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LINGUISTIC CHANGE

BY RULE GENERALIZATION AS ILLUSTRATED BY

PORTUGUESE NASALIZATION AND RADICAL VOWEL ALTERNATIONS

by

Paul McFetridge

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS

in the Department
of
Languages, Literatures and Linguistics

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August 1981

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Title of Thesis/Dissertation:

Linguistic Change by Rule Generalization
as Illustrated by Portuguese Nasalization
and Radical Vowel Alternations

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ABSTRACT

In the theory of phonology formulated by J. Foley, it is maintained that "phonological change is not caused by the addition of rules to a grammar, but by the repetition or modification of rules already existing in the language". (Foley, "The Latin origin of Romance rules"). It is maintained that linguistic change, change in processes operating in the language, occurs in three ways: generalization of application to include more elements, generalization of environment, and repetition of processes. This concept of linguistic change is applied to the analysis of two aspects of Portuguese phonology: nasalization and radical vowel alternations.

Chapter I presents a brief outline of the conception of linguistic change as generalization of rules which exist in the language. It is demonstrated that denial of the traditional synchronic/diachronic distinction permits analyses which simultaneously explain data traditionally classified as synchronic as well as the linguistic change from historically earlier stages of the language by reference to the same set of processes and principles.

In Chapter II, nasal diphthongs and the retention of preconsonantal nasals are examined. The latter is theoretically anomalous as it predicts that if intervocalic nasals efface preconsonantal nasals also efface. It is argued that their
retention is only apparent, the result of generalization of Latin vocalization which causes a glide to remain after nasal effacement. This glide either forms a nasal diphthong with the preceding vowel or consonantalizes before a stop. This is further related to the vocalization of ĭ̆ and the palatalization of s.

In Chapter 3, the radical vowel alternations of the Portuguese verb are examined. Analyses by Williams and Harris, which propose rules of assimilation, are considered, but rejected: the former because it appeals to analogy, the latter because it uses morphologically sensitive and language particular rules. It is argued that the alternations are caused by the generalization of Latin contraction. The contraction of dissimilar vowels causes weakening of the radical vowel in proportion to the strength required for contraction. Evidence from Old Portuguese is adduced in support of this claim.

It is concluded that Portuguese rules are the result of continuing linguistic change generalizing Latin rules.
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I. Introduction

Writing in 1906, Meillet argued that linguistic change is neither an aberration nor a collection of arbitrary unrelated events, but a continuing coherent process. He maintained that explanation of this must refer to universal "timeless linguistic laws".

"Il y a ... une continuité dans l'évolution linguistique, et cette continuité révèle la constance des causes qui déterminent les modalités du changement.

Les changements linguistiques ne prennent leur sens que si l'on considère tout l'ensemble du développement dont ils font partie; un même changement a une signification absolument différente suivant le procès dont il relève, et il n'est jamais légitime d'essayer d'expliquer un détail en dehors de la considération du système général de la langue où il apparaît.

Des lors la nécessité s'impose de chercher à formuler les lois suivant lesquelles sont susceptibles de s'opérer les changements linguistiques. On déterminera aînai, non plus des lois historiques, telles que sont les <<lois phonétiques>> ou les formules analogiques qui emplissent les manuels actuels de linguistique, mais des lois générales qui ne valent par pour une seul moment du développement d'une langue, qui au contraire sont de tous les temps; qui ne sont pas limitées à une langue donnée, qui au contraire s'étendent également à toutes les langues. Et, qu'on le remarque, ce ne seront ni des lois physiologiques ni des lois psychiques, mais
Since de Saussure, it has been generally assumed that the study of linguistic change and the study of a particular synchronic stage on a language are separate fields of inquiry. Ontological and methodological priority has been placed on synchrony and diachrony has become the comparison of synchronic grammars. The result has not been genial to the perception of continuing trends in language, their explanation, nor the discovery of universal phonological processes. The synchronic/diachronic distinction legitimizes the analysis of a particular language as an isolated entity, unrelated to other languages or even to its historical precursor. As a result, rules formulated for a particular language are typically unattested in languages of the world. Moreover, there is no necessary reason why a particular language should share a common set of rules with its historical precursor.

Theoretical Phonology, the theory of phonology proposed by Professor J. Foley (1970, 1971, 1972, 1975, 1977, 1979), denies the synchronic/diachronic distinction maintaining that the processes and principles which explain alternations perceived in synchronic grammars are also those which explain historical developments. These processes are universal processes. They are, moreover, phonological processes, not "lois phonetiques". The

1Meillet (1965: pg. 11).
2See especially Foley (1977) for the arguments for the parameters used in this work.
elements on which they operate are therefore phonological elements, not phonetic elements.

The Inertial Development Principle (IDP), which governs the application of phonological processes on phonological elements, states that strong elements strengthen preferentially in strong environments and weak elements weaken preferentially in weak environments. It follows that the "primordial" rules are those which strengthen the strongest element in a strong environment or weaken the weakest element in a weak environment.

For example, a weakening process which ranges over the

\[
\begin{array}{c|c|c|c}
  k & t & p \\
  \hline
  1 & 2 & 3 \\
\end{array}
\]

begins in a language as

\[ k \rightarrow k^- \]

The IDP predicts that if a language has the rule

\[ p \rightarrow p^- \]

then it also has the rule

\[ p \rightarrow p^- \]

---

3 See Foley (1977: pg. 28).
4 The superscript '-' indicates a weakened element.
because $p$ is stronger than $t$. Therefore, it is predicted that if the primordial rule $k \rightarrow \theta$ generalizes, it will generalize first to include $t$ and later to $p$. It will never generalize to $p$ unless it has first generalized to $t$.

Theoretical Phonology explains the continuing trends of linguistic change perceived by Meillet as the coherent generalization of rules governed by the IDP. In general, strengthening processes generalize to apply to weaker elements and/or in weak environments; weakening processes generalize to apply to stronger elements and/or in strong environments.

As illustration of the difference between theories which maintain the synchronic/diachronic distinction and Theoretical Phonology, a simple example from Greek is considered. Koutsoudas (1962) in attempting to account for alternations such as [grafo] 'I write' and [grapso] 'I will be writing', posits the underlying stem *graf- and the rule

This prediction holds only for those languages in which the Alpha parameter is manifested as above. The Romance languages are examples of such languages. In languages such as German and English, the Alpha parameter is manifested as

In these languages, it is predicted that the primordial rule will not generalize to include $t$ unless it first generalizes to include $p$. See Foley (1977: pp. 48-52) for further discussion.
A similar analysis of the Ancient Greek alternation of [gra(p,h)o] and [grapso] would reveal the underlying stem *gra(p,h)- and the rule:

\[ (p,h) \rightarrow p/\_C \]

The historical change of [gra(p,h)o] > [grapso] is:

\[ (p,h) \rightarrow f \]

This rule never appears in the synchronic grammar of Modern Greek. It must consequently be concluded that it has been "morphologized". Thus, the synchronic/diachronic distinction necessitates postulating two different underlying stems, a "morphologized" diachronic rule, and two unrelated synchronic rules.

The Theoretical solution maintains that the underlying stem is *gra(p,h)- in both languages. The Ancient Greek forms are derived as:

\[
\begin{align*}
\text{gra(p,h)o} & \quad \text{grapso} \\
\quad & \quad (p,h) \rightarrow p/\_C
\end{align*}
\]

The Modern Greek forms are derived as:

6The symbol (p,h) indicates the aspirated labial stop.
This process is interpreted as the compression of diphthongs and is represented as

\[(\Gamma, \lambda)^1 \rightarrow (\Gamma, \lambda)^2\]

which ranges over the Gamma parameter.

The Modern Greek rule \( (p, h) \rightarrow f \) is a manifestation of a general process also represented by the following:

\[(t, h) \rightarrow \theta \ [t, h \gamma a] > [\theta u r a] \]
\[(k, h) \rightarrow \chi \ [e(k, h) o] > [e x o] \]

The crucial difference between Ancient Greek and Modern Greek is

---

Foley (1977: pg. 41).
the application of this process in Ancient Greek to diphthongs containing w but to diphthongs containing h in Modern Greek. As represented by the Alpha parameter, w is stronger than h:

\[
\begin{array}{c|ccc}
 & h & y & w \\ \hline
1 & 2 & 3 \\
\end{array}
\]

The process is reformulated as

\[(C,Cn)^1 \rightarrow (C,Cn)^2\]

Universal Condition: n\rightarrow A

Parochial Conditions: A=3 for Ancient Greek
A=1 for Modern Greek

In consonance with the IDP, this process applies preferentially to diphthongs containing the strongest glide. Represented in this manner, it is evident that the rule \((p,h)\rightarrow f\) is not an arbitrary addition to the grammar of Modern Greek but the result of generalization of a rule already in the language. In Ancient Greek, it applies to diphthongs containing the strongest glide. In Modern Greek, it has generalized to apply to diphthongs containing weaker glides.

Whereas Koutsoudas' solution accounted for only an alternation in Modern Greek and used a rule unrelated to that in Ancient Greek, the Theoretical solution explains a constellation of facts: the alternations of Modern Greek and Ancient Greek, and the change from Ancient Greek to Modern Greek. It represents linguistic change as coherent and non-arbitrary, as the
generalization of a rule in the direction predicted by the IDP.

The rules used in this solution are also found in other languages. The compression of diphthongs is found in Latin fero, Sanskrit bhara:mi, and in English father, Latin pater. The rule eliding the glide element of a diphthong before a consonant is found in Latin vectum < *ve(g,h)rum, first singular veho, cf. English wagon.

In the following chapters aspects of Portuguese nasalization and radical vowel alternations are analyzed.

Although these phenomena are traditionally thought to be peculiar to Portuguese, it is argued that they are, in fact, the result of generalization of Latin rules. It is maintained that more general and explanatory analyses are made available when it is recognized that these phenomena are the result of generalization of rules already existing in the language. To paraphrase Meillet, observed phonetic changes or alternations have meaning only when their place in a general system of processes is understood.

---

Buck (1933: pg. 121).
II. Nasalization

This chapter presents an analysis of two aspects of Portuguese nasalization: the formation of nasal diphthongs and the differential application of nasal effacement. It is argued that these seemingly disparate phenomena are in fact manifestations of the same process.

It is apparently a fact about languages of the world that nasal effacement applies preferentially to syllable final nasals\(^1\). For example, syllable final \(m\) effaces in French but intervocalic \(m\) does not: champ \([\textit{S}\#]\), ami. Theoretical Phonology explains this fact as the preferential effacement of elements in weak position over elements in strong position. Syllable final position is weaker than syllable initial position. Intervocalic elements are in syllable initial position. Consequently, effacement of nasals in syllable final position is expected before effacement in intervocalic (syllable initial) position\(^2\).

According to the IDP, the following rule configurations are allowed:

---

\(^1\)Cf. Foley (1977).
\(^2\)Foley (1977: pg. 60).
It is predicted by the IDP that the following rule configuration does not exist:

\[
\begin{align*}
n &\rightarrow \text{idem/\%} \\
n &\rightarrow \text{idem/\%}
\end{align*}
\]

for this configuration maintains that \(n\) is effaced in a strong position but not in a weak position.

In Portuguese, intervocalic nasals efface:

<table>
<thead>
<tr>
<th>LATIN</th>
<th>PORTUGUESE</th>
</tr>
</thead>
<tbody>
<tr>
<td>manum</td>
<td>mão</td>
</tr>
<tr>
<td>canem</td>
<td>cão</td>
</tr>
<tr>
<td>lanam</td>
<td>lá</td>
</tr>
</tbody>
</table>

However, preconsonantal nasals do not appear to efface:\(^3\):

- *pontem* \rightarrow *ponte* \[pont@\]
- *tantum* \rightarrow *tanto* \[tântu\]
- *dentem* \rightarrow *dente* \[dênt@\]

The rule configuration is

\(^3\)The symbol '@' is used throughout to designate schwa.
This rule configuration is the one which the theory predicts does not exist. It appears initially that this is a counterexample to the claims of the theory.

In response to this problem Foley writes:

"since intervocalic (heterosyllabic) nasal effacement implies preconsonantal (tautosyllabic) effacement, if nasal effacement occurs in manum > mño then it must also occur in centum > *sêntu. The phonetic nasal in cento [sêntu] therefore cannot be the original, but must represent posteffacement epenthesis".

For this explanation to be complete, an explanation of epenthesis is necessary. This is especially so as epenthesis normally occurs in consonant clusters: e.g. Latin simila:re, Portuguese sembrar (< semblar < *semlar).

As Meillet correctly noted, a phonetic change cannot be understood when viewed as an isolated phenomenon. To understand the insertion of a nasal between as nasal vowel and a stop, it is necessary to relate the development of nasals to that of other elements. In the following, the developments of Portuguese 1 and s are considered. The motivation for this procedure is their proximity on the Rho parameter.

---

where \( t \) represents stops, \( s \) sibilants, \( n \) nasals, and \( l \) liquids.

Proximal elements are expected to behave similarly.

In Portuguese, as well as other Western Romance languages, preconsonantal \( l \) vocalizes:

<table>
<thead>
<tr>
<th>LATIN</th>
<th>PORT.</th>
<th>SPANISH</th>
<th>FRENCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>alterum</td>
<td>outro</td>
<td>otro</td>
<td>autre</td>
</tr>
<tr>
<td>falce</td>
<td>fouce</td>
<td>hoz</td>
<td>faux</td>
</tr>
<tr>
<td>insulsum</td>
<td>ensoso</td>
<td>soso</td>
<td></td>
</tr>
<tr>
<td>palpa:re</td>
<td>poupar</td>
<td>popar</td>
<td></td>
</tr>
</tbody>
</table>

The rule initially appears to be

\[
1 \rightarrow \text{w/} \_ C
\]

Foley(1975) argues that this rule is derived from a rule applying in Latin. The evidence for this comes from the present tense of the Latin verb \( \text{veile} \):

\[
\begin{align*}
\text{volo:} & \quad \text{volumus} \\
\text{vi:s} & \quad \text{vultis} \\
\text{vult} & \quad \text{volunt}
\end{align*}
\]

In need of explanation are the raising of the vowel in \( \text{vult} \), \( \text{vultis} \), and the raising and lengthening of the vowel in \( \text{vi:s} \).

\[6\] The following data is taken from Boyd-Bowman(1954).
Foley argues that both are attributable to vocalization of $1$ and posits the rule\textsuperscript{7}

\[ 1 \rightarrow (1, y)/ + C \]

The character of the glide is apparently determined by the preceding vowel. After vocalization, the radical vowel assimilates to the epenthetic glide. The liquid onset of $(1, y)$ is lost before $s$; otherwise the glide element is elided. The length of the vowel is attributed to the subsequent contraction of $iy$. The derivations of $vis$ and $vult$ illustrate these rules:

| ve(l,y)+s | vo(l,w)+t | vocalization |
| ve(l,y)+s | vo(l,w)+t | assimilation |
| vi(l,y)+s | vu(l,w)+t | 1→0/ $s$ |
| vi:s     | vult     | (l,w)→1    |

The vocalization rule is reinterpreted as a strengthening process, followed by depotentiation of strengthened $1$ as a consonantal diphthong\textsuperscript{8}:

\[ 1 \rightarrow 1^+/ + C \]
\[ 1 \rightarrow (1, w) \]

In this manner it is possible to relate Latin vocalization of $1$ with English vocalization of $1$ between a consonant and a

\textsuperscript{7}The symbol $(1, y)$ indicates a segment with a liquid onset and glide offset.
\textsuperscript{8}The superscript '+' indicates a strengthened element.
non-syllabic element; e.g. bottle [baD@l]. Both are the result of strengthening; however in Latin the strengthened \( l \) depotentiates as a diphthong, whereas in English strengthened \( l \) depotentiates as [@1]:

\[
\begin{align*}
1^+ & \rightarrow (1,w) \text{ in Latin} \\
1^+ & \rightarrow @1 \text{ in English}
\end{align*}
\]

The Romance rule vocalizing \( l \) is the result of generalization of two rules. The first is the rule strengthening \( l \) before a morpheme boundary and a consonant. This rule generalizes in Romance so that the morpheme boundary is no longer required:

\[
1 \rightarrow 1^+/c \Rightarrow 1 \rightarrow 1^+/c
\]

Second, the rule eliding the liquid onset of the resulting diphthong is generalized so that the liquid is lost before stops as well as \( s \):

\[
(l,w) \rightarrow w/s \Rightarrow (l,w) \rightarrow w/c
\]

The relevant part of the derivation of Portuguese outro is:

\[
\begin{align*}
{altro} & \rightarrow 1^+/c \\
{al'tro} & \rightarrow (l,w) \\
{a(l,w)tro} & \rightarrow (l,w) \rightarrow w/c
\end{align*}
\]
In isolation, the vocalization of _ has no bearing on the problem of the retention of syllable final nasals. It is necessary to consider the behavior of preconsonantal _s_. In most Portuguese dialects, though in no other Romance language, _s_ palatalizes before consonants:

<table>
<thead>
<tr>
<th>LATIN</th>
<th>PORT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>vestir</td>
<td>vestir</td>
</tr>
<tr>
<td>escola</td>
<td>escola</td>
</tr>
<tr>
<td>ausculto</td>
<td>escuto</td>
</tr>
</tbody>
</table>

From the fact that intervocalic dental nasals efface, but intervocalic palatal nasals do not, it is concluded that palatal elements are stronger than their dental counterparts:

<table>
<thead>
<tr>
<th>LATIN</th>
<th>PORTUGUESE</th>
</tr>
</thead>
<tbody>
<tr>
<td>manum</td>
<td>mão</td>
</tr>
<tr>
<td>senio:rem</td>
<td>senhor</td>
</tr>
</tbody>
</table>

Therefore, the rule

\[ s \rightarrow \theta / C \]

describes a strengthening process:

---

9 The following data is from Williams (1962). According to Willis (1962: pg. 447), in the dialect of Sao Paulo, _s_ is not palatalized before consonants. The symbol ‘Ω’ is used throughout to designate schwa.
Finally, note that palatal $\underline{\mathbf{s}}$ is normally the reflex of $\underline{\mathbf{s}}y$:

Latin *russeum*, Portuguese *roxo* '[roʃu]$^{10}$ This suggests that the vocalization of $\underline{l}$ and the palatalization of $\underline{s}$ are the result of the same process: strengthening before consonants with depotentiation as a diphthong:

\[
\begin{align*}
\underline{s} & \rightarrow \underline{s}^+ / \underline{C} \\
\underline{s} & \rightarrow (s,y)
\end{align*}
\]

\[
\begin{align*}
\underline{l} & \rightarrow \underline{l}^+ / \underline{C} \\
\underline{l} & \rightarrow (l,w)
\end{align*}
\]

The different manifestations of these diphthongs are due to the generalization of the Latin rule eliding $\underline{l}$ before a consonant. The diphthong $(s,y)$ contracts to the palatal $\underline{s}$.

Compare the derivations of *vestir* and *outro*.

<table>
<thead>
<tr>
<th>vestir</th>
<th>altro</th>
</tr>
</thead>
<tbody>
<tr>
<td>ves'tir</td>
<td>al'tro</td>
</tr>
<tr>
<td>ve(s,y)</td>
<td>tro</td>
</tr>
</tbody>
</table>

The theory predicts that if a weak element strengthens, then all stronger elements strengthen in the same environment.

---

$^{10}$ See Foley (1977: Chap 6) who explains the palatization of assibilated reflexes as contraction of $\underline{sy}$.
Thus the rule configuration

\[
s \rightarrow s^+ / _C \\
n \rightarrow \text{idem} / _C
\]

violates the IDP, for nasals are stronger than s as represented on the Rho parameter:

<table>
<thead>
<tr>
<th>s</th>
<th>n</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Therefore, nasals must also strengthen before consonants:

\[
n \rightarrow n^+ / _C
\]

It is concluded that Portuguese includes a single process which strengthens consonants of a Rho value greater than or equal to 2 before other consonants:

\[
C \rightarrow C^+ / _C
\]

Universal Condition: \( r \Rightarrow n \)
Parochial Condition: \( n = 2 \) for Portuguese

Since both \( l \) and \( s \) depotentiate as consonantal diphthongs, \( n \) also depotentiates as a consonantal diphthong, \((n,y)\).

Additional evidence for the strengthening of \( n \) is found in the raising of the preceding vowel in, for example, Latin _dentem_, Portuguese _dente_ [dẽntẽ] not *[dẽntẽ*]. The normal development of stressed short \( e \) and \( o \) is Romance open \( e \) and \( o \) respectively: Latin _petram_, Portuguese _pedra_; Latin _fortem_,
Portuguese *forte*. However, when short *e* and *o* are followed by a tautosyllabic nasal they raise to closed *e* and *o* respectively.\(^1\)

The vocalization of the nasal provides an immediate explanation for the raising of these vowels. As is the case in the derivation of Latin *vult*, the preceding vowel assimilates to the following glide.\(^2\)

Brasington (1971), Almeida (1976) and Williams (1962) posit rules of progressive nasalization. This is especially evident in forms such as *muito* [m\(\text{W}+\text{tu}\)] from Latin *multum*. Brasington and Almeida argue for such a rule on the grounds that the glide element of a nasal diphthong is also nasal. It is maintained here that the phonetic nasal is the reflex of this nasalized glide. That is, the glide consonantalizes when followed by a stop. The derivation of *ponte* illustrates the vocalization of the nasal and the subsequent consonantalization of the nasalized glide.

\[\begin{array}{ll}
\text{ponte} & \text{nasal assimilation} \\
\text{p\(\text{\text{"o}}\)nte} & n\rightarrow n \\
p\(\text{\text{"o}}\)nte & n\rightarrow(n,y) \\
p\(\text{\text{"o}}\)nte & y\rightarrow w/o \_\_ \\
p\(\text{\text{"o}}\)nte & \text{assimilation} \\
p\(\text{\text{"o}}\)nte & n\rightarrow \emptyset/\_\_ \_ \\
p\(\text{\text{"o}}\)nte & \text{nasal assimilation} \\
p\(\text{\text{"o}}\)nte & \text{consonantalization} \\
p\(\text{\text{"o}}\)nte & \text{mt\rightarrow nt} \\
\end{array}\]

\(^1\) Williams (1962: pg. 32 and 37).

\(^2\) This is also the explanation given by Foley (1977: pp. 56-58) for the raising of vowels before nasals.
Evidence for this claim is found in forms such as tendes [təndəs] 'you (pl.) have'. From the Latin form tene:ti:s, it is evident that Portuguese tendes is not derived by syncope for the vowel which is to be elided is stressed. Rather, after nasal effacement and contraction of the vowels, the radical vowel, strengthened by nasalization, contraction and stress, diphthongizes. The nasal glide consonantalizes producing the phonetic nasal:

\[
\begin{array}{l|l}
\text{tənedəs} & \text{nasal assimilation} \\
\hline
\text{təndəs} & \text{n--->φ} \\
\text{tədəs} & \text{contraction} \\
\text{təydəs} & \text{diphthongization} \\
\text{təfədəs} & \text{nasalization} \\
\text{təndəs} & \text{consonantalization} \\
\end{array}
\]

Effacement of the nasal and contraction are also found in the traditional explanation of tendes. However, whereas the traditional solution claims that the phonetic nasal was inserted after contraction, the analysis presented here explains why it appears. A similar analysis seems available for forms such as muito which have a nasal consonant where none previously existed.

This analysis illustrates how recognition of historical developments provides solutions to theoretical problems. In particular, it is argued that the process of vocalization has.

---

13 Williams (1962: pg. 73).
generalized from application to only 1, as in Latin and early Romance, to application to 1, nasals, and s in Portuguese. After nasal effacement, the remaining glide nasalizes and consonantizes.

In contrast to the analysis of Brasington (1971) wherein it is sufficient to posit a rule which elides intervocalic nasals but not preconsonantal nasals, a rule configuration predicted by the IDP not to exist, the Theoretical analysis is forced to explain the anomalous retention of preconsonantal nasals. The result is a deeper analysis which reveals the coherent and continuing generalization of a Latin rule which by interaction with other rules produces the Portuguese phonetic nasals.

Although formulated to explain the apparent retention of preconsonantal nasals, this analysis also explains the formation of nasal diphthongs. The phenomena of nasal diphthongs is especially evident in the formation of the singular and plural nouns.

The following data is taken from Brasington (1971). It is representative of the dialect of Rio de Janeiro.
Brasington (1971) and St. Clair (1971) posit a stem final vowel which is elided after l, r, s, z, and n. This vowel is to account for alternations such as pais/paises and flor/flores. This underlying vowel is also present in the diphthongs formed in the plural forms such as caes and capitais. The derivations of these forms are:

<table>
<thead>
<tr>
<th>sao</th>
<th>[kaʊ]</th>
<th>dog</th>
</tr>
</thead>
<tbody>
<tr>
<td>caes</td>
<td>[kaɪ̞s]</td>
<td>dog</td>
</tr>
<tr>
<td>pao</td>
<td>[paʊ]</td>
<td>bread</td>
</tr>
<tr>
<td>paes</td>
<td>[paɪ̞s]</td>
<td>breads</td>
</tr>
<tr>
<td>capital</td>
<td>[kapitaw]</td>
<td>capital</td>
</tr>
<tr>
<td>capitais</td>
<td>[kapitay̞s]</td>
<td>capitals</td>
</tr>
<tr>
<td>pais</td>
<td>[paɪ̞s]</td>
<td>country</td>
</tr>
<tr>
<td>paises</td>
<td>[paizi̞s]</td>
<td>countries</td>
</tr>
<tr>
<td>la</td>
<td>[la]</td>
<td>wool</td>
</tr>
<tr>
<td>las</td>
<td>[laʃ]</td>
<td>wools</td>
</tr>
</tbody>
</table>

Brasington posits underlying final l, St. Clair underlying final e. The difference is immaterial as St. Clair also uses a rule which raises e to i when unstressed. Herein, the underlying vowel is taken to be e as this reflects the historical fact.
s or c, or the group t+i preceded by a vowel, it fell: so:lem > sol, ... venit > vem, ... amo:rem > amor, ... facit > faz ... If e was not the final letter, it did not fall, although it was preceded by l, n, r, s, and c, or the group t+i: so:les > sois, ... vic:es > vezes, ... amo:res > amores, ... canes > caes.16

The rule for the elision of stem final e is

\[ e \rightarrow \emptyset/VCr \]
\[ r \rightarrow 2 \]

where r refers to the Rho value of the preceding consonant.

The problem is now to determine how the diphthong in, for example, cae is formed. That the glide element is not that of caes, and that e elides after n indicates that the diphthong cannot be formed in the same manner as that of caes.

Brasington proposes the rule

\[ \emptyset \rightarrow w, y/a, e \_ n \]

That is, nasal vowels followed by a word final n diphthongize.

Williams17 appears to posit the same rule. However, this solution maintains that unstressed vowels diphthongize, for it is also used to explain the diphthongs of the third plural forms where the final vowel is unstressed: Cf. levam [levam], movem [møyam]. Since unstressed vowels do not normally diphthongize, diphthongization of final nasal vowels appears to be a

16 Williams (1962: pg. 47).
17 Williams (1962: pg 34)
Theoretically suspect solution. 

The form capital [kapitaw] indicates that the rule for the vocalization of _ also applies in word final position. Moreover, s palatalizes in word final position: Cf. pais [pai$], paizes [paizi$]. It is concluded that the process strengthening s and _ has further generalized in environment to include a final word boundary. Since s vocalizes in word final position, it is predicted by the IDP that _ also vocalizes in this position. The Portuguese process of vocalization is consequently:

\[
\begin{align*}
\text{Cr} & \rightarrow \text{C}' / _-X \\
\text{r} & \rightarrow 2 \\
X & = \text{C or } #
\end{align*}
\]

The glide element is apparently determined by the preceding vowel. In word final position, the nasal elides, producing a nasal diphthong. The derivations of cao and movem illustrate the vocalization of _:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>kane</td>
<td>moven</td>
<td>&quot;</td>
<td>e--&gt;Ø/VCr_#</td>
</tr>
<tr>
<td>kan</td>
<td></td>
<td>moven</td>
<td>nasal assimilation</td>
</tr>
<tr>
<td>kān</td>
<td>+</td>
<td>moven</td>
<td>n--&gt;n /_#</td>
</tr>
<tr>
<td>kā(n,y)</td>
<td>movè(n,y)</td>
<td>&quot;</td>
<td>n--&gt;t(n,y)</td>
</tr>
<tr>
<td>kā(w)</td>
<td>movè</td>
<td>&quot;</td>
<td>y--&gt;w/a</td>
</tr>
<tr>
<td>kāv</td>
<td>movèy</td>
<td>a--&gt;Ø/ _#</td>
<td></td>
</tr>
<tr>
<td>kēw</td>
<td>movèy</td>
<td>a,e--&gt;Ø/ _w,y</td>
<td></td>
</tr>
</tbody>
</table>

---

18 Note that the hypothesis that sufficiently strong nasal vowels diphthongize, which was used in the explanation of tendes < tene:tis, does not imply that unstressed vowels diphthongize.
This analysis does not claim that unstressed vowels diphthongize, a claim for which no independent evidence has been offered. Rather, it reveals nasal diphthongs to be the product of the same process which is responsible for the epenthetic nasals, the palatalization of s, and the vocalization of l.

The vocalization of nasals is not restricted to Portuguese. The effacement of a nasal in Polish also produces a nasal diphthong: Cf. kaski [kɔwskʲi] 'pieces', konski [kɔjskʲi] 'equine'. This is to be expected. Theoretical Phonology claims that there are no language particular processes.

Finally, this analysis reveals that the non-palatalization of s in Sao Paulo and the Brazilian dialects described by Hall(1943) and Feldman(1967) is not anomalous. It is the result of the failure of the Latin vocalization rule to generalize as extensively as it has in Rio de Janeiro and Portugal.

\[ C_r \rightarrow C^+ / X \]
\[ X = C \text{ or } \# \]
\[ r = 2 \text{ in Sao Paulo} \]
\[ r = 3 \text{ in Portugal and Rio de Janeiro} \]

In consonance with the IDP, this process applies to l and n, or l, n, and s, but does not apply to s unless it also applies to l.

---

20 Neither Hall nor Feldman explicitly state which dialect their are describing. From the little data which they provide (menos [menus] 'less') it can only be determined that palatalization does not apply to word-final s. It is assumed that it does not apply to preconsonantal s.
Summary

There are a constellation of facts which argue for the generalization of the Latin rule

\[ 1 \rightarrow l^+/\_+c \]

In previous analyses, these facts have been thought to be unrelated and consequently have been accounted for by a set of unrelated language particular rules. In the analysis offered here, it is argued that the following are all the result of the application of the same process:

1. The apparent retention of nasals before consonants;
2. The raising of vowels before nasals;
3. The formation of nasals diphthongs when word final nasals are effaced;
4. The vocalization of preconsonantal and word final liquids;
5. The palatalization of preconsonantal and word final liquids.

The process which is responsible for these phenomena is one which strengthens sufficiently strong consonants:

\[ Cr \rightarrow C^+/E \]

\[ r \rightarrow n \]
In Latin, this process is manifested as

\[ \text{Cr} \rightarrow C^+ / \_ + C \]

Universal Condition: \( r \rightarrow n \)
Parochial Condition: \( n = 4 \)

In Romance, this process has generalized so that the morpheme boundary is no longer required:

\[ \text{Cr} \rightarrow C^+ / \_ C \]

Universal Condition: \( r \rightarrow n \)
Parochial Condition: \( n = 4 \)

In Portuguese, the environment of this process has further generalized so that strengthening applies in word final position:

\[ \text{Cr} \rightarrow C^+ / \_ X \]

\( X = C \) or \( \# \)

This process has also generalized to apply to weaker elements. In some dialects, the process now applies to \( l \) and \( n \). In the majority of Portuguese dialects, it applies to \( l \), \( n \), and \( s \).

\[ \text{Cr} \rightarrow C^+ / \_ X \]

\( X = C \) or \( \# \)

Universal Condition: \( r \rightarrow n \)
Parochial Conditions: \( n = 3 \) in Sao Paulo
\( n = 2 \) in Rio de Janeiro and Portugal

The advantages of this analysis of nasalization over those of Brasington or Williams are:

1. It does not require rules which delete nasals only
2. It reveals the underlying regularity of disparate phenomena using rules which are manifested in other Romance languages, whereas the rules of Brasington and Williams are language particular;

3. It reveals these phenomena to be the result of a coherent linguistic change, the generalization of a Latin rule in a manner which is predicted by the theory, whereas the rules of Brasington and Williams bear no relation to those of Latin.
III. Radical Vowel Alternations in the Portuguese Verb

The Portuguese verbs exhibit alternations among e/i and o/u in the present tense. Previous analyses have all assumed that the process of assimilation is in part responsible for these alternations. In this chapter, two analyses which make this claim are examined. It is argued that neither can explain this phenomena in a Theoretically adequate manner nor reveal the relation between Portuguese and its historical precursors. As data, the singular forms in the present tense of the following verbs are considered:

<table>
<thead>
<tr>
<th>INDICATIVE</th>
<th>SUBJUNCTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>levar</td>
<td>to bring</td>
</tr>
<tr>
<td>levo</td>
<td>leve</td>
</tr>
<tr>
<td>levas</td>
<td>leves</td>
</tr>
<tr>
<td>leva</td>
<td>leve</td>
</tr>
<tr>
<td>tocá</td>
<td>to touch</td>
</tr>
<tr>
<td>toco</td>
<td>toque</td>
</tr>
<tr>
<td>tocás</td>
<td>toques</td>
</tr>
<tr>
<td>tocá</td>
<td>toque</td>
</tr>
</tbody>
</table>

The symbols & and o represent open e and o respectively. The symbols e and o represent closed e and o respectively.
As the data illustrates, in the present subjunctive and the first person singular present indicative the radical vowels "q" and "u" raise to "i" and "u" respectively in the third ("i-theme") conjugation, to "e" and "o" in the second ("e-theme") conjugation, but remain in the first ("a-theme") conjugation.

Williams\(^2\) proposes the following rules to explain the raising of the verb in the second and third conjugations:

\(^2\)Williams (1962). Atkinson (1954) also supports the analysis of Williams.
Although Williams maintains that these are assimilation rules, it is not clear why a final \( o \) should have a different effect depending on the "assimilating" vowel. However, from underlying *mov\( o \) and *serv\( o \), he apparently derives mov\( o \) and serv\( o \) as follows.

<table>
<thead>
<tr>
<th>mov( o )</th>
<th>serv( y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;</td>
<td>serv( y)</td>
</tr>
<tr>
<td>&quot;</td>
<td>serv( o )</td>
</tr>
<tr>
<td>mov( o )</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

These rules do not account for the subjunctive forms, which do not end in \( o \). Indeed, elsewhere Williams proposes the rule

\[
e, o \rightarrow \varphi, \varphi/_{C(C)}a\#
\]

Cf. me\( : tam \) > med\( a \), fo\( rma \) > forma. This rule incorrectly predicts the subjunctive forms.

Williams explains the subjunctive forms as a product of analogy. The vowels in the subjunctive raise by analogy with the first singular present indicative forms. He does not explain why vowels should rise by analogy with the first singular rather than remain open by analogy with the statistically more frequent...
second and third singular forms. In general, the ability to invoke analogy whenever convenient renders it vacuous as an explanatory concept. Scientific concepts are typified by the fact that they prohibit certain events from occurring. Analogy prohibits nothing. Indeed, it is frequently invoked, as in this case, when a prohibited event, the raising not lowering of the radical vowel in the subjunctive, is found to actually occur.

This inadequacy is especially evident in Williams' explanation for why the radical vowel in the first person singular in the first conjugation does not raise: E.g. levo, not *levo. Since these forms contain word final o, Williams' rule predicts that the vowel will raise. Williams claims that the vowel remained open by analogy with the second and third persons singular. He provides no reason why the radical vowel in the first person singular should remain by analogy with the second and third persons singular in the first conjugation but not in the other conjugations.

It is concluded that Williams' analysis is inadequate. It is forced to rely on the non-scientific concept of analogy and it uses rules which are inexplicably sensitive to morphological categories.
The analysis of Harris\(^5\) comprises an argument for the "Elsewhere Condition", a hypothesis about the ordering of rules in Transformational Phonology. Consequently, many of the details of his argument are not relevant to a theoretical consideration of this problem. Of concern is his plausible suggestion that the radical vowels assimilate to the theme vowel of the verb.

Harris proposes a rule by which the radical vowel assimilates to the height of the theme vowel when the theme vowel is followed by another vowel. He argues that the morphological structure of the verb is

\[
[[\text{root+theme}]+\text{mood+person}]_{SV}^V_B
\]

The theme vowel is always followed by another vowel in the subjunctive as, according to Harris, the subjunctive morpheme is e in the first conjugation and a in the second and third conjugation. Moreover, as the first singular morpheme is o in the present indicative these forms also meet the environment of his rule. The first singular forms of mover in the present indicative and present subjunctive are underlingly \([\text{mov+e}]+\theta+0\) and \([\text{mov+e}]+a+\theta\). The rule governing the alternations expands as

\[
\begin{align*}
\varepsilon, \varepsilon-e, o/ & \quad C(C)+e] +V]_{SV}^V_B \\
\varepsilon, \varepsilon-i, u/ & \quad C(C)+i] +V]_{SV}^V_B
\end{align*}
\]

\(^5\)Harris(1974).
Superficially, this appears to answer the questions posed by the data. There is no raising in the first conjugation because the assimilation rule only assimilates vowels to a following e or i. Vowels do not raise in second and third person singular forms in the present indicative because the theme vowel is not followed by another vowel in these forms.

There are, however, several problems with this solution, not the least of which is the fact that it uses particular rules, rules which are not found in any other Romance language. As a consequence, it is difficult to relate the alternations of Modern Portuguese with the rules of Latin. Rather, it must be maintained that the assimilation rules were added to the grammar of Portuguese, contrary to the claim of Theoretical Phonology.

This rule was not added to the grammar of Portuguese as it appears in Modern Portuguese. In Old Portuguese, the radical vowel in verbs with e-themes raises: sejo [se xu] < sedeo. This follows the rule of Harris. However, it does not raise until later in verbs with i-themes: Huber lists the following alternate Old Portuguese first singular forms of servir and dormir:

---

6 Huber (1933: pg. 51).
7 Huber (1933: pp. 201–202).
Although it is possible to argue that the rule generalized from Old Portuguese to Modern Portuguese, the problem of the lack of a source for the Old Portuguese rule remains. Moreover, the Old Portuguese data reveals that the radical vowel does not raise unless the theme vowel is lost. The analysis of Harris does not acknowledge this. There is, however, no evidence to deny it; that is, there is no form such as *sirvio which would confirm that the loss of the theme vowel is unrelated to the raising of the radical vowel. It will be argued later that this fact is crucial to understanding the Portuguese radical vowel alternations.

Finally, this assimilation rule must be restricted to verbs, which Harris in fact does, thereby limiting its ability to explain these alternations as a phonological phenomena. Notice for example that in Latin *terminum*, Old Portuguese *termio*, Modern Portuguese *termo* [termu] the radical vowel does not raise to i as predicted by Harris' assimilation rule, but rather to closed e. The restriction that this rule applies only
to verbs transforms into one describing morpheme alternates.

Though Harris' assimilation rule appears to answer the relevant questions about the behaviour of the radical vowels in verbs, it is nonetheless inadequate for it uses a rule which is unattested in any other language and makes incorrect predictions about nouns which contain the environment in which the rule should apply but does not.

The analysis presented here begins with two observations. First, as Harris correctly observes, the theme vowel plays a crucial role in determining whether and how far the radical vowel will raise. The Old Portuguese forms above appear to bear this out, for it is only when the theme vowel is lost that the radical vowel raises. This suggests that the process by which the theme vowel is lost plays an important role in the raising of the radical vowel. Second, in general vowel raising is a manifestation of a weakening process. The raising of open e and o to i and u is weakening on the Eta parameter, which is represented below as the vertical axis of the Eta/Omega parameter. 8

---

8 Foley (1977: pg. 47). Foley frequently represents the Eta/Omega parameter as

```
_ 1  e  u  o  a
| 1  2  3  4  5 |
```

arguing that a is stronger than all vowels (Cf. Latin amicam > French amie, but Latin amicum > French ami) and that the strengths of e and u are ambiguous relative to each other. The representation of Eta/Omega as a two dimensional matrix is used here because processes often range over only one of Eta or Omega. For example, in French a nasalized i strengthens to e.
To determine the relative strengths of open and closed e and o, the application of diphthongization in French, Spanish, and Portuguese open syllables is considered.

<table>
<thead>
<tr>
<th>LATIN</th>
<th>FRENCH</th>
<th>SPANISH</th>
<th>PORTUGUESE</th>
</tr>
</thead>
<tbody>
<tr>
<td>flo:rem</td>
<td>fleur</td>
<td>flor</td>
<td>flor</td>
</tr>
<tr>
<td>ho:ram</td>
<td>heur</td>
<td>hora</td>
<td>hora</td>
</tr>
<tr>
<td>famo:sum</td>
<td>fameux</td>
<td>famoso</td>
<td>famoso</td>
</tr>
<tr>
<td>tre:s</td>
<td>trois</td>
<td>tres</td>
<td>tres</td>
</tr>
<tr>
<td>me:nsem</td>
<td>mois</td>
<td>mes</td>
<td>mes</td>
</tr>
<tr>
<td>cre:dit</td>
<td>croit</td>
<td>cree</td>
<td>cre</td>
</tr>
</tbody>
</table>

(cont'd) (fin [fĩ])}, nasal e strengthens to a (tempus > temps [tũ]) (Pope(1934: pp. 171, 236, 240)). Each is a strengthening by 1 on the Eta parameter. In Latin medial a weakens to e in closed syllables (facio:, perfectus) and to i in open syllables (facio:, perficio:) indicating successive weakenings on the Eta parameter. The greater strength of a is represented on the two dimensional matrix as the highest Eta value. The ambiguity of e and u is represented by the equality of their combined Eta/Omega strengths (3).
Diphthongization applies preferentially to strong elements.

In Romance, it exhibits the following configurations:

**FRENCH**
- \( \varepsilon \rightarrow \varepsilon^u \rightarrow \varepsilon^u \rightarrow \varepsilon^o \)
- \( \varepsilon \rightarrow \varepsilon^i \)
- \( o \rightarrow o^u \rightarrow \varepsilon^o \)
- \( e \rightarrow e^i \rightarrow o^i (\rightarrow w^e \rightarrow w^u) \)

**SPANISH**
- \( \varepsilon \rightarrow \varepsilon^u \rightarrow \varepsilon^u \)
- \( \varepsilon \rightarrow \varepsilon^i \)
- \( e \rightarrow \text{idem} \)
- \( o \rightarrow \text{idem} \)

**PORTUGUESE**
- \( \varepsilon \rightarrow \text{idem} \)
- \( \varepsilon \rightarrow \text{idem} \)
- \( o \rightarrow \text{idem} \)
- \( e \rightarrow \text{idem} \)

As diphthongization applies preferentially to \( \varepsilon \) and \( o \), it is concluded that they are stronger than \( e \) and \( o \). This and the fact that \( e \) and \( o \) are stronger than \( i \) and \( u \) establishes that the following parameter:
From this parameter, it is evident that the raising of the radical vowel in the Portuguese verb is a manifestation of a weakening process. In particular, the alternations $e/e$ and $q/o$ represent a weakening of $l$; the alternations $e/i$ and $q/u$ a weakening of $2$. This appears initially anomalous for the radical vowels which raise are stressed, and stressed vowels do not typically weaken.

A similar phenomena is found in the Latin weakening of medial vowels. Examples of weakening of stressed vowels include:

- facio: perfectus
- teneo: attineo:
- legontor: leguntur

Traditionally, the weakening of stressed vowels is explained by positing an initial stress accent. After weakening of posttonic vowels, the stress is shifted to the penultimate syllable if it is long, else to the antepenultimate syllable.

---

9 The radical vowel raises in the second and third persons in the present subjunctive. In these forms it is not stressed.

Within Theoretical Phonology, the assumption of an initial stress is unnecessary. The theory maintains that

"morphological units such as words and syllables have a certain inherent, rather constant strength. The more phonological elements this strength must be distributed over, the weaker each phonological element."

The addition of an affix distributes the strength of the word over more elements. This strength attenuation is manifested as the weakening of the radical vowel. Thus, the derivation of attineo: contains the following stages:

attineo: strength attenuation
attineo: e → i

This analysis is not directly applicable to Portuguese where vowels weaken without the addition of elements to the word. It does however indicate that vowels may weaken even under stress.

As indicated above, this weakening is apparently related to the theme vowel. This relationship between radical and theme.

---

\[\text{Foley}(1977: \text{pg. 86})\]
vowels is not unusual. Foley\textsuperscript{12} explains the diphthongization in French \textit{tient} (Latin \textit{tenet}) but not in \textit{leve} (Latin \textit{levat}) as the result of strengthening of theme \textit{a} but not theme \textit{e} (in consonance with the IDP) with concommitant weakening of the radical vowel in \textit{leve} but not in \textit{tient} (in consonance with the principle of strength conservation\textsuperscript{13}). The weakening of the vowel in \textit{leve} blocks diphthongization:

\begin{center}
\begin{tabular}{ccc}
tenet & \textit{levat} & strength fluxion \\
itient & \textit{leva} & diphthongization \\
itent & \textit{leve} & \\
\end{tabular}
\end{center}

The influence of the theme vowel over the radical vowel in Portuguese appears to depend crucially on the loss of the theme vowel: Cf. Old Portuguese alternates \textit{servio}, \textit{sirvo}. Consequently it is necessary to consider the process responsible for the loss of the theme vowel.

The transformational analysis of the Portuguese verb by Harris\textsuperscript{14}(1974) contains a "truncation" rule

\textsuperscript{12}Foley\textsuperscript{1979: pg. 204}.\textsuperscript{13}Foley\textsuperscript{1979: pg. 198}. The principle of strength conservation is that alluded to above: Each word maintains a constant unit of strength. Consequently, the weakening of an element releases strength which may be used to strengthen other elements; the strengthening of an element removes strength from other elements. This flow of strength throughout the word is appeled "strength fluxion".
to account for the loss of the theme vowel in the present subjunctive and the first person present indicative.

<table>
<thead>
<tr>
<th>INDICATIVE</th>
<th>SUBJUNCTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>comprar</strong></td>
<td>'to buy'</td>
</tr>
<tr>
<td>compre</td>
<td>compremos</td>
</tr>
<tr>
<td>compran</td>
<td>compre</td>
</tr>
<tr>
<td>compras</td>
<td>compresas</td>
</tr>
<tr>
<td>compramos</td>
<td>compreis</td>
</tr>
<tr>
<td>compras</td>
<td>compre</td>
</tr>
<tr>
<td>compra</td>
<td>comprem</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>vender</strong></th>
<th>'to sell'</th>
</tr>
</thead>
<tbody>
<tr>
<td>vendo</td>
<td>vendemos</td>
</tr>
<tr>
<td>vendes</td>
<td>vendes</td>
</tr>
<tr>
<td>vende</td>
<td>vendem</td>
</tr>
<tr>
<td>vendas</td>
<td>vendas</td>
</tr>
<tr>
<td>vendamos</td>
<td>vendas</td>
</tr>
<tr>
<td>vendais</td>
<td>vendam</td>
</tr>
<tr>
<td>vendam</td>
<td>vendam</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>partir</strong></th>
<th>'to depart'</th>
</tr>
</thead>
<tbody>
<tr>
<td>parto</td>
<td>partimos</td>
</tr>
<tr>
<td>partes</td>
<td>partis</td>
</tr>
<tr>
<td>parte</td>
<td>partem</td>
</tr>
<tr>
<td>partamos</td>
<td>partas</td>
</tr>
<tr>
<td>partais</td>
<td>partam</td>
</tr>
</tbody>
</table>

Harris' rule deletes the final vowel of verb stem when it is followed by another vowel. The second vowel is either the first person singular morpheme o or the subjunctive morpheme, e in verbs with theme a, and e in verbs with theme e or i. For example,
Since a is stronger than e which is stronger than i, an elision of the sort which Harris proposes has the following expansion:

\[ i \rightarrow \emptyset/ \_ \_ V \\
\[ e \rightarrow \emptyset/ \_ \_ V \\
\[ a \rightarrow \emptyset/ \_ \_ V \]

Given only the synchronic data, no decision can be made about whether elision is the correct process, for all three vowels elide. To determine whether a process is correctly formulated, it is necessary to have first, the relative strengths of the participating elements \((X, Y)\), and second, a rule configuration of the form:

\[ X \rightarrow Z \]
\[ Y \rightarrow \text{idem} \]

If \( X \) is stronger than \( Y \) then the process is incorrectly formulated as it violates the IDP. To decide on this question, the behavior of the theme vowel in Latin and Old Portuguese is considered.

The analysis begins with the present indicative forms:
If elision is the correct interpretation then the only rule required is

\[ a \rightarrow \emptyset/\_+o \]

However, as \( a \) is the strongest vowel its elision implies (by the IDP)

\[ e \rightarrow \emptyset/\_+o \]
\[ i \rightarrow \emptyset/\_+o \]

As these rules are contradicted by the data, elision cannot be the correct interpretation.

The Theoretical interpretation is contraction. Foley (1977) formulates the process as

\[ V_n V_m \rightarrow V_0 \]

Universal Condition: \(|n-m| \leq D\)

Sufficiently similar vowels contract. Similarity is measured by combining the Eta and Omega strengths of the participating vowels. Herein, the relevant contraction process is Right to Left contraction; that is, the right-most element dominates. The process is formulated as

\[ \text{---------} \]

\[ \text{See page 36 above for the Eta and Omega parameters.} \]
The following parameter results from the addition of the Eta and Omega values of each vowel:

\[
\begin{array}{c}
\text{u} & \text{o} \\
\text{i} & \text{e} & \text{a} \\
2 & 3 & 4
\end{array}
\]

When the Eta/Omega strengths of the vowels are compared, it is evident that only those vowels with equal Eta/Omega strengths contract:

- a+o→o \quad |a-o|=0
- e+o→idem \quad |e-o|=1
- i+o→idem \quad |i-o|=2

The value of D for Latin is set at 0.

In Old Portuguese, both themes -a and -e are lost in the first person present indicative. Huber lists as examples:

- cantar 'to sing'
- canto 'I sing'
- cantas 'you (sg.) sing'
- vender 'to sell'
- vendo 'I sell'
- vendes 'you (sg.) sell'

\[15\text{Huber}(1933: \text{pg. 191-200}).\]
However, in the third conjugation the loss of the theme \( i \) does not occur until later. Huber\(^{16} \) lists the following first person singular alternates of \textit{servir} and \textit{dormir}:

\begin{itemize}
  \item servio
  \item servho
  \item sirvo
  \item dormio
  \item dormho
  \item durmo
\end{itemize}

Consequently, if elision is posited for Old Portuguese then, at the time at which \textit{servio} coincides with \textit{canto} and \textit{vendo}, the rule configuration is

\[
\begin{align*}
  a & \rightarrow \emptyset/\_+o \\
  e & \rightarrow \emptyset/\_+o \\
  i & \rightarrow \text{idem}/\_+o
\end{align*}
\]

This rule configuration violates the IDP, as it claims that \( i \), the weakest vowel, is maintained in an environment in which stronger vowels elide.

However, if the relevant process is contraction then the rule configuration is

---

\(^{16}\)Huber(1933: pp. 200-202).
This rule configuration is in consonance with the condition on contraction that only sufficiently similar elements contract. Moreover, it is evident that the loss of the theme e in Old Portuguese is the result of the generalization of contraction. That is, the linguistic change from Latin to Old Portuguese is caused by the rule:

\[ D=\emptyset \Rightarrow D=1 \]

Returning to Modern Portuguese, if contraction is the relevant process here then the rule configuration is:

\[
\begin{align*}
a+o & \rightarrow o & a-o & = \emptyset \\
e+o & \rightarrow o & e-o & = 1 \\
i+o & \rightarrow \text{idem} & i-o & = 2
\end{align*}
\]

As neither this configuration nor that of the "truncation" rule of Harris violate any of the principles of the theory there can be no choice between them, based on Modern Portuguese alone. However, if one wishes to relate the loss of the theme vowel in Modern Portuguese with the loss of the theme vowel in Old Portuguese and Latin then contraction must be selected as the relevant process. Whereas the elision analysis must maintain
that the contraction process of Latin and Old Portuguese was lost and replaced by a general elision rule, the analysis proposed here represents the loss of the theme vowels in Modern Portuguese as the result of a continuing, coherent generalization of contraction:

\[ D = 0 \implies D = 1 \implies D = 2 \]

It is now possible to explain the different manifestations of the radical vowel. Contraction is an endothermic process requiring strength. According to the principle of strength conservation, when an element strengthens, other elements in the word correspondingly weaken; when an element weakens, other elements in the word correspondingly strengthen. Foley utilizes this concept to explain the assimilation of \( d \) in French close from underlying *clauđeja (Latin clauđeam) but not in croie from underlying *credeja as the result of contraction of au in the former which utilizes the strength necessary for the contraction of dy to y. The remaining dy cluster is the etymon of s in close. The strength necessary for contraction is provided by the elision of the theme vowel e.

---

17Foley(1979: pg. 115).
18Foley(1979: pg. 202)
19The symbol 'S' is used to represent this unit of strength. The notation represents elision as the release of strength concomitant with the loss of an element, and contraction as the absorption of this strength.
The relative amount of strength required for contraction is determined by the difference between the relative strengths of the participating vowels. This difference corresponds to the relative weakening of the radical vowel on the parameter repeated here from page 38:

```
<table>
<thead>
<tr>
<th>u</th>
<th>o</th>
<th>q</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>e</td>
<td>ə</td>
</tr>
</tbody>
</table>
```

The following table illustrates the relation between contraction and the weakening of the radical vowel:

<table>
<thead>
<tr>
<th>CONTRACTION</th>
<th>STRENGTH REQUIRED</th>
<th>EXAMPLE</th>
<th>RADICAL VOWEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>a+o→o</td>
<td></td>
<td>levo</td>
<td>q→idem</td>
</tr>
<tr>
<td>e+o→o</td>
<td></td>
<td>rego</td>
<td>q→e</td>
</tr>
<tr>
<td>i+o→o</td>
<td></td>
<td>sirvo</td>
<td>q→i</td>
</tr>
</tbody>
</table>

48
The raising of the vowel is explained as a weakening concomitant with the contraction of dissimilar vowels. When vowels which differ by 1 contract, the radical vowel weakens by 1. When vowels which differ by 2 contract, the radical vowel weakens by 2.

The relationship between contraction and vowel weakening is illustrated in the derivations of levo, movo and sirvo.

Note that this analysis need not be restricted to verbs, but also applies to nouns such as limpo [limpu] < *lempu < limpidum (with regular lowering of Latin i to Romance e) and termo [termu] < termio < terminum:

The assimilation rule of Harris, which maintains that a vowel assimilates to the height of the following vowel if it is
termio. The analysis offered here, which maintains that the difference in the phonological strengths between contracting vowels determines the extent to which the preceding vowel weakens, makes the correct prediction. As the difference between i and u is 1, the preceding vowel weakens by 1.

If this relation is not spurious, then it should also be responsible for the weakening of the radical vowel in the subjunctive. As before, the analysis begins with a comparison of contraction in Latin, Old Portuguese, and Modern Portuguese.

In Latin, the subjunctive morpheme appears as a in verbs with e and i themes, but as e in verbs with a theme. Ignoring the first conjugation for the moment, the following forms bear out the prediction that only vowels whose phonological difference is 0 contract in Latin:

moneam first singular
monea:s second singular

audiam first singular
audia:s second singular

The rule configuration is

e+a→idem | e-a| = 1
i+a→idem | i-a| = 2
Huber lists Old Portuguese forms such as first singular subjunctive venda, and aduga with e-themes but first singular subjunctive servia, servha, and dormha with i-theme. The rule configuration is

\[
\begin{align*}
\text{e}+\text{a} & \rightarrow \text{a} & |\text{e-}a| = 1 \\
\text{i}+\text{a} & \rightarrow \text{idem} & |\text{i-}a| = 2
\end{align*}
\]

This follows the prediction that vowels which differ by no more than 1 contract in Old Portuguese.

In Modern Portuguese, the theme vowel is lost in verbs with both e and i themes. Note the first singular forms

- rega inf. reger
- mova inf. mover
- sirva inf. servir
- durma inf. dormir

The rule configuration is

\[
\begin{align*}
\text{e}+\text{a} & \rightarrow \text{a} & |\text{e-}a| = 1 \\
\text{i}+\text{a} & \rightarrow \text{a} & |\text{i-}a| = 2
\end{align*}
\]

The claim that contraction has generalized from Latin to Portuguese to allow contraction of increasingly dissimilar vowels is upheld. Moreover, the difference between the

\[20\text{Huber}(1933: \text{pp. 193, 201-202}).\]
contracting vowels corresponds to the degree of weakening of the radical vowels in the subjunctive. This is illustrated in the derivations of *rega* and *sirva*:

\[
\begin{array}{ccc}
\text{rega} & \text{sirva} \\
\text{r} & \text{sg} & \text{r} \\
\text{v} & \text{va} & \\
\text{a} & \text{i} & \\
\end{array}
\]

Returning to the first conjugation, it appears initially that the contraction of *ae* in Latin *amen* < *amaem* is a counterexample to the claim that only vowels which are equal in phonological strength contract in Latin. Moreover, from the contraction of *ae* in Portuguese *leve* < *levae*, it is predicted that the vowel should weaken by 1. Thus, *leve* appears to be a counterexample to the claim that weakening is caused by the contraction of dissimilar vowels.

Williams\(^{21}\) argues that contraction applies preferentially when the contracting vowel is more open than the dominant vowel. He interprets contraction as assimilation of the lower vowel to the higher, followed by contraction of identical vowels: e.g. *calentum* > *caente* > *queente* > *quente*, *veni:re* > *veir* > *vir*.

The advantages of this interpretation are three. First, preferential contraction of vowels of which the first is lower

\(^{21}\)Williams(1962: pp. 94–97).
(i.e. stronger) than the second explains why ae contracts in Latin amem < *amaem, but ea does not contract in Latin moneam. Second, whereas the IDP does not explicitly govern contraction, it does state that assimilation applies preferentially to similar elements. Consequently, by interpreting contraction as two stages beginning with assimilation, this process is brought under the domain of the IDP while simultaneously retaining the analysis of the loss of the theme vowel in Portuguese as the result of generalization of a Latin rule: The similarity requirement on assimilation has been relaxed. Finally, the assimilation analysis reveals in greater detail why the contraction of ea weakens the radical vowel by 1 in Portuguese, but the contraction of ae does not. The rule

\[ ea \rightarrow aa \rightarrow a \]

represents a strengthening of e by 1 on the Eta parameter.

According to the principle of strength conservation, the strengthening of e by 1 weakens the word by 1. This weakening is manifested by the weakening of the radical vowel by 1.

Similarly, the rule

\[ eo \rightarrow oo \rightarrow o \]

represents a strengthening of e by 1 on the Omega parameter, and

the rules

\[ \text{Foley(1977: pg. 143).} \]
io—>oo—>o  
ia—>aa—>a

represent a strengthening of i by 2. In each case the vowel is weakened accordingly. However, the rule

ae—>ee—>e

represents a weakening of a. Consequently, the contraction of ae to e does not remove strength from the word and the radical vowel does not weaken.

The process of Right to Left contraction is reformulated as

\[ V_n V_m \rightarrow V_m \]

Universal Condition: \( X < n - m < Y \)

The condition still stipulates that the difference between the relative strengths of the participating vowels must be sufficiently small. However, it is now possible to stipulate that the left vowel must be stronger than the right. The rule configuration for Latin is

<table>
<thead>
<tr>
<th>Rule</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>a+o—&gt;o</td>
<td>n−m=0</td>
</tr>
<tr>
<td>a+e—&gt;e</td>
<td>n−m=1</td>
</tr>
<tr>
<td>e+o—&gt;idem</td>
<td>n−m=−1</td>
</tr>
<tr>
<td>e+a—&gt;idem</td>
<td>n−m=−1</td>
</tr>
<tr>
<td>i+o—&gt;idem</td>
<td>n−m=−2</td>
</tr>
<tr>
<td>i+a—&gt;idem</td>
<td>n−m=−2</td>
</tr>
</tbody>
</table>

The complete Latin rule is
Universal Condition: \( X_n \rightarrow m \ Y \)
Parochial Condition: \( X = \emptyset \ Y = 1 \)

This permits the contraction of \( \text{ae} \), but not the contraction of \( \text{ea} \).

The linguistic change from Latin through Old Portuguese to Modern Portuguese is the change in \( X \):

\[
X = \emptyset \rightarrow X = -1 \rightarrow X = -2
\]

Note Portuguese \( \text{sair} < \text{sali:re} \) where though the vowels differ by 2, contraction does not apply because the first is stronger than the second by 2, not 1 as the condition stipulates.

It is concluded that the radical vowel alterations of the Portuguese verb are caused by the generalization of the Latin rule of Right to Left contraction. This generalization permits the contraction of increasingly dissimilar elements. The contraction of dissimilar elements removes strength from the word. This weakening is manifested by the weakening of the radical vowel.

Summary

It is argued that the raising of radical vowels is the product of a weakening process ranging over the parameter
This weakening is caused by the contraction of dissimilar vowels which remove strength from the word. The weakening of the word is manifested as the weakening of the radical vowel. The amount of strength required for contraction determines the degree of weakening of the radical vowel.

The advantages of this analysis are:

1. It does not use language particular rules, but rules which are found in Latin;
2. It reveals the vowel alternations as the product of a linguistic change, the generalization of the Latin contraction rule, whereas the rules of Williams and Harris cannot be related to those of Latin;
3. It explains rather than describes why the radical vowels do not weaken in the first conjugation where contraction does not use sufficient strength to cause vowel weakening;
4. It explains why the vowel in Old Portuguese forms such as servir does not weaken until the theme vowel is lost, whereas the analyses of Williams and Harris treat vowel raising and loss of the theme vowel as unrelated;
5. It does not require morphologically sensitive rules to restrict their application to verbs, but also explains the weakening of the vowel in nouns such as *termo* < *termio*. 
IV. Conclusion

Previous analyses of Portuguese nasalization and radical vowel alternations have represented these phenomena as the products of rules peculiar to Portuguese. This is, in many cases, a result of analysis of Modern Portuguese as an isolated entity. As a consequence, the rules postulated for Portuguese bear no relation to those found in Latin. This necessitates perception of linguistic change from Latin to Portuguese as the arbitrary addition of rules to the grammar of Portuguese. This perception of linguistic change fails to address the problem raised by Meillet, the continuity of linguistic change.

Theoretical Phonology maintains that linguistic change

"is not caused by the addition of rules to a grammar, but the repetition or modification of rules already existing in the language."

This claim follows directly from the claim that the rules of a particular language are instantiations of universal phonological processes. Moreover, it also follows from the Inertial Development Principle that the "modification" of rules is itself coherent. As the IDP predicts that no language contains a rule weakening a strong element unless it also weakens all weaker elements appearing in the same environment, or a rule

\[\text{Foley}(1975: \text{pg. } 54).\]
strengthening a weak element unless it also strengthens all
stronger elements appearing in the same environment, no rule
will generalize in a manner which will create such a situation.
Rather, a weakening process generalizes to include the next
strongest element; a strengthening process generalizes to
include the next weakest element.

By denying the synchronic/diachronic distinction,
Theoretical Phonology permits explanation of facts perceived in
the synchronic grammars of languages, as well as explanation of
the linguistic changes which produced the rules responsible for
these facts. Moreover, the analyses which result represent the
linguistic change as a continuing coherent generalization of
processes.

This is perhaps most evident in the case of the Latin rule
for the vocalization of \( _1 \):

\[
1^{+} \rightarrow 1^{+} / - + C \\
1^{+} \rightarrow (1, w)
\]

This rule is, in fact, an instantiation of a general process
strengthening consonants in a particular environment:

\[
C \rightarrow C^{+} / E
\]

This process is realized in Latin as the strengthening of the
strongest consonant when followed by a morpheme boundary and a
consonant. It is not the case that contiguity to a morpheme
boundary is a strong environment. Rather, the morpheme boundary serves as a catalyst, facilitating the application of all processes. The environment for this rule has generalized in Romance so that the morpheme boundary is no longer necessary:

\[ l \rightarrow l^+ / C \]

Cf. Latin alterum, Spanish otro, French autre, Portuguese outro.

In Portuguese, though in no other Romance language, the environment of this process has generalized further to include a word final boundary:

\[ C \rightarrow C^+ / X \]
\[ X = C \text{ or #} \]

Cf. capital [kapitaw].

Finally, the process of vocalization has generalized in Portuguese, though again not in any other Romance language, to include nasals and s:

\[ Cr \rightarrow C^+ / X \]
\[ X = C \text{ or #} \]
\[ r \geq 2 \]

This generalization has particular importance in the explanation of aspects of Portuguese nasalization.

Traditional analyses have postulated rules of spontaneous diphthongization to account for Portuguese nasal diphthongs.

\[ ^2 \text{Foley}(1971). \]
These rules are suspect because they apply to unstressed vowels, which typically do not diphthongize. The nasal diphthongs were explained here as the result of vocalization of the nasal. Subsequent to vocalization, the nasal effaces leaving a glide to form a diphthong with the preceding vowel.

Although it is recognized that nasalization typically applies when the nasal is tautosyllabic with the preceding vowel, the apparent failure of preconsonantal nasals to efface has not been previously perceived as a problem, perhaps because nor other theory claims that phonological rules used to explain phenomena of a particular language are universal. As Theoretical Phonology predicts that if intervocalic nasals efface then preconsonantal nasals efface also, their apparent retention presents a problem.

It is argued that the phonetic nasal is again the result of vocalization of the nasal. The nasal does in fact efface. However, the remaining glide consonantalizes when followed by a stop.

Whereas the analyses of Brasington, St. Clair, and Williams represent these two phenomena as unrelated, the Theoretical analysis reveals a single process which relates both nasal diphthongs and the apparent retention of nasals, as well the vocalization of l and the palatalization of s. Moreover, it represents these phenomena as the result of a continuing generalization of a Latin process.
It is possible to isolate four stages in the history of this process. The first is that of Latin wherein it applied to the strongest element to a restricted number of forms. The second is the Romance process wherein the environment has generalized to exclude the requirement of a morpheme boundary. The third is the process which applies in those Brazilian Portuguese dialects described by Hall (1943) and Feldman (1967) wherein the environment has generalized to include word final boundary and the process applies to weaker $n$ though not $s$. In the dialects of Rio de Janeiro and Portugal, the process has further generalized further to apply to $s$.

\[ Cr \rightarrow C^+ / X \]
\[ X = C \text{ or } \# \]

Universal Condition: \( r \rightarrow r \)
Panochial Conditions: \( r = 3 \) for Sao Paulo
\( n = 2 \) for Portugal and Rio de Janeiro

This is the manner of generalization which is predicted by the Inertial Development Principle.

Consideration of Portuguese nasalization illustrates two types of generalization: generalization of environment and generalization of rule. The third type of generalization is relaxation of the similarity requirement permitting assimilation and subsequent contraction of increasingly dissimilar vowels. The process of contraction is
\[ V_n V_m \rightarrow V_m \]

Universal Condition: \( X_n = m \)

Parochial Conditions: \( X = \emptyset \), \( Y = 1 \) for Latin
\( X = 1 \) for Old Portuguese
\( X = 2 \) for Modern Portuguese

As the parochial conditions indicate, this rule has generalized in continuing coherent manner.

As is the case in vocalization, the generalization of contraction has ramifications which are not superficially apparent. In the case of contraction, the contraction of increasing disparate vowels weakens the word accordingly. It is this strength attenuation which explains why the radical vowel raises only when contraction has occurred.

In Latin, where only phonologically identical vowels contract, the radical vowels are not weakened by contraction. In Old Portuguese, only identical vowels or those which differ by 1 contract. Correspondingly, the radical vowels in the second conjugation, where eo and ea contract, weaken by one unit of strength when contraction has applied: E.g. sejo [sežu] \(<\) sedejo. In Modern Portuguese, contraction applies to vowels which differ by no more than 2. Consequently, the radical vowels in the second conjugation weaken by 1 unit of strength and the vowels in the third conjugation weaken by 2 units of strength.

Whereas previous analyses have described Portuguese as an isolated entity, the analyses provided here explain the same set of data using rules which are manifested in other languages, and
in addition explain this data as the natural consequence of continuing linguistic change.


