to include initial voiceless velar stops (Adboul-Fe'oush 68, Mitchell 47n.). Moreover, the extension of the assimilatory process is optional, so a word like kaatib 'clerk' would have either Tikkaatib or Tikkaatib as the definite form 'the clerk'. The fact that the assimilation is extended optionally in some dialects is important for two reasons. First the fact of extension itself, particularly optional extension, indicates that the process is viable and genuinely productive.
Second, the particular segments which are included in the extension of the process are highly significant. Note that the segments which participate in assimilation in all dialects are located along a place of articulation continuum ranging from dental to palatal. All of these segments involve the tongue as an active articulator, as does the segment / which is assimilated. Of all consonants, those which are most similar to the set of consonants involved in this assimilation phenomenon are / and g. By 'most similar' I mean simply that / and g are the next segments along the dental-palatal place of articulation continuum where this process has its domain.

I have considered two possible ways by which this assimilation and its extension might be accomplished. Frankly, each solution has a problem, neither of which, however, seems to me to be insurmountable. I shall deal with each possible solution separately, but first consider the important features shared by each of them. The definite article in all dialects is a proclitic and is unstressed (cf. e.g. Covell 1954). Thus the proclitic is weak and subject to possible changes.

The first possible interpretation of these data is to consider that the / in the weakened position loses its lateral release becoming d. Such an alternation of / and d is not untested. There is such an alternation for example in Ilk (Westerman and Wart 1974). In addition d is frequently a substitution for / in child language (Edwards 1973, Schourup forthcoming). Once such a substitution has been effected the
subsequent complete assimilation of d to a following dental, alveolar, palatal, and--optionally--a velar is readily explained on the same basis as those which have been discussed in reference to the Latin prefix at- and the Greek apocopated prefix pat-.

There are, however, a number of problems with this analysis as I have already mentioned. First, although there are a number of attestations of l + d, there is no evidence internal to Arabic which justifies this alternation. On the other hand there is no other l occurring in the dialects in precisely this weakened position, i.e. there are no other l proclitics. A greater problem is the fact that the l + d change would have to occur in just those environments where it will subsequently assimilate completely. That is to say that the process causing a weakened l to lose its laterality becoming d would be dependent on an immediately following dental, alveolar, palatal or (in some dialects) velar. Then the assimilation of the derived d would be mandatory.

The second interpretation of these data is nearly identical to that of the preceding paragraph with one major exception. Rather than positing a change from a weak, unstressed l to d as suggested above, suppose that the weakening of l involves losing not just the laterality of the segment but rather losing all features except the lingual nature of the articulation, creating as it were a kind of lingual archisegment which would then assimilate completely to a consonant which follows immediately.

The major problem with this analysis is the intermediate step
involving an archisegment, an entity for which there is little
hard evidence in linguistic theory. The archisegmental analysis
also shares the difficulties of the previous analysis in that
the archisegment would be created in just those environments
where it would necessarily assimilate completely. Elsewhere I
would retain its lateral, liquid articulation despite the
weakness of the proclitic.

I should further observe that these two analyses might
well be only apparently different. My reason for stating this is
that the creation of the lingual archisegment and the creation of
\( \tilde{\varepsilon} \) depend on precisely the same conditions. Moreover, both
segments must assimilate, i.e. they are created just so that
they can be changed to something else. The intermediate \( \tilde{\varepsilon} \) also
has a different status than the other underlying \( \varepsilon \)'s in the language
which show no tendency to assimilate any feature other than
emphasis. Thus it would seem that positing \( \tilde{\varepsilon} \) rather than an
archisegment may well be motivated by nothing other than a bias
against archisegments.

What is clear is that \( \varepsilon \) is weakened in the unstressed
proclitic, that it does lose its laterality in specific environments,
and that having lost its laterality it necessarily assimilates to
a following consonant. Furthermore there is nothing other than
phonological conditioning at work here, although I will suggest
that the definite article assimilation in Arabic is an excellent
candidate for morphologization (below chapter four).
3.4. Final remarks on single process complete assimilations.

At the outset of this chapter I cited a passage from the Sound Pattern of English which in effect made the claim that complete assimilations, i.e., ones which assimilate all features, were of the same nature as highly specific, single feature assimilations such as palatalization and velarization, i.e., single process 'swoop' assimilations. Such a stipulation is absolutely necessary if assimilation is a "special process... ranging from complete assimilation...of all features to assimilation of only a single feature" as Chomsky and Halle wish to establish. I have offered many examples of complete assimilations which, if phonological rules are to embody their own explanations, cannot be interpreted as complex single process operations but as a combination of simple operations. The sole exceptions to this claim seem to be limited to a special class of segments, the glottal segments, which by reason of the fact that they are nonspecified as to supra-glottal articulators are relatively free to assimilate such supra-glottal articulatory features from neighboring segments. If the archisegment interpretation of the Arabic definite article assimilation is correct, then it too is a special case of the kind of assimilation of unspecifio features just referred to.

If the problem is viewed slightly differently it can be seen that phonological processes of assimilation are of two basic kinds. There are processes which involve the assimilation
of features which were not crucial to the primary mode of articulation of the changing segment. Such processes include the assimilation of glottal segments to neighboring segments. There are other assimilatory processes which involve changing features which are critical to the specification of the assimilated segment. It is precisely in such cases, where complete assimilations which involve changing more than one primary feature, that the single process or fell swoop interpretation of assimilation is not tenable. And to the extent that such complete assimilations are included in Chomsky and Halle's wish to establish a natural hierarchy of assimilatory processes, such hopes are not capable of being realized.
CHAPTER IV
STRENGTH, WEAKNESS AND A NOTE ON MORPHOLOGIZATION

4.0. Grammont’s ‘law of the stronger’

Grammont (1933:185-6) makes the following statement regarding the reasons for the phenomenon of assimilation.

Ce qu’il importe de savoir c’est pourquoi tel phonème a été assimilé et tel autre assimilé.... Ce trait qui est capital c’est qu’il y a un phonème qui commande à l’autre; le mouvement s’accomplit dans un sens ou dans l’autre (régessif ou progressif) selon que le phonème commandé se trouve placé avant ou après.

Le phonème qui commande est celui qui plus de force ou de résistance ou de stabilité ou de faveur. Ces qualités peuvent être déterminées d’avance d’après le système de la langue, et par suite le sens dans lequel l’assimilation s’accomplira peut être prévu, ce qui exclut le caprice. Pour simplifier on peut les désigner tout par un seul mot: la force. L’assimilation obéit à une seule loi: la loi du plus fort.... elle règle non seulement l’assimilation et la dissimilation mais tous les phénomènes dans lesquels l’altération d’un phonème est provoquée par un autre phonème.

A cette loi il n’y a pas d’exceptions et il ne saurait y en avoir.

The ‘law of the stronger’ is for Grammont an a priori statement of a necessary truth. In the Traité de phonétique (1933), after having stated the law he then lists a number of examples which support his statement (cf. Posner 7–9) for a discussion of Grammont’s methodology and philosophy of science). The
notion that the stronger of two segments will assimilate the weaker to itself (or conversely that the weaker will assimilate to the stronger) is so broad a statement as to prove almost useless. It is necessary to define strength and weakness in a way which makes such concepts useful in the description of phonological processes. In the case of complete assimilations such a definition has proved an impossibility. Again, the impossibility of the task resulted largely from a fundamental misconception of the nature of complete assimilations. This misconception results, as has been thoroughly discussed in chapters two and three of this dissertation, from viewing complete assimilation as a single process and confusing the statement of a correspondence $C_1 \rightarrow C_2$ with the statement of a single process. In many instances discussed in the preceding pages such a viewpoint was shown to be untenable especially with regard to embodying explanatory statements into a phonological rule.

Indeed there may be many factors which contribute to determining whether or not an individual segment is weak or strong. As a matter of fact, weakness or strength may have to do with individual features rather than individual segments and an individual segment may show both strength and weakness with respect to different features. Such a situation obtains, for example, in languages which have nasal assimilation rules and rules which assimilate homorganic stops to nasals. Such languages
are Finnish (above chapter two) and German (below p. 86).

Further complicating the situation is the fact that, not only can there be different phonological processes involved in determining the cause of a derivation, but these processes can come into conflict and there is no independent way of determining which process will 'win'. Moreover, it is necessary to include factors which are not basically phonological or phonetic in any consideration of weakness or strength. In the following paragraphs I consider a number of phonological and nonphonological considerations in determining relative strength and weakness in assimilation rules with the specific intent of showing why Grammont's a priori law of the stronger is so general as to be vacuous and of little or no use to phonologists who are interested in explaining phonological processes.

4.1.0. Some phonological factors having to do with strength/weakness.

In many assimilation rules the basis of the change can be determined by the phonetic makeup of the segments themselves. This is particularly true in assimilations involving sonority.

A. There is a well attested hierarchy of relative sonority in consonant articulations. This hierarchy can have a definite effect
is context-sensitive processes (cf. Zivicky 1972 for the hierarchy
via à via syncope). If assimilation rules the more sonorous
segments tend to be stronger, ceteris paribus. Thus segments less
sonorous than the liquids tend to assimilate to the liquids especially
if they share other features, like point of articulation. So,
for example, Latin dl, dr, nr, nr, sl, sl, all became ll (Buck
and Hale 24):

*sed-*la > *sed*la
*cor*nl > *cor*nl
*per-*los > *per*los
*gel*d > *gel*d
*col*nt > *col*nt
*vel-*n > *vel*nt (via vel-*nt, cf. above p. 52)

Another example of such an assimilation of manner being governed
by strength of sonority is the frequent assimilation of a stop
to a homorganic nasal (cf. the example from southern Italian
-nt-, -nt-, 9n- mm, mm, 9n, above pp. 35-37).

2. Certain segments are especially prone to change of
position. This is true of nasals, particularly the dental/
silvinal nasal s. Whereas most examples of nasal assimilation
are regressive assimilations to following obstruents, e.g.,
Finnish, Latin, Greek, English, Sanskrit, to name only a
few, there are also well attested examples of progressive
assimilation of position in obstruent plus (dental) nasal clusters.
Consider German fast speech (cf. W.L.G. No. 1):
wir haben 'we have' [haben]

[haben] progressive nasal assimilation

[hamə] regressive assimilation of nasality

Similarly English casual speech:

He's rubbing us the wrong way.


[ramə] ŋ → n → ɹ

[ranə] regressive assimilation of nasality

C. Another phonetically motivated assimilative change has to do with specific sequencing difficulties. A good example of this is one which I discussed in detail in chapter one, the markedness of apical plus sonorant clusters (above pp. 13-20).

Another type of sequencing constraint has to do with voicing. It is nearly impossible to pronounce a sequence of tautosyllabic obstruents where such obstruents have different voicing values; furthermore, this difficulty extends in many cases to heterosyllabic obstruents. This difficulty is responsible for the many voicing assimilation rules in the languages of the world. Though most voicing assimilation rules seem to work reggressively (practically every Indo-European language still has vestiges of the PIE regressive voicing rule, e.g. Latin, Greek, Sanskrit. Cf. chapter two above), there are good examples of progressive voicing rules. Consider for example the morpheme structure rule in English which
requires that any obstruent which follows an initial s must be voiceless. Stampe (1972b:36) has shown that this morpheme structure condition is a productive phonological rule which can be reapplied in fast speech, e.g.:

\[ \text{Let's go} \rightarrow \text{let's go} \rightarrow \text{let's go} \rightarrow \text{bog} \rightarrow \text{gog} \rightarrow \text{slow} \]

There is of course the progressive voice assimilation associated with the English inflectional endings where—regardless of the particular interpretation of how this rule actually works—a rule of voicing assimilation of the ending to the final segment of the root is required.

D. Such assimilation phenomena as have just been discussed have as their motivating factor(s) specific phonetic reasons which can be identified through a careful analysis of the articulation of the segments or sequences of segments in question. These are by no means all of the relevant features (cf. Grammont 1933:186-199), but they suffice to show that one kind of weakness/strength has to do with phonetic factors which can be explained entirely by analyzing the segments involved. Another phonological factor which frequently helps to determine strength or weakness in assimilatory processes (as well as other phonological processes) is the location of a segment within a syllable. Many authors
have commented on the apparently universal fact that there is a tendency toward weakening of syllable offsets (cf. Vennemann 1972b, Jones 1951, Malamberg 1955, 1961, 1964). Furthermore, it has been shown recently that rules which change the syllabification of a word are persistent rules, i.e. they have the capability of reapplying several times in a derivation (Venneman 1972, Stampe 1972b). Stampe has shown the importance of such resyllabication processes rather dramatically in the casual speech derivation of digraphy of the 1972b:56).

The tendency toward weakening of syllable final segments is manifested in a variety of ways. In the acquisition of language by children the weakness of syllable final position is shown by the deletion of all syllable offsets and the production of only CV sequences. (Velleman 1943, Stampe 1969). Syllable-final devoicing is also an instance of the tendency toward weakening of syllable-final consonants. But perhaps the best evidence of this tendency is to be found in the very phenomenon which is the subject of my investigation. In a number of the particular assimilations discussed (Latin, Italian, Greek) a tendency toward the development of a rule which simply assimilates regressive a CV sequence is found. Such a rule is basic to Italian consonantism.2

2Although arguments have been made that assimilation no longer plays a role in the synchronic grammar of Italian (Saltarello 1970:30-31), the facts concerning the evolution of the present system clearly involve an assimilation rule which changes C1 C2 -> C1 C2 (rule d. below).
Modern Italian includes rules which limit permissible consonant sequences in the following ways (as permissible sequences cf. Agard and DiPietro 1965:30-34):

a. There are no sequences of obstruent initial non-semitone consonant clusters except when the initial obstruent is s. (s cannot precede a palatal consonant, but other combinations are possible).

b. There are no nasal plus liquid clusters.

Since all these combinations are theoretically possible in derivational morpheme boundaries, there must be some means of eliminating all such impermissible sequences. One class of impermissible clusters, those of nasal plus liquid (b above) can be eliminated through a very straightforward rule which assimilates a nasal to a more sonorous liquid segment.

c. \( n \rightarrow \left( \begin{array}{c} i \\ r \end{array} \right) \)

\( e.g. \)\( non-le > pollo \)

\( ton-le > collo \)

\( operato > orrate \) (after syncope)

(cf. Grandgent)

The resolution of impermissible obstruent initial clusters is covered by a rule like (d).

d. \( C_1 \rightarrow C_2 / V \rightarrow \star C_2 \)
condition 1. \( C_i \) is [+nasal] and [+sibilant]
2. If \( C_i \) is [+sibilant] and \( C_2 \) is
   [+palatal] then \( d \) operates;
   otherwise \( d \) is blocked.

\[ \text{e.g.} \quad \text{dek} + \text{to} \rightarrow \text{setto} \]
\[ \text{clv} + \text{tag} \rightarrow \text{cittag} \] (Saltarrelli 95-6 for examples, not for interpretation).

Unlike many other examples of multi-feature assimilations which I have considered up to this point, there seems to be no reason to assume that Italian accomplishes the assimilations in a stepwise fashion. However, the explanation for assimilations like those of \( d \) cannot be found by an examination of individual segments, their phonetic features, and their relationships to neighboring segments, i.e. there is no process-internal motivation here.

Rather the explanation must be sought in the fact that the weakness of syllable final segments (at least syllable final obstruents) has become important enough in the phonological system of Italian that other phonetic considerations, like marked vs. unmarked sequences of apical and non-apical clusters, can be overridden.

Even though certain processes can be shown to have phonetic motivation and thus to have some kind of universal status, there is no necessity for every phonetically motivated process to apply. Processes are necessarily constrained and restricted in many ways.
Tocc processes often operate for a time and then cease to have an effect. The Latin voicing and rhotacism rule of a clearly operated for a time and then ceased to have any effect. At a later time, perhaps reinforced by analogy to the developments with prefix assimilations, a rule assimilating the first of a sequence of intervocalic consonants was established, giving developments like *doestum, petarum* < *doestum, petarum*, whereas earlier such clusters would have assimilated to r (cf. above chapter two).

From a phonological point of view factors governing strength and weakness derive from a number of sources, some having to do with the phonetic makeup of individual segments, others with sequencing difficulties and still others with notions of syllable structure. Indeed such considerations are so diverse that an attempt to explain assimilation, particularly so complex an operation as many complete assimilations turn out to be, on the basis of the 'law of the stronger' is not a very useful or rewarding pursuit. Moreover, yet another fact complicates the notion of strength/weakness to an even greater degree. There are non-phonological factors which influence the operation of natural phonological rules, including assimilatory ones.

4.1.2. Nonphonological Influences on Strength/Weakness.

It is well-known that the phonological component of a grammar cannot be strictly separated from other components. Indeed, the syntactico-morphological realm of grammar has been demonstrated to
exert important constraints on phonological processes. One attempt to characterize the nature of nonphonological influence on natural processes is that of Zwicky (1972a). After pointing out that casual speech processes 'seem to be constrained to be phonetically natural' (p. 608), he considers a number of ways in which natural processes are conditioned by nonphonetic factors and fail to apply maximally. These nonphonetic conditioning factors are subsumed under two major headings—grammatization and syntactification. Except for the extreme of complete syntactification, which totally removes the rule or rules from the realm of phonetically motivated phonological processes, most of his examples involve phonetically plausible processes which require as a part of their statement some nonphonological information. Zwicky uses examples primarily from Welsh and English to demonstrate the variety of ways such nonphonological information is necessary in the statement of phonological processes. Similar situations obtain in many of the processes which have been described in the preceding pages of this dissertation. A case in point is the Arabic definite article discussed at length in chapter three. Even though stress probably plays a role in determining the weakness of 1, all prefixes being unstressed, the close syntactic connection between the article and its noun, as well as the fact that the closed class of morphemes (one member) is highly redundant may very well contribute to the segment's weakness and its subsequent assimilability. Indeed as Zwicky says (611):
It is, unfortunately, often difficult to assess the relative importance of stress levels and structural cohesion, since the two are not infrequently related. Thus the recurrence of special casual speech processes affecting the combinations article and noun...surely is not accidental, but does this follow from the intimate syntactic relations between the two elements, or from the low stress on one of them, or are both of these factors relevant, and are the positions in fact different?

Indeed many of the complete consonantal assimilatory processes involve affixes, and in the overwhelming majority of cases where an assimilation occurs across a boundary between an affix and a root, and where the presence of that boundary is a necessary condition for the assimilation, the segment which assimilates (i.e. the weaker segment) belongs to the affix. Such weakness must be conditioned to some extent by grammatical factors such as those outlined by Zwicky. Weakness engendered by such morphological factors can have far reaching effects on assimilatory rules, leading in many cases to a change in the nature of the assimilatory rule.

For this reason I would like to deal in somewhat more detail with this phenomenon.

4.2. Excurse: Morphologization of Phonological Processes.

There are a number of ways in which an originally phonetically motivated phonological process can become morphologized, i.e.,
the motivation for the alternation is no longer exclusively determined by phonological factors but rather by association with particular paradigms or individual morphemes. One way in which this happens is for the phonetic motivating factor to be lost through some new phonological change. If afterwards the original alternation is preserved it necessarily becomes associated with some paradigmatic or morphological phenomenon. An excellent illustration of such a morphologization of an originally phonological process is Modern German unlaute. Originally unlaute was a purely phonetic process, a palatal assimilation of a back vowel caused by an i or y in the following syllable. At a later stage in the language inflectional endings were reduced and among others the i vowel of the unlaute plural was reduced to [ə]. Once the conditioning factor was lost the regular alternation of back vowels with their fronted counterparts became associated with the morpheme which had originally contained a palatal vowel. Where there was no alternation, e.g. für < OHG fari via FERI and schön < OHG schōni via SCHONI the unlaute vowel became phonemicized through restructuring (cf. Tvedt:1938, Wurzel 1970).

Another way in which a phonological process can be morphologized is through an analogical extension, usually within the domain of a paradigm. A case in point is the evolution of the Latin noun HONOR. The original paradigm included a nominative singular form HONOR and a genitive singular HONORIS. The genitive
(along with the other oblique cases) provided the environment for rhotacism (cf. above chapter two). After the effect of rhotacism the result was a skewed paradigm nom. e.g. *honor*, oblique stem *honor*. At a later period the r, which had come into being by the operation of a strictly phonetically motivated processes, was extended to the nom. e.g., giving a form *honor* and establishing a regular paradigm for the noun once again.

A third kind of morphologization is connected to linguistic borrowing. Consider a rule like the velar softening rule in English. This rule underlies alternations of k - s in related words like electric, electricity. Originally the velar softening rule was a phonetically motivated rule of palatalization in French. The change k → s was caused by the palatal vowel i; however, even though the rule is productive in Modern English (cf. forms like ad hocity [ad has'istik]) it has never had in English the phonetic motivation which it had in French.

Such morphologization of originally phonological processes is also apparent in many complete assimilation rules. In the preceding paragraphs of this chapter I discussed a number of ways in which nonphonological factors can have an influence on the operation of assimilatory rules. Frequently such nonphonological factors are the key to morphologization of phonological rules (in Zwicky 1972a such morphologization is called total syntactification).
In two recent articles (1972, 1973) Kiparsky has spoken to the issue of morphologization. He develops a notion of paradigmatic coherence (1972:206ff) to explain the kind of analogical extension shown in the development of *hono* > *honor*. Paradigm coherence basically means that allomorphy within a paradigm which arises due to some phonetically motivated process tends to be reduced.

Kiparsky argues further that, even though such a reduction involves complicating the grammar in the sense of requiring more complicated and often arbitrary rules with nonphonological conditioning factors, the grammar has been simplified in a functional sense. This notion of the strength of the paradigm as well as its role in the extension of phonological rules is developed and refined in Kiparsky's second paper (1973). Here he combines the notion of paradigmatic coherence with transparency, opacity and the importance of derived vs. underived forms, demonstrating that generalizations usually occur across morpheme boundaries i.e., in derived forms. The following statement is not only interesting as an illustration of Kiparsky's claim but particularly so since it involves an instance of complete assimilation (14-15):

Finnish had an old rule of assimilation

(6) \( n + 1 \) / \( \_\_ \)

which applied, as a historical change, inside morphemes i.e., lows like *viila* 'wool' (cf. Lith. *vīna*), *halja* 'frost' (cf. Lith. *žalna*), and across morpheme boundaries, e.g. in past participles like *tulaut* / *tulaut* 'come'
or in potential forms like /koolänes/ → koolëes 'will probably die'. Across morpheme boundaries the rule continued to operate as a synchronic process, whereas the morpheme-internal cases were restructured as /villsi/, /halla/, which are the modern Finnish underlying forms of these words.

At a later stage in Finnish, rule (6) was generalized to apply after any stem-final consonant.

\[(7) \text{ n} + \text{C}_{1} / \text{C}_{4} \_\_\_\] giving not only /tullinut/ → tullin, /koolänes/ but also /purunut/ → purun 'should', /purus/ → purus 'will probably hit', /pesyn/ → pesyn 'washed', /pesänee/ → pesäne 'will probably wash'. But (7) applies only to derived sin clusters. E.g. koiran 'bell', koiran 'back of a tree', käännö 'calars', käännö 'present' are not affected by the generalized assimilation rule, although they contain just the clusters which undergo assimilation across morpheme boundaries.

It is possible to constrain the application of (7) to the appropriate case by inserting a morpheme boundary in its environment.

\[(7') \text{ n} + \text{C}_{1} / \text{C}_{4} +\_\_\_] However, it is not necessary to do so if we accept (4) for this principle restricts the rule to derived inputs, which here in practice means across a boundary.

It is interesting to note that the original rule (4) is a natural process which also occurs e.g. in English (kill → kill), Latin (collis → collis), and Greek (polnimi → alluni). The same claim cannot be made for the generalized rule (7). In fact, the process Van → Vas is unique as far as I know. Rule (7) seems to be a case of a "crazy rule" originating by generalization from a natural nucleus (Sa ech and Närse 1972).

This appears to be a common pattern of change: a neutralization rule.

\[(8) \text{ A} + \text{B} / \_\_\_\_\_\_]
enters a language, affecting both morpheme-internal AC sequences and A + C sequences arising in morpheme combinations. The former are reanalyzed as underlying /BC/, whereas the latter retain their underlying form /A + C/ and continue to undergo (8) as a synchronic morphophonemic process. Subsequently, the rule is generalized to a wider class of inputs A'C' (A + A' or C C'). Now the generalization affects only derived inputs.

Why should it be natural for rules to generalize just to derived environments, even where in terms of standard generative phonology this involves either complicating the rules or marking morphemes as exceptions to them? At least part of the answer is contained in principle (4), which allow lexical representations to function as "cost-free" exception markers to rules. If the language learning situation involves the expectation that neutralizing rules apply only to derived forms, then non-derived forms acquired by the speaker will not undergo the generalized rule, by virtue of their inherent representation.

Principle (4) which is frequently referred to in the extended quotation above is the assertion that neutralization processes apply to derived forms only, i.e. if the environment is met in the underlying representation then the rule will not apply. I have included this long quotation in its entirety for a number of what I hope are justifiable reasons. First, as I mentioned before, the passage includes a good example of a complete consonantal assimilation which began as a natural process and was then morphologized. Second, the passage includes a number of indications of how and where to look for the phenomenon which I have called morphologization. This is particularly important since present theory lacks any coherent testable theory
of morphology. Generalizations of phonological processes are associated at least in part with the notion of the paradigm and its integrity as a morphological unit. In the case of nouns becoming *honor* through generalization the allomorphy engendered by the rhotacisation rule was eliminated making for a more coherent invariant paradigm. In the case of the Finnish assimilation above, generalization apparently works in precisely the opposite way, i.e. it increases allomorphy in the morphemes *-nut* and *-nem*. I would like to claim, however, that the difference is really only apparent. What has happened is that through the generalization of the assimilation rule, the coherence of the paradigm for the morphemes *-nut*, *-nem* is maintained by regularly associating the process of assimilation with the morphemes in question. The additional fact that this environment is limited to just two morphemes probably contributes to such a morphologization.

The criteria for determining whether or not a process has become morphologized, which seem to emerge from the foregoing, involve paradigmatic considerations and the associating of a process with a specific morpheme(s) rather than with the natural teleology of the original assimilation rule, thus allowing for generalization and the establishment of unnatural rules.

Unfortunately, it is not always clear when the change from phonological rule to morphological rule has been accomplished. In part this difficulty arises from the previously mentioned
lack of any theory of morphology. There is, however, another
and even more upsetting aspect to the problem. That is the real
ignorance of what constitutes 'psychological reality'. At
present we have no really sound way of establishing tests
for determining definitely whether or not the assimilations associated
with the morpheme ad- in Vulgar Latin are at all times the result of
a combination of individual natural assimilatory processes or
whether at some time the notion of a process of assimilation became
associated with this morpheme so that the process itself became
'psychologically real'. Similar problems exist with many of the
assimilatory processes I have discussed. The fact that so many
of them occur only at morpheme boundaries and that such
juxtapositions of segments often occur associated with a very
small class of morphemes makes it at least possible to consider
that the assimilatory process might become associated with a
morpheme even though there is no clear-cut generalization producing
a 'crazy rule'.

Possible candidates for status as morphologized rules (or
rules in a possible transitional stage) from the complete assimilations
which have thus far been described include the Greek resonant
cluster processes. Even though these processes, e.g. metathesis,
s → h, h → s and VH → VH or VH; are well motivated phonologically,
there is at least an indication that by the time the phenomenon
was attested in the inscriptions, it had already become associated
in the case of -rs-, -ls- clusters with a specific class of words,
the segmentic sorists, because other -ra-, -la- clusters underwent different, equally natural changes (above p. 40, Malikovski-Orchman, p. 3).

Before leaving the question of morphologization of phonologically natural processes, I would like to indulge in some speculation. If the potential criteria for morphologization are indeed actual ones, than one assimilation which was discussed in some detail would seem to be a perfect candidate for morphologization.

The assimilation I have in mind is the one associated with the Arabic definite article.. As was mentioned in the consideration of morphologically influenced weakness in assimilation rules, the only initial clusters are those involving the 1 of the definite article, i.e. only derived clusters in close syntactic connection. Thus the assimilation is limited to a single morphological entity, and, in the case of at least one dialect the process is being extended to include more segments. At the present time the extension is along phonetically predictable lines; however, if the process is extended even further, it would seem reasonable to assume that the ultimate result would be that complete assimilation would become a morphological process associated with definiteness.

A similar speculation can be made with respect to the assimilations associated with final glottal closure in Finnish (above, chapter two).

As was mentioned earlier this process is limited to three verbal suffix morphemes. The limited distribution of and its complete lack in other dialects where there is gemination associated with
the morphemes in question makes the claim that the process has been morphologized just as plausible as positing a live phonological process and reconstructing underlying glottal stop (or h) in the underlying representations.

Unfortunately such speculation is just that—speculation.

Further development of testable criteria for determining plausible distinctions between morphological rules and phonological processes is a prerequisite for going beyond speculation. 3

3Harris (forthcoming) has asked some interesting and important questions about the relationship between morphology and phonology and status of 'linguistically significant generalizations' of the type made by Leu and Borrelleis (1973).
CHAPTER V
CONCLUSION

5.0. Complete Assimilation as a Phonological Process.

In the introduction to this dissertation a quotation from Eduard Sievers was used. This quotation included the observation that complete assimilations tend to happen when the segments involved are already similar (above p. 3). A more recent statement by Michael Kenstowicz added the observation that complete assimilation implies partial assimilation. Those instances of genuine phonological assimilation, primarily the processes covered in Chapters 1 and 2, bore out the accuracy of these observations and indeed allow the incorporation of both into the statement of a principle which constrains possible phonological assimilations. I have called it the principle of similarity.

5.1. The Principle of Similarity.

In those instances where a correspondence shows a complete assimilation and that assimilation is a purely phonological process, the rule which actually produces the geminate sequence normally changes only a single major feature. That is to say, segments must be nearly identical in order to assimilate completely.

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This principle has been shown at work in two basic ways. Either the two segments of a C1 C2 sequence were already nearly identical and a single-feature assimilation accomplished complete assimilation, or a number of processes, not necessarily all assimilatory, gradually created the necessary similarity and then complete assimilation took place (cf. esp. chapter two).

One necessary modification of the principle of similarity is necessary. This necessity derives from phenomena like that of the Arabic definite article assimilation. In this case of complete assimilation a plausible phonetic motivation was discussed (below, p. 79); however, there is no way in which the assimilation itself could be broken down into single feature assimilations. This particular assimilation does, on the other hand, include a set of segments which can be characterized in a natural way. The segments to which 1 assimilates are all segments which make use of the tongue as an active articulator. Moreover, these segments exhaustively include those tongue articulations which are most similar to 1 in place of articulation. When, as in the case of Cairo Arabic the process is extended, it extends to include the next most similar articulations after dentals, alveolars, and palatals, the velar stops k and g. ¹

¹What I have said about the principle of similarity and the nature of hierarchical implications leads to the expectation that if a language has a rule of - m and there are clusters of nd in the language, then such clusters would necessarily assimilate to nd also. In fact I believe this to be the case.
I know of only one apparent counter example which I cannot explain at present. Old Norse has a rule which assimilates clusters $n\theta$ to an while clusters of $n\theta$ become $n\theta$, contrary to all expectations.

It is the constraining nature of this principle which explains why all cases of undisputed phonological complete consonantal assimilations are of the type discussed in chapters one, two, and three. It turns out that those correspondences which involve large changes and which seem to achieve these changes in single rules all require an appeal to either a more abstract phonological rule of syllable structure, or, as is sometimes the case, the processes may have become morphological and thus removed from the domain of natural phonological rules.

5.2. Some misconceptions and not-too useful concepts.

I have further shown, I believe, that a theory of phonology which does not distinguish between essentially morphological rules and those which are natural phonological processes (even when such distinctions are difficult to make with any degree of assuredness) leads to investigations and goals of an unrealistic nature. Thus the desire to arrange assimilatory processes hierarchically ranging from complete assimilation to partial assimilation is doomed because it fails to take into consideration the fact that most complete assimilations are either not single process operations or are so conditioned
morphologically that they cannot fit into a hierarchy with natural processes which have a specific phonetic motivation.

I have also shown that the concept of weakness/strength in Grammar's 'law of the stronger' is so broad a concept as to prove almost valueless in attempting to determine the essential nature of complete consonantal assimilations. Such assimilations are often incredibly complex, involving several different phonetic processes each with its own teleology and hierarchy of applicability and frequently involving nonphonetic conditioning factors as well (cf. the Greek resonant assimilations).

5.3. Final Remarks.

Like so many investigations of this nature, the present study has left unanswered fully as many questions as it has answered. Of particular importance to the ultimate definitive answer to the problem of complete consonantal assimilations is the solution to the fundamental problem of the relationship (synchronic as well as diachronic, psychological as well as systematic) between those phonological rules which are phonological processes and are a part of universal phonological theory and those which are either partially or totally conditioned by nonphonological processes and are thus language specific and must be acquired in a fundamentally different way. There is also the related question of whether or not such different kinds of phonological rules need to be characterised and/or valued
differently in a synchronic description of a language. To these as to so many important questions I can offer no significant answer. I can only hope that as I stated at the outset of this work that at least the questions can be asked in a way which might lead more fruitfully to correct answers.
APPENDIX

The following pages include data from a number of diverse languages which show assimilatory rules illustrating the types of assimilation (especially fortuitous and combinatorial) which were discussed in the body of this dissertation. I have given no special arrangement to the examples and most examples are cited precisely as given by the authors of the various texts.

**Syrian Arabic (Covell 27)**

\[ n + m / __ (+labial). \text{optional!} \]

This rule produces a number of fortuitous complete assimilations. \[ \text{un} \]

- e.g. \[ \text{merrut} \to \text{marrut} \text{ 'we die'} \]
- \[ \text{?am} \to \text{qam} \text{ 'nose'} \]
- \[ \text{mam bārūt} \to \text{man bārūt} \text{ 'from Beirut'} \]

\[ n + \{\text{i}^2\} / __ \{\text{i}^2\} \text{ optional} \]

- e.g. \[ \text{?absal-lak} \to \text{?absan-lak} \text{ 'better for you'} \]
- \[ \text{r-rāḥ} \to \text{n-rāḥ} \text{ 'if he goes'} \]

**Bardi (Westerman and Ward 124-5)**

- \( p, t, k \) in word final position become \( n, s, s \) when followed by a nasal initial word.
This produces fortuitous complete assimilations when the following nasal is homorganic.

E.g. a ko metnan is pronounced
     a ko mënna : 'he didn't see me'.

Moor (Westerman and Ward 123)

get + de 'his child' > geste
(fortuitous assimilation due to general regressive voice assimilation rule)

Breton (Termes 70ff.)

Breton has the following rules of Sanshi:

1. Sonorant + Sonorant  no change
2. Sonorant + Obstruent  no change
3. Obstruent + Sonorant  Obs → [+voiced]
4. Obstruent + Obstruent  either both become [+voice]
   or both become [-voice].

Rule 4 produces a number of fortuitous complete assimilations where the only difference was that the feature voice; however the resulting geminate case obligatorily reduced to a simple consonant.

E.g. p + b → p  pep + blal → pe blal  'each year'
     t + d → d  nomes pet + dew → nomes pe dew  'J'en ai en deux'
\[ t + d = t \quad \text{and} \quad \text{adj} \rightarrow \text{and} \text{adj} \quad \text{the third day} \]

etc.

Burmese (Okell 6-8)

Burmese has just two final consonants, \( t \) and \( /s/ \), which shows up as nasalisation of the final vowel in absolute final position.

1. In close syntactic connection and/or fast speech \( /s/ \) is pronounced as a nasal consonant homorganic to a following syllable initial consonant:

\[
/\text{mn} / = \eta / \text{[velar]}
\]

\[
\eta / \text{[+alveolar]}
\]

\[
m / \text{[+labial]}
\]

\[
N / \text{[+palatal]}
\]

\[
n / \text{[+dental]}
\]

e.g. kyaut-twe → kyaut-[n]twe 'alter completely'

Kpyi-tewe → Kpyin-tewe 'go outside'

thaw-jal → thaw-[n]jal 'iron hook'

cif-jae → cim-jae 'at home'

Such a nasal assimilation rule produces a number of fortuitous assimilations, since there are nasal initial consonants at all the positions of articulation listed above except [+dental].

Of further interest is the following phenomenon associated with nasal final syllables:
In 'closely linked' syllables, nasal final syllables extend the nasality to a following voiceless stop (b d g) and rarely to the voiced dental fricative ññ, an example of combinatorial assimilation.

e.g. Méd-ša + kštqul-ñ2al 'will, good'

tš-še + ti/nem 'it is tight'

ybal-kvé + yqalm-kvé 'competition'

kšqâ-šk + mšqâ-šk 'tomato'

B. Final glottal stop is regularly assimilated to the initial consonant of a following syllable.

e.g. ykal-kvé + ykal-kvé 'area'

kšl-tsh + kšl-tsh 'opinion'

oil-mu + aim-mu 'I will sleep'

Note: In the case of a syllable initial voiced obstruent following the ? the assimilation is to the voiceless counterpart.

e.g. laq?-a? + laq-a? 'fistulations story'

Here glottal stop behaves similarly to examples discussed in chapter three.

Ganda (Bantu Family) (D. T. Cole 14-16)

Nasal assimilations:

A prefix /š-/ occurs in the following situations:

(a) Noun Prefixes

(b) Adjectival prefixes

(c) Subject prefix 1st p. sg.

(d) Object prefix 1st p. sg.
"In all cases /h/- is manifest as a nasal consonant
Cm, m, n, ñ, hj homorganic with the initial consonant of the
stem or radical."

\[ \begin{align*}
N + p & = mp \\
t + nt & = rt \\
c + x & = xc \\
k + ox & = kx \\
d + nd & = dx \\
N + m & = mm \\
n & = nm \\
ny & = Mm \\
q & = qm \\
\end{align*} \]

These are examples of fortuitous assimilations.

Coordinatory assimilations:

\[ \begin{align*}
N + b & = nb = nb \\
m & = n & & \\
\end{align*} \]

\( mm \) occurs when preceding a VC cluster in the next syllable.

\[ \begin{align*}
\text{e.g. } & \text{}^{m}h\h\text{n} & \text{grindstones} & \text{cf. } & 10\h\text{h} & \h\text{p} \\
\text{h} & \text{w} & \text{would} & \text{cf. } & \text{w} & \text{w} \\
N + l & = nd = nd \\
y & = fj = fj \\
g & = g & & \\
\end{align*} \]

\( mm \) occurs when preceding either a VC cluster or a plain
nasal consonant in the next syllable.

Japanese (McCawley 122-126)

The development of the more obstruct and more nasal in Japanese involve a number of different assimilation rules (an example of combinatorial assimilation). I cite the rules as McCawley gives them.

A. (McCawley's No. 4)

\[ (+\text{obs}) / (+\text{obs}) \]

By this rule the /t/ of the past tense ending becomes d after verb stems ending in /b, g, n, r/.

B. (McCawley's No. 7)

\[ (+\text{obs}) / (+\text{obs}) \]

This rule affects verb stem final /r/ which becomes an obstruct before en ending with /t/.

C. (McCawley's No. 14)

\[ (+\text{cns.}) / (+\text{cns.}) \]

More nasal and more obstruct assimilate the point of articulation and the sharpness of a following consonant.

D. (McCawley's No. 15)

\[ (-\text{voice}) / (-\text{voice}) \]

A more obstruct assumes the continuance and voicing of a following consonant or glide.

A further rule (No. 17) converts the initial segment of a sequence of identical voiced consonants to a nasal (a mora nasal).
Karok (Bright 39)

r ~ r / [nasal] - fortuitous assimilation where [nasal] is r.

ikxwµn 'darkness' + -ri- 'place' → ikxwµniri- 'darkplace'

io?ra'n 'stranger' io?ra'rai- 'among strangers'

ia?– 'to eat' ia?m 'place' → ian?ram → ian?ran 'hotel'

(? is a morphophoneme which is manifested phonetically as a preconsonantally.)

Kolami (imenea 42-73)

(9) → r / _ r ca

e.g. caaged : caageryal

sapoge : saporrel

mi'tele : mi-teeral (this assimilation is restricted to occurrences with the suffix -ri.)

ad ('that' (non-nasc. sg.) +

at, at, at, and at / _ r, s-, z-, s-

similarly ia iia, iia, and iia-

e.g. at tin 'that tin'

a s sak 'that egg'

a s ca'm 'that animal'

a c ca'ku 'that knife'

Kpelle (Iyman 184-186)

Kpelle has two underlying nasal prefixes one with high tone (marked ") and one with low tone (marked ".")
There are a number of assimilatory rules associated with these prefixes.

1. The nasal assimilates to the position of a following consonant.
2. The initial voiced obstruents become voiceless.
3. The initial sonorants assimilate completely to the nasal prefix. (Sonorant consonants are b, l, v, y, r, m, n, ny, r.)

\[ \text{e.g.} \quad \text{ῆ [hē]} \quad \text{'companion'} \quad /\text{ῆ}/ \quad \text{'his'} \quad /\text{ῆ}/ \quad \text{'my'} \]

\[ \text{ē} + \text{ῆ} \rightarrow \text{ῆē} = \text{āē} + \text{ē} \rightarrow \text{ēē} \quad \text{'his companion'} \]

Korean (Martin 19 and 92)

Korean shows a number of assimilations of nasality and lateralization, producing some tortuous complete assimilations.

\[ p \rightarrow m \quad / n \quad [\text{nasal}] \quad k \rightarrow n \]

\[ \text{e.g.} \quad \text{simpān} \quad \text{'10,000'} \]

\[ \text{mōt daynta} \quad \text{('cannot pay')} \quad n \rightarrow l \quad / l \]

\[ \text{e.g.} \quad \text{vērē naa nolay} \quad \text{('old time song')} \]

\[ \text{vērē} \quad \text{('well') \quad 'originally'} \]

Kurdish (MacKenzie)

Suleimaniye dialect

\[ t \rightarrow \text{[ṭ]} \quad / \quad \text{[ṭ]} \quad \text{regressive} \]
nātmasim (n:ın n:isım)

Cilt ır kird ['tʃi:lle: ı:k]'ird]

but d
n / n
ə / ə __ progressive
v
y

Sændır [s:a:n'dɛr] birsandır [bɾis'nɛːɾ]  
Dildär [diːl'dɛːɾ] havda [hav'da]

Savla'n ([meΊ ja:n])

In inner and postvocalic position d is normally realized as the
continuant [z]

Old Norse (Noreen 200)

One set of assimilations in Old Norse (actually from the
Ur-Ioræ period) is of particular interest since it relates to
the type of assimilations discussed in chapter two (resonants + s).
The consonant groups IR, NR, RR, SR become assimilated to LL,
nn, rr and ss respectively. R derives from an original PIE s
which first became voiced to z and then rhotacized to r (in-
distinguishable from original r). Thus, historically this set
of assimilations is the result of a series of processes not unlike
those in Latin.

e.g. OH stōl 'chair' cf. Got. stōla

stein 'stone' cf. Got. steins

meýr 'famous' < Ur.N. mariR

lænas '-less' < Ur.N. lausR
Papago (Sexton 29-35)

/ʃ ʃ d/ → /t a n/ / _ [dentals]
/
/
/
/
/
/
/
/
/
/

Provencal (Anglade 202-3)

In addition to assimilations originating in Vulgar Latin

Provencal shows the following:

ns > as  pessar < pensar  essens < initul+a
nf > nf  effar < enfam  effern < onfer
m + n / _ h. domina > donna  fessu > fonna

N

t + 1 / _ l. matu lavar > manlever > mallever

d

nolus > nolle

rotulus > rolle

Russian (Jones and Ward 200-201)

Russian has a rule of palatal assimilation which results in a number of fortuitous complete assimilations.

a. V - V / _ \{ V \}

b. t - t / _ \{ t \}

n - n / _ \{ n \}
c. \( c + d, / - \begin{align*}
& a \\
& e \\
& g \\
\end{align*} \)  
\( z + r, - \begin{align*}
& b \\
& g_e \\
& h \\
\end{align*} \)

Quoting Jones & Ward: "There is some individual variation in this matter and also some difference between the older and younger generations."

**Sanskrit (Macdonell 1544.)**

Some of the external sandhi rules of Sanskrit show fortuitous and/or combinatory complete consonantal assimilations.

A. The final voiceless consonants *p, t, ṭ, k*, and *h* must be voiced before voiced initials. Thus *p, t, ṭ, k* become *b, d, q, g* before voiced segments.

- e.g. *dik-ga jah* → *dīgajah* 'world elephant'
  - *mahā-nāśah* → *mahā-nāśah* 'a large box'

B. *g* → *g*

\[ g + n \rightarrow \begin{align*}
& g \\
& p \\
& k \\
& m \\
\end{align*} \]

(note: all final *g, d, j* and *b* come from *k, ṭ, and ṭ* through rule A.)

- e.g. *jagad-nāśah* → *jagān-nāśah* 'lord of the world'

C. *s* → *l* / __ *l* (\(d\) comes from \(t\) via rule A)

- *tāl labdhaḥ* 'that is taken'

D. *s* → *l* / __ *l*

- *mahā lābhaḥ* → *mālā lābhaḥ* 'great profit'
E. a. \( t - [+\text{pal}] / - [-\text{pal}] \)
   \( \bullet \)
   b. \( t - [+\text{retroflex}] / - [-\text{retroflex}] \)
   Thus \( t - c, \bar{c} (a) \) or \( \bar{\bar{c}} (b) \). The voiced palatal and retroflex assimilated via rule A.

Telegu (Jagannath 280)

The plural marker in Telegu is -lu.

An assimilation of the final consonant of a noun stem (after final vowel loss) is assimilated to \( l \) of \( lu \) with the additional reflexion of the \( ll \) cluster.

e.g. ag. pl.

\[
\begin{array}{ll}
gu\bar{d}i & g\bar{u}lu \quad \text{‘temple(s)’} \\
g\bar{u}g\bar{u} & g\bar{u}lu \quad \text{‘nest(s)’} \\
g\bar{u}g\bar{u} & g\bar{u}lu \quad \text{‘clean shaved head(s)’} \\
\bar{\bar{a}}\bar{g}\bar{\bar{i}}lu & \bar{\bar{a}}\bar{g}\bar{\bar{i}}lu \quad \text{‘courtyard(s)’} \\
\bar{i}lu & \bar{i}lu \quad \text{‘house(s)’} \\
\bar{\bar{o}}\bar{\bar{o}}\bar{\bar{u}} & \bar{\bar{o}}\bar{\bar{o}}\bar{\bar{u}} \quad \text{‘mouth(s)’} \\
\bar{k}\bar{\bar{u}}u & \bar{\bar{k}}\bar{\bar{u}}u \quad \text{‘eye(s)’} \\
\end{array}
\]

(There is a rule deleting the first consonant of triconsonantal clusters.)

This involves a kind of combinatorial assimilation involving regressive assimilation of laterality and progressive assimilation of retroflexion. The development of \( ll \) from \( ml \) \( ll \) is evidently due to some restriction on non-retroflex geminate laterals.
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