A Theoretical Phonology

of

Old English

by

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A Theoretical Phonology of Old English

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Abstract

A tenet of *Theoretical Phonology* is that phonetic alternations are the consequence of the operation of a small set of universal phonological processes. A goal of linguistic research is to define these processes. A definition consists of a description of the process itself and of the conditions under which the process applies.

The phonology of Old English is examined in this light. A definition of a universal process of Apocope is given by considering its application in languages other than Old English. It is demonstrated that the traditional analysis of Apocope in Old English, that it is conditioned by 'syllable weight', contradicts the universal definition. It is proposed instead that Old English Apocope is evidence of an earlier stress system.

The reconstructed stress system is independently motivated by portions of Old English phonology. It solves a rule ordering paradox involving Gemination and Breaking. It permits an explanation of dialectal differences involving Vocalization which are inexplicable in other analyses. It is demonstrated further how Old English phonology is related to that of other Germanic languages by small variations in the stress system and rules conditioned by it.

I give a universal definition of Gemination, one which shows why Gemination in Old English is apparently conditioned by the same environment as Apocope and Syncope. The definition gives an account of why the same elements in both Italian and Old English fail to geminate. The definition is further justified by relating it to Holtzmann's Law in both Germanic and Bantu.

Finally, a definition of Syncope is given. This includes a demonstration that Syncope and Apocope are different processes, though they share similar environments. The definition of Syncope together with the account of stress provide a more comprehensive account of the facts of Old English than has been given to date. They give a natural explanation of what have been thought to be exceptions.

Acknowledgements

The intellectual debt which I owe Professor James Foley is apparent throughout this thesis.

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1. INTRODUCTION

A central tenet of *Theoretical Phonology* [Foley, 1977] is that phonetic alternations are the consequence of the operation of a small set of universal phonological processes. These processes are universal in the sense that they are not only found in all languages but also that the processes which comprise the phonology of a particular language will come from only this set. The claim, then, is that the phonologies of languages of the world are essentially identical, consisting of the same set of processes. Languages differ primarily in the conditions governing the application of each process, as well of course in the material to which the processes apply.

A goal of *Theoretical Phonology* is the isolation and definition of the members of the set of universal processes. Each definition consists of a description of the transformation effected by the process and the conditions which govern the application of the process. These conditions together with the general principles of the theory predict the conditions under which the process preferentially applies, in effect giving the form of the primordial rule which will first apply in the lauage, as well as predicting ways in which the process may generalize over time.

For example, Foley [1977: pg. 72] gives an analysis of Apocope which includes in part a condition on the number of preceding consonants.

universal rule: $V \rightarrow \emptyset \,/\, C^n \_\_ \#$
universal condition: $1 \leq n \leq m$

The prediction inherent in the definition is that when Apocope first applies in a language it will do so first only after a single consonant; it will fail to apply after more than one consonant. Later, it may generalize to apply after more than one consonant as the value of *m* increases.

Any language, and Old English is no exception, includes phenomena that appear to contradict the claim that the phonology of a language consists of all and only the set of universal processes. Each language seems to have a feature which is unique to it or its family. Obviously, if the claim of universality is to be maintained, these phenomena must be reanalysed.

The particular problem presented by Old English is that the focus of much of its phonology is on the number and 'weight' of the preceding syllables. Vowel elision rules, vocalization and the processes responsible for gemination are sensitive to the preceding syllable configuration.

Old English shares this focus with the Germanic languages and to a lesser extent with Latin, Ancient Greek and Sanskrit. Many of the phonological processes in these languages are apparently conditioned by the 'weight' of the preceding syllable.

This sensitivity to syllable configuration was apparently first noticed by Eduard Sievers who predicted which of u̯ and iu̯ appeared by the 'weight' of the preceding syllable. Sievers presented his law in Sievers [1878]. The law and interpretations of it are discussed in Collinge [1985: pp.

159–174]. Sievers predicted that yod simplex appeared if the preceding syllable was 'light'; if the preceding syllable was 'heavy' iu appeared. Sievers later extended the analysis to Gothic to explain the alternation between u and ī; cf. harjis *army* with yod and haírdeis *shepherd* with [ī]. The yod appears after 'light' syllables, [ī] after 'heavy'.

The environment also plays a role in West Germanic Consonant Gemination, which includes Old English gemination. For example, Old English fremman *perform* (Gothic framjan) shows geminate m after a 'light' syllable, but dēman, *judge* (Gothic dōmjan) show single m after a 'heavy' syllable.

An extension of the environment has also been argued to a conditioning factor in Old English vowel elision rules. For example, the nominative plural -u elides after 'heavy' syllables — word < *wordu *words* — but is retained after 'light' syllables — scipu *ships*.

Other processes from Old English, Germanic and Latin can be cited and will be addressed in subsequent chapters.

These phenomena present an intriguing problem for any theory, one which cannot be addressed by developing a notation which characterizes the environment. The crucial problem is determining why this environment should condition processes as disparate as vowel elision and gemination. One wishes to show that the environment not only distinguishes forms to which the process applies from those to which it does not, but that there is some theoretical connection between the environment and the transformation.

The problem posed by these phenomena is particularly acute for *Theoretical Phonology*. Obviously, processes such as vowel elision are not universally conditioned by the 'weight' of the preceding syllables, which questions the claim that a process can be given a universal definition. Furthermore, *Theoretical Phonology* claims that environments truly condition phonological processes rather than serve to merely distinguish forms to which a process applies from those to which it does not apply. This is clearly seen in the Inertial Development Principle which strengthening processes apply preferentially in strong environments, weakening process preferentially in weak environments (see [Foley, 1977: pp. 107–129]).That an environment such as 'weight of preceding syllable', which has no theoretical definition, should serve as the distinguishing environment for many disparate processes further questions the claim that a process can be defined in part by a set of conditions governing its application, conditions which are theoretically connected to the transformation.

The solution which I propose to this problem is to reanalyze both the processes and the environment. I will argue that the traditional environment is a relic of an older stress system. The phonological processes of Old English which are traditionally analysed as conditioned by syllable 'weight' can be reanalysed as conditioned by this older stress system.

The strategy of the argument is to begin in chapter 2 with a simple process, Apocope. I show that when Old English is ignored it is possible to give a universal definition of Apocope. I then show that Apocope is Old English agrees with this definition if one views the problem as one of reconstructing an earlier stress system, rather than connecting Apocope with syllable 'weight'. The older stress system can be viewed as an historical precursor to the stress system of extant Old English, namely word initial stress.

In chapter 3, I provide analyses of several Old English processes as conditioned by this reconstructed stress system. I show that the critical question of how very disparate processes are conditioned by the same environment receives a natural answer when they are interpreted as conditioned by stress. I show that a subtle dialectal difference between West Saxon and other Old English dialects can only be understood as differential application of a rule which is conditioned by the older stress system. I show also the differences among Germanic languages are best understood as differences among the rules which produce the older stress system and among rules which are sensitive to stress.

Finally, in chapter 4, I continue the analysis of vowel elision, this time examining Syncope. I give a universal definition of Syncope and show that the principles governing vowel elision which were developed in chapter II by considering vowel elision in languages other than Old English explain a class of 'exceptions' to Syncope which has never before been explained.

2. VOWEL ELISION 1: APOCOPE

2.1. Introduction

Traditional analyses of Old English vowel elision consistently interpret it as metrically conditioned. It stands as one of many IndoEuropean phenomena which are apparently conditioned by syllable weight, particularly the weight of preceding syllables.

The traditional analysis assumes that the final vowel is unstressed and that the weight of all preceding syllables condition its loss.

> "*u* and *i*, whether originally short, or due to Gmc. reduction of older long vowels ... were lost in Primitive OE, in final unaccented syllables after a long accented syllable, or a short accented syllable and another syllable. They remained after a short accented syllable, or a long accented syllable followed by a short syllable." [Campbell, 1962: §345]

The traditional description contrasts two environments. The first, in which Apocope applies, apparently consists of three subparts:

$$\left\{ \begin{matrix} \bar{V}C \\ VCC \\ \breve{V}CVC \end{matrix} \right\} \_\_$$

The second, in which Apocope fails, consists of two subparts:

$$\left\{ \begin{matrix} \_VC \\ \bar{V}CVC \end{matrix} \right\} \_\_$$

The critical problems include the apparent equivalence of $\underline{\bar{V}C} \equiv \underline{VCC}$ which are traditionally classed as 'heavy syllables', the functional unity of 'heavy syllables' and $\underline{\breve{V}CVC}$, the functional unity of 'light' syllables and $\underline{\bar{V}CVC}$, and the peculiar functional difference between $\underline{\breve{V}CVC}$ and $\underline{\bar{V}CVC}$ where the weight of the first syllable apparently determines whether the final vowel elides.

The loss of i is apparent in the Imperative Singular. The Germanic Imperative Singular was $\bar{\text{i}}$, which is orthographically represented in Gothic as ei. Final i was regularly shortened in Old English, and when retained lowered to e (cf. [Wright, 1914: §215]).

Old English	Gothic	
freme	framei	*perform*
nere	nasei	*save*
dēm	dōmei	*judge*
sēc	sōkei	*seek*

Apocope of u is apparent among neuter nouns. In these, the Nominative Plural is u. The declensions of hof *dwelling* and mǣden *maiden* show the plural u in the Nominative and Accusative.

Singular		
Nominative	hof	mǣden
Accusative	hof	mǣden
Genitive	hofes	mǣdnes
Dative	hofe	mǣdne

Plural		
Nominative	hofu	mǣdnu
Accusative	hofu	mǣdnu
Genitive	hofa	mǣdna
Dative	hofum	mǣdnum

Other examples are listed below. In **I**, the stem is monosyllabic and the first syllable is light. In **II**, the stem is disyllabic and the first syllable is heavy.

	Nom Sg	Nom Pl	
I	brim	brimu	*sea*
	broc	brocu	*affliction*
	broþ	broþu	*broth*
	ceaf	ceafu	*chaff*
	cliof	cliofu	*cliff*
	col	colu	*coal*
	dor	doru	*door*
	geoc	geocu	*yoke*
	god	godu	*god*
	hlid	hlidu	*lid*
	hof	hofu	*dwelling*
	hol	holu	*hole*
	lim	limu	*limb*
	loc	locu	*lock*
	lot	lotu	*deceit*
	scip	scipu	*ship*
	sol	solu	*mud*
	spor	sporu	*track*
	twig	twigu	*twig*

	Nom Sg	Nom Pl	
II	clīewen	clīewnu	*claw*
	hēafod	hēafdu	*head*
	mǣden	mǣdnu	*maiden*
	nīeten	nīetnu	*animal*

Contrasting with the data in **I** and **II**, which retain the plural morpheme, are those which either have heavy monosyllabic stems or have disyllabic stems whose first syllable is light. The paradigms of ār *brass*; word *word* and werod *troop* are examples of nouns which delete u when final.

Singular			
Nominative	ār	word	werod
Accusative	ār	word	werod
Genitive	āres	wordes	werodes
Dative	āre	worde	werode

Plural			
Nominative	ār	word	werod
Accusative	ār	word	werod
Genitive	āra	worda	weroda
Dative	ārum	wordum	werodum

More examples are listed below. Those in **III** have a stem which is heavy by virtue of containing a long vowel, analogous to ār. Those in **IV** have a heavy stem by virtue of being closed by one or more consonants, analogous to word. Those in **V**, like werod, have bisyllabic stems which have a light initial syllable.

III	Nom Sg	Nom Pl	
	ār	ār	*brass*
	bǣl	bǣl	*funeral pile*
	bān	bān	*bone*
	bēor	bēor	*beer*
	blōd	blōd	*blood*
	brēost	brēost	*breast*
	dēor	dēor	*wild animal*
	dūst	dūst	*dust*
	fām	fām	*foam*
	gēar	gēar	*year*
	hrēod	hrēod	*reed*
	hrīs	hrīs	*twig*
	hūs	hūs	*house*
	īs	īs	*ice*
	lām	lām	*clay*
	lēaf	lēaf	*leaf*
	lēan	lēan	*reward*
	lēoþ	lēoþ	*song*
	līc	līc	*body*
	līn	līn	*flax*
	mān	mān	*crime*
	mōd	mōd	*mind*
	nēat	nēat	*ox*
	nīþ	nīþ	*enmity*
	sār	sār	*pain*
	scēap	scēap	*sheep*
	tōl	tōl	*tool*
	wīf	wīf	*woman*

IV	Nom Sg	Nom Pl	
	bearn	bearn	*child*
	bold	bold	*dwelling*
	bord	bord	*board*
	corn	corn	*corn*
	fearn	fearn	*fern*
	feax	feax	*hair*
	fleax	fleax	*flax*
	folc	folc	*folk*
	gearn	gearn	*yarn*
	gield	gield	*payment*
	gold	gold	*gold*
	hord	hord	*treasure*
	horn	horn	*horn*
	hors	hors	*horse*
	land	land	*land*
	morþ	morþ	*murder*
	nest	nest	*nest*
	seax	seax	*knife*
	sweord	sweord	*sword*
	þing	þing	*thing*
	weorc	weorc	*work*
	weorþ	weorþ	*worth*
	word	word	*word*

V	Nom Sg	Nom Pl	
	gamen	gamen	*game*
	ofet	ofet	*fruit*
	reced	reced	*house*
	werod	werod	*troop*

The analysis of Campbell's cited above is an example of the philological analysis. Wright[1914] and Sievers[1968] give analyses which are identical. Innovation in the contemporary literature is has been on two fronts. One problem has been to show why the environments claimed for Apocope in the philological analysis are so united. An analysis such as that in Peinovich[1979] illustrates the nature of the problem.

Old English Apocope (Peinovich)

$$\begin{bmatrix} \text{-cons} \\ \text{+high} \end{bmatrix} \rightarrow \emptyset / C\,V \begin{Bmatrix} V \\ C \\ CV \end{Bmatrix} C_1 \_\_ \#$$

If the parenthesis notation has content, this rule seems to be a claim that V, C and CV are somehow equivalent. There is no *a priori* reason for expecting this, nor is there any theoretical reason justifying it.

The second front is the domain of the rule. The philological analysis interprets Apocope as a process separate from others of Old English. However, Syncope is conditioned by a similar envi-

ronment,[1] namely $\left\{ \begin{matrix} \bar{V}C \\ VCC \end{matrix} \right\}$ __. This is sufficient in Dresher[1978] to conclude that there must be a single vowel elision rule.

The process of extending the domain of the rule is continued in Kiparsky and O'Neil[1976]. They note the parallelism between the environments of Apocope, Syncope and Gemination, all of which are apparently conditioned by the weight of the preceding syllables.[2] They also note the problem of adequately representing 'syllable weight'. Their solution is a rule which assigns a feature [+strong] to a vowel or glide if it is preceded by a single consonant which is itself preceded by a short vowel.

[+strong] Assignment(Kiparsky and O'Neil)

$$[\text{-cons}] \rightarrow [\text{+strong}] \,/ \begin{bmatrix} \text{-cons} \\ \text{-long} \\ \text{-strong} \end{bmatrix} \left\{ \begin{matrix} [\text{-syll}] \\ + \end{matrix} \right\} \_\_$$

(left-to-right iterative)

This rule marks the final vowel of *hofu as [+strong] but does not so mark the final vowel of *wordu.

A second rule, ordered after [+strong] Assignment, deletes [-strong] vowels in the appropriate environments.

Vowel Deletion (Kiparsky and O'Neil[3])

$$\begin{bmatrix} \text{-cons} \\ \text{+high} \\ \text{-strong} \\ \text{-stress} \\ \text{<+syl>}_a \end{bmatrix} \rightarrow \emptyset \,/\, C \_\_ \left\{ \begin{matrix} \text{<C>} \\ \text{<\#>}_b \end{matrix} \quad \begin{bmatrix} V \\ \text{<-high>} \end{bmatrix} \right\}$$

Condition: If b, then a.

Thus, the final vowel of *hofu is retained because it is marked [+strong]; the final vowel of *word+u elides because it is marked [-strong].

The general strategy of Kiparsky and O'Neil is based on the observation that the environment in which Apocope fails (after light syllables) is easier to characterize than that in which Apocope applies. They have provided a rule, [+strong] Assignment, which refers to the simpler environment and then formulated a deletion rule which is sensitive to the value of the feature [±strong].

From the first analysis of Old English, it has been assumed that syllable weight was efficacious. The problem is to show how. The metrical phonological analysis is presented in Keyser and O'Neil [1985]. It is argued there that the traditional representation of the environment

$$\left\{ \begin{matrix} \bar{V}C \\ VCC \\ \breve{V}CVC \end{matrix} \right\} \_\_$$

---

1 See chapter 4 for an analysis of Syncope.

2 See chapter 3 for further elaboration and analysis of Gemination.

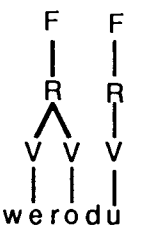
3 The condition restricts the rule to vowels when it applies word finally, but permits it to apply to glides as well as vowels when it applies word medially.

is inadequate because although the notation collapses diverse environments, it does not demonstrate an intrinsic similarity among them.

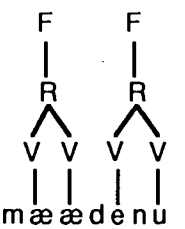
> "[S]ince all of the environments [in the traditional representation] trigger vowel deletion, it natural to suppose that there is something about those particular strings which is equivalent. A segmental representation of the strings ... does not provide insight into what this equivalence might be." (pg. 5)

Notice that the argument is directed against the notation. It is never doubted that the three environments are equivalent. The problem, according to Keyser and O'Neil, is to develop a notation which expresses the equivalence.

The notation used by Keyser and O'Neil is that of a tree which represents the rime structure of each string. A rime consists of the syllabic nucleus and the appendix of the syllable. Rimes are subsequently collected into feet. A foot is a binary node which is not right-branching. According to this algorithm, forms which lose the final vowel are assigned trees in which the final vowel follows a foot.



Those which do not lose the final vowel are assigned trees in which the final vowel does not follow a foot.



On the observation that the respective trees are different, Keyser and O'Neil claim that vowel elision is sensitive to rime structure. The final vowel deletes if it follows a foot.

Vowel Elision (Keyser and O'Neil)

$$V \rightarrow \emptyset \;/\; F\ [\_\_]_{R}$$

$$V_{[+high]}$$

This rule is also intended to account for instances of Syncope such as that in mǣdnu < *mǣdenu. The medial vowel e is deleted because it follows a foot.

Although Keyser and O'Neil claim progress over the traditional analyses, their analysis is not substantively different from the others. It differs from the others only in the notation in which it expresses the claim made by Campbell and cited at the beginning of this chapter, that Old English vowel elision is conditioned by the weight of the preceding syllables. For ease of reference it will consequently be subsumed with the other analyses under the rubric 'traditional analysis'.

2.2. Arguments for an Alternative Analysis

In this and subsequent chapters, an alternative analysis will be developed. I present here four arguments which motivate this alternative and which reveal the failure of the traditional analysis.

2.2.1. Universality

The traditional analysis of Old English vowel elision is parochial, it reveals nothing about vowel elision as it applies in languages of the world. It is a description only of vowel elision as it occurs in Old English and is a claim that it is conditioned by syllable weight.

Apocope applies in Portuguese in an environment which can be metrically described. When other factors are held constant, Apocope applies after a light syllable, but not after a heavy syllable, i.e. in an environment opposite to that of Old English. For example, Apocope applies in Latin male > mal *evil*, but not in Latin ille > êle *he*. In the former, the final vowel does not follow a foot, but Apocope fails. In the latter, the final vowel follows a foot, but Apocope applies.

The traditional analysis claims that the environment which distinguishes those words to which Apocope applies from those in which it fails may be characterized in terms of syllable weight. The question is whether this is the environment which *conditions* Apocope, whether it is a fact about

Language that Apocope is conditioned by a preceding heavy syllable, whether there is a causal connection between Apocope and a preceding heavy syllable. The Portuguese data, *prima facie*, argues that Apocope is not conditioned by syllable weight.

The parochial character of the metrical analysis is not fatal to transformational phonological analyses, since it is the cognitive elements represented by the notation which are claimed to be universal. There is no expectation that the analysis of one language should be relevant to any other, except insofar as it provides evidence for a notation which can be used to describe other languages.

In contrast, a central claim of Theoretical Phonology is that Language is comprised of a finite set of processes. These processes are delimitable and definable. Although superficial appearances may be chaotic, there are underlying principles which govern the application of these processes. The study of a particular language is an opportunity to discover and clarify these principles. The rules which comprise the analysis of one language should provide insight into phenomena in other languages. Indeed, as a methodological principle, parochial rules are evidence of failure. Further discussion of of universality as a methodological governor is in Foley[1985].

Since few if any languages are without vowel elision, the study of vowel elision in any lauage should shed light on its application in all other languages. That the traditional analysis makes no claims beyond Old English eliminates it from serious consideration as a claim about Language.

2.2.2. Comprehensiveness

No analysis is constructed with reference to all possible data. The relative values of competing analyses are measured against novel data. The argument for universality entails that a linguistic analysis should make predictions about the phenomenon which it purports to explain in other lauages. A weaker requirement is that an analysis should make correct predictions about the lauage for which it is proposed. The traditional analysis also fails this weaker requirement.

There are classes of words which apparently meet the conditions on vowel elision, as defined by the traditional analysis, but fail to undergo vowel elision. The data in I are examples of the preterite -ede in which Syncope anomalously fails, though the preceding syllable is heavy. The examples in II show that the medial vowel is normally retained when the preceding vowel is light. Those in III show that the medial vowel is normally elided when the preceding vowel is heavy.

	Infinitive	Preterite	
I	bīecnan	bīecnede	*make a sign*
	dīeglan	dīeglede	*conceal*
	frēfran	frēfrede	*comfort*
	hyngran	hyngrede	*hunger*
	symblan	symblede	*feast*
	timbran	timbrede	*build*
	wrixlan	wrixlede	*change*

II	Infinitive	Preterite	
	clynnan	clynede	*sound*
	cnyssan	cnysede	*knock*
	fremman	fremede	*perform*
	gremman	gremede	*anger*
	hlynnan	hlynede	*roar*
	hrissan	hrisede	*shake*
	sceþþan	sceþede	*injure*
	sweþþan	sweþede	*swathe*
	temman	temede	*tame*
	trymman	trymede	*strengthen*
	þennan	þenede	*stretch*
	wennan	wenede	*accustom*
	wreþþan	wreþede	*support*

III	Infinitive	Preterite	
	ærnan	ærnde	*gallop*
	byrgan	byrgde	*bury*
	bærnan	bærnde	*burn up*
	cemban	cembde	*comb*
	cennan	cende	*bring forth*
	cierran	cierde	*turn*
	clyppan	clypde	*embrace*
	cwielman	cwielmde	*kill*
	cyssan	cyste	*kiss*
	fiellan	fielde	*fell*
	fylgan	fylgde	*follow*
	fyllan	fylde	*fill*
	glengan	glengde	*adorn*
	hringan	hringde	*ring*
	hwierfan	hwierfte	*convert*
	lengan	lengde	*require*
	mengan	mengde	*mix*
	mierran	mierde	*mar*
	nemnan	nemde	*name*
	pyffan	pyfte	*puff*
	sengan	sengde	*singe*
	spillan	spilte	*spill*
	sprengan	sprengde	*burst*
	stillan	stilt	*still*
	tengan	tengde	*hasten*
	wemman	wemde	*defile*
	wiernan	wiernde	*refuse*

The forms in **I** are counter-examples to the claim that vowels elide after a 'heavy' syllable, or on Keyser and O'Neil's analysis, after a foot. Clearly, the medial vowels of both frēfrede and *arnede follow a 'heavy' syllable. Yet only the medial vowel of *arnede elides.

A second example is the analysis of Gemination. According to Keyser and O'Neil, the environment for Gemination includes the morphological class of the word and the foot structure of the word. They fail to address the failure of r to geminate although it also fails to geminate in Italian.

It is always possible to claim that these are 'exceptions'. But there is no particular reason for so doing, except that they do not conform to the rule. It will be demonstrated that these 'exceptions' are predicted from consideration of vowel elision in other languages. That is, they are not exceptions but predicted consequences from a general theory of vowel elision.

2.2.3. Linguistic Relevance

The problem posed by vowel elision is the apparent functional unity of distinct environments. A linguistic analysis should explain not only why these environments function similarly, perhaps by providing a notation which gives them the same representation, but also why they have that function at all. Why do they condition vowel elision? What is the relevance of the environment?

The focus of the modern versions of the traditional analysis has been on the functional unity of these environments, not on their efficacy. Whatever their success in representing the environment, they fail to show how this environment conditions vowel elision.

Kiparsky and O'Neil have proposed a rule which creates an environment which they claim is superior to listing the three environments in which Apocope applies. However, their attempt to demonstrate the efficacy of this environment by creating the feature [±strong] is subterfuge. Although Kiparsky and O'Neil use the words 'weak' and 'strong', they do not define them. These concepts must be defined within the theory before they can be used in an argument for an analysis, or proposed as a phonetic feature.

Kiparsky and O'Neil do not define the concepts nor provide for them a phonetic correlate. They do not describe what it is for a segment to be phonetically 'weak' or 'strong'. They do not correlate [±strong] with a manner or place of articulation. They do not attempt to motivate the feature by demonstrating its necessity in the analyses of phenomena in other languages. They use the words 'weak' and 'strong' connotatively rather than denotatively.

Kiparsky and O'Neil claim that their analysis

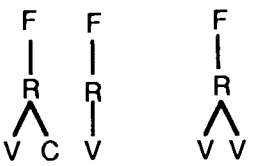
> "shows how it is that in disyllabic stems whose second syllables are light, deletion in the third depends on the quantity of the first, whereas a heavy second syllable causes deletion regardless of whether the first is heavy or light." (pg. 63)

But, because they have not defined what it is for a segment to be phonetically weak, because they have not demonstrated a causal connection between phonetic weakness and elision and because they have not demonstrated a causal connection between syllable weight and phonetic weakness, the claim that a heavy second syllable *causes* deletion and the claim that they have demonstrated the causal mechanism are premature.

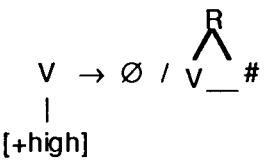
The metrical analysis claims progress by providing a notation by which the various environments in which Apocope applies can be represented by a single tree. However, Keyser and O'Neil do not demonstrate that these trees are efficacious.

That it is possible to write rules which refer to metrical trees is not in itself sufficient to demonstrate that they are relevant. If it is true that vowel elision is conditioned by a preceding foot, then given the trees in **a** and **b**[4] the theory should predict that if vowel elision applies to only one of the trees, it applies in **a** but not that in **b.**

a. **b.**



However, the theory makes no such prediction. A rule such as that below (long high vowels shorten when final) is as likely as that which they propose for Old English.



2.2.4. Coherence with other Processes

Apocope and the environment in which it putatively applies are not isolated phenomena in Old English. They are part of the fabric of Old English and of other Germanic languages. The environment has been claimed as the conditioning factor for many other processes in Germanic. It is argued in Kiparsky[1976] that an analysis of Old English vowel elision should relate it to West Germanic consonant gemination. Aspects of Vocalization in Old English are apparently distiuished by weight of the preceding syllable; for example, r vocalizes after a 'light' syllable but not after a 'heavy' syllable. The environment has been claimed as relevant to Sievers' Law governing the alternation ɣi~ī in Gothic: cf. harjis < *har+ɣ+is *army* with ɣi after a light syllable, but hairdeis < *haird+ɣ+is *shepherd*, with ī after a heavy syllable. Holtzmann's Law, which governs the lengthening and addition of a stop to a glide, applies only after a short vowel. A final example is that of deiotation in Old Norse, where yod elides when preceded by a 'heavy syllable, but not when preceded by a 'light syllable': cf. Old Norse niþjar, Gothic niþjōs *descendants*, but Old Norse hirþar, Gothic hairdjōs *shepherds.*

If these processes are truly related, an analysis of any of them should be able to highlight why they are apparently conditioned by the same or similar environments.

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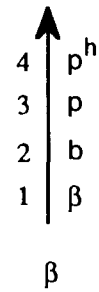
4 The tree in **a** corresponds to that assigned to word < *wordu; that in **b** to hofu.

2.3. Apocope as a Universal Process

The data from Old English cannot be understood in isolation. They must be considered as a manifestation of the application of a phonological process which also applies in other languages. Consequently, before presenting a Theoretical Phonological analysis of Old English Apocope, the process of Apocope as a universal process, a process which applies in other languages, is first considered.

The definition of a process has two parts. The first is a description of the process as a phonological rule. The second is a declaration of the conditions under which the process applies.

One of the more celebrated aspects of Theoretical Phonology is the specification of phonological distinctive features in the form of parameters over which phonological process range. The parameters together with the conditions on the application of process and the principles which govern those conditions determine which of a set of phonological elements a process will apply to and in what order. For example, given the β parameter [Foley, 1977]:



and the Inertial Development Principle — "strong elements strengthen first and most extensively and preferentially in strong environments, and ... weak elements weaken first and most extensively and preferentially in weak environments" [Foley, 1977: pg. 107] — a prediction may be made that processes which range over this parameter will apply to these elements either in the order (p,b,β) or in the order (β,b,p), but in no other order.

Unfortunately, the concept of parameter and universal process has often been misunderstood. The common attack on these notions has been a attempt to demonstrate that parameters are not universal.[5] The standard argument proceeds by claiming that a parameter ϕ predicts that a process will apply in the order (x,y,z) but in language X in applies in the order (z,y,x) contrary to the putative prediction. This sort of argument demonstrates a failure to understand the concept of 'universal' as it applies to parameters and processes, since it has been nowhere claimed that parameters are universal.

In feature theory, a phonetic feature defines a salient property of phonetic elements. The notion of 'salient' may be defined perceptually, acoustically, physiologically or phonologically. In

5 See, for example [Katamba, 1979]

Theoretical Phonology, a parameter defines a salient property of phonological elements. One such property is propensity to weaken or strengthen. This is established by consideration of the participation of phonological elements in weakening and strengthening processes. Other characteristics are internal structure, which is represented by the γ parameter, and relative resonance, which is represented by the ρ parameter. The exact set of phonological parameters is an empirical issue.

The definition of a phonological element is the conjunction of its values on each parameter of which it is a member. A phonological element is manifested in each language as a phonetic element; for example $\rho_1\alpha_1\beta_1$ appears in Spanish as [γ].

The question of 'universality' concerns the definition of phonological elements and the phonetic manifestation of these elements in particular languages. There are several possible hypotheses on the 'universality' of parameters and processes.

1. Parameters may be 'universal' with respect to language but 'parochial' with respect to process. Under this interpretation, each process is sensitive to a phonological characteristic to which no other is sensitive. There is, therefore, a one-to-one mapping of process to parameter. However, the phonetic manifestation of each parameter is identical among languages.
2. Parameters may be 'parochial' with respect to language and process. On this hypothesis, there is a one-to-one mapping between process and parameters and the phonetic manifestation of the parameters may differ among languages.
3. Parameters may be 'universal' with respect to process but 'parochial' with respect to language. On this hypothesis, a parameter may receive different phonetic manifestations among languages, but within a single language, all processes which focus on the phonological characteristic defined by a parameter do so consistently; the parameter does not vary from process to process within a language.
4. Parameters are 'universal' with respect to process and language.

The hypothesis of 4 is the ideal. If true, understanding gained from the analysis of clear cases in well-documented languages would easily translate to less well-understood languages. Unfortunately, the hypothesis that parameters are 'universal' is, *prima facie*, false. For example, it is argued in Foley[1977] that the α parameter, which defines propensity to strengthen and weaken, receives phonetic manifestations in Germanic different from that in Romance. If this is correct, then the hypotheses of 1 and 4 must be rejected.

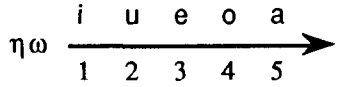
The working hypothesis of this dissertation is that of 3. This is also the hypothesis proposed by Foley:

"Though the phonetic manifestation of phonological elements may vary from lauage to language, it does not vary within any particular language" [Foley, 1977: pg. 49]

If true, then though parameters are not necessarily manifest identically among languages, they are not necessarily manifested diversely either, and, consequently, it may be assumed that unless conterexamples are discovered, evidence for the configuration of a parameter from one language may be used in another. Moreover, unlike the hypothesis of 2, consistency within a language permits independent motivation from within the same language.

2.3.1. Defining Apocope

The parameter over which Apocope ranges is the ηω which is defined in [Foley, 1977] with respect to Spanish Apocope, Latin Medial Vowel Weakening, French Nasalization and Greek Unstressed Vowel Reduction.



Apocope is a weakening process, one which elides phonological elements. By the Inertial Development Principle, it applies preferentially to weak elements as defined by the ηω parameter. This is incorporated into the definition of Apocope as:

Apocope
Universal Process: $V \rightarrow \varnothing / \_\_ \#$
Universal Condition: $|V|_{\eta\omega} \leq \Omega$

This serves as illustration of the definition of a universal phonological process. The universal rule states that the process elides vowels at the end of a word. The universal condition states the selection of the vowel is a function of its value on the ηω parameter. The notation $|\varepsilon|_{\varphi}$ is read as 'the value of the phonological element ε on the φ parameter'. Which vowels elide in any particular language is determined by the manifestation of the ηω parameter and the value of Ω. If in a particular language the ηω parameter is manifested as above, then by the Universal Inequality Condition, Apocope will expand in that language as any of the the following but as no others:

$i \rightarrow \varnothing / \_\_ \#$
$i,u \rightarrow \varnothing / \_\_ \#$
$i,u,e \rightarrow \varnothing / \_\_ \#$
$i,u,e,o \rightarrow \varnothing / \_\_ \#$
$i,u,e,o,a \rightarrow \varnothing / \_\_ \#$

The focus of this work is not on the parameter to which Apocope applies, but on the conditions on its applications. The value of a vowel on the ηω parameter is not the only universal condition governing the application of Apocope. There are also conditions on the environment in which it applies.

For example, Foley[1977] argues that a condition on Apocope — and vowel elision in general — is the number of preceding consonants. Vowel elision applies preferentially after one consonant and later after two.

Evidence is adduced from two sources.

One is the comparison of the application of Apocope in different languages. In Spanish, Apocope applies after one consonant (papel, *paper* < *papele; cf. pl. papeles) but not after two (arte, *art*). By way of contrast, Apocope applies in French after one consonant (papier) and after two (art).

This observation that vowel elision applies preferentially after one consonant is corroborated by Piro, an Arawakan language of Peru, where vowel elision applies medially before a morpheme boundary [Matteson, 1965]. When the possessive suffix ne is added to a noun or or the nominalizer]u is added to a verb, the environment for Syncope is created. The process applies when only one consonant precedes the stem final vowel, but fails when two consonants precede.

I	xipalu	*sweet potato*	nxipalne	*my sweet potato*
	čalu	*fish net*	nčalne	*my fish net*
	yimaka	*teach*	yimaklu	*teaching*
	kama	*to make*	kamlu	*handicraft*
II	kahli	*clay*	nkahline	*my clay*
	xinri	*palm tree*	nxinrine	*my palm tree*

The stem final vowel of xipalu is elided in nxipalne < *n+xipalu+ne where it is preceded by one consonant, but is retained in nxinrine < *n+xinri+ne where it is preceded by two consonants.

The second source of evidence is found in the morphophonology of particular languages. An example from Spanish is the failure of Assibilation in 1st Singular hago (Infinitive hacer *to make*) in contrast with Assibilation in venzo (Infinitive vencer *to conquer*). In venzo, the thematic vowel provides the environment for Assibilation. In each, the thematic vowel elides before the 1st singular o. To produce the correct results, it must elide before the application of Assibilation in hago, but after Assibilation in venzo. The correct forms can only be derived as:

hak+e+o	venk+e+o	
hako	"	$e \rightarrow \emptyset / C^1\_\_$
"	venseo	$k \rightarrow s / \_\_ e$
"	venso	$e \rightarrow \emptyset / C^2\_\_$
hago	venzo	Miscellaneous Rules

Both the cross linguistic data and required rule ordering from Spanish

$e \rightarrow \emptyset / C^1\_\_$

$e \rightarrow \emptyset / C^2\_\_$

are predicted by the definition of Apocope.

Apocope[6]

Universal Process: $V \rightarrow \emptyset / C \_\_ \#$

Universal Condition: $|V|_{\eta\omega} \leq \Omega$

$\Sigma|C| \leq T$

The Inertial Development Principle predicts that when a process begins application in a lauage, the conditions on its application are the severest. The condition $\Sigma|C| \leq T$ prohibits application of Apocope after two consonants ($T = 2$) unless it also applies after one consonant ($T = 1$). If only one of

1. $V \rightarrow \emptyset / C^1 \_\_$
2. $V \rightarrow \emptyset / C^2 \_\_$

applies in a particular language, it must be 1. The prediction is that no language will have 2 unless it also has 1. Furthermore, the Universal Inequality Condition predicts that the order of application must be 1/2, as in Spanish.

2.3.2. Portuguese

The number of preceding consonants is not the only condition on Apocope. In Portuguese, the condition is evident; Apocope applies after one consonant, but fails after two. However, Apocope in Portuguese is further limited, it fails after a single consonant if that consonant is a stop.

This may be illustrated with Portuguese noun morphology.

I	Singular	Plural	Stem	
	a dente	as dentes	dente	*tooth*
	a mesa	as mesas	mesa	*table*
	o livro	os livros	livro	*book*

A stem final e appears in the plural, but is deleted in the singular, where it is word final, if the preceding consonant is a sibilant or resonant (but not a stop) and is not itself preceded by a consonant [St. Clair, 1971]:

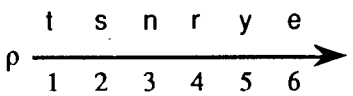
II	Singular	Plural	Stem	
	o canal	os canais	canale	*canal*
	o cão	cães	cane	*dog*
	o cruz	as cruzes	cruze	*cross*
	o favor	o favores	favore	*favour*
	o papel	os papéis	papele	*paper*
	o pão	os pães	pane	*bread*
	a parede	as paredes	parede	*wall*

6 The notation $\Sigma|X|$ is read as 'the quantity of X'.

The same restriction on Apocope is found historically [Williams, 1962]. After two consonants or a single stop, final e remains(III). After a single resonant or sibilant it elides(IV).

	Latin	Portuguese	
III	carnem	carne	*flesh, meat*
	dentem	dente	*tooth*
	dīxit	disse	*to say*
	ille	êle	*he*
	sitim	sede	*site*
	veritātem	verdade	*truth*
IV	amōrem	amor	*love*
	facit	faz	*he makes*
	fēcit	fêz	*he made*
	fīnem	fim	*limit*
	male	mal	*evil*
	mensem	mês	*mind*
	quaerit	quer	*he asks*
	sōlem	sol	*sun*
	venit	vem	*he comes*
	vicem	vez	*change*

The evidence from Portuguese indicates that the quantity of preceding consonants is not the only factor conditioning Apocope. Even if there is only one consonant, in Portuguese it cannot be a stop. This suggests that the environment of Apocope is sensitive to the ρ parameter, which specifies the relative resonancy of phonological elements:[7]



In particular, Apocope applies preferentially in a resonant environment, after elements of greater value on the ρ parameter. This condition is specified as $|C|_\rho \geq P$; i.e the ρ value of the preceding consonant must be greater than a value P specified for each language.

Apocope

Universal Process:	$V \rightarrow \emptyset / C \_\_ \#$
Universal Condition:	$\|V\|_{\eta\omega} \leq \Omega$
	$\Sigma\|C\| \leq T$
	$\|C\|_\rho \geq P$

For Portuguese, the value of T is 1 (permitting Apocope only after a single consonant) and the value of P is 2 (inhibiting Apocope after stops).

7 Using t for stops, s for sibilants, n for nasals, r for liquids, y for glides and e for vowels.

This condition in Portuguese is not limited to Apocope. The analysis finds support from Syncope. A medial i elides when preceded by a resonant (**V**), but not if preceded by a nonresonant (**VI**):

	Latin	Portuguese	
V	aliquod	algo	*some*
	amites	andas	*pole*
	animal	alma	*animal*
	domitum	dondo	*taming*
	ērigo	ergo	*erect*
	gallicum	galgo	*chicken*
	līmites	lindes	*path*
	manicam	manga	*glove*
VI	cubitum	covedo	*elbow*
	decimum	dízimo	*tenth*
	dēbitam	divida	*debt*
	lēgitimum	lídimo	*legitimate*

2.3.3. French

An embarrassment in the definition of Apocope is the interpretation of the conjunction of the conditions

$$\Sigma|C| \leq T$$
$$|C|_\rho \geq P$$

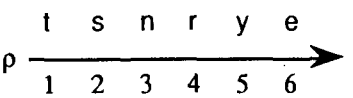
If $T = 2$, i.e. if Apocope applies after two consonants, what is the interpretation of $|C|_\rho \geq P$? Is the resonance of both consonants included in the calculation or only one, and if so which one? To settle this question, Apocope in other languages is considered.

In French, Apocope applies to all vowels but a after one and two consonants (**I**) [Fouché, 1969]. There are several classes of 'exceptions' many of which require explanation by rule ordering. However, some are clearly conditioned by the elements preceding the final vowel.. According to Fouché, the main groups are those in which the final vowel is preceded by a sequence of stop + liquid (**II**) and those in which the preceding combination has assibilated (**III**).[8]

8 There is another class which is not yet understood. These are a few forms in which the sequence [lm] precedes the final vowel, but the final vowel does not elide. Most are Germanic borrowings. The only Latinate form is ulmu > Old French oume *elm.*

	Latin	French	
I	calidu	chaud	*hot*
	canis	chien	*dog*
	carne	chair	*flesh*
	colapu	coup	*blow*
	diurnu	jour	*day*
	femina	femme	*woman*
	frigidu	froid	*cold*
	frūctu	fruit	*fruit*
	harpa	harpe	*harp*
	hēri	hier	*yesterday*
	laridu	lard	*bacon*
	mūla	mule	*mule*
	mūru	mur	*wall*
	ursu	ours	*bear*
	valle	val	*valley*
	via	voie	*way*
	viride	vert	*green*
II	duplu	double	*double*
	febre	fièvre	*fever*
	lepore	lièvre	*hare*
	matre	mère	*mere*
	patre	père	*father*
III	hordeu	orge	*barley*
	rubeu	rouge	*red*
	simiu	singe	*ape*
	somniu	songe	*dream*

The sequence stop+liquid may be characterized as one in which the ρ value of the first element is less than the ρ value of the second: $|t|_\rho = 1 < |r|_\rho = 4$.



The following tables demonstrate that this serves to distinguish the environments in which Apocope applies from those in which it does not apply. Using $\underline{\varepsilon}_i$ to represent the first element and $\underline{\varepsilon}_j$ to represent the second, the tables below show that Apocope applies when the difference between the ρ values of $\underline{\varepsilon}_i$ and $\underline{\varepsilon}_j$ is greater than or equal to 0.

	Latin	French	$\lvert\varepsilon_1\rvert - \lvert\varepsilon_j\rvert$
I	calidu	chaud	3
	canis	chien	3
	carne	chair	1
	colapu	coup	3
	diurnu	jour	1
	femina	femme	N/A
	frigidu	froid	0
	frūctu	fruit	0
	harpa	harpe	N/A
	hēri	hier	2
	laridu	lard	3
	mūla	mule	N/A
	mūru	mur	2
	ursu	ours	2
	valle	val	0
	via	voie	N/A
	viride	vert	3
II	duplu	double	−3
	febre	fiévre	−3
	lepore	lièvre	−3
	matre	mère	−3
	patre	père	−3

According to Fouché, the data in III, where Apocope fails, are distinguished from forms in which Apocope applies by Assibilation. He does not, however, give a reason why Assibilation should block Apocope. If instead the relative ρ values of the preceding elements are considered, it is apparent that the data in II and III are examples of the same phenomenon. In both, the difference between the relative ρ values of the preceding elements is less than 0.

	Latin	French	$\lvert\varepsilon_1\rvert - \lvert\varepsilon_j\rvert$
III	hordeu	orge	−5
	rubeu	rouge	−5
	simiu	singe	−3
	somniu	songe	−3

It is proposed that Apocope is conditioned by the relative ρ values of the preceding elements. This is illustrated in figure 1 below. The x-axis represents ε_i, the first element in the sequence preceding the final vowel. The y-axis represents the relative difference between the first and second elements preceding the final vowel. The combinations of elements after which Apocope applies (or is predicted to apply but for which there are no examples of application or non-application) are enclosed in the box.

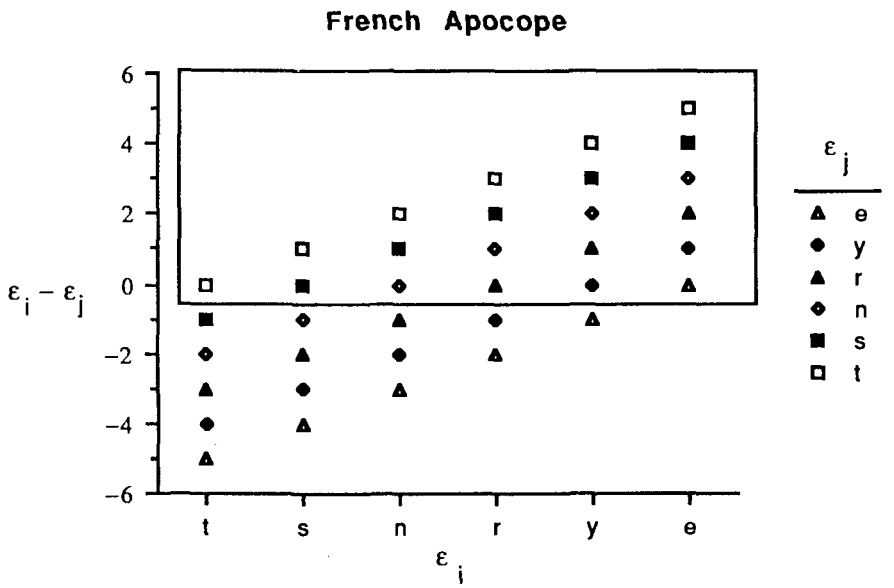


Figure 1

As Figure 1 illustrates, if the first element (ε_i) is a stop Apocope will apply only if the second element (ε_j) is a stop. If the first element is a sibilant Apocope will apply only if the second element is a stop or sibilant. And so on, until Apocope always succeeds if the first element is a vowel.

2.3.4. Romanian

In Romanian, Apocope reportedly applies in a wide variety of environments which apparently have no common properties. According to Nandris[1963] the environments are the number and type of preceding consonants, whether the final vowel forms a diphthong with a preceding vowel and if so whether the preceding vowel is stressed. The analysis that Apocope is conditioned by the relative ρ values of the preceding elements is able to demonstrate that these varied environments are derived from a single condition.

According to Nandris' analysis, a final u elides if preceded by a single consonant (**I**) or by two consonants (**II**). However, if it is preceded by two consonants, the last of which is r or l, Apocope fails (**III**). If the preceding element is a vowel other than i, the final vowel is retained (**IV**). If the preceding vowel is a stressed i, the final vowel is retained (**V**); if it is an unstressed i the final vowel elides (**VI**). According to Nandris,[9] the orthographic u in **VI** does not represent a phonetic element.

9 "D'après la nouvelle orthographe roum. cet *-u* n'est plus écrit." pg. 43.

	Latin	Romanian	
I	bonum	bon	*good*
	homō	um	*man*
	lupum	lup	*wolf*
	rogō	rog	*I ask*
II	calcō	calc	*I trample*
	calidu	cald	*cold*
	dominu	domn	*master*
	orbum	orb	*orphan*
	pāscō	pasc	*I feed*
	saccu	sac	*sack*
	ursum	urs	*bear*
III	acru	acru	*heap*
	ambulō	umblo	*I walk*
	nigrum	negru	*black*
	socru	socru	*mother-in-law*
	sufflō	sufflo	*I blow*
IV	bibō	beau	*I drink*
	granu	grâu	*grain*
	levō	iau	*I lift*
	novu	nou	*new*
	reu	râu	*defendant*
V	aurivu	auriu	*gold pigment*
	fīliu	fiu	*son*
	tardīvu	târziu	*slow*
	vivu	viu	*alive*
VI	calcaneu	calcâiu	*lime*
	cuneu	cuiu/cui	*wedge*
	malleu	maiu	*hammer*

The failure of Apocope in **IV** and **V** is related to the formation of a diphthong by two contiguous vowels, the first of which is stressed. Nandris refers to this process as Syneresis. The creation of a diphthong blocks Apocope from deleting the second vowel; Apocope applies to independent elements, not to those which form a composite element. Apocope fails in reu > râu because the vowels form a diphthong, but applies in cuneu > cui because Syneresis forms a diphthong with ûe not êu.

réu	cúneu	
"	cúeu	n → ∅
rêu	cûeu	Syneresis
"	cûe	Apocope

Two questions remain. Why does Apocope fail in **III**? Is the application of Apocope in **VI** predicted or counterdicted by the analysis of Apocope?

The failure in **III** falls within the domain of the condition formulated for French. When Apocope fails, the difference between the relative ρ values of the preceding elements is less than the difference between the ρ values of the preceding elements when Apocope applies. The condition correctly predicts that character of Apocope for both French and Romanian.

Latin	Romanian	$\lvert\varepsilon_i\rvert - \lvert\varepsilon_j\rvert$	Apocope?
bonum	bon	3	√
calcō	calc	3	√
dominu	domn	0	√
pāscō	pasc	1	√
saccu	sac	0	√
ursum	urs	2	√
acru	acru	−3	x
ambulō	umblo	−3	x
nigrum	negru	−3	x
socru	socru	−3	x
sufflō	sufflo	−3	x
calcaneu	calcâiu	0	√
cuneu	cuiu	0	√
malleu	maiu	0	√

The application of Apocope in **VI** is predicted by the same condition which predicts the failure of Apocope in **III**. Since Apocope applies in **II** where the difference between the ρ values of the preceding elements is at least 0 (dominu > domn and saccu > sac), the condition predicts that, when all else is equal, Apocope applies in Romanian whenever the difference between the ρ values of the preceding elements is 0.

2.4. The Resonancy Gradient

Comparison of languages such as Portuguese on the one hand and French and Romanian on the other uncovers two types of languages with respect to the application of Apocope. In one, Apocope is restricted to environments in which a single consonant precedes the vowel. This type of Apocope may be further conditioned by the ρ value of the preceding consonant: Apocope applies only if the preceding consonant is sufficiently large. In the other language type, Apocope applies after more than one consonant, but may be restricted by the difference between the ρ values of the preceding elements.

The latter condition assigns preferential status to an environment in which the ρ values of the preceding elements are decreasing. When the value of $|\varepsilon_i|_\rho - |\varepsilon_j|_\rho$ is greater than 0, the environment in which Apocope preferentially applies, the ρ value of the first element is greater than that of the second. The environment in which Apocope typically fails is that in which the ρ value of the first

element is less than that of the second. This relationship between ρ values will be called the 'resonancy gradient'.

Vowels which occur after a decreasing resonancy gradient are in a weak position. Vowels which occur after an increasing resonancy gradient are in a strong position. Thus, the final vowel of Latin patre > French père is in a strong position while the final vowel of carne > chair is in a weak position.

That languages must be assigned to one of two classes based on the application of Apocope is an undesirable feature of the analysis. The necessity of so classifying languages is suspicious since both types of Apocope are conditioned by the ρ values of the preceding elements. The various conditions on Apocope are a function of whether Apocope is also conditioned by the number of preceding consonants: the ρ value of the immediately preceding element conditions Apocope if Apocope applies only after one consonant; the *difference* in the ρ values of the preceding elements conditions Apocope if Apocope applies after more than one consonant.

In order to consolidate both types of Apocope, that which applies only after a single consonant is interpreted as a special case of the resonancy gradient, one in which the gradient is calculated over a single element. The resonancy gradient is calculated over the elements intervening between the final vowel and the preceding salient vowel. This connects the resonancy gradient with the condition governing the number of preceding consonants: $\Sigma|\varepsilon| \geq T$. When T is 1, only the ρ value of the immediately preceding element is considered. When T = 2, the resonancy gradient is calculated over the two preceding elements.

To incorporate this into the definition, the number of preceding elements is recorded as τ. This value is then used as an index for selecting elements in the calculation of the resonancy gradient. The elements intervening between the salient vowel and the final vowel are numbered left to right.

c	a	r	n	e		m	a	l	e
		1	2					1	

Given this indexing convention, it is possible to formulate Apocope as applying when the number of intervening elements (τ) is less than the limit set for the language (T), and when the difference between the values of the first intervening element (τ - 1) and the second (τ) is greater than the limit set for the language (Δ). By convention, the value of $|\varepsilon_0|_\rho - |\varepsilon_1|$ is equal to $|\varepsilon_1|$.

Apocope

Universal Process: $V_1 \rightarrow \varnothing / V_2 \varepsilon \_\_ \#$

Universal Condition: $|V_1|_{\eta\omega} \leq \Omega$

$\Sigma|\varepsilon| = \tau \leq T$

$|\varepsilon_{\tau-1}|_\rho - |\varepsilon_\tau|_\rho \geq \Delta$

To illustrate, in Portuguese the value of T is set at 1 — Only one consonant may intervene — and the value of Δ is set at 2 — Apocope fails when the preceding element is a stop. The final vowel of carne fails to elide because the number of intervening consonants is greater than 1. The final vowel of male elides because the number of intervening consonants is equal to 1 and the value of $|\varepsilon_{\tau-1}|_\rho - |\varepsilon_\tau|_\rho$ is $|\varepsilon_0|_\rho - |l|_\rho$ which is 4. However, the final vowel of parede fails to elide because although the number of intervening consonants is 1, the value of $|\varepsilon_{\tau-1}|_\rho - |\varepsilon_\tau|_\rho$ is $|\varepsilon_0|_\rho - |d|_\rho$ which is 1.

In contrast, in French the value of T is 2 and the value of Δ is 0. Thus, Apocope applies in carne > chair, because the value of $|\varepsilon_{\tau-1}|_\rho - |\varepsilon_\tau|_\rho$ is $|r|_\rho - |n|_\rho = 4 - 3 = 1$. However, it fails in *patre > père because the value of $|\varepsilon_{\tau-1}|_\rho - |\varepsilon_\tau|_\rho$ is $|t|_\rho - |r|_\rho = 1 - 4 = -3$.

Two issues have been left open in this definition. The data is so impoverished with respect to both that little constructive can be offered except to note them. First, the concept of 'salient vowel' was used without formal definition. It is suspected that frequently the salient vowel is the stressed vowel. This would allow vowels to intervene between the salient vowel and the final vowel, and so contribute to the resonancy gradient. This seems clear in French rouge < rubeu in which the resonancy gradient is calculated over be, the elements intervening between the stressed vowel and the final vowel.

The second issue concerns how the resonancy gradient is calculated when more than two elements intervene. As written, the definition predicts that the resonancy gradient is calculated over the the last two elements in a consonant cluster, implying that in a cluster of three consonants the element preceding the final vowel is irrelevant, and that a long vowel preceding a consonant cluster is irrelevant. The data surveyed to this point cannot settle this issue. However, evidence form Old English presented in Chapter IV suggests that the current interpretation is correct. The resonancy gradient is calculated over only the two preceding elements.

2.5. Old English Apocope

Although the traditional analysis of Apocope as it applies in Old English makes the correct predictions for Old English, it does not make the correct predictions for other languages. It may be argued that it makes no predictions at all, being simply a description of the facts of Old English. There is, however, a claim within the description, namely that syllable weight is a salient feature of Apocope. Investigations of other languages do not support this.

On the other hand, if the definition of Apocope developed in this chapter is truly universal, then it should apply to Old English. Yet, the definition does not make any reference to the weight of the previous syllable. On the contrary, it was argued that any effort to define Apocope as a process of Language which is conditioned by a heavy preceding syllable is doomed since the distiuishing syllable weight in Portuguese is opposite to that in Old English.

As the goal is to produce a universal definition of Apocope, it is assumed that the definition developed to this point is correct. It remains to develop an analysis of Old English Apocope which coheres with the definition of Apocope.

The required move has an honourable tradition in Germanic linguistics, beginning with Karl Verner who noticed that certain 'exceptions' to Grimm's Law could be explained only if one assumed that the relevant stress pattern was not Germanic, but Indo-European as revealed by Sanskrit and Ancient Greek.

2.5.1. Stress and Apocope

The definition of Apocope was proposed without making explicit an assumption obvious enough that it is uncontroversial: Apocope — and vowel elision, in general — applies preferentially to unstressed vowels. For example, evidence from Portuguese has been adduced to demonstrate that i elides when preceded by an element which is sufficiently resonant. In each case, the vowel which elided was unstressed. A stressed i in the same environment does not elide. Examples of both stressed and unstressed i in environments which are otherwise (nearly) identical are found in Latin dominicum > Portuguese domingo, *master*. The first i follows a nasal, is stressed and is retained, the second follows a nasal, is unstressed and elides.

That Apocope applies preferentially to unstressed vowels is predicted from the higher order condition that it applies preferentially to weak vowels. One consequence of this condition is that Apocope applies preferentially to vowels of lower value on the ηω parameter. To express the second consequence — that Apocope applies preferentially to unstressed vowels — a new parameter σ is introduced.

$$\sigma \quad \overset{\varepsilon \quad \acute{\varepsilon}}{\underset{1 \quad 2}{\longrightarrow}}$$

This parameter expresses the relationship between stress and strength; stressed elements are stronger than unstressed elements.

The σ parameter is salient to other processes than Apocope. A condition on Diphthongization is that it applies preferentially to stressed vowels. In Italian, stressed ɛ diphthongized to ie in open syllables (I), but unstressed ɛ does not (II) [Meyer-Lübke, 1979].

	Latin	Italian	
I	décem	dieci	*ten*
	péde	piede	*foot*
	vétu	vieto	*old*
II	decémber	dicembre	*December*
	fenéstra	finestra	*window*
	medúlla	midollo	*bone marrow*
	nepóte	nipote	*nephew*

A definition of Diphthongization must include in the conditions governing its application the condition that it apply preferentially to stressed vowels. This condition refers to the σ parameter, so that a minimal definition of diphthongization is:

Diphthongization

Universal Process: $V_i \rightarrow V_iV_j$

Universal Condition: $|V_i|_\sigma \geq \Sigma$

To accommodate this insight, the definition of Apocope is revised as:

Apocope

Universal Process: $V_1 \rightarrow \emptyset / V_2\, \varepsilon \_\_ \#$

Universal Condition: $|V_1|_{\eta\omega} \leq \Omega$

$|V_1|_\sigma \leq \Sigma$

$\Sigma|\varepsilon| = \tau \leq T$

$|\varepsilon_{\tau-1}|_\rho - |\varepsilon_\tau|_\rho \geq \Delta$

The first two clauses of the Universal Conditions govern the relative strength of the vowel. It is weak relative to other vowels and it is weak with respect to stress. The last clauses govern the environment in which Apocope applies.

This definition does not preclude the elision of unstressed elements. It has been argued [Halle and Vergnaud, 1987] that stressed vowels elide in Russian with subsequent shift of stress to the initial vowel. They cite the singular forms of zajom *loan*, wherein the vowel o elides when medial, as evidence.

zajóm	nom./acc.
zájma	gen.
zájmu	dat.
zájme	prep.

The definition predicts that if stressed vowels elide in a particular language then, *ceteris paribus*, so too do unstressed vowels. This a testable claim; it can be falsified by a language in which stressed vowels elide under conditions in which unstressed vowels are retained.

2.5.2. Stress and Old English Apocope

It may not seem at first that stress is relevant to Old English Apocope. The handbooks agree that Germanic stress was word initial. Consequently, stress will not distinguish between final vow-

els which elide and those which do not. However, as Verner demonstrated, the key to understanding Germanic is to accept that Germanic stress is an innovation, a relatively new phenomenon. The consequence of Verner's insight is that it is always necessary to distinguish among processes which apply before the Germanic Stress Shift to initial stress and those which apply after the shift.

Given Verner's insight, it is possible to turn the problem of Old English Apocope around. Rather than formulate a language specific Apocope rule for Old English, it is assumed as an hypothesis that Old English Apocope is no different than Apocope as it applies in any other lauage, that it is subject to the same conditions as Apocope in other languages. Since Apocope applies after more than one consonant (note word < *word+u) and it applies after an increasing resonancy gradient (tungol < *tungl+u *star*), neither of the conditions

$$\Sigma|\varepsilon| = \tau \leq T$$
$$|\varepsilon_{\tau-1}|_\rho - |\varepsilon_\tau|_\rho \geq \Delta$$

is relevant. Since the only vowels under consideration are u and i, the condition

$$|V_1|_{\eta\omega} \leq \Omega$$

is not relevant. By elimination the operative condition must be

$$|V_1|_\sigma \geq \Sigma$$

That is, the conditioning factor is stress. Consequently the problem changes from developing a notation to express syllable weight to reconstructing a stress pattern under which Apocope, defined as a universal process, applies.

The resulting stress pattern is a familiar one. Consider the plurals with monosyllabic stems:

*hof+u	hofu
*word+u	word
*ār+u	ār

If the salient feature is stress and only unstressed vowels elide, then the stress must be assigned as:

*hof+ú	hofu
*wórd+u	word
*ár+u	ār

The rule which assigns this stress is first introduced with a prose description. In chapter III, it will be formally defined.

Main Stress
Stress the first syllable if it is heavy. Otherwise, stress the second.

This rule is unsurprising since it refers to the notion of syllable weight, which is usual of stress rules. Compare the Latin stress rule for polysyllabic words:

> Stress the penultimate syllable if it is heavy. Otherwise, stress the antepenultimate.

The Main Stress rule clearly gives the correct results for monosyllabic stems. There are two types of bisyllabic stems. The first type includes those which have a 'light' initial syllable. In these the stress falls on the medial syllable; e.g. gamen < *gamén+u. The analysis correctly predicts that the final u elides.

The second type bisyllabic stem include those which have 'heavy' initial stems, for which initial stress is predicted; e.g. mædnu < *mæden+u. The retention of the final vowel is anomalous as it is not stressed by the Main Stress rule. This is evidence that a single stress rule is insufficient. In addition, there must be alternating stress.

Alternating Stress
Beginning with the stressed vowel, stress alternate vowels to the right.

A significant argument in favour of this analysis is that it also predicts the configuration of Syncope as it applies in Old English. The stress rules assign stress as *mǽdenù. Since stress conditions vowel elision, the prediction is that if a vowel is elided from *mǽdenù it will be the medial e. This prediction is correct: the reflex of *mǽdenù is mædnu. Thus, the proposed stress pattern predicts both Apocope and aspects of Syncope.

Old English Apocope is no different in form than Apocope in other languages. The only significant difference between Old English and the other languages which have been examined is that the condition governing the relative ρ values of the preceding elements has generalized in Old English to allow Apocope after both increasing and decreasing resonancy gradients. However, in all languages the condition governing the σ value of the vowel is relevant. Only unstressed vowels elide.

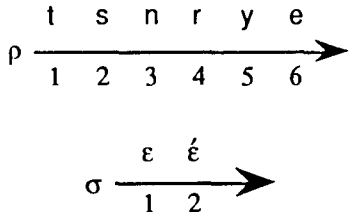
hof+u	mǽden+u	word+u	gamen+u	
hof+ú	mǽden+u	wórd+u	gamén+u	Main Stress
"	mǽden+ù	"	"	Alternating Stress
"	"	wórd	gamén	Apocope: σ = 1
fails	fails	"	"	Apocope: σ = 2
"	mǽdnù	"	"	Syncope

2.5.3. Parametric Variation

The issue of universality in language is uncontroversial in contemporary linguistics. The goal of linguistics has been extended beyond successful description of particular languages. Uncovering the defining features of Language, the properties which make something Language, is now recognized as essential.

A claim of Theoretical Phonology is that the defining features of Language include the processes which apply in particular languages. These processes are universal, they apply in every language; languages do not differ in their phonological rules or processes. Linguistic variation is parametric.

This may be illustrated by reviewing the analyses of the languages considered in this chapter. The definition of Apocope is identical for each language. The differences among the languages are attributed to the parochial conditions assigned by each language. The parochial conditions specify the elements on each parameter to which a process applies.



Apocope

Universal Process:	$V_1 \rightarrow \varnothing / V_2\, \varepsilon \_\_ \#$	
Universal Condition:	$\lvert V_1 \rvert_{\eta\omega} \leq \Omega$	(1
	$\lvert V_1 \rvert_{\sigma} \leq \Sigma$	(2
	$\Sigma \lvert \varepsilon \rvert = \tau \leq T$	(3
	$\lvert \varepsilon_{\tau-1} \rvert_{\rho} - \lvert \varepsilon_{\tau} \rvert_{\rho} \geq \Delta$	(4

The universal conditions on Apocope are

1. that the $\eta\omega$ value of the vowel be sufficiently small, i.e. that Apocope applies preferentially to weak vowels;
2. that Apocope applies preferentially to unstressed vowels;
3. that Apocope is sensitive to the number of preceding consonants, applying preferentially after fewer consonants;
4. that Apocope applies preferentially after a decreasing resonancy gradient.

In none of the languages examined does Apocope apply when $\lvert V \rvert_{\sigma}$ is greater than 1. The last two conditions govern the calculation of the resonancy gradient. In Portuguese, T is 1, meaning that only one element may intervene between the final vowel and the salient vowel and that the resonancy gradient is calculated over that single element. This permits Apocope in male > mal, but blocks it in ille > êle. The value of Δ is 2 prohibiting Apocope after stops; Apocope applies in male but not in sitim > sede.

In French, Romanian and Old English the value of T is at least 2; the number of preceding consonants does not block Apocope. In French and Roumanian, the value of Δ is 0 prohibiting Apocope after an increasing resonancy gradient. Apocope applies in French carne > chair, but fails in patre > pere because the preceding resonancy gradient is increasing in the latter. In Old English, Apocope applies regardless of the direction of the resonancy gradient.

2.5.4. Ex Nihilo Nihil Fit

Although it is universally agreed that Germanic Initial Stress is an innovation, there has been little interest in the mechanism of the innovation. The traditional handbooks imply that the change from the 'mobile', i.e. unpredictable, Indo-European stress was directly to word initial stress. It is described by Wright as:

> "In the parent language the chief accent of a word did not always fall upon the same syllable of a word, but was free or movable as in Sanskrit and Greek, cp. e.g. Gr. nom. πατήρ, *father*, voc. πάτερ, acc. πατέρα; Skr. ê mi, *I go*, pl. i mas, *we go* ... At a later period of the prim. Germanic language, the chief accent of a word became confined to the first syllable." [Wright, 1914: §9]

This sort of complete and general shift is not the usual case. Consider Slavonic where stress conditionally shifts to an initial syllable, if it is heavy. The shift was originally formulated as a sound law by Hirt[1895]. The traditional formulation is awkward, relying on 'laryngeal theory' to distinguish among words in which the stress shifts and those in which stress does not shift. According to Ebeling[1967], the stress shifted to the root syllable if that syllable consisted of a vowel followed by a laryngeal followed by a sonant. His example is Slavic *grîva < *grīwá < *griHwá. The important point is that the shift was not general, but began in a restricted environment.

The analysis of stress which contributes to the explanation of Old English Apocope provides the historical precursor to the Germanic Initial Stress. The prose description of the Main Stress rule is sufficient to demonstrate this:

Main Stress
Stress the first syllable if it is heavy. Otherwise stress the second.

When this rule is generalized, it becomes

Germanic Stress
Stress the first syllable.

This generalization provides some insight into how the stress shifted from the 'mobile' Indo-European stress pattern to the Germanic word initial stress pattern. This shift was not a simple general shift to word initial stress as so often portrayed. Rather, it began gradually, first to 'heavy' initial syllables and only later generalized to include all initial syllables. The contrast is between a general rule which applies uniformly throughout the language and a rule which is sensitive to differences among words. A central tenet of Theoretical Phonology is that the latter is 'typical' of lauages; the former is a special case, the result of generalizing the original rule.

Another important point concerns the origin of phonological rules in a language. The principle from biological evolution that new structures are transforms of old applies also to linguistic evolution. 'Innovation' is not the introduction of new rules, but the generalization of existing rules. The point has been made with respect to the origin of Romance rules in Foley[1975]. A problem with

the traditional interpretation of the Germanic Stress Shift is that it is unable to relate this shift to previous rules in Germanic. The analysis which I am proposing shows that the rule responsible for Germanic Initial Stress is a generalization of a previously existing rule.

Of course, the same considerations should apply to this earlier rule. It too should have a precursor. Unfortunately, any attempt to locate a precursor to the earlier rule is hindered by the current deficient understanding of Indo-European stress. However, the similarity between the Main Stress rule and Hirt's law for Slavonic provides a marginal argument that they are each the product of generalizing the same rule in similar ways, a generalization which continued in Germanic to produce unconditional initial stress.

The analysis proposes that the stress pattern under which Apocope applies is the result of the evolution of two independent stress rules in Germanic. The Main Stress rule stresses a first syllable if it is 'heavy', where concept of 'heavy' is used pre-theoretically. In keeping with its identification with an historical process, it is renamed as PreGermanic Stress. The second rule apparently evolved later and shifted stress to alternating unstressed vowels. Its later development will be demonstrated in Chapter III by showing that it is derivative of the PreGermanic Stress rule and that it does not apply in other Germanic languages such as Gothic, although the PreGermanic Stress rule does.

The discussion has ignored the issue of primary and secondary stress. It is assumed that the Alternating Stress rule assigns primary stress if no other vowel in the word is stressed and secondary stress otherwise. Admittedly, there is no evidence for or against this assumption, though it is aesthetically appealing. Nothing of consequence depends on it.

2.5.5. Old Norse Denasalization

The claim that the stress pattern reconstructed for Old English is actually PreGermanic will be justified over the course of this dissertation by demonstrating that aspects of the phonology of Old English is better understood as conditioned by this stress pattern than by other factors. Since this work is nominally concerned with the phonology of Old English, the concentration is on processes which are evident in that language. However, Old English is not the exclusive source of evidence; if it were the analysis would be suspect. This section presents an interpretation of Old Norse Fracture.

Fracture of Germanic e to Old Norse ya is traditionally analyzed as conditioned by a following a (I). Particularly important is mjaðar which shows that the conditioning factor cannot be a following tautosyllabic liquid, or syllable structure. The only feature shared by the forms in I is the following a.

	Old Norse	German	
I	bjarga	bergen	*save*
	gjalda	bezahlen	*pay*
	hjarta	herz	*heart*
	stjarna	Stern	*star*
	mjaðar	Metes	*mead (pl.)*
II	gefa	geben	*give*
	nema	nehmen	*take*
	stela	stehlen	*steal*

The forms in II illustrate a restriction on Fracture. When the conditioning vowel is a reflex of the infinitive marker, Fracture applies only when the conditioning vowel is oral; it fails when the conditioning vowel is still nasal [Gordon, 1927; Heusler, 1964].

The vowel of the infinitive is nasalized with the loss of n. Denasalization applies twice, first after a 'heavy' syllable and later after a 'light' syllable. The two applications of denasalization are interrupted by the application of Fracture.

meðar	bergan	stelan	
"	bergã	stelã	Nasalization
"	berga	"	Denasalization I
myaða	byarna	"	Fracture
"	"	stela	Denasalization II

Assuming that this analysis is correct, that Fracture is conditioned by an oral a, the problem is the explanation of the preferential application of Denasalization. The traditional analysis merely notes differential application. The stress pattern argued for Old English Apocope makes available a theoretically coherent explanation.

The explanation begins with the observation that nasal vowels are stronger than oral vowels. This is apparent from the application of Vowel Elision which applies to oral vowels in preference to nasal vowels. The paradigms of the athematic Latin verbs sum and ferre show elision of the medial vowel when the following consonant is oral, but not when it is nasal.

Singular				
1st	sum	s+am	n/a	n/a
2nd	es	s+s	fers	fer+as
3rd	est	s+t	fert	fer+as
Plural				
1st	sumus	s+amus	ferimus	fer+amus
2nd	estis	s+atis	fertis	fer+atis
3rd	sunt	s+ant	ferunt	fer+ant

The thematicity of the 1st singular and plural and the 3rd plural, beside the athematicity of the other forms, is an example of the blockage of Vowel Elision by Nasalization.

s+amus	s+atis	fer+amus	fer+atis	
s+ãmus	"	fer+ãmus	"	Nasalization
"	stis	"	fertis	Vowel Elision
"	estis	"	"	Prothesis
sumus	"	ferimus	"	Misc. Rules

If nasal vowels are stronger than oral vowels, then Denasalization must be a weakening process applying preferentially to weak vowels. It has been argued independently that stressed vowels are stronger than unstressed vowels. Therefore, Denasalization will apply preferentially to unstressed vowels. Finally, it has been argued independently that the stress pattern for preGermanic is one in which the first syllable is stressed only if it is 'heavy'. If the first syllable is 'light', the second syllable is stressed. Together these predict that Denasalization will apply to *bergã which is stressed as *bérgã in preference to *stelã which is stressed on the second syllable.

bergan	stelan	
bérgan	stelán	Stress Assignment
bérgã	stelã́	$n \rightarrow \varnothing + \tilde{}$
bérga	"	$\tilde{a}^{\circ} \rightarrow a$
byárga	"	Fracture
"	stelá	$\tilde{a} \rightarrow \acute{a}$

2.6. Observations on Stress from the Traditional Analysis

Towards the end of their analysis, Kiparsky and O'Neil note that "[+strong] has no demonstrable direct phonetic interpretation in Old English".(pg. 53) By way of apology, they note that the [+strong] Assignment rule bears a resemblance to "the well-known type of alternating stress rule". However, they do not develop the idea beyond noting it.

Keyser and O'Neil also note a resemblance between their analysis and stress rules. They point out that the metrical trees which they use to describe Old English vowel elision bear a resemblance to trees which have been used to assign stress in other languages. They then reject the resemblance as spurious because

> "as is well known, stress in Old English falls exclusively on the first syllable of a word ... To assign stress correctly to these words, we must assume a different tree construction algorithm, one which gathers rimes into a left-headed unbounded foot." (pp. 10–11)

Rather than seeking a reason for the similarity between stress assignment and vowel elision, they instead see an opportunity for more notational development.

> "Old English ... provides evidence for separate tree construction algorithms for stress and for deletion phenomena." (pg. 12)

Their claim is that stress and vowel elision are unrelated. This is contradicted by the many lauages in which vowel elision is quite clearly conditioned by the stress pattern of the word.

2.7. Conclusion

This chapter has introduced two new analyses of aspects of Old English phonology. First, it has been demonstrated that Apocope in Old English is fundamentally no different from Apocope in other languages. Differences in the application of Apocope among languages are parametric, the definition of Apocope is the same among languages.

Second, in order to apply the universal definition of Apocope to Old English, it is necessary to assume that the stress pattern present during the application of Apocope was not that usually attributed to Old English. Subsequent chapters will demonstrate that other Old English phenomenon are best explained with reference to the stress assignment rules proposed in this chapter.

In contrast to the traditional analysis, in which deletion of the final vowel is contingent on the weight of the first syllable, the analysis of Apocope in Old English which I am proposing is straightforward.

$$\left\{ \begin{matrix} u^{\circ} \\ \rho \end{matrix} \right\} \rightarrow \varnothing / \_\_ \#$$

Weak unstressed vowels elide when word final.

This analysis is a considerable improvement over the traditional analysis. It is universal: it applies according to the definition of Apocope which was formulated for other languages. And it is linguistically relevant: the environment proposed for Old English Apocope truly *conditions* Apocope.

3. OLD ENGLISH GEMINATION, VOCALIZATION AND BREAKING

3.1. Introduction

When Verner proposed his explanation of a class of exceptions to the Germanic consonant shift, his argument was buttressed by Sanskrit which exhibited the stress pattern he used in his explanation. Unfortunately, there is no direct physical evidence for the stress pattern I have argued is required for the definition of Apocope to apply correctly in Old English. Instead, support for a precursor to the Germanic stress rule must be found in the insights it provides into other phenomena in Old English, in particular, and Germanic languages, in general.

This chapter examines aspects of several process in Old English and demonstrates that each is best understood as applying before the completion of the Germanic Stress Shift. The processes which will be examined are Gemination, Vocalization and Breaking. It is argued that each of these is conditioned by the PreGermanic Stress rule.

The argument for the PreGermanic Stress rule is not only that other processes can be interpreted with respect to it. The justification of the PreGermanic Stress rule depends on being able to interpret other processes with it, but in so doing it has not been distinguished from the traditional analyses which also offer interpretations of these processes. The justification of Pre-Germanic stress is in the broader scope of these interpretations and the explanations it provides of the 'exceptions' which the traditional analyses typically acknowledge.

The strategy of this chapter will be to first examine the environment in which Gemination applies to further isolate the PreGermanic stress pattern. A formal analysis of the stress assignment rules will then be given. This analysis will then be used to illuminate dialectal variation with respect to Vocalization. The analysis of Vocalization will motivate a refinement of the ρ parameter which will be relevant to the definition of Gemination. Finally, a rule ordering paradox in the traditional analysis of Breaking will be resolved by appealing to the PreGermanic stress pattern.

3.2. Gemination

Gemination is traditionally characterized as being sensitive to the same syllable weight distinctions as Apocope .

> "All single consonants, except r, were doubled after a short vowel before a j"
>
> [Wright, 1914: §254]

The alternation between geminates and a single consonant is evident in the paradigms of weak verbs with the yod suffix: fremman, Gothic framjan *perform* and dēman, Gothic domjan *judge*.

	OE	Gothic	OE	Gothic
Singular 1st	fremme	framja	dēme	dōmja
2nd	fremest	framjis	dēmest	dōmeis
3rd	freme þ	framji þ	dēme þ	dōmei þ
Plural	fremma þ	framjand	dēma þ	dōmand

Forms in Gothic which have j after a light syllable regularly have a geminate consonant in Old English, unless the following vowel is i. The failure of Gemination before i is usually explained by invoking rule ordering.

> "The j in the combination ji had disappeared before the West Germanic doubling of consonants took place, e.g. in the 2. and 3. pers. sing. of the pres. indicative ..." [Wright, 1914: §254]

The 'disappearance' of j is interpreted here as the result of Contraction: ji → ī. The long vowel is subsequently shortened and lowered. Both lowering and shortening apply to original ī.

> "All long vowels underwent shortening in prehistoric Old English: ... ī > i, later e ... as gl y den (OHG. gu l dīn) from *g u l þ īnaz; mædgen = OHG. magatīn, *maiden*; subj.pret.plural bǣren = Goth. bērei n a, OHG. bārīn, *they might bear* ..."[Wright, 1914: §218.5]

fremyan	fremyist	dēmyan	
"	fremīst	"	Contraction
"	fremist	"	Shortening
"	fremest	"	Lowering
fremmyan	"	fails	Gemination
fremman	"	dēman	j → ∅

Contraction is not limited to ji but applied to wu as well.

> "w disappeared before u, and e (= older i), as nom. **clēa** from ***cla(w)u**, *claw* ... **betuh**, *between* ... beside older **betwuh** ... **gierep** *he prepared*, ... beside inf. **gierwan**"[Wright, 1914: §266]

The process is defined as:

Contraction

Process: $GV \rightarrow \bar{V}$

Conditions: $|V| - |G| \leq \Delta$

The process contracts a vowel with a previous glide if they are sufficiently similar. Similarity is defined by the absolute value of the difference in their relative values.[1] For example, Contraction applies to ji but not to ja because ji are more similar than ja. Contraction of wi is the result first of Assimilation (wi → ji), then Contraction.

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1 See [Foley, 1977: pp. 17–18] for another example of identity condition with respect to contraction.

Examples of verbs with short stems in which Gemination applies are given in **II**. Those with long stems in which Gemination fails are given in **I**. The preterite is usually traditionally as consisting of the root plus desinence in contrast with the infinitive which consists of the root with yod plus desinence. Thus, temede < tem+ede, but temman < tem+y+an.

	Infinitive	Preterite	
I	dǽlan	dǽlde	share
	ǽlan	ǽlde	set on fire
	bǽdan	bǽdde	compel
	bīegan	bīegde	bend
	brǽdan	brǽdde	broaden
	cēlan	cēlde	cool
	cīegan	cīegde	call
	dīedan	dīedde	kill
	drǽfan	drǽfte	stir up
	dēman	dēmde	judge
	drȳgan	drȳgde	dry
	fēdan	fēdde	feed
	fēgan	fēgde	join
	fēran	fērde	journey
	flīeman	flīemde	put to flight
	fȳsan	fȳste	hasten
	gīeman	gīemde	heed
	hǽlan	hǽlde	heal
	hǽman	hǽmde	marry
	hīenan	hīende	humiliate
	hīeran	hīerde	hear
	hlȳdan	hlȳdde	make a noise
	hȳdan	hȳdde	hide
	lǽdan	lǽdde	lead
	lǽfan	lǽfte	leave
	lǽnan	lǽnde	lend
	lǽran	lǽrde	teach
	līesan	līeste	set free
	mǽnan	mǽnde	moan
	mǽran	mǽrde	proclaim
	nīedan	nīedde	compel
	rǽran	rǽrde	raise
	rǽsan	rǽste	rush
	rȳman	rȳmde	make room
	sǽgan	sǽgde	lay low
	sǽlan	sǽlde	bind
	scrȳdan	scrȳdde	clothe
	sprǽdan	sprǽdde	spread
	stīeran	stīerde	steer
	strīenan	strīende	acquire
	swēgan	swēgde	make a sound
	tǽlan	tǽlde	blame
	tȳnan	tȳnde	enclose
	wrēgan	wrēgde	accuse

II	Infinitive	Preterite	
	temman	temede	tame
	clynnan	clynede	sound
	cnyssan	cnysede	knock
	fremman	fremede	perform
	gremman	gremede	anger
	hlynnan	hlynede	roar
	hrissan	hrisede	shake
	sceþþan	sceþede	injure
	sweþþan	sweþede	swathe
	trymman	trymede	strengthen
	þennan	þenede	stretch
	wennan	wenede	accustom
	wreþþan	wreþede	support

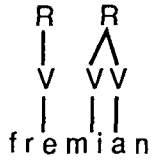
Gemination applies also in nouns which have a yod suffix, if a short vowel precedes. If the preceding vowel is long or a consonant precedes, the yod vocalizes and lowers to e when final, otherwise yod is lost [Wright, 1914: §274]. As examples, the paradigms of the neuter nouns wīte *punishment*, ierfe *inheritance* and cynn *race* (compare Gothic kuni, pl. kunja with yod) are given. The geminates of cynn are the product of Gemination. Gemination fails in wīte and the yod appears as e.

Singular			
Nominative	wīte	ierfe	cynn
Accusative	wīte	ierfe	cynn
Genitive	wītes	ierfes	cynnes
Dative	wīte	ierfe	cynne
Plural			
Nominative	wītu	ierfu	cynn
Accusative	wītu	ierfu	cynn
Genitive	wīta	ierfa	cynna
Dative	wītum	ierfum	cynnum

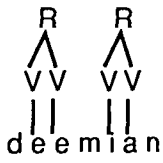
3.2.1. The Metrical Analysis of Old English Gemination

It is argued by Keyser and O'Neil[1985] that Gemination is an operation on a metrical tree. Their analysis proposes that the etyma of fremman and dēman are *fremian and *dēmian, respectively. These are assigned the metrical trees of **a.** and **b.**

a.

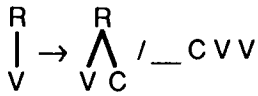


b.



According to Keyser and O'Neil, Gemination is an operation on a configuration of a metrical tree, adding a C segment to a rime if it is nonbranching and the environment is satisfied.

Gemination (Keyser and O'Neil)



where this rule is assumed to be morphologically restricted to Class I weak verbs.

By convention, the phonetic feature matrix of the new C segment is that of the consonant to the right.

They offer two arguments in favour of this rule for Gemination:

> "First, the geminating forms all exhibit an initial non-branching rime. This distiuishes them from such forms as *deemian*. Second, the geminating forms all contain a sequence of two V-elements immediately following the C which undergoes gemination." (pg. 19)

Several comments are apposite. Although Keyser and O'Neil claim that it is "the C which undergoes gemination", their rule describes Gemination as an operation on a rime, not on a consonant. To informally describe Gemination as an operation on a consonant establishes an connection between their analysis and the traditional one, but there is no basis for this connection. It also obscures Keyser and O'Neil's answer to one of the questions raised by Gemination as it applies in Old English, namely, what is the conditioning environment?

The traditional interpretation of Gemination is of an operation on a consonant conditioned by the length of the preceding vowel, although how the length of the preceding vowel *conditioned* Gemination is never stated. Keyser and O'Neil have reversed this interpretation. For them, the operation is on a rime structure, the environment requires a single following consonant which is itself followed by two vowels. This environment correctly picks out sequences before which the rime operation of gemination occurs. However, no argument is given demonstrating that this environment truly *conditions* Gemination.

If the environment conditions the process, there should be a theoretical reason why the process applies preferentially in that environment, there should be a theoretical connection between the process and the environment. Keyser and O'Neil offer none.

It is unlikely that there is a reason since the environment in their rule is not coherent with the process. Keyser and O'Neil claim that the process is a metrical process, an operation on rime structure. But the environment is not metrically related to the operation. There is no theoretical connection between a non-branching rime and a C-element which is followed by a sequence of two V-elements such that the latter can affect the former.

Keyser and O'Neil part with tradition in their analysis of the etyma, claiming the vowel i in *fremian where others have u. They give no arguments for an etymological *i but assume it with-

out discussion.[2] Since the yod never appears in Old English, there is no evidence for it in a synchronic grammar. By the same token, the i which Keyser and O'Neil would have does not appear phonetically either. From the synchronic point of view, there is no argument for any underlying element to condition Gemination. Synchronically, there is no elegant solution because words which undergo Gemination are indistinguishable at the phonetic level from those which do not. The argument for an element which conditions the Gemination is an historical one; when a consonant is preceded by a short vowel and followed by a yod in Gothic, it is geminate in Old English.

The only discernable reason for assuming underlying *frem+i+an rather than *frem+y+an is that, if [y] is a C-element, the latter has the same rime structure as *dēm+y+an

If the underlying representations of fremman and dēman have identical rime structures then, of course, rime structure cannot be used to distinguish between them. Since Keyser and O'Neil wish to give a metrical analysis of Gemination, it is necessary for them to somehow metrically distinguish between them. Reanalyzing *fremyan as *fremian is the way they do so.

Since the historical evidence points to an etymological yod not *i, and the only argument in favour of *i is that without it, Keyser and O'Neil's analysis won't work, it is assumed that the traditional yod is the correct analysis.

A final comment concerns the parochial nature of this analysis. The condition which restricts application to Class I weak verbs means that this can never be considered other than a parochial description of the behaviour of a class of Old English verbs. It is not intended to contribute to an explanation of the history Old English nouns which have a yod suffix (see Introduction). No attempt is made to relate Gemination to Holtzmann's Law which governs the strengthening of glides in Gothic and Old Norse; intervocalic glides gain a stop when preceded by a short vowel: Gothic. twaddjē , O.Icel. tveggja, OHG. zweio, Skr. dváyos *of two*. A linguistic analysis is motivated in part by its ability to demonstrate the relatedness of phenomena in many languages.

3.2.2. A Boundary Analysis of Gemination

An account of Gemination in terms of syllable boundaries rather than syllable weight is given in Murray and Vennemann[1983]. Using the scale of Consonant Strength from [Hooper, 1976]

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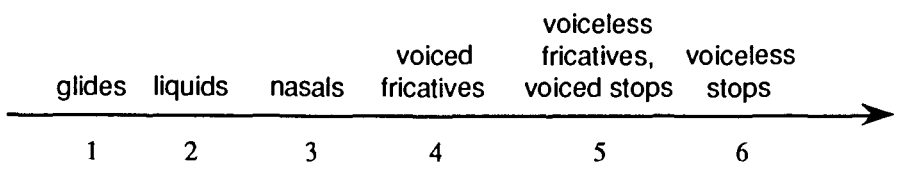
2 Their discussion on the morphology of the Old English verb is found in the first paragraph of pg. 18. The relevant part of the discussion is "We take the verbs ... to be derived from the abstract verbal stems of the type /deem-/ and /frem-/ to which are added the endings ... Consequently, the underlying representation of the first and second person singular present indicative forms of *fremman* are /frem+ie/ and /frem+ist/, respectively."



they propose that the 'preferred' syllable structure is one in which the value of the coda of the first syllable on this scale is greater than the value of the onset of the next element. This is expressed as their Syllable Contact Law:

> "The preference for a syllable structure $A^{\$}B$, where *A* and *B* are marginal elements and *a* and *b* are the Consonantal Strength values of *A* and *B* respectively, increases with the value of *b* minus *a*."[Murray and Vennemann, 1983: pg. 520]

Since the value of glides is always less than the value of another element, the sequence $\underline{C}^{\$}\underline{\jmath}$ will always violate the Syllable Contact Law. They contend that when the law is violated, the syllable structure must change to create a more preferred syllable structure. Thus, the sequence $\underline{C}^{\$}\underline{\jmath}$ must change to $\underline{C}^{\$}\underline{C\jmath}$.

Teleological explanations such as this are suspect. They raise many questions which are never answered. If it is true that this is not a 'preferred' syllable type, what is the mechanism which is able to 'look ahead' in the derivation to determine that Gemination will give a 'preferred' syllable type? If this sequence is not 'preferred', why was it created in the first place? Why do other rules in the language create syllable types which are not 'preferred'? Syncope creates violations of the Syllable Contact Law in the genitive bīetles (cf. nominative bīetel *mallet*) among others. Why does the Law permit violations to be created? Finally, why was Gemination chosen as the method to be rid of the violation? Other possible methods include resyllabification (which Murray and Vennemann reject because it would not produce an 'ideal' syllable type), loss of the yod, and vocalization of the yod.

Philosophical objections aside, there is strong reason to doubt that syllable structure constraints are responsible for Gemination: the analysis makes incorrect predictions. The claim is that the sequence consonant+glide violates the Syllable Contact Law if a syllable boundary intervenes, and that this must be remedied by geminating the consonant. However, Gemination only applies when the glide is j, it does not apply when the glide is w.

I	Nominative	Genitive	
	beadu	beadwes	*battle*
	bealu	bealwes	*evil*
	cudu	cudwes	*cud*
	meolu	meolwes	*meal*
	sceadu	sceadwes	*shadow*
	sinu	sinwes	*sinew*

The genitive forms all contain violations of the Syllable Contact Law which remain uncorrected.

3.2.3. The Environment for Gemination

The process of Gemination is explored first through consideration of the environment in which it applies. The approach to determining the conditioning environment in which Gemination applies is by considering surface exceptions to Apocope, a process whose application has been established and defined for Old English. The forms of interest are the ja stem nouns, particularly the neuter nouns. These are nouns which form a stem by adding the increment j. As usual, these have been distinguished by reference to the weight of the preceding syllable. The Old English forms cynn *race* with a 'light' root syllable and rīce *kingdom* with a 'heavy' root syllable will be used as examples. Their paradigms are given below with their Gothic cognates.

Singular	O.E.	Goth.	O.E.	Goth.
Nominative	cynn	kuni	rīce	reiki
Accusative	cynn	kuni	rīce	reiki
Genitive	cynnes	kunjis	rīces	reikjis
Dative	cynne	kunja	rīce	reikja
Plural				
Nominative	cynn	kunja	rīcu	reikja
Accusative	cynn	kunja	rīcu	reikja
Genitive	cynna	kunjē	rīca	reikjē
Dative	cynnum	kunjam	rīcum	reikjam

The first observation is that the nominative plural rīcu is a *prima facie* counterexample to the claim that Apocope applies after heavy syllables. Compare the paradigm of ār *brass* where Apocope applies in the plural ār < *ār+u.

Singular		
Nominative	ār	rīce
Accusative	ār	rīce
Genitive	āres	rīces
Dative	āre	rīce
Plural		
Nominative	ār	rīcu
Accusative	ār	rīcu
Genitive	āra	rīca
Dative	ārum	rīcum

Other examples of apparent failure of Apocope in an environment where it is expected to apply are listed in **I.**

	Singular	Plural	
	fēþe	fēþu	*walking*
	flicce	fliccu	*flitch*
	gefilde	gefildu	*plain*
	gefylce	gefylcu	*troop*
	gemierce	gemiercu	*boundary*
	getimbre	getimbru	*building*
	getīeme	getīemu	*yoke team*
	gewǣde	gewǣdu	*dress*
	geþīode	geþīodu	*language*
	ierfe	ierfu	*inheritance*
	rīce	rīcu	*kingdom*
	rȳne	rȳnu	*mystery*
	stīele	stīelu	*steel*
	stycce	styccu	*piece*
	wǣghe	wǣghu	*cup*

In each of the forms where Apocope apparently fails, there is an underlying yod which has been elided. In the nominative and accusative singular the yod has vocalized and lowered to e. The etyma of rīce and rīcu are *rīc+y and *rīc+y+u, respectively.

Since the underlying yod in *rīc+y+u is the only substantive difference between ār < *ār+u and rīcu < *rīc+y+u, it is natural to assume that its presence in some way blocks Apocope.

The sensitivity of Apocope to stress argues that the presence of yod influences stress. Since the final vowel in *rīc+y+u does not elide, it must be stressed. This follows from the analysis of the previous chapter that word final u elides only when unstressed. Since the first vowel is long, it too must be stressed. Thus, the stress pattern must be *rí̀c+y+ù analogous to *hé̀afodù > hēafdu. To arrive at this stress pattern, the rule responsible for assigning alternating stress must include yod as a possible stressed element. Instead of assigning stress to a vowel if the preceding vowel is unstressed, the rule must assign stress to a vowel if a preceding vowel or glide is unstressed.

ār+u	rīc+y+u	
ár+u	rí̀c+y+u	PreGermanic Stress
"	rí̀c+y+ù	Alternating Stress
ár	"	Apocope
"	rí̀c+ù	y → Ø

The failure of u to elide in rīcu < *rīc+y+u establishes that yod must condition stress. I show next that, in addition to conditioning stress, yod may also be stressed.

When the root of a ya stem noun is light, the final u elides in the nominative plural; e.g. cynn < *kyn+y+u. According to the definition of Apocope and the conditions on its application in Old English, if the final vowel elides, it must be unstressed. According to the Alternating Stress Rule, if the final vowel is to remain unstressed the preceding stressable element must be stressed. In cynn < *kyn+y+u, the preceding stressable element is yod. If yod is stressed, the

preceding stressable element must be unstressed. Consequently the stress pattern of *kün+ų+u must be *kün+ú+u.

A comparison of *rîc+ų+ù, without Gemination, and *kün+ú+u, with Gemination, reveals that the stress pattern provides a distinguishing environment for Gemination. Gemination applies when the yod is stressed, it fails when the yod is unstressed.

rīc+ų+u	kün+ų+u	
rîc+ų+u	kün+ú+u	Stress Assignment
"	kün+ú	Apocope
"	künnú	Gemination
rīc+u	künn	ų → Ø

The stress pattern predicted by the PreGermanic Stress rule and the Alternating Stress rule provides a distinguishing environment for Gemination. Moreover, the stress pattern is independently motivated. The stress patterns of geminating and non-geminating forms were derived by considering the stress pattern required for Apocope, not Gemination.

The analysis demonstrates the reason why Apocope and Gemination have been felt to be related in Old English. The point was made by Kiparsky and O'Neil who felt that it was notable that these two processes should refer to the same environment. On the face of it, there is nothing about either Gemination nor Apocope which would lead one expect that they should be related. However, if they are both sensitive to stress, it is unsurprising that they should organize themselves around the stress pattern of the language and, hence, appear to be sensitive to the same environment.

3.3. Stress Assignment

The type of stress rules required to explain facts about Old English Apocope and Gemination are common among languages of the world. Stress is frequently sensitive to syllable weight and the alternating stress pattern proposed is one of the major stress distribution patterns among lauages of the world [Halle and Vergnaud, 1987]. In this section I give formal definitions of these stress rules.

It is generally agreed that linear rule types of the sort defined in *The Sound Pattern of English* [Chomsky and Halle, 1968] are inadequate for explanation of phenomena associated with stress assignment [Halle and Vergnaud, 1987]. The rule types defined in *Foundations of Theoretical Phonology* [Foley, 1977] share with *SPE* rules the feature of linearity; rules in *Foundations of Theoretical Phonology* refer to strings of segments without reference to the structure, syllabic or otherwise, of the string. Nonetheless, it is clear that some development towards rule types which refer to planes other than the segmental was anticipated. In *Foundations of Theoretical Phonology*, environments classed as 'strong' and 'weak' include position in the syllable as well as contiguity to 'heavy' and 'light' syllables. In *Theoretical Morphology of the French Verb* [Foley,

1979], the reflex of the thematic vowel of the French verb is predicted by rules governing length alternation:

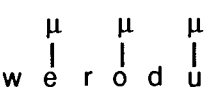
$$LL \rightarrow LS$$
$$SS \rightarrow SL$$

That is, a long vowel shortens after a long syllable and a short vowel lengthens after a short syllable.

I present next a sketch of a theory of stress assignment which is sufficient to understand the phonology of Old English which is affected by stress and how stress rules themselves have changed. This sketch will be directed at solving two problems. One is defining the units which determine stress assignment and the principles which associate these units with the segmental plane. The second is defining what has been informally called 'syllable weight'.

I assume that stress assignment is not sensitive to the content of the segmental plane, but is instead sensitive to a level or representation which is abstracted from the segmental plane. This assumption has a long traditional and has been made independently in many different theories. For example, Allen[1973], who argues for a physiological basis for syllable weight, and McCarthy[1979], who describes stress phenomena in terms of metrical trees, abstract the features relevant to stress from the segmental plane and represent them in an independent level of representation. Unlike Allen, McCarthy and others, I do not assume syllabification prior to stress assignment. I assume no syllabification at all.

If there is no prior syllabification, then clearly it cannot be the syllable which is either the bearer of stress or the determinant. The unit I propose, the mora (μ), is adapted from the Praguian school [Trubetskoi, 1969]. The Praguian notion of mora is of a feature which is abstracted from the syllable. This supposes three levels of representation: those of the segment, the syllable and the mora. I propose instead that morae are associated with individual elements from the segmental plane. The set of elements which are so associated can be determined in part by observing which elements are affected by stress assignment. For example, considerations of Apocope and Diphthongization have revealed that both are conditioned by stress. Since these processes apply to vowels, vowels must be associated with the μ plane. For example, the mora association of *werodu, the etymon of werod, is



If syllabification is irrelevant to the assignment of stress, the correlate of 'syllable weight' is, in so far as it is relevant to stress assignment, cannot be defined in terms of the syllable or its structure. Therefore, the approach I will advocate will be a departure from that of, for example, [McCarthy, 1979] or [Clements and Keyser, 1983] who distinguish between heavy and light sylla-

bles by the topography of the trees which represent the internal structure of the syllable. In their accounts, the initial syllables of *aaru and *wordu are both heavy because they have the same internal structure, a structure which is different from that of *werodu. In the approach I will advocate, the notion of syllable quality—heavy or light—is replaced with that of mora quantity. I assign morae to *aaru and *wordu as

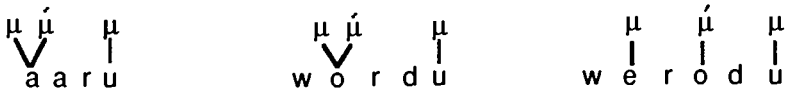
On this account, processes such as stress assignment appear to treat the initial vowels of *aaru and *werodu differently because they differ in their association with the μ plane.

Given this assignment of morae, the stress rules required for Old English are transparent. The PreGermanic Stress rule was informally defined as "Stress the first syllable if it is heavy, otherwise stress the second." In terms of the μ plane, the rule is "Assign stress to the second μ."

PreGermanic Stress

$$\#\,\mu\,\mu \rightarrow \#\,\mu\,\acute{\mu}$$

Given μ association as illustrated above, this rule assigns stress to the μ associated with the first vowel in *aaru and *wordu but to the μ associated with the second vowel in *werodu.

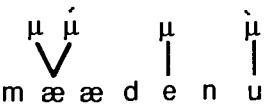


The Alternating Stress rule, which is required to assign stress to the final vowel of *mæædenu, assigns stress to μ if the preceding μ is unstressed.

Alternating Stress

$$\mu\,\mu \rightarrow \mu\,\grave{\mu}$$

The PreGermanic Stress rule assigns stress to the second mora associated with the first vowel in *mæædenu. The μ associated with the medial vowel remains unstressed because the preceding μ is stressed. Alternating Stress assigns stress to the μ associated with the final vowel because the preceding μ is unstressed.



3.3.1. Principles of Mora Association

To complete this sketch of Old English Stress, we require principles for associating elements from the segmental plane with the μ plane. This requires two major rules. One determines which segments in the word are associated with the μ plane. The second determines which are associ-

ated a second time, in effect defining what has been informally described as 'heavy syllable'. I define the second principle first, and then return to the first. A third minor rule will be discussed after these have been established.

A major goal of any account of stress assignment is the apparent functional unity of the sequences $\bar{V}C$ and VCC. In many languages, they both attract stress, in contrast to VC, although they are apparently compositionally distinct. Although there are many approaches to explaining this functional unity, they share the characteristic of assuming that these are distinct sequences at the segmental plane, but that at some other level of representation they are equivalent.

For example, Allen[1973] takes a physiological approach in which $\bar{V}C$ and VCC have different arrest phases (thoracic and oral, respectively) which are equivalent in creating a heavy syllable. In effect, Allen attempts to define $\left\{ \begin{matrix} V \\ C \end{matrix} \right\}$ as a natural class when it follows the nucleus of the syllable. A metrical account finds functional equivalence in similar or identical configuration of trees. Both approaches, physiological and phonological, assume a prior algorithm for assigning syllable boundaries and seek to find a similar structure within the syllable.

The approach I will advocate is a departure from this traditional approach. First, I do not assume prior syllabification. Instead, the association of a segment with a second μ is determined by the following segments. In turns out on this view that the sequences $\bar{V}C$ and VCC function identically with respect to stress because for the purposes of association with the μ plane they *are* identical.

Also requiring explanation is the apparent failure of some consonant sequences to create a 'heavy' syllable. For example, in Latin (see below), a sequence of stop+liquid does not create a heavy syllable, although the sequence liquid+stop does.

The explanation is found in the resonancy gradient which follows the vowel. The following tables illustrate the correlation between the placement of stress and a flat or decreasing resonancy gradient, i.e. a gradient where in the sequence $V\varepsilon_1\varepsilon_2$, $|\varepsilon_1|_\rho - |\varepsilon_2|_\rho \geq 0$. The position of stress is empirically determined by observing Apocope and Gemination. In **I**, the final vowel elides indicating that it is unstressed. Therefore, it can be concluded that the first vowel of each word in **I** is associated with two morae. In **II**, the final vowel does not elide indicating that it is stressed and that the first vowel is associated with one mora. In **III**, Gemination applies indicating that the glide is stressed and that the first vowel is associated with one mora. In **IV**, Gemination fails indicating that the glide is not stressed and that the first vowel is associated with two morae.

	Etymon	Reflex	$\lvert\varepsilon_1\rvert_\rho - \lvert\varepsilon_2\rvert_\rho$	Initial stress?
I	béarn+u	bearn	1	√
	bóld+u	bold	3	√
	hórs+u	hors	2	√
	lánd+u	land	2	√
	nést+u	nest	1	√
	áar+u	aar	2	√
	bæ̀æ̀l+u	bæ̀æ̀l	2	√
	báan+u	baan	3	√
II	brim+ú	brimu	−3	x
	broc+ú	brocu	−5	x
	hof+ú	hofu	−5	x
	hol+ú	holu	−2	x
	lim+ú	limu	−3	x
III	cyn+ú+u	cynn	−2	x
	bed+ú+u	bedd	−4	x
	tel+ú+an	tellan	−1	x
IV	flícc+y+u	fliccu	0	√
	iérf+y+u	ierfu	3	√
	ríik+y+u	rīcu	5	√

A segment is associated with a second mora in Old English if the ρ value of the element following it is equal to or greater than that of the following segment. The first vowel of *riikyu, the etymon of rīcu, is associated with two morae because $\lvert i\rvert_\rho - \lvert k\rvert_\rho = 6 - 1 = 5$. But the vowel of *kiinyu is associated with one mora because $\lvert n\rvert_\rho - \lvert y\rvert_\rho = 3 - 5 = -2$. To put it informally, a segment is associated with a second mora if it precedes a flat or decreasing resonance gradient.

The association of a segment with a second mora will be defined as

μ Association II

Process: $\overset{\mu}{|}_{\varepsilon_1\ \varepsilon_2\ \varepsilon_3} \Rightarrow \overset{\mu\ \mu}{\vee}_{\varepsilon_1\ \varepsilon_2\ \varepsilon_3}$

Condition: $\lvert\varepsilon_2\rvert_\rho - \lvert\varepsilon_3\rvert_\rho \geq \Delta$

A point about ordering must be made. In many languages, a sequence of stop+liquid creates a 'heavy' syllable. In terms of mora, a vowel will be associated with a second mora even though the following resonancy gradient is increasing. Sanskrit is such a language; pitriyas *paternal* has iy which according to Sievers' Law occurs after 'heavy' syllables. If the preceding syllable is light', the alternate y appears. There is an apparent prediction that if a language assigns two μ to a vowel when the following consonants are tr then it should also assign two μ to a vowel which is followed

by nV because the difference in ρ values of the following elements is –3 in both cases. However, this is not the case. The difference between the two strings is that in the latter the second element (ε_3 in the definition) is associated with a mora, but the second element in the former is not. M Association assigns association structures as:

Only the first meets the environment of μ Association II. This indicates that the word is first scanned for elements which are associated, simpliciter, with the μ plane. That is, the principles assigning elements to the μ plane must be ordered and the ordering must be μ Association I/μ Association II. This ordering is also assumed in the definition by restricting its application to those segments which have already been associated with the μ plane.

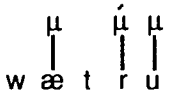
A second observation is that the principle of explicit representation also prohibits association of the yod in *riikuu with a second mora, although the following vowel is more resonant than the word boundary. The yod cannot be associated with the μ plane twice, because the rule requires that neither of the subsequent elements be associated with the μ plane.

Each language defines the set of elements which can be eligible for μ association. One expects, of course, that this set will include vowels, but other elements may also be associated. For example, in Lithuanian [Kiparsky and Halle, 1977] liquids as well as vowels may be stressed. In vir̃ti *cook*, the vowel is stressed [vírti]; in mir̃ti *die*, the liquid is stressed [miŕti]. I argued at the beginning of this chapter that the facts of Apocope and Gemination reveal a stress pattern which includes glides among the set of elements which receive stress. Since a segment can receive stress only by virtue of its association with the μ plane, a stressed liquid or glide is evidence they are among the set of elements which can be associated with a μ.

Membership in this set is defined, in part, by the ρ parameter. A element may be associated with μ only if its ρ value is sufficiently large. This predicts that if an element with ρ value X is associated with the μ then elements with values X+1 must also be eligible for association with the μ plane. For example, if a language permits a liquid to be associate with the μ plane then it also permits glides and vowels.

However, the ρ value of a segment is not the only factor determining μ association. Consider the nominative plural wæter the etymon of which is *wætru.[3] Since the final vowel elides, the vowel cannot be stressed. However, the first vowel cannot be associated with two morae and therefore cannot be stressed because the following resonancy gradient is increasing. The remaining candidate for stress is r. The stress pattern of *wætru is apparently identical to that of *kiinuu.

[3] See below for arguments on the etymon of wæter.



This stress pattern makes the correct prediction about Apocope. The argument, then, is that Old English permits liquids to be associated with the μ plane. However, it is not true that the r of werod is so associated.

The difference between the r of *wætru and that of werod is their position in the resonance contour of the word. In the former, the r is a member of an increasing resonancy gradient, its ρ value is greater than that of the preceding element. In the latter, the ρ value of the preceding element is greater than that of r. Thus, a condition on μ association is that the difference in the ρ values of the segment and that preceding be sufficiently large.

μ Association I

Process: $\varepsilon_1\ \varepsilon_2 \Rightarrow \varepsilon_1\ \overset{\mu}{\varepsilon_2}$

Conditions: $|\varepsilon_2|_\rho \geq P$

$|\varepsilon_2| - |\varepsilon_1|_\rho \geq \Delta$

A desired consequence of the principle of explicit representation on μ association is that μ Association fails in the case of the second vowel of *aaru. Recall that the μ plane of *aaru is

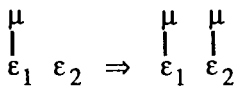
Given the principle of explicit representation, association lines must be explicit in the definition; the absence of an association line means that the segment cannot be associate with the μ plane. The definition as it stands cannot associate the second vowel of *aaru with the μ plane because the first vowel of *aaru (ε_1 in the definition) is associated with the μ plane.

This interpretation of the notation has two consequences. First, it makes a special case of true dieresis, as in Aïda. This seems desirable as the second vowel of *aaru is a consequence of representing long vowels as geminates, unlike the second vowel of Aïda.

I define dieresis as the association of the second of two contiguous vowels with the μ plane in the case that it is not identical with the first.

Dieresis

Process:



Conditions: $|\varepsilon_2|_\rho \geq P$

$|\varepsilon_1| \neq |\varepsilon_2|$

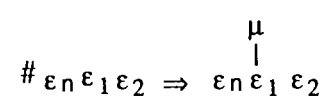
A second consequence of blocking μ Association I when the immediately preceding element is associated with the μ plane is that final vowel of *riikyu will not be associated by μ Association I because the preceding yod is so associated. But we know that the final vowel in this word is associated with the μ plane because it is stressed; it does not elide. In this case, Dieresis associates the final vowel with the μ plane because the relevant elements are not identical.

As it stands, μ Association I gives the incorrect result in a word like brimu *seas*. μ Association I predicts that the r will be associated with μ plane because its ρ value is greater than that of b. Similarly considerations apply to geocu [yoku] *yokes*. In neither case is it likely that any element other than the vowel is the first element in the word associated with the μ plane. In geocu there is particular evidence that the yod is not associated with the μ plane. If it were, the stress would fall on the first vowel and the final vowel would elide.

Words such as brimu and geocu suggest that the first element in the word which is associated with the μ plane is the peak of the first gradient. To accommodate this observation, a subrule to μ Association I is added which initiates association of elements in the word with the μ plane by associating the resonance peak of the first sequence of elements with the μ plane. The peak is defined as the first element with a ρ value greater than that of the following element.

μ Association Ia

Process:



Conditions: $|\varepsilon_1|_\rho - |\varepsilon_2| \geq \Delta$

The definition of μ Association is revised so that it applies only when there is a preceding element associated with the μ plane.

μ Association I

Process: $\overset{\mu}{|}\ \varepsilon\ \varepsilon_n\varepsilon_1\varepsilon_2 \Rightarrow \overset{\mu}{|}\ \overset{\mu}{|}\ \varepsilon\ \varepsilon_n\varepsilon_1\varepsilon_2$

Conditions: $|\varepsilon_2|_\rho \geq P$

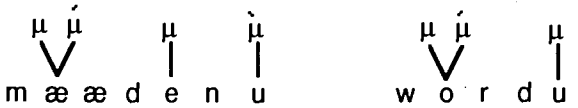
$|\varepsilon_2| - |\varepsilon_1|_\rho \geq \Delta$

To summarize, segments are associated with the μ plane by the following algorithm. First, the word is scanned left to right by μ Association I which associates each possible element with the μ plane. μ Association I is sensitive to its own output so that it does not associate two contiguous segments with the μ plane.

Dieresis and μ Association II then scan the word. The ordering must be Dieresis/μ Association II. In *riikyu, it is necessary to block association of yod with two morae. It was argued that this was a natural consequence of the association of u with a mora; μ Association II applies only if the following segments are not associated with a mora. That the u of *riikyu is so associated by Dieresis means that the application of Dieresis must precede μ Association II.

The general picture of μ association which emerges is one in which μ Association I and Dieresis determine the morae of the word and μ Association II marks individual segments as 'heavy'.

The μ association and stress assignments for the etyma of the plural forms mǣdnu *maids*, word *words*, werod *troops*, scipu *ships*, rīku *kingdoms* and cynn *race* illustrate the results of these three principles. Wherever the μ association and stress rules predict that a medial or final vowel is unstressed, it elides. Wherever, they predict that a yod is stressed, Gemination applies.



Etymon	Reflex	Etymon	Reflex
mǣ́denù	mǣdnu	wórdu	word
weródu	werod	scipú	scipu
rī́kyù	rīcu	künýu	cynn

3.3.2. Typological Variation

The definition of 'heavy' and 'light' syllables varies among languages. For example, in Sanskrit and Ancient Greek there is an alternation between ɥ and iɥ dependent on the weight of the preceding syllable. So Greek μεσος from *μεφγος, Sanskrit madhyas, IndoEuropean *medhyos *middle* with ɥ after 'light' syllables, but Greek πατριος from *πατριγος, Sanskrit pitriyas, IndoEuropean *pətriyos *paternal* with iɥ after 'heavy' syllables..

The relevant point here is that in both Greek and Sanskrit the first vowel of *pətriyos is associated with two morae. In Old English, this same segment must be associated with one mora because $|t|_\rho - |r|_\rho = 1 - 4 = -3$. The difference between Old English on the one hand and Greek and Sanskrit on the other, with respect to μ Association II, is the value of Δ. Old English places a more restricted condition than Greek and Sanskrit.

The interpretation of the initial syllable of *πατριγοσ as heavy is not true of all Greek dialects. Attic Greek is similar to Old English in that a vowel is associated with two morae only if the following resonancy gradient is flat or decreasing. This is seen in the 'linking' vowel in the comparative of adjectives, -τερος. This vowel is either ο or ω. The vowel can be predicted by the weight of the preceding syllable; ο after heavy syllables, ω after light. Thus λεπτοτερος, ωμοτερος with ο+τερος, but σοφωτερος with ω+τερος. In classical Attic, sequences of stop+liquid and stop+nasal do not create a heavy syllable: ερυθρωτερος, εμμετρωτερος and ευτεκνωτατος with long 'linking' ω [Allen, 1973]. In terms of morae, the alternation is ο after a segment which is associated with two morae, ω after a segment which is associated with one mora. A segment is not associated with two morae if the following resonancy gradient is increasing; e.g. if the following sequence is κν, the preceding vowel is associated with only one mora.

Similarly, Latin does not define as heavy a syllable which precedes a sequence of stop+liquid. For example, the Latin stress rule stresses the penultimate syllable if it is heavy.

> "the accent in polysyllables falls on the penultimate if this is of heavy quantity, and on the antepenultimate ... if the penultimate is light ... It should be remembered that in normal spoken Latin the group plosive+liquid ... invariably belongs to the following syllable, so that a preceding syllable containing a short vowel is light (e.g. *té-ne-brae* , not *te-néb-rae*)." [Allen, 1965: pg. 83]

Latin associates a segment with an extra mora if it precedes a flat or decreasing resonancy gradient, but not an increasing gradient. It should be noted that Latin phonology has removed all instances of stop+nasal and sibilant+nasal or liquid which are also instances of an increasing resonancy gradient; that Allen does not cite these as belonging the same class as stop+liquid is not an indication that these are counterexamples to this interpretation of Latin. The combinations simply do not exist in Latin.

In their analysis of English stress, Chomsky and Halle[1968] find it necessary to refer to an entity they call a 'weak cluster' and formalize (pg. 83) as

$$\begin{bmatrix} \text{-tense} \\ \text{V} \end{bmatrix} \; C_0^1 \begin{bmatrix} \alpha\text{voc} \\ \alpha\text{cons} \\ \text{-ant} \end{bmatrix}_0$$

A 'weak cluster' consists of a lax vowel optionally followed by no more than one consonant and r. If the vowel of the penultimate syllable is that of a 'weak cluster', stress falls on the antepenult: e.g álgebra and vértebra. Quite clearly they have defined the Latin 'light' syllable, except that they exclude l as a possible final consonant in the cluster. Their argument for excluding l is that geminate ll creates a 'strong cluster': cf. cerebéllar, but álgebra. From this they conclude that any Cl creates a 'strong cluster'. However, elsewhere (pg. 140 and pg. 197) they note 'exceptions', e.g. disciplinary, and decide that the status of a VCl cluster is 'uncertain'.

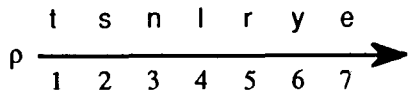
Obviously, the reason a vowel is stressed before ll but not pl is that the difference in ρ values is 0 for ll, but -3 for pl. Chomsky and Halle were likely swayed by their argument that the behaviour of geminate ll was indicative of all VCl clusters, even in the face of obvious counter-examples, by the inelegance of the resulting definition of 'weak cluster' as including l as a possible final consonant if the preceding consonant is not also l.

Note also that Chomsky and Halle's definition of 'weak cluster' is parochial, it does not apply to Attic Greek, in which stop+r, stop+l and stop+nasal function identically. The notion of 'resonancy gradient' captures this identity whereas that of 'weak cluster' cannot.

For Chomsky and Halle, this cluster is a coincidental constellation of feature complexes. The theory does not predict that the sequences Cl, Cr or Cn should behave differently than lC, rC or nC. It is merely noted that they do. The significance of the analyses of stress and vowel elision which I have proposed is that the separate behaviour of these clusters is a natural consequence of the topography of the ρ parameter, it is not a coincidence.

Finally, in their discussion of 'weak clusters', Chomsky and Halle (pg. 83) note that lr creates a 'weak cluster'. Their evidence is the stress in chívalrous. If lr created a 'strong cluster' the stress would be *chiválrous. This raises the question of the relative ρ values of l and r. If they have the same ρ values, then they should create a strong cluster, as does ll.

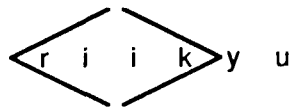
Foley presents arguments in *Foundations of Theoretical Phonology* (pp. 37–38) that |l| < |r|. Murray and Vennemann (pg. 523) also propose that l and r be distinguished. Facts from gemination (see below) also suggest that l and r be formally distinguished and the ρ parameter be revised as:



This revised parameter correctly predicts the stress in chivalrous. It also predicts that rules which are sensitive to the ρ parameter may distinguish between l and r. This will be demonstrated where appropriate in subsequent sections.

3.3.3. The Resonance Contour

The effect of μ Association I and μ Association II is to replace the notion of syllable with that of the resonance contour, for the purposes of stress assignment. These principles of association between the segmental plane and the μ plane are sensitive to the relative ρ values of contiguous segments. Together they define the optimal element to which stress will be assigned in terms of the flux of resonance among it and the elements contiguous to it. In particular, the optimal element is part a resonance contour like that of the first vowel of rīcu.



μ Association I defines the optimal segment as the second in an increasing resonancy gradient; μ Association II associates that segment with a second μ, as one preceding a flat or decreasing resonancy gradient. Together, these rules define the optimal element for stress assignment as being the first highest point in the resonancy contour.

The picture of the word which emerges from this sketch is that of a flux of resonance, the peaks of which are associated with the μ plane. Stress assignment is sensitive to the minimal structure of the μ plane.

3.3.4. Linguistic Change

The facts of Old English stress, both the Germanic initial stress rule cited in the handbooks and the older stress pattern which conditions much of Old English phonology, are derived from what I have called the PreGermanic Stress rule.

PreGermanic Stress

$$\# \mu \mu \rightarrow \# \mu \acute{\mu}$$

The Alternating Stress rule is derived from this rule by a meta-rule which relaxes the condition that it apply word initially.

$$\# \Rightarrow \varnothing$$

The consequence of this meta-rule is a second rule which stresses alternate morae.

$$\# \mu \mu \rightarrow \mu \acute{\mu} \quad \Rightarrow \quad \mu \mu \rightarrow \mu \acute{\mu}$$

The concept of meta-rule is introduced in [Foley, 1972]. It is argued there that phonological change is not the result of adding rules to the grammar but is the result of changes to rules which already exist in the language.

The Germanic Initial Stress rule is derived from PreGermanic Stress by relaxing the condition that a μ element appear between the stressed μ element and the beginning of the word.

$$\#\,\mu\,\mu \rightarrow \mu\,\acute{\mu} \quad \Rightarrow \quad \#\,\mu \rightarrow \#\,\acute{\mu}$$

3.3.5. Gothic Contraction

If this analysis is truly PreGermanic then its effects should be evident in other Germanic lauages. In fact, it provides a natural analysis of the alternation between ji [ɣi] and ei [ī] in Gothic. This alternation is apparent when comparing the paradigms of harjis *army* and haírdeis *shepherd*. Where ji appears in the nominative and genitive singular after a 'light' syllable, ei [ī] appears after a 'heavy' syllable.

Singular		
Nominative	harjis	haírdeis
Accusative	hari	haírdi
Genitive	harjis	haírdeis
Dative	harja	haírdja
Plural		
Nominative	harjōs	haírdjōs
Accusative	harjans	haírdjans
Genitive	harjē	haírdjē
Dative	harjam	haírdjam

One of the traditional analyses [Wright, 1910] claims that Sievers' Law underlies this alternation. This law was originally formulated for the alternation ɣ~iɣ in Sanskrit and Ancient Greek and predicts ɣ after 'light' syllables and iɣ after 'heavy'. The former appears after light syllables, the latter after heavy syllables. This initial difference is then used to derive the different reflexes.

haryis	hairdyis	
"	hairdiyis	Sievers' Law
"	hairdīs	iyi → ī

There are several problems with the analysis. One is that the required set of phonological rules is inelegant and unmotivated. To derive genitive hairdeis, it is claimed that the cluster iyi < *iye contracts to ī.

hairdyes	
hairdyis	ye → yi
hairdiyis	Sievers' Law
hairdīs	iyi → ī

However, the long vowel of the nominative hairdeis is not similarly derived. First, the a of the nominative marker elides, a loss evident in dags < *dagaz, Lithuanian dagas *day*. After Sievers' Law applies, the resulting iy contracts to ī.

hairdyas	
hairdys	a → Ø
hairdiys	Sievers' Law
hairdīs	iy → ī

Thus, the analysis requires two contractions rules: iyi → ī and iy → ī. It is possible that more than one rule is responsible for the alternation, but no argument is given. The only argument in 'workability', the analysis does not work unless two contraction rules are posited.

A second problem is that the rules which comprise the analysis must be blocked for no principled reason. For example, the rule iy → ī must be blocked in, *inter alia*, the nominative plural hairdjōs. If is not blocked then incorrect *hairdīōs will result. To block the rule, it is claimed that iy reverted to y if a back vowel followed.

hairdyas	hairdyōs	
hairdys	"	a → Ø
hairdiys	hairdiyōs	Sievers' Law
"	hairdyōs	iy → y / __ [V, +back]
hairdīs	"	iy → ī

Conversely, one could restrict the contraction rule iy → ī to just those environments in which { s, þ } follow.[4] On this account, the rule in which iy reverts to y can apply unconditionally after contraction.

hairdyas	hairdyōs	
hairdys	"	a → Ø
hairdiys	hairdiyōs	Sievers' Law
hairdīs	"	iy → ī / __ { s, þ }
"	haridyōs	iy → y

This is the account given by Beade{,1972 #58}. This is really no improvement. Whereas Wright's analysis requires an unmotivated condition on vowel elision, that i be followed by y and a back vowel, Beade's analysis requires an unmotivated condition on contraction, that the following consonant be s or þ.

A final problem with the traditional analysis is that it requires nonlinguistic and unprincipled 'explanations' for forms where it does not work. In the nominative singular harjis, a 'light stem' noun, the rule set predicts *haris.

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4 The þ must be mentioned because of the third person singular. Cf. nasjiþ *he names*, but sōkeiþ *he seeks*.

haryas	
harys	a → ∅
"	Sievers' Law
"	iy → ī
¢haris	y → i / C__ $\left\{ \begin{matrix} \# \\ C \end{matrix} \right\}$

Wright explains away this anomaly by analogy, claiming that yod was 'extended' to *haris to give harjis from the forms in which it was regular. He does not explain why yod was not also extended to the accusative hari nor why it was not lost in the oblique forms on analogy with nominative and accusative *haris and hari. That the analysis must be patched in this way casts doubt on it.

An alternative analysis begins with the problem of the nominative singular. From the etymon *haryas, the i of harjis can be derived by assimilation: ya → yi. This is a more general application of ye → yi which is required in any case for the genitive harjis < *haryes. It is more general in the sense that ya are less similar than ye.

haryes	haryas	dagas	
haryis	"	"	ye → yi
"	haryis	"	ya → yi
"	"	dags	a → ∅

This solution makes the nominative singular regular. The assimilation rule applies only to a and e, not to o; cf. nominative and dative plural harjōs and harjam < *haryomiz. It does not apply in accusative plural harjans because of the following ns cluster. Foley [1977] argues that vowels preceding nasal+continuant are preferentially longer or nasal. The assimilation rule ya → yi applies only if a is neither lengthened nor nasalized.

The assimilation rule provides a sequence which can contract to give a long vowel after 'heavy' stems.

haryas	hairdyas	
haryis	hairdyis	ya → yi
fails	hairdīs	yi → ī

Thus, it is not necessary to posit Sievers' Law in Gothic. Consequently, the unmotivated loss of vowel when iy follows a back vowel is unnecessary. Furthermore, only one contraction rule yi → ī is necessary, the genitive hairdeis may be derived by the same contraction rule as the nominative.

hairdyas	hairdyes	
"	hairdyis	ye → yi
hairdyis	"	ya → yi
hairdīs	hairdīs	yi → ī

This analysis seems to be that proposed by Prokosch[1939] and Murray and Vennemann. The problem it poses is why contraction applies in *hairdyis but not in *haryis. In Prokosch and

Murray and Vennemann, the solution is sought in syllable structure. Prokosch writes that the alternation

> "... is due to a difference in syllabification. In the former type, the syllable division is between stem and ending: ... *har-jis* ... In the later type, the final consonant of the stem belongs to the next syllable: ... *hair-deis*, and intervocalic *-ji- = ii* was contracted to ī." (§34d)

Murray and Vennemann assume Prokosch's analysis when they write

> "The glide [y] underwent contraction with a following *i* when it could not establish itself in syllable initial position; but in that position it was preserved." (pg. 518)

The remarkable aspect of this account is that syllable boundary assignment depends on the number of syllables. Not only does contraction apply when the preceding syllable is 'heavy' as in haírdeis and lēkeis *physician*, but it also applies when the stem has more than one syllable in ragineis *counsellor*, sipōneis *disciple*, bōkareis *scribe* regardless of the weights of any of the syllables.

For example, although Prokosch assigns a syllable boundary in harjis as har-yis, he assigns one in *raginyis as ragi-nyis. The rule for syllabification is something like "The first of two consonants belongs with the prior syllable unless more than one syllable precedes in which case it belongs with the following syllable." Murray and Vennemann must also assume this syllabification.

A better analysis is available if we consider the stress pattern of Gothic. The stress rules I have argued for Old English predict that the stress patterns are harýis and *háirdyis. That is, among monosyllabic stems, yi contracts if the yod is unstressed. We can propose a process of Contraction.

Contraction(Gothic)
Process: y° i → ī

Notice that this is a restricted form of the contraction rule proposed earlier for Old English. In Old English, yi contract regardless of stress placement. This is evident in the second person siulars fremes and dēmes. The failure of Gemination in the former is attributed to the prior application of Contraction.

fremyes	dēmyes	
fremyis	dēmyis	ye → yi
fremīs	dēmīs	yi → ī
"	"	Gemination
fremis	dēmis	ī → i

To unify the facts of Gothic and Old English, I add a second condition to the definition of Contraction for English, that the value of the glide on the σ parameter be sufficiently small.

Contraction(Gothic and Old English)

Process: $GV \rightarrow \bar{V}$

Conditions: $|V| - |G| \leq \Delta$

$|G|_{\sigma} \leq \Sigma$

The difference between Gothic and Old English, with respect to Contraction, is the influence of stress. In Gothic, only y°i contracts. In Old English, the process has generalized so that both y°i and ýi contract. The derivations of the second person singular of the cognates ner-ian/nasyan *to name* and dēman/dōmyan *to judge* illustrate.

O.E.	Gothic	O.E.	Gothic	
neryis	nasyis	dēmyis	dōmyis	
neryís	nasýis	dḗmyis	dṓmyis	Stress Assignment
"	"	dḗmīs	dṓmīs	y°i → ī(Go. & O.E.)
nerīs	"	"	"	ýi — ī (O.E.)
neres	"	dēmes	"	Shortening/Lowering

The analysis that stress determines whether Contraction applies provides a natural explanation for contraction in multisyllabic words such as ragineis, sipōneis and bōkareis. The PreGermanic Stress rule

$$\# \mu \mu \rightarrow \# \mu \acute{\mu}$$

assigns stress to these as *ragínyis, *sipṓnyis and *bṓkaryis, which is exactly what is required for Contraction to give the right results. These words are evidence against the existence of the Alternating Stress rule in Gothic.

Thus, the stress patterns of Old English and Gothic differ by the presence of the Alternating Stress rule in the former but not in the latter. This in turn is a consequence of the meta-rule

$$\# \Rightarrow \varnothing$$

which applied in Old English, but not in Gothic.

3.3.6. Latin -y- verbs

It has been argued by Niedermann [1975] that the processes underlying the Gothic alternation between ji and yi has a parallel in Latin, found in verbs of the types represented by capis *take* and audīs*hear*. The alternation is in the thematic vowel which is either long or short. If the root is a light monosyllable the thematic vowel is -ĭ- (I). However, if the root is a heavy monosyllable the thematic vowel is -ī-(II).

I	capis	*you take*
	cupis	*you desire*
	facis	*you do*
	fodis	*you dig*
	fugis	*you escape*
	gradior	*I walk*
	iacis	*you lay*
	icis	*you hit*
	patior	*I experience*
	quatis	*you shake*
	rapis	*you seize*
	sapis	*you have the flavour of*
	specis	*you look at*
II	audīs	*you hear*
	dormīs	*you sleep*
	farcīs	*you stuff*
	fulcīs	*you support*
	gānīs	*you snarl*
	ordīrī	*I begin*
	sancīs	*you consecrate*
	sarcīs	*you patch*
	sāgīs	*you perceive quickly*
	sentīs	*you feel*
	sōpīs	*you put to sleep*
	vincīs	*you vanquish*

The verbs in question are those which like nerian in Old English and nasjan in Gothic form the verbal stem with a yod increment. Underlying capis and dormīs are *capyis and *dormyis. The long -ī- of dormīs is formed by Contraction: yi → ī. The problem is why Contraction applies in dormīs but not in capis.

It is traditionally argued that the stress pattern in prehistoric Latin was word initial (see, for example, Buck [1933: pg. 165]). I have argued that this stress pattern arose in Germanic by generalizing a rule which assigned stress to the second mora in the word to one which assigned stress to the first mora. The alternation in Latin is evidence that word initial stress arose there in the same manner. Contraction applies in dormīs < *dormyis but not in capis < *capyis because the yod was stressed in the latter, but not in the former. Latin and Gothic have the same rule set, except that the yod of *capyis deletes at some later point in Latin, but does not in Gothic. The derivations of Latin capis and dormīs, contrasted with Gothic nasjis and dōmeis illustrate.

Latin	Gothic	Latin	Gothic	
capyis	nasyis	dormyis	dōmyis	
cápyis	nasýis	dórmyis	dṓmyis	Stress Assignment
"	"	dórmīs	dṓmīs	y°i → ī
cápyis	násyis	"	"	Stress Shift
cápis	"	"	"	y → Ø (Latin)

Niedermann notes that there are putative exceptions to his observation (**III**). These are verbs which have a 'light' root but a long -ī- theme vowel. These can be distinguished from those which have a 'light' root and a short -ĭ- theme vowel by the final radical consonant. In table **I**, all roots end in a stop. However, in table **III** all roots end in a nasal, liquid or glide.

III	ferīs	*strike*
	harīs	*draw*
	morior	*die*
	orior	*rise*
	parīs	*bear*
	pavīs	*strike*
	polīs	*polish*
	salīs	*jump*
	sarīs	*hoe*
	venīs	*come*

That these two groups of verbs can be so distinguished is predicted by the principles of μ association. Recall that the first element in the sequence $\varepsilon_1\varepsilon_2\varepsilon_3$ may be associated with the μ plane twice if the condition $|\varepsilon_2|_\rho - |\varepsilon_3|_\rho \geq \Delta$ is met. In the instances examined previously, the value of Δ has been 0. However, during the period in which the ĭ/ī alternation arose, the process had generalized and the value of Δ was –2

Etymon	Reflex	$\lvert\varepsilon_2\rvert_\rho - \lvert\varepsilon_3\rvert_\rho$
capyis	capis	–4
venyis	venīs	–2
salyis	salīs	–1
saryis	sarīs	–1

The difference between capyis and venyis is that the radical vowel of the first is associated with the μ plane once, but that of the second is associated twice. Stress consequently falls on the first vowel of venyis but on the yod of capyis.

One conjectures that this is illustration of the development of prehistoric Latin initial stress. The generalization of the principles of μ association permit an increasing variety of sequences to condition a second association of a vowel with the μ plane. Eventually, the generalization permits all initial vowels to be associated with the μ plane twice.

3.4. Vocalization

Vocalization is the process by which as resonant element acquires a vocalic onset or offset. The process is replete in Indo-European. In the noun paradigm of Latin, for example, a word final liquid vocalizes if it is precede by a consonant. The paradigms of rēx *king* and pater *father* illustrate.

Singular		
Nominative	rēx	pater
Accusative	rēgem	patrem
Genitive	rēgis	patris
Dative	rēgī	patrī

In the nominative singular, the suffix -s (rēks < *rēg+s, pater < *patr+s) assimilates to a preceding r and the resulting geminate degeminates. The r then vocalizes.

rēg+s	patr+s	
rēk+s	patr+r	Assimilation
"	patr	Degemination
"	pater	Vocalization

The purpose of this section is to demonstrate that not only can the facts of Vocalization in Old English be analyzed as evidence of the stress pattern exemplified by both Apocope and Gemination, but that subtle dialectal differences are a consequence of small differences in μ Association. As well, I will argue for a minor modification of the ρ parameter which will be important when the analysis of Gemination resumes. The dialects which I will compare are Kent [Campbell, 1962] and West Saxon [Wright, 1914].

3.4.1. A Definition of Vocalization

In Old English, Vocalization originally applied as in Latin: to a liquid, and to a lesser extent a nasal, which occurred word finally and was preceded by a consonant. It is apparent in the nominative and accusative of ātor *poison* and wæter *water*.

Singular		
Nominative	ātor	wæter
Accusative	ātor	wæter
Genitive	ātres	wætres
Dative	ātre	wætre
Plural		
Nominative	ātor	wæter
Accusative	ātor	wæter
Genitive	ātra	wætra
Dative	ātrum	wætrum

The second vowels of ātor and wæter are not etymological. The roots are √ātr and √wætr, not ¢√ātor and ¢√wæter. The plural ātor cannot be derived from *ātor+u; all analyses predict that if this were the etymon the final u would be retained. Nor can the genitive wætres be derived from *wæteres as the medial vowel does not normally elide when the preceding vowel is 'light'; cf. werodes *troop's*.

A final argument for distinguishing ātor and wæter from true disyllabic roots is that they behave differently when the plural u is 'analogically' restored in later documents. In Dahl's study of extant Old English documents [Dahl, 1938], if the plural u reappears in a true disyllabic stem such

as mægen the medial vowel remains and the new plural is mægenu. However, if the u reappears in wæter, the resulting form is wætru.[5] This difference is natural if the root structure of mægen and wæter are different.

Vocalization is clearly sensitive to the ρ parameter: elements which vocalize have a greater ρ value than those which do not. Thus, r vocalizes in wæter < *wætr, but d does not in word, though both are word final and preceded by a consonant. A first approximation of the definition of Vocalization could be:

Vocalization (first version)

Process: $C_1 \rightarrow \text{ə}C_1 \,/\, C_2 \_\_ \#$

Conditions: $|C|_\rho \geq P$

The anaptyctic vowel introduced by Vocalization harmonizes with the preceding vowel. The vowel appears as o after back vowels and e after front vowels.

wætr+u	wætr+es	ātr+u	ātr+es	
wætr	"	ātr	"	Apocope
wætər	"	ātər	"	Vocalization
wæter	"	ātor	"	Harmony

The definition as it stands is incomplete. The issue that it does not address is that C_1 vocalizes only if its ρ value is greater than that of C_2. For example, word final n vocalizes in brægen *brain*, genitive brægnes, but not in bearn *child*, word final l vocalizes in tungol *star*, genitive tungles, but not in earl. This condition is also part of the definition of μ Association. Recall that an element is associated with the μ plane only if it has a greater ρ value than the element preceding it.

μ **Association I**

$$\begin{array}{rl} & \mu \\ & | \\ \text{Process:} & \varepsilon_1\,\varepsilon_2 \Rightarrow \varepsilon_1\,\varepsilon_2 \\ \text{Conditions:} & |\varepsilon_2|_\rho \geq P \\ & |\varepsilon_2| - |\varepsilon_1|_\rho \geq \Delta \end{array}$$

This suggests that Vocalization is conditioned conditioned by μ Association. To so define Vocalization seems to give it the correct characterization. Consonants vocalize if they are at the peak of the resonance contour and sufficiently resonant. The definition of Vocalization is revised so that it applies to a word final element which is associated with the μ plane and has a sufficiently large ρ value.

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5 On pages 69–70, Dahl lists nouns which have what he considers to be an 'analogical' plural. He gives 8 citations of wætru. After one he includes in parentheses *-ter-* without comment. This appears to be the only instance of an anptyctic medial vowel in an 'analogical' plural. 8 instances is not a sufficiently large sample size to claim statistical significance, but on the other hand 1 out of 8 is not sufficient to support an argument that the root of wæter is √wæter rather than √wætr.

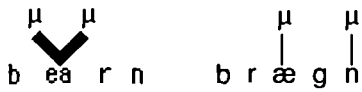
Vocalization (second version)

Process: $\overset{\mu}{|}\ \overset{\mu}{|}$ $C \rightarrow \text{ə}\ C\ /\ \#$

Conditions: $|C|_{\rho} \geq P$

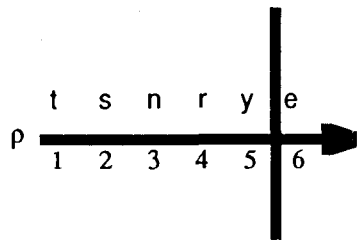
There is no evidence that s vocalizes in Old English. Thus the parochial value of P for Old English is 3, that of nasals.

With this change to the analysis of μ Association I, the structures of *brægn > brægen and *bearn > *idem* are:



The n of brægn vocalizes because it is associated with the μ plane; that of bearn does not vocalize although word final and preceded by a consonant because it is not associated with the μ plane.

It is worth noting that the definition of Vocalization assumes, as does the earlier definition of Apocope, a prior distinction between vowels and consonants. Obviously, one can be given by reference to the ρ parameter.



Vowels are those elements which have a ρ value of 6; consonants are those which have a ρ value of less than 6. The frequent ambiguity of glides may be product of their proximity to the dividing line.

Unfortunately, lacking from such a definition is any reason why there should be a consistent distinction between $|\varepsilon|_{\rho=6}$ (vowels) and other elements. For example, from this definition questions such as why Apocope must be limited to the elision of vowels and can not include consonants, and why Vocalization does not generalize to include vowels have no obvious answer.

One possible solution is to accept the distinction as primitive and construct the ρ parameter as ranging over consonants alone. This problem is left unresolved.

3.4.2. Vocalization of Glides

The condition on Vocalization that only sufficiently resonant consonants vocalize entails the prediction that if nasals and/or liquids vocalize, then glides must also. This prediction is borne out

in Old English where vocalization applies to glides as well as liquids and nasals. When word final, w vocalizes to u:

> "When **w** came to stand at the ends of a word or syllable, it became vocalized to **u** (later **o**)" [Wright, 1914: §265]

I	Nominative	Genitive	
	bealu	bealwes	*evil*
	bearu	bearwes	*grove*
	gearu	gearwes	*ready*
	mearu	mearwes	*tender*
	nearu	nearwes	*narrow*
	sceadu	sceadwes	*shadow*
	searu	searwes	*armour*

Similarly, y became i when word final.

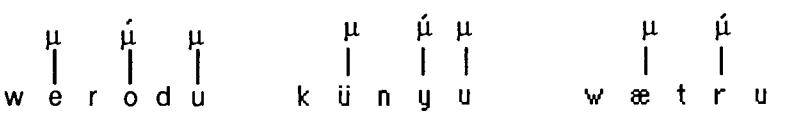
> "When **j** came to stand finally after the loss of the case endings **-az, -an** ... it became vocalized to **-i** which became **-e** at a later period, as **hierde**, O.S. **hirdi**, OHG **hirti**, Goth. **haíði**, *shepherd.*' [Wright, 1914: §274]

The shifts w > u and y > i are the result of Vocalization with subsequent contraction of the glide with the preceding vowel, parallel to the contraction of yi → ī discussed with reference to the failure of Gemination when yod is followed by i.

wætr+u	bealw+a	hierd+y+a	
wætr	bealw	heirdy	Apocope
wætər	bealəw	heirdəy	Vocalization
wæter	bealuw	heirdiy	Harmony
"	bealu	hierdi	Contraction/Shortening

3.4.3. Apocope after Resonants

The μ structures assigned to words such as *wætru > wæter correctly predict that the final vowel will elide. Since the stem-final resonant is associated with the second μ in the plane, it rather than the final vowel will receive stress. Thus, the structure of *wætru is parallel to that of *werodu and *künyu.[6]



However, words such as plural ātor < *ātru seem to have exceptional Apocope. If the liquid in *ātru is associated with the μ plane then the μ structure and stress pattern of *ātru appears to be identical to that of *mæædenu and *riikyu.

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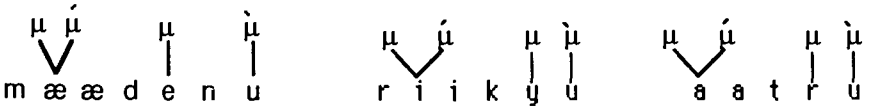
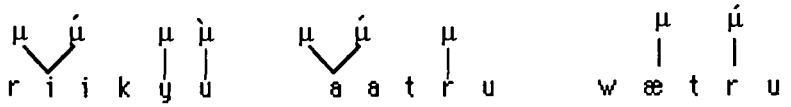
6 See the following argument for why the final vowel is not associated with a μ element.



This cannot be correct because although the final vowels of *mǣdenu and n̄kyu, the final vowel of *ātru elides and consequently cannot be stressed.

The solution to this dilemma is evident when one tries to discover how the final vowel could be associated with the μ plane, and thereby be eligible for stress. μ Association I will not associate it because the previous segment is associated with the μ plane. μ Association II is contingent on the following resonance gradient and is consequently irrelevant to this vowel. This leaves Dieresis. However, Dieresis permits two continuous segments to associated with the μ plane only if they are sufficiently similar. In the case of yu, the difference in ρ values is 1; in the case of ru, the difference is 2.

I claim that Dieresis in Old English is restricted to just those cases where the difference in ρ values of two contiguous segments is less than or equal to 1. This means that the final vowel of *riikyu is associated with the μ plane because the difference between it and the previous segment is 1. But the final vowel of *ātru is not associated with the μ plane, because the difference between it and the previous segment is 2. Hence, it cannot be stressed. The correct μ structures and stress patterns of *riikyu, *aatru and *wætru are:



This analysis correctly predicts that the final vowel of *ātru elides.

3.4.4. Vocalization and Stress

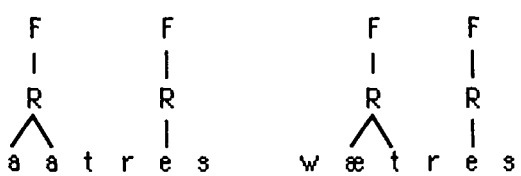
The first vowel of *wætru cannot be associated with two morae although that vowel precedes two consonants, because the condition that the ρ value of the first succeeding element be sufficiently greater than that of the second does not hold ($|\varepsilon_1|_\rho - |\varepsilon_2| \geq \Delta$). Consequently, the stress patterns of *ātru and *wætru must be different. This account makes the prediction that rules which are sensitive to stress will distinguish between these words. This prediction distinguishes this analysis from the metrical analysis of Keyser and O'Neil who argue [Keyser and O'Neil, 1985: pp. 136–138] that the metrical trees of forms like *wætru (their example is stefn < *stefnu *voice*) must have the *same* metrical structure as *ātru. I will argue that there are vocalization phenomena which contradict Keyser and O'Neil's analysis.

The argument centres on a phonological change which distinguishes West Saxon from other Old English dialects. In West Saxon, liquids and nasals vocalize word medially as well as word fi-

nally, if the preceding syllable is 'light'. If the preceding syllable is 'heavy', the segment remains as in Kentish (see Wright[1914: §347–349]). Contrast the paradigms of *ātor and wæter in West Saxon.

Singular	West Saxon			
Nominative	ātor	wæter	ātor	wæter
Accusative	ātor	wæter	ātor	wæter
Genitive	ātres	wæteres	ātres	wætres
Dative	ātre	wætere	ātre	wætre
Plural				
Nominative	ātor	wæter	ātor	wæter
Accusative	ātor	wæter	ātor	wæter
Gentive	ātra	wætera	ātra	wætra
Dative	ātrum	wæterum	ātrum	wætrum

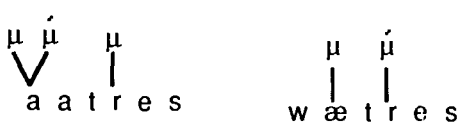
Keyser and O'Neil{Keyser, 1985 #61: pp. 236–138} have argued that *ātru and *wætru (the example which they use for the philological 'light' stem is *stefnu > stefn *voice*) must have the same metrical structure. They must argue this because Apocope has applied to both and because, on their analysis, Apocope is conditioned by metrical structure. On their analysis, the metrical structure of the genitives *atres > *idem* and *wætres > wæteres are:



Since *atres and *wætres have the same metrical structure, a distinguishing environment can not be formulated at this level. The metrical account cannot distinguish between strings to which Vocalization applies and those to which it does not.

It is possible to construct an environment built around, perhaps, the number of consonants intervening between the last segment associated with a rime and the resonant which vocalizes, but only at the cost of the original insight that syllable weight in some way conditions vocalization.

I have argued that *atres and *wætres must have different μ structures and consequently different stress patterns. It is the stress pattern which serves to distinguish those words with internal vocalization from those without. The stress patterns of the genitive are:



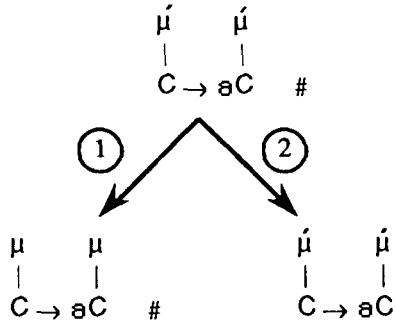
It is only when a segment is stressed that it vocalizes. A condition on Vocalization is that it applies preferentially to stress segments.

Vocalization (final version)

$$\begin{array}{rl} & \overset{\mu}{|} \quad \overset{\mu}{|} \\ \text{Process:} & C \rightarrow \text{ə}\ C\ /\ \_\_\ \# \\ \text{Conditions:} & |C|_{\rho} \geq P \\ & |C|_{\rho} \geq \Sigma \end{array}$$

The distinctions this process makes between elements associated with the μ plane and those which are not, and between stressed and unstressed elements cannot be made by the metrical theory of Keyser and O'Neil.

The word final and word medial vocalization rules the consequence of two generalizations. From an unattested rule in which only stressed word final elements vocalize is derived a rule in which both stressed and unstressed word final elements vocalize (1), by relaxing the condition on Σ. Again from the original rule is derived another in which medial stressed elements vocalize (2), by removing the condition that it apply word finally.

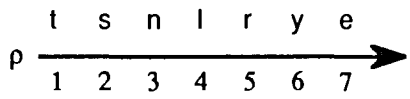


3.4.5. Restricted Medial Vocalization

According to Campbell, word medial vocalization was originally restricted to r and glides.

> "Extension of a parasitic vowel to internal open syllables is frequent only with *r* after short syllables, e.g. *fægeres*, *æceres*, less frequently *fugoles*."[Campbell, 1962: §363]
>
> "Especially W[est]-S[axon], already present in Ælfred, and increasingly frequent in later texts, is a tendency to develop [ɥ] and [w] after a short syllable to [iɥ] and [uw], e.g. *herigas* armies, *herigan* praise, ... *beaduwe* d.s.battle, *seoneuwa* n.p. sinews." [Campbell, 1962: §365]

The application of Vocalization to medial ɥ, w and r but not l is evidence that the classification of r and l together as liquids is incorrect. Vocalization reveals that r shares some phonological properties with glides. I suggest that the ρ parameter be revised to distinguish r from l.



Foley [1977: pp. 37–38] gives several arguments for |r| > |l| although he does not explicitly incorporate this relationship in to the ρ parameter. Murray and Vennemann argue for a similar distinction on their parameter though their arguments are from considerations of syllable boundaries. This revision will be independently justified when consideration of Gemination is resumed.

3.5. Gemination as a Universal Process

This section continues the analysis of Gemination begun earlier in this chapter. There it was argued that the stress pattern of a word could serve as distinguishing environment for Gemination. The suggestion is that a stronger claim can be made, that the stress pattern of a word conditions Gemination.

In order to establish the *conditions* on Gemination, I address several questions.

1. What is the underlying process? The answer is by no means obvious. The following possibilities have been suggested.
   a. Gemination is an operation on rime structure. This is the view of Keyser and O'Neil discussed above.
   b. Gemination is the doubling or lengthening of a consonant. This is the analysis proposed by Kiparsky and O'Neil.

      $$\begin{bmatrix}+\text{syll}\\-\text{long}\end{bmatrix} \quad C \quad y$$
      $$1 \quad 2 \quad 3 \quad \Rightarrow 1\,2\,2$$

      Condition: $2 \neq$ /r/
   c. Geminate consonants result from epenthesis and assimilation. A consonant is inserted between another and a yod. The new consonant assimilates to the preceding consonant. This is the view of Lass and Anderson[1975].

      $$\varnothing \rightarrow \begin{bmatrix}\alpha[\text{artic}]\\ \beta[\text{phon}]\end{bmatrix} \; / \; V_1^1 \begin{bmatrix}\alpha \begin{bmatrix}\text{artic}\\-\text{low}\end{bmatrix}\\ \beta \begin{bmatrix}\text{phon}\\+\text{cons}\end{bmatrix}\end{bmatrix} \_\_ + \begin{bmatrix}+\text{high}\\-\text{back}\end{bmatrix}$$
   d. Geminates result from the assimilation of yod to the preceding consonant [Kurath, 1956]. "Most long consonants in this position result from assimilation of /j/ to the preceding consonant, as in *settan* < **satja-nam*"
2. Why does r fail to geminate? The failure is evident in nerjan < *neryan, cf. Gothic nasjan *name*. Only Lass and Anderson make a serious attempt to answer this question. Kiparsky and O'Neil, for example, are content to note the failure of r in the rule. The failure of r is important because it also fails to geminate in Italian, where conso-

nants normally geminate when a yod follows. An analysis should show why r fails in both languages.

3. What are the conditions on the loss of yod? Yod normally elides in Old English when preceded by a consonant. However, if the consonant is r and the vowel preceding is short, yod fails to elide; e.g. nerian. If the vowel preceding r is long, the yod elides; e.g. fēran < *fēryan

With the exception of the analysis of Kurath, those in 1 above share the feature that although the presence of yod is necessary for the application of the rule, it does not seem to participate in the rule in any interesting way. There is no evidence that it conditions Gemination.

I have argued that for Gemination to apply the yod must be stressed which strongly suggests that yod is the focus of the rule. Whereas other accounts assume that the yod is part of the environment of a gemination process, I will argue that the process which creates geminates in Old English and Italian has the form ɣ → ψ, that it is an operation on yod . This leaves open the possibility of Gemination proper, i.e. C → CC, in other languages.

The argument appeals to universality and comprehensiveness; an account which systematically relates phenomena from different languages with a small set of rules and which does so without 'exceptions' is preferred over those which are parochial and cannot fully account for the data in the language for which they are formulated.

I note that yod cannot be the focus of the rule in the way in which Kurath has it. Kurath's analysis is parochial, for it cannot be related to Gemination in Italian or Old English's sister Old Saxon where geminates are not coincident with the loss of yod. For example, Kurath gives settan < *set+yan as an example of assimilation of yod to t, but the Old Saxon cognate is settian. Similarly, Italian geminates retain yod; cf. Latin apiu > Italian appio *celery*. One can also argue against it on theoretical grounds. It is counter-predicted by the condition on Assimilation that the (inherently and/or positionally) stronger element controls Assimilation [Foley, 1977: pg. 36]; in the sequence tɣ yod is both positionally and inherently stronger than t. The account given by Kiparsky and O'Neil also states yod elides as a consequence of Gemination, though it could be easily repaired to correctly describe Gemination in Old Saxon and Old Saxon.

To show that the focus of the process responsible for geminates in Old English is an operation on yod, I first give an analysis of glide strengthening in Bantu. In this process, the focus is unarguably the glide. The next step in the argument is to show that the process in Bantu is the same process as that which creates geminates in Old English.

3.5.1. Bantu

Stem initial glides in Bantu alternate with obstruents when preceded by a nasal prefix.[Brown, 1972; Foley, 1983; Katamba, 1979]. A stem initial yod assibilates. A stem initial vav alternates with p.

I	Luganda	Lufumbo	Luhugu	
	iɲju	indzu	inzu	*house*
	kaɣu	kaɣu	kaɣu	*small house*
	ɲjela			*I sweep*
	ɣela			*sweep!*
		indzofu	inzofu	*elephant*
		kaɣofu	kaɣofu	*small elephant*
		indzuci	inzuci	*bee*
		kaɣuci	kaɣuci	*small bee*
		indzoha	inzowa	*I pound*
		kudzoha	kuzowa	*to pound*
	mpeta			*ring*
	kaweta			*small ring*
	mpa			*I give*
	kuwa			*to give*

There is a tradition in *Theoretical Phonology* to give an account of alternations such as w~p as the result of the sequence of two processes rather than that of a single process w → p. The first process adds a stop onset to a glide and is possibly identified with Holtzmann's Law. The second contracts a stop and glide to a stop.

1. w → kw
2. kw → p

The factors determining which stop is acquired will be identified below. In Bantu, the stop is unvoiced. If a voiced stop is added, the contraction rule is gw → b; if a fricative is added, the contraction rule is ɣw → β/v.

The rule in 1 above occurs also to Germanic borrowings in French. The effects of the process are available from English. The words in the second column in II below are loans from French, which in turn borrowed them from Germanic. The French forms show the stop onset.

II	Germanic	French
	ward	guard
	warrantee	guarantee
	William	Guillaume
	war	guerre (Fr.)

The rule in 2 is interpreted by Foley[1977] as an increase in bond strength. That is, kw → p is an abbreviation of $(kw)_\gamma \rightarrow (kw)_{\gamma+1}$, where $(kw)_3$ = p. Evidence for the process is its application in Ancient Greek: Sanskrit aɕvas, Latin equus, Greek ιππος *horse*; Latin sequor, Greek επομαι *follow*. It is used also in the account of the Romanian shift kt > pt [Foley, 1975]. In Western Romance, a yod is inserted in this cluster and, in French and Portuguese, the k elides: Latin

noctem > nokʸte, French nuit, Portuguese noite *night*. In Romanian, a vav rather than yod is inserted and k^w contracts to p: noctem > nok^wtem > noapte.

The analysis of w > p as the product of two rules, the first of which adds a stop onset to a glide, makes available an account of why in Bantu w alternates with p when preceded by a nasal prefix, but y assibilates, instead of alternating with, say, t. Since both are glides, one expects similar reflexes, that is, one expects that the same process which applies to w applies to y.

The interpretation of assibilation [Foley, 1977] is not of a single rule y → dz, but of a sequence of rules, the first of which is y → dy.

y → dy	
dy → dzy	Assibilation proper
zy → ž	Contraction (Luganda)
y → ∅	Deiotation (Lufumbo and Luhugu)
dž,dz → ž,z	Lenition (Luhugu)

The argument for the first rule is that the reflex of assibilation is always an affricate the onset of which is a dental stop.

The parallelism between the account of Assibilation and that of w > p is evident. They both begin with a rule by which the glide acquires a stop onset. It is the processes which apply subsequently which are responsible for the appearance of the different reflexes of w and y; kw contracts, but dy assibilates.

What sort of a process is w → kw / y → dy? One way of answering this question is to determine the relative strength of the environment in which it applies. If it can be shown that

1. w → kw / E^+
2. w → *idem* / E^-

that the process applies to w only if it is positionally strong, then the process is a strengthening process. This follows from the Inertial Development Principle [Foley, 1977], by which strengthening processes apply preferentially to strong elements in strong environments. To demonstrate that the environment in which the process applies in Bantu is stronger than others in which glides appear, I show that alternations among other elements occur in the same environments and that these alternations are governed by processes which are known independently to be strengthening processes.

In Bantu, consonants strengthen when after a nasal, but do not strengthen when intervocalic. For example, in Luganda the spirants β and ð strength to b and d [Foley, 1983; Katamba, 1979; Meinhof, 1899]:

mbuzi	*goat*	kaβuzi	*small goat*
mbala	*I count*	βala	*count*
mbama	*I rush about*	kubama	*to rush about*
ndiga	*sheep*	βuliga	*small sheep*
ndaβa	*I see*	laβa	*see!*

ndoŋgwa	*I talk nonsense*	kudoŋgwa	*to talk nonsense*
ŋgo	*leopard*	kago	*small leopard*
ŋgaβa	*I give out*	gaβa	*give out!*

The alternation between d and l has been interpreted as the result of the element ð shifting conditionally to d and afterwards unconditionally to l [Foley, 1983].

1. ð → d / N___
2. ð → l

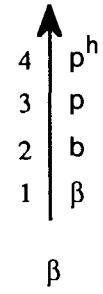
A similar alternation is found in Indo-European: cf. Latin lingua and English tongue. This interpretation assumes the importance of the phonetic classification of l as a liquid not a spirant.

An alternative is a single rule l → d / N ___. It has been noticed [Meinhof, 1899] that the oral consonants of proto-Bantu phonologically pattern as:

p	t	k
β	l	γ

If the phonetic classification of l as liquid is ignored and its phonological properties in Bantu are given precedence, then it should be classed with β and γ. This classification reinforces the argument of Foley[1970; 1977] that phonetic properties of elements are not phonologically relevant.

The issue of whether the correct rule is l → d / N ___ or ð → d / N ___ is not relevant to the main argument of this section. It is sufficient to note that there is a process which converts a class of elements (β {l ð} γ) to the corresponding voiced stops after a nasal. In terms of the β parameter, the parameter over which this process ranges, this is a conversion of $\beta_1 \rightarrow \beta_2$.[7]



The shift $\beta_1 \rightarrow \beta_2$ is an increase in strength, indicating that the process of which it is an instantiation is a strengthening process.

The point can be reinforced by determining the general process of which $\beta_1 \rightarrow \beta_2$ is one expansion. To do so, we note that the shift $\beta_1 \rightarrow \beta_2$ predicts $\beta_2 \rightarrow \beta_3$ and $\beta_3 \rightarrow \beta_4$; that is, if β → b by a general strengthening process, then the theory predicts that b → p and p → p^h. The prediction

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7 There is an unfortunate ambiguity in the interpretation of the symbol β. On the one hand, it refers to a phonetic or phonological element. On the other, it refers to a phonological parameter. When the symbol is subscripted, it refers to the phonological parameter; β_2 refers to the element indexed by 2 on the β parameter. When the symbol is not subscripted, it refers to the phonetic or phonological element: [β] denotes the voiced labial spirant, β the phonological element corresponding to β_1.

that $\beta_2 \rightarrow \beta_3$ (e.g. b → p) can be neither supported nor disconfirmed, because proto-Bantu apparently had no voiced stops [Meinhof, 1899]; words such as mbama / kubama are neologisms. However, support is found for the latter prediction that voiced stops strengthened after nasals.

The shift after nasals occurs also in Swahili. In data available in Meinhof[1899] voiced spirants shift to voiced stops and voiceless stops aspirate. The nasal deletes before aspirates.

Singular	Plural	
uɣwe	ngwe	*string*
ukumbuu	k^humbuu	*belt*
ulimi	ndimi	*tongue*
utambi	t^hambi	*wick*
uβinu	mbingu	*heaven*
upau	p^hau	*roofing*

Both shifts are instances of $\beta_n \rightarrow \beta_{n+1}$. The process increases the strength of a phonological element by one unit on the β parameter.

The process is best known as Grimm's Law, constituting the Germanic consonant shift [Foley, 1970]; e.g. Latin dentem, English tooth. The general term is Fortition, the opposite of Lenition. The difference between Swahili and Germanic is that the process is restricted to strong environments in the former and has generalized in the latter.

The configuration of Fortition in Bantu demonstrates that the environment N __ is stronger than V __ V. Stops and spirants are positionally stronger after nasals than when intervocalic. This in turn provides evidence that the process w → kw / y → dy which applies preferentially after nasals is also a strengthening process, applying preferentially to positionally strong glides.

A point of speculation is why the environment N__ is stronger than V__V. An obvious possibility is that an element following a nasal nasalizes. It has been argued in *FTP* and in the section on Old Norse denasalization that a nasalized element is stronger than its oral counterpart. Thus, a configuration of rules such as

1. $\tilde{w} \rightarrow wk$
2. $w \rightarrow$ *idem*

is predicted.

3.5.2. Glide Strengthening in Old English

The process isolated in Bantu will be called Glide Strengthening. The interesting aspects of this process are that it applies preferentially to strong glides and that it adds a consonant to the glide.

In Old English, these are both points of contact with the facts of the process which creates geminates. It too applies preferentially to strong glides, though here strength is determined by stress. And if, as suggested, the process is to be interpreted as of the form ɣ → ψ, rather than as

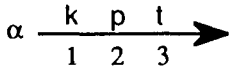
C → CC or ∅ → C, then ψ must be replaced with C̲ψ where C̲ is either a fully specified segment or a segment unspecified for values on the α and β parameters, values which are filled in after it is inserted.

A process by which a glide acquires a consonantal onset has also been claimed for Gothic and Old Norse [Prokosch, 1939] and is usually associated with Holtzmann's Law.

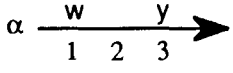
I	Gothic	Old Norse	
dvayōs (Skr)	twaddyē	tueggia	*of two*
priya (Skr)		Frigg	*wife*
ei (OHG)	ada	egg	*egg*
triuwa (OHG)	triggwa	tryggvar	*trust*
glēaw (OE)	glaggwo	gloggr	*clever*

In Old Norse, the consonant which appears as the onset to the glide is always g̲. On the other hand, in Gothic, as in Bantu, the segment which appears as the onset depends on the glide. I take this as evidence that the specification of the segment is a parochial condition, it is specified for each language.

Since it is common for the specification of the segment to depend on the glide, we require a method of stating that parametric values of the segment are determined by the glide. To do so, I assume that glides have values on the α parameter.



In particular, I assume that the values of vav and yod are:



The relative order of vav and yod can be justified by the failure of vav to participate in Glide Strengthening in Old English; e.g. s̲e̲l̲l̲a̲n̲ < *s̲a̲l̲y̲a̲n̲ *sell* with Glide Strengthening, but b̲e̲a̲l̲w̲e̲s̲ *evil's* without Glide Strengthening. The failure of w̲ to strengthen is a consequence of the general condition that glide strengthening apply preferentially to strong glides. This condition is in part realized as the condition in Old English that Glide Strengthening apply preferentially to stressed glides, in part by the condition in Bantu that Glide Strengthening apply preferentially to nasalized glides and by the condition that Glide Strengthening apply preferentially to inherently strong glides.

The lacuna in the second position is deliberate. Although it is not immediately obvious, there are candidates for this position intermediate between w̲ and y̲. For example, in Ancient Greek both w̲ and y̲ weaken (though y̲ also strengthens to d̲z̲, though a distinguishing environment has yet to be determined). As predicted by the parameter, weakening of w̲ is complete, but y̲ weakens first to h̲ which later elides.

II	Sanskrit	Greek	
	yūyám	ὑμεις	*you*
	yugam	ζυγον	*yoke*
	jēr(Gothic)	ὡρα	*year/season*
	weihs(Gothic)	οικος	*town/house*
	vēda	οιδα	*I know*

A possible interpretation is $|G|_\alpha \rightarrow |G|_{\alpha-1}$, that the α value of each element decreases by 1. If so, then w $\rightarrow \varnothing$ and y $\rightarrow$ h is evidence that the α value of h is 2.

The rules w $\rightarrow$ kw and y $\rightarrow$ ty are instantiations of the schema G $\rightarrow \varepsilon$G where $|\varepsilon|_\alpha = |G|_\alpha$. This condition, as Old Norse makes clear, is parochial. Indeed, the values for each relevant parameter must be specified for each language. For example, in the languages examined to this point, the onset has always been a stop. However, the shift in French w > v, e.g. Latin vita [wita] French vie [vi], may be interpreted as the sequence

1. Glide Strengthening: w $\rightarrow$ γw
2. Contraction: γw $\rightarrow$ v

The process for Glide Strengthening can be defined as:

Glide Strengthening

Universal Process:	$G \rightarrow \varepsilon G$
	$\|\varepsilon\|_\alpha = A$
	$\|\varepsilon\|_\beta = B$
Universal Conditions:	$\|G\|_\pi \geq \Pi$ where Π is a parameter

The values of A and B are established for each language. In some languages, they are derived from the glide. In others, they are fixed. In Old Norse, the value of A is 1; the stop onset is always g. In Gothic, the value of A is $|G|_\alpha$; that is the α value of the stop is determined by the α value of the glide.

To return finally to Old English, we note that the values of A and B are neither fixed nor derived from the glide. Rather, they and the ρ value of the onset are derived from the preceding consonant. In effect, the onset added to the glide assimilates completely to the preceding consonant.

When this is included, the definition of Glide Strengthening as it appears in Old English is:

Glide Strengthening

Universal Process: $G \rightarrow \varepsilon G / C\_\_$

$|\varepsilon|_\alpha = A$

$|\varepsilon|_\beta = B$

$|\varepsilon|_\rho = P$

Universal Conditions: $|G|_\sigma \geq \Sigma$

$|G|_\alpha \geq \Gamma$

Old English Parochial Conditions: $\Sigma = 2$

$\Gamma = 3$

$A = |C|_\alpha$

$B = |C|_\beta$

$P = |C|_\rho$

On this definition, a glide acquires an onset which has the same values of the α, β and ρ parameters as the preceding consonant, if the σ value of the glide is greater than or equal to 2 (i.e. the glide is stressed) and the α value of the glide is greater than or equal to 3 (i.e. the glide is yod). It is worth noting that when yod is intervocalic, it is not associated with the μ plane[8] and, hence, cannot be stressed. Thus this definition correctly predicts that in Old English intervocalic yod does not strengthen; cf. Old Norse Frigg but Old English frēo *wife/woman.*

As it stands, the definition predicts that yod will add an onset whenever it is stressed. This is not obviously true, since there is no geminate when the preceding consonant is r.

III	Gothic	Old English	
		āmerian	*purify*
		berian	*make bare*
		byrian	*belong to*
		derian	*injure*
	arjan	erian	*plough*
	farjan	ferian	*carry*
	hazjan	herian	*praise*
		onhyrian	*emulate*
		scierian	*allot*
		snyrian	*hasten*
		spyrian	*pursue*
		styrian	*stir*
	warjan	werian	*defend*

The issue is whether there is something special about r and/or the process such that Glide Strengthening fails after r. More generally, is the putative failure of Glide Strengthening evidence that it is sensitive to the preceding element? This is the position of Lass and Anderson, who give an account in which gemination fails when the consonant is [+back]. They argue on independent grounds that r is [+back], in fact the only [+back] consonant. There is however no theoretical rea-

8 Recall that the parochial condition on μ Association stipulated that the ρ value of the segment must be greater than that of the preceding segment.

son for [+back] consonants to fail to geminate and Lass and Anderson admit that have no real confidence in the analysis.

I have argued that the ρ parameter distinguishes r from other elements. That r can be distiuished means that it possible to contrive a rule which strengthened glides after all consonants but r. Such a rule would have a condition on it governing the relative ρ value of the preceding segment. This condition would state that the ρ value of the preceding element must be sufficiently small, where 'sufficiently small' is defined for each language.

There are two objections to this account. First, there is no principle in *ThP* from which it can be argued that an element following r is positionally weaker than one following any other consonant. This is what the account claims; if Glide Strengthening fails after r, that environment is weaker than those in which it applies. But this is not predicted by the theory, and there is no independent evidence that it is true.

The second objection is that we want Glide Strengthening after vowels in Italian: cf. Latin pĕjor Italian peggiore *worse*. However, Glide Strengthening in Italian also apparently fails after r (see below). Thus, if Glide Strengthening is sensitive to the ρ value of the preceding element the failure after r is a unexpected and inexplicable blip on the parameter.

Italian provides evidence for an alternative account which, though not forced by the theory, is at least coherent with it and has aspects which are predicted by it.

3.5.3. Italian Gemination

Italian Gemination parallels Old English Gemination, except that it is not conditioned by stress. A consonant which precedes yod (I) or vav (II) geminates if it does not otherwise palatalize (e.g. Latin alium Italian aglio *garlic*).

	Latin	Italian	
I	apiu	appio	*celery*
	cavea	gabbia	*den*
	rabies	rabbia	*rage*
	triviu	trebbio	*corner*
	rubia	robbia	*red*
	scabies	scabbia	*mange*
	sepia	seppia	*cuttle fish*
	simia	scimmia	*monkey*
	vindemia	vindemmia	*vintage*
II	aqua	acqua	*water*
	futuit	fotte	*he fornicated*
	habuit	ebbe	*he had*
	januariu	gennaio	*January*
	tenuit	tenne	*he held*

The sole exception to Italian Gemination is r which as in Old English fails to geminate. Rather than geminate, r is lost.[9]

III	Latin	Italian	
	coriu	cuoio	*skin*
	furia	foia	*rage*
	glarea	ghiaia	*gravel*
	lōrea	loia	*striped*
	paria	paia	*Parian*
	variu	vaio	*various*
	vulturiu	avoltoio	*vulture*

One possible account of the failure of r to geminate is the rule sequence

1. r-loss: $r \rightarrow \emptyset / \_\_ y$
2. Glide Strengthening: $Cy \rightarrow CCy$

The rule sequence provides a serviceable account, but it does so without any theoretical motivation. There is no immediately obvious reason why r should be lost before y.

Instead, we note that in a sequence of two consonants, the first assimilates completely to the second (e.g. Latin lactem Italian latte *milk*) if two conditions are met. The second consonant must be as strong or stronger than the first. For example, p assimilates to s in Latin capsa Italian cassa *box*, but s does not assimilate to p in Latin asper Italian aspro *rough*. The second condition is that the consonants be sufficiently similar. For example, when the difference is 1 or 0 on the ρ parameter, the first consonant assimilates to the second. Thus p assimilates to t in Latin captivus Italian cattivo *caught* and to s in cassa. But it does not assimilate to l or r (where the difference is 3 and 4) in Latin duplus Italian duppio *double* and Latin capra Italian capra *goat*. A rough definition of Assimilation is

Assimilation[10]

Universal Process: $C_1 \rightarrow C_2 / \_\_ C_2$

Universal Conditions: $|C_2|_\rho - |C_1|_\rho \geq \Gamma$

$|C_2|_\rho - |C_1|_\rho \leq \Delta$

The account of the failure of r to geminate is now the rule sequence

1. Assimilation: $r \rightarrow y / \_\_ y$
2. Glide Strengthening: $Cy \rightarrow CCy$

Assimilation of r to y, but not l to y, is predicted if the value of Δ in the definition of Assimilation is set at 1 for Italian. According to the expanded ρ parameter

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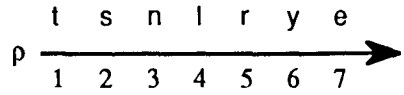
9 The exception to this observation is Latin area, Italian aria *site*. It is not clear why this r neither geminates nor is lost.

10 This is a restatement of the definition of Assimilation given in *Foundations of Theoretical Phonology* (pg. 143).



only r̲ is eligible to assimilate with y̲. Foley[1985] provides morphological evidence for sm → mm. The ρ value of m̲ is greater than that of s̲ and the difference in ρ values is 1.

After the assimilation of r̲ with y̲, the resulting y̲y̲ cluster contracts.

capsa	coryu	apyu	
cassa	coyyu	"	Assimilation
"	coyu	"	yy → y
"	"	appyu	Glide Strengthening

3.5.4. Assimilation and the 'Failure' of Glide Strengthening

The account of the failure of Glide Strengthening in Italian can be extended to Old English. Whereas in Italian r̲ assimilates to the following glide before Glide Strengthening, the order is reversed in Old English. Glide Strengthening does apply following r̲, but the new geminate assimilates to the following yod.[11]

neryan	fremyan	
neryan	fremyan	PreGermanic Stress
nerryan	fremmyan	Glide Strengthening
neryyan	"	Assimilation

This is not a 'revolving door' type of analysis: first r̲ is simplex, then geminate, then simplex again just to save the analysis of Glide Strengthening. It finds support in the account it provides of the failure of yod to elide in just those words where Glide Strengthening putatively fails. The process responsible for the loss of yod, Deiotation, deletes unstressed yod (*dḗmyan > dēman) and stressed yod (*fremyán > fremman), but it does not delete the geminate or long yod of neryyan. Since Deiotation is a weakening process, it applies to short yod in preference to long. This parallels the application of vowel elision processes to short vowels in preference to long vowels.

3.5.5. Deiotation

As noted, regardless of the prior application of Glide Strengthening and of the stress pattern of the word, a yod elides if preceded by a consonant. If remains if preceded by a vowel.

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[11] A similar analysis has been suggested by Fred Householder, reported by Lass and Anderson(pg. 258–259).

> "you could have a rule producing geminate palatalized consonants ... then a rule converting the second palatalized [r] to [i], then one depalatalizing all geminates."

I	frēmman	*fremyan	*perform*
	dēman	*dēmyan	*judge*
	fēran	*fēryan	*go*
	frīgea	Go. frauja	*lord*

The process responsible for the loss of yod cannot function in Old English as a single rule such as $y \rightarrow \emptyset / C \_\_$. This is the traditional account which deletes yod after 'heavy' syllables and those which have become 'heavy' because the consonant has geminated. The reason is that a single rule cannot be ordered with respect to Assimilation to give the correct results for both ferian and fēran. If the order is Assimilation/Deiotation fēran cannot be derived.

fremýan	ferýan	fér yan	
fremmýan	ferrýan	"	Glide Strengthening
"	feryýan	féyyan	Assimilation
fremman	ferýan	*féyan	Deiotation

On the other hand, if the order is Deiotation/Assimilation ferian cannot be derived.

fremýan	ferýan	fér yan	
fremmýan	ferrýan	"	Glide Strengthening
fremman	*ferran	féran	Deiotation
"	"	"	Assimilation

The obvious difference between *feryan and *fēryan is their respective stress patterns. The yod of the former is stressed, that of the latter unstressed. Deiotation is a weakening process and hence applies preferentially to weak elements. If the process of Deiotation is expanded as two rule schemata, the predicted order is

1. $y^{\circ} \rightarrow \emptyset$
2. $\acute{y} \rightarrow \emptyset$

That is, if yod elides, a weak yod elides before a strong yod does, where strength is defined here by the σ parameter. When this rule sequence is interrupted by Assimilation, the correct forms are derived.

fremýan	ferýan	fér yan	
fremmýan	ferrýan	"	Glide Strengthening
"	"	féran	$y^{\circ} \rightarrow \emptyset / C \_\_$
"	feryýan	"	Assimilation
fremman	feryan	"	$\acute{y} \rightarrow \emptyset / C \_\_$

If we define Deiotation as

Deiotation

Universal Process: $y \rightarrow \emptyset / C \_\_$

Universal Condition: $|y|_{\sigma} \leq \Sigma$

then the theory predicts that there are languages in which both stressed and unstressed yod elides (Old English) and languages in which only unstressed yod elides, but no language in which only stressed yod elides.

Old Norse is an example of a language in which only unstressed yod elides. When yod does not contract with a following front vowel it elides when the preceding syllable is 'heavy' but remains when the preceding syllable 'light'. The plurals of the nouns niþr *kinsman* and hirþer *shepherd* illustrate.

	Norse	Gothic	Norse	Gothic
Nominative	niþiar	niþjōs	hirþar	hairdjōs
Accusative	niþia	niþjans	hirþa	hairdjans
Genitive	niþia	niþjē	hirþa	hairdjē
Dative	niþiom	niþjam	hirþom	hairdjam

On the analysis of Germanic stress for which I have been arguing, this is interpreted as elision when the the yod is unstressed and retention when the yod is stressed. The stress patterns of the Nominative plurals are *niþyar and hírþyar.

An alternative analysis is that of Murray and Vennemann who claim that the reflexes of yod are predicated on syllable structure. They claim that the syllable divisions are

*niþ$yar > niþiar
*hir$þyar > hirþar

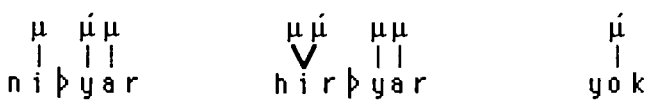
The yod is maintained in syllable initial position, but lost when it is syllable medial.

The analyses can be distinguished by considering word initial yod. Since word initial position is syllable initial position, Murray and Vennemann's analysis predicts that word initial yod will be retained. In fact, it elides.

II

Old Norse	Gothic	
ár	yēr	*year*
ungr	juggs	*young*
ok	juk	*yoke*

Elision is predicted if the Old Norse rule is simply y° → ∅, that is unstressed yod elides. The stress patterns of *niþyar, *hirþyar and *yok > *ok are



When yod is unstressed in Old Norse, it elides. This is additional support for the analysis of PreGermanic stress. It makes the correct predictions about Old Norse Deiotation, where that of Murray and Vennemann fails.

Old Norse Deiotation contrasts with that in Old English in two ways. Old English Deiotation is restricted to yod which is preceded by a consonant. For example, the yod in *dēmyan > dēman *judge* elides, but that in geoc *yoke* does not, although both are unstressed. In Old Norse, there is no such restriction. On the other hand, both stressed and unstressed yod elide in Old English, but only unstressed yod elides in Old Norse.

When the restriction on Old English Deiotation is added, the universal process of Deiotation is defined as

Deiotation

Universal Process: $ȝ \rightarrow \varnothing / C \_\_$

Universal Condition: $|ȝ|_{\sigma} \leq \Sigma$

$\Sigma|C| \geq T$

Old English has generalized the value of Σ ($\Sigma = 1$) but been conservative with T ($T = 1$). Old Norse has been conservative with Σ ($\Sigma = 0$), but has generalized T ($T = 0$). The universal process is instantiated in each language as

Old English: $ȝ \rightarrow \varnothing / C \_\_$

Old Norse: $ȝ^{\circ} \rightarrow \varnothing$

3.5.6. Summary

I have argued that Old English geminates are not the result of a process which doubles or lengthens a consonant, though such a process may well exist. Rather, I have analyzed the process as Glide Strengthening wherein the consonant added to the glide assimilates with the preceding consonant. I have offered two types of argument.

The first argument is that the focus of the rule is the glide. The geminates appear only after a stressed yod, but there is no principle which states that __ȳ is a strong environment inducing Gemination.

The second argument appeals to both comprehensiveness and universality. By defining the process has having the form $ȝ \rightarrow ψ$, it is possible to relate it to phenomena in other languages and through analysis of them arrive at a universal definition. In particular, it was argued that a single process was responsible for Old English geminates, the addition of a stop to vav to Germanic borrowings in French, Bantu glide strengthening, Hotzmann's Law in Gothic and Old Norse, and Italian geminates.

It was also argued that there is nothing in the definition of this process which inhibits Glide Strengthening after r as is usually claimed. Instead, an account was given in which Glide Strengthening applied whenever yod was stressed (and hence failed when yod was intervocalic and not stressed). Subsequently, r assimilated to the following glide. The arguments for this analysis are its coherence with the facts of Italian gemination and its account of why yod fails to elide when stressed and preceded by r.

3.6. Breaking and Rule Ordering

As a final note to this chapter, I emphasize the importance of PreGermanic Stress to Old English phonology by showing how it resolves what has been thought to be an ordering paradox.

The problem concerns Old English breaking, particularly breaking of a which converts to ea (the phonetic properties of which are disputed [Lass and Anderson, 1975]) when followed by h [χ] or $\left\{ \begin{matrix} r \\ l \end{matrix} \right\}$ C.

I	Gothic	Old English	
	slahan	slēan	*strike*
	ahtau	eahta	*eight*
	barn	bearn	*child*
	kalds	ceald	*cold.*

Although the change a > ea occurs before both h [χ] and $\left\{ \begin{matrix} r \\ l \end{matrix} \right\}$ C, this is not in itself sufficient to conclude that these environments share a property which conditions the change. It is possible that there are different processes involved which produce the same reflex or that that these environments condition the same process in different ways. I argue first that these are separate environments.

In Old High German where au monophthongizes before both dentals and h.

II	Gothic	Old High German	
	augo	Auge	*eye*
	hauhs	hōh	*high*
	nauþs	nōt	*need*
	launs	lōn	*reward*
	laus	lōs	*empty*

The same process, monophthongization of au to ō, has applied in both hōh and nōt, but it has done so for different reasons. Taylor{,1989 #48} argues that monophthongization before dentals is a function of their strength relative to labials and velars, but that monophthongization before h is a function of weakening of h.

Rather than seek a unitary process to account for the facts of Breaking, I propose two separate processes. One is umlaut or phonetic assimilation, which shifts a to ea before a back element. The element may be either [χ] or [u]. The other is true Breaking which shifts a to ea before a liquid which is followed by a consonant. This approach does not require that liquids and [χ] share a feature or property.

The obvious interpretation of the shift a > ea before [χ] is to relate it to umlaut, particularly the shift a > ea when a u followed; e.g. ealu *ale*, beadu *battle*. This observation forms the basis of Lass and Anderson's analysis. They claim that Breaking is conditioned by a following back element. This places them in the position of arguing that both r and l are [+back] consonants, an argument they admit is unconvincing.

Support for the umlaut interpretation is the behaviour of e, which shifts to eo before [χ] (cneoht, OHG kneht *knight*), but does not break before l unless it is followed by [χ] (helpan not

¢heolpan *help*, but eolh *elk*, seolh *seal*).[12] Lass and Anderson note the problem but admit that they cannot state a rule which will block breaking of e before lC unless C=[χ]. The solution is that e does not break before lC at all. Instead, umlaut shifts e to eo when a back element follows; cf. eofur OHG ebur *boar*. These facts point to the environment $\_\_C_0 \begin{bmatrix} +high \\ +back \end{bmatrix}$ for umlaut. This environment includes [χ], the only high back consonant in Old English and u, the high back vowel. It is also different from that of true Breaking which requires a liquid followed by a consonant.

I propose two rules which for a are defined as

Umlaut

Process: $a \rightarrow ea / \_\_C_0 \begin{bmatrix} +high \\ +back \end{bmatrix}$

Breaking

Process: $a \rightarrow ea / \_\_ \begin{Bmatrix} r \\ l \end{Bmatrix} C$

There are many other complications which do not concern us here. For example, both e and i break before rC but not before lC. Umlaut is also selective, applying in some dialects before both [χ] and u, but in others only before [χ].

The interesting aspect of Old English Breaking is a restriction on the breaking of a; namely that it breaks before geminate ll only if it is etymological. Breaking before ll fails if the geminate is a reflex of lu.

III

Old English	Gothic	
eall	all	*all*
feallan	fallan(OHG)	*fall*
sellan	saljan	*sell*
tellan	taljan	*count*

It has been argued by Postal{,1968 #36} and Lass and Anderson[1975] that to derive the correct forms, the rules Gemination and Breaking must be applied in an order opposite of the chronology. The chronological order is arguably Gemination/Breaking because Gemination is a West Germanic phenomenon and breaking is Old English. However, when applied in this order sellan cannot be derived.

all	salyan	
"	sallyan	Gemination
eall	¢seallyan	Breaking

On the other hand, it is argued that if the rules are reversed then sellan cannot be derived.

all	salyan	
eall	"	Breaking
"	sallyan	Gemination

12 There are also sporadic variations in self~seolf *self* and ascelcan~asceolcan *become languid*. These do not point to anything definite.

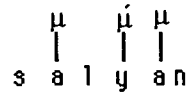
It is noteworthy that for this account to work, breaking must be defined so that it fails before l̲u̲. Postal does not define a rule. The rule given by Lass and Anderson is

$$\varnothing \rightarrow \begin{bmatrix} V \\ +back \end{bmatrix} / \begin{bmatrix} V \\ -back \end{bmatrix} \_\_ \begin{bmatrix} +cons \\ +back \\ +cont \\ <-obs> \end{bmatrix} <+cons>$$

which will break a̲ before r̲ and l̲ just if the following segment is [+cons]. Unfortunately for their account, they argue elsewhere (pp. 9–13) that [y] must be marked as [+cons]. If [y] is defined as [+cons], then the sequence l̲u̲ will condition Breaking. Thus, even though Lass and Anderson argue for nonchronological rule ordering, their rule gives incorrect results with both chronological and nonchronological ordering.

The correct analysis begins with the recognition that if breaking is a form of diphthongization, as argued by Lass and Anderson[1975], Dresher[1978], Wright[1914] and others, then it is sensitive to stress. This was demonstrated earlier by diphthongization in Italian, but is obvious in all the Romance languages. In particular, Diphthongization applies preferentially to stressed vowels.That is, one expects languages in which stressed vowels diphthongize but unstressed vowels do not, languages in which both stressed and unstressed vowels diphthongize, but no language in which unstressed vowels diphthongize but stressed vowels do not.

The stress pattern of *s̲a̲l̲u̲a̲n̲ is



This pattern is predicted by the principles of mora association together with the PreGermanic Stress rule. The prediction is verified by the strengthening of u̲ to l̲u̲. It was argued previously that Glide Strengthening applied in Old English only if the glide was stressed. On the other hand, the stress patterns of *a̲l̲l̲ > e̲a̲l̲l̲ and *f̲a̲l̲l̲a̲n̲ > f̲e̲a̲l̲l̲a̲n̲ are

It is evident that the reason that Breaking fails before l̲u̲ is that the vowel is unstressed.

á l l	saĺu̲an	
"	salĺu̲an	Gemination
éall	"	Breaking

There is no need for nonchronological rule ordering, or even for chronological rule ordering. Breaking and Glide Strengthening are unrelated processes, except that both are sensitive to stress. As unrelated processes, the order in which they apply is irrelevant. The ordering which is

relevant is that between Breaking and the Germanic Stress Shift, the shift to word initial stress. But this is true of all Old English phonology.

4. VOWEL ELISION II: SYNCOPE

4.1. Introduction

The proposal that Old English phonology is sensitive to a stress pattern other than that usually proposed for Germanic languages, that the relevant stress pattern is conditionally word initial, was originally forced by an analysis of Apocope as a universal phonological process. If the universal definition of Apocope is to apply to Old English, then the stress pattern cannot be simply word initial.

The preceding chapter demonstrated that the stress pattern assumed for Apocope can be motivated by consideration of other processes in Old English. This chapter demonstrates that the analysis of vowel elision subsumed in the definition of Apocope is necessary to explain Syncope in Old English.

4.2. Old English Syncope

The traditional interpretation of Syncope of Old English supposes that it is in part conditioned by the weight of the preceding syllable. A vowel elides if the preceding syllable is 'heavy' (I), but remains if the preceding syllable is 'light' (II)

	Nominative	Genitive	
I	æled	ældes	*fire*
	āþum	āþmes	*son-in-law*
	bīetel	bīetles	*mallet*
	brēmel	brēmles	*bramble*
	dēofol	dēofles	*devil*
	dīegol	dīegles	*secret*
	hālig	hālges	*holy*
	hēafod	hēafdes	*head*
	māþum	māþmes	*treasure*
	ōfer	ōfres	*shore*
	ōþer	ōþres	*other*
	þȳmel	þȳmles	*thimble*

Infinitive	Preterite	
ǣlan	ǣlde	*set on fire*
bǣdan	bǣdde	*compel*
bīegan	bīegde	*bend*
brǣdan	brǣdde	*broaden*
cēlan	cēlde	*cool*
cīegan	cīegde	*call*
dǣlan	dǣlde	*share*
dīedan	dīedde	*kill*
drǣfan	drǣfte	*stir up*
dēman	dēmde	*judge*
drȳgan	drȳgde	*dry*
fēdan	fēdde	*feed*
fēgan	fēgde	*join*
fēran	fērde	*journey*
flīeman	flīemde	*put to flight*
fȳsan	fȳste	*hasten*
gīeman	gīemde	*heed*
hǣlan	hǣlde	*heal*
hǣman	hǣmde	*marry*
hīenan	hīende	*humiliate*
hīeran	hīerde	*hear*
hlȳdan	hlȳdde	*make a noise*
hȳdan	hȳdde	*hide*
lǣdan	lǣdde	*lead*
lǣfan	lǣfte	*leave*
lǣnan	lǣnde	*lend*
lǣran	lǣrde	*teach*
līesan	līeste	*set free*
mǣnan	mǣnde	*moan*
mǣran	mǣrde	*proclaim*
nīedan	nīedde	*compel*
rǣran	rǣrde	*raise*
rǣsan	rǣste	*rush*
rȳman	rȳmde	*make room*
sǣgan	sǣgde	*lay low*
sǣlan	sǣlde	*bind*
scrȳdan	scrȳdde	*clothe*
sprǣdan	sprǣdde	*spread*
stīeran	stīerde	*steer*
strīenan	strīende	*acquire*
swēgan	swēgde	*make a sound*
tǣlan	tǣlde	*blame*
tȳnan	tȳnde	*enclose*
wrēgan	wrēgde	*accuse*
wȳscan	wȳscte	*wish*

Infinitive	Preterite	
āfierran	āfierde	*remove*
ærnan	ærnde	*gallop*
byrgan	byrgde	*bury*
bærnan	bærnde	*burn up*
cemban	cembde	*comb*
cennan	cende	*bring forth*
cierran	cierde	*turn*
clyppan	clypde	*embrace*
cwielman	cwielmde	*kill*
cyssan	cyste	*kiss*
fiellan	fielde	*fell*
fylgan	fylgde	*follow*
fyllan	fylde	*fill*
glengan	glengde	*adorn*
hringan	hringde	*ring*
hwierfan	hwierfte	*convert*
lengan	lengde	*require*
mengan	mengde	*mix*
mierran	mierde	*mar*
nemnan	nemde	*name*
pyffan	pyfte	*puff*
sengan	sengde	*singe*
spillan	spilte	*spill*
sprengan	sprengde	*burst*
stillan	stilt	*still*
tengan	tengde	*hasten*
wemman	wemde	*defile*
wiernan	wiernde	*refuse*

Nominative	Genitive	
angel	angles	*fishhook*
bealdor	bealdres	*prince*
bolster	bolstres	*bolster*
dryhten	dryhtnes	*lord*
ealdor	ealdres	*prince*
engel	engles	*angel*
finger	fingres	*finger*
hleahtor	hleahtres	*laughter*
morgen	morgnes	*morning*

II

Nominative	Genitive	
heofon	heofones	*heaven*
metod	metodes	*creator*
nacod	nacodes	*naked*

Infinitive	Preterite	
clynnan	clynede	*sound*
cnyssan	cnysede	*knock*
fremman	fremede	*perform*
gremman	gremede	*anger*
hlynnan	hlynede	*roar*
hrissan	hrisede	*shake*
sceþþan	sceþede	*injure*
sweþþan	sweþede	*swathe*
temman	temede	*tame*
trymman	trymede	*strengthen*
þennan	þenede	*stretch*
wennan	wenede	*accustom*
wreþþan	wreþede	*support*

Infinitive	Preterite	
berian	berede	*bare*
byrian	byrede	*pertain*
derian	derede	*injure*
erian	erede	*plough*
ferian	ferede	*carry*
herian	herede	*praise*
nerian	nerede	*save*
scierian	scierede	*allot*
snyrian	snyrede	*pursue*
styrian	styrede	*stir*
werian	werede	*defend*

4.2.1. Syncope and Apocope

Since Apocope and Syncope are both apparently conditioned by the weight of the preceding syllable, the transformational phonological interpretation has been that they must be collapsed into a single rule. There are several arguments against this manoeuvre. First, since Syncope applies word medially the conditions on its application are more complicated than those on Apocope. It is demonstrated later in this chapter that there are conditions on the application of Syncope — conditions which form the definition of Syncope — which do not condition Apocope.

A second argument concerns the putative 'exceptions' to Syncope in Old English mentioned in chapter 2. It will be demonstrated in the chapter that these are not exceptions but follow directly from the definition of Syncope aspects of which were developed in Chapter 2. The relevance of these 'exceptions' to the issue of the distinctness of Apocope and Syncope is that the condition which accounts for the failure of Syncope in Old English in these cases is irrelevant to the application of Apocope in Old English. That is, all else being equal, Syncope fails in environments in which Apocope applies. This could not be so if Syncope and Apocope were the same rule.

A final argument also concerns the failure of Syncope and the explanation of this failure. Syncope is sensitive to etymological vowel length, Apocope is not.

"*i* and *u* are ... lost in open medial syllables after a long stressed syllable. This applies to original short vowels only, as *ī* and *ū* had not yet been shortened in this position."[Campbell, 1962: §351]

In the table below, Syncope fails in the genitive even though the preceding syllable is 'heavy' (cf. Nom. æled, Gen. ældes *fire*).

I	Nominative	Genitive	
	drūgoþ	drūgoþes	*drought*
	fiscoþ	fiscoþes	*fishing*
	huntoþ	huntoþes	*hunting*
	langoþ	langoþes	*longing*
	swoloþ	swoloþes	*heat*

These nouns are suffiex with -oþ which forms abstract nouns from verbs. The vowel of the suffix is etymologically long: cf. Gothic -ōþu, Old High German -ōd, Latin -ātu, Greek -ητυ. Syncope also fails to elide the initial vowel of the suffix -ere (contemporary English -er, used to form *nomina agentis*)when it follows a 'heavy' syllable. This vowel was also etymologically long; cf. Old High German -āri, Latin -ārius.

II		
	costere	*tempter*
	crēopere	*cripple*
	drēamere	*musician*
	drincere	*drinker*
	folgere	*follower*
	gītsere	*miser*
	lǣnere	*lender*
	mangere	*merchant*
	reccere	*ruler*
	sangere	*singer*
	sēamere	*tailor*

The obvious interpretation of the problem is to invoke rule ordering; long vowels are shortened after Syncope. This, of course, assumes that vowel elision is sensitive to vowel length, that part of the definition of vowel elision rules is that they preferentially apply to short vowels. Although this was not discussed during the development of the definition of Apocope in chapter 2, it is sufficiently uncontroversial that it is proposed here without much comment. Evidence is found from Latin in the past participle where the thematic vowel elides when short, but remains when long.

III	Infinitive	Participle	
	amāre	amātus	*love*
	monēre	monētus	*show*
	audīre	audītus	*hear*
	regere	rectus	*rule*

The ordering of vowel elision and vowel shortening must be elision/shortening.

drūgōþes	costēre	
"	"	Vowel elision: V̆ → ∅
drūgoþes	costere	V̄° → V̆

However, if Syncope and Apocope are the same rule, if there is but one rule of vowel elision in Old English, then the loss of final vowels which were originally long is anomalous. The usual interpretation of the imperatives freme *perform* and dēm *judge* is that the etymon of each ends in a long vowel which shortens and elides after a 'heavy' syllable; cf. Gothic framei and dōmei. Note also that the etymon of the neuter plural -u was -ō [Wright, 1914: §214]; e.g. word < *word+u < *word+ō. The traditional interpretation of final long vowels is that ī shortened and lowered to e (e.g. imperative freme, Gothic framei) and ō shortened and raised to u (e.g. beru *I bear*, Latin ferō, Greek φερω). If the ordering between vowel elision and shortening is elision/shortening, then word cannot be derived.

drūgōþes	word+ō	
"	"	Vowel elision: V̆ → ∅
drūgoþes	¢word+u	V̄° → V̆

On the other hand, if the ordering is shortening/elision then the neuter plurals can be derived, but nouns with the abstract suffix cannot.

drūgōþes	word+ō	
drūgoþes	word+u	V̄° → V̆
¢drūgþes	word	Vowel elision: V̆ → ∅

The dilemma arises because of the mistaken assumption that because the environments of Apocope and Syncope intersect, they must be collapsed into a single rule. When they are separated, there is no dilemma.

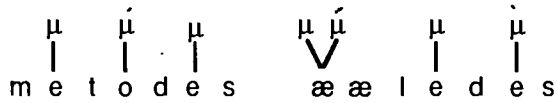
drūgōþes	word+ō	
"	"	Syncope: V̆ → ∅
drūgoþes	word+u	V̄° → V̆
"	word	Apocope: V̆ → ∅

Since Apocope and Syncope are both elision processes, it is expected that the conditions on their applications should intersect. It does not follow that they are the same process, although they may be derivable from a single more abstract definition of vowel elision or perhaps elision in general. It particularly does not follow that all vowel elision must apply as a single rule in Old English. Considerations of vowel elision and shortening demonstrate that Syncope and Apocope do not apply as a single rule in Old English.

4.3. Syncope and PreGermanic Stress

In chapter 2, it was briefly mentioned that the PreGermanic Stress rule together with the Alternating Stress rule correctly predicted aspects of Syncope in Old English, as well as Apocope. This is clear from the preceding data. Syncope applies after 'heavy' syllables and fails after 'light'

syllables. When recast in light of the PreGermanic stress rules, this is equivalent to saying that Syncope applies when the vowel is unstressed and fails when the vowel is stressed. The medial vowel of metodes does not elide because it is stressed; the medial vowel vowel of ældes < *æledes does elide because it is unstressed. The preferential application of Syncope is predicted by the general condition on vowel elision that vowel elision rules apply preferentially to unstressed vowels.



4.4. Syncope as a Universal Process

The discussion of Apocope in chapter 2 uncovered several conditions on vowel elision. Many of these conditions were discovered with reference to both Apocope and Syncope. Consequently, it is assumed that the analysis of Apocope holds for Syncope where relevant; that is, it is assumed that the universal definition of Syncope is identical to that of Apocope except for obvious considerations about elements which follow the vowel.

Syncope

Universal Process: $V_1 \rightarrow \emptyset \,/\, V_2\, \varepsilon_j \_\_ \varepsilon_k V_3$

Universal Conditions:
$|V_1|_{\eta\omega} \leq \Omega$
$|V_1|_{\sigma} \leq \Sigma$
$\Sigma|\varepsilon_j| = \tau \leq T$
$|\varepsilon_{\tau-1}||_{\rho} - |\varepsilon_{\tau}|_{\rho} \geq \Delta$

The available evidence indicates there are conditions on the elements which follow the vowel.

4.4.1. Tonkawa

Syncope in Tonkawa deletes the second vowel of a word [Kenstowicz and Kisseberth, 1977]

netle-n-o?	we-ntale-n-o?	*he is licking it/them*
picna-n-o?	we-pcena-n-o?	*he is cutting it/the*

The vowel of the root √netale elides when the prefix we is added.

However, if the vowel is followed by two consonants the vowel fails to elide. Thus, the vowel of the root √salke *pull sinew from meat* does not elide: we-salk-o? *he pulls sinews from meat.* Similarly, the medial vowel of √nepaxke *smoke* never elides: nepaxke-n-o? *he is smoking*, not ¢nepxke-n-o?. Kenstowicz and Kisseberth use this to argue that phonology in Tonkawa is constrained by its products, it cannot produce three consonant clusters.

The Tonkawa data can be reanalysed as evidence for a constraint on the application of Syncope in all languages, not only Tonkawa. That Syncope fails before two consonants but ap-

plies before one is reminiscent of the condition found in many languages that it applies preferentially after one consonant. The Tonkawa data is evidence for a 'mirror' condition: Syncope is sensitive to the number of following consonants. It applies preferentially before a single consonant. To express this, the condition that the number of following consonants be sufficiently small is added to the definition of Syncope.

Syncope

Universal Process: $V_1 \rightarrow \emptyset \,/\, V_2\, \varepsilon_j \_\_ \varepsilon_k V_3$

Universal Conditions:
$|V_1|_{\eta\omega} \leq \Omega$
$|V_1|_{\sigma} \leq \Sigma$
$\Sigma|\varepsilon_j| = \tau \leq T_1$
$|\varepsilon_{\tau-1}||_{\rho} - |\varepsilon_{\tau}|_{\rho} \geq \Delta$
$\Sigma|\varepsilon_k| \leq T_2$

This condition is not a language particular condition, but a claim about the application of Syncope in any language. The condition claims that Syncope applies preferentially before few consonants over many. This may be falsified by demonstrating that Syncope applies in a particular language, *ceteris paribus*, preferentially before two consonants over one, i.e. that Syncope applies before two consonants but fails before one.

4.4.2. Old English

Apocope applies in Old English with comparatively few restrictions. The only restrictions are that the $\eta\omega$ value of the vowel be sufficiently small and that the vowel be unstressed. It has been demonstrated that Syncope is also restricted to unstressed vowels. However, that the elements following the vowel are relevant to Syncope provides more opportunity for restricting its application.

I

Nominative	Genitive	
bærnet	bærnettes	*arson*
cyning	cyninges	*king*
fæsten	fæstennes	*fortress*
fǣtels	fǣtelses	*tub*
hengest	hengestes	*stallion*
nierwet	nierwettes	*narrowness*
sǣwet	sǣwettes	*sawing*
wēsten	wēstennes	*desert*

The data is **I** demonstrate that even when the preceding syllable is 'heavy', Syncope fails if the vowel is followed by more than one consonant. The definition of Syncope which includes the condition $\Sigma|\varepsilon_k| \leq T_2$ predicts that this is possible.

Notice that the analysis of Kenstowicz and Kisseberth cannot be extended to Old English. Kenstowicz and Kisseberth claim that Syncope inTonkawa is blocked if a three consonant cluster results. But Old English permits three consonant clusters, e.g. hyngran *to hunger.*

The analysis which I am proposing gives an account of Syncope in both Tonkawa and Old English.

4.4.3. 'Exceptions' to Syncope in Old English

One method of evaluating competing analyses is by their relative comprehensiveness. An analysis which explains more data plausibly, *ceteris paribus*, is more highly valued. In linguistics, this criterion may be applied in two arenas. One was mentioned above: an analysis which applies to all languages is preferable to a parochial analysis. The second arena is within a single language: how many data superficially contradict the analysis and how plausible is the explanation of their superficially anomalous behaviour are measures of its value with respect to other analyses.

4.4.4. Failure of Syncope after 'Heavy' Syllables

There are a class of 'exceptions' to Syncope in Old English which provide a critical test. These are mentioned in all philological handbooks on Old English. The data in **I** and **II** illustrate failure of Syncope even though the preceding syllable is 'heavy'. The preterite is formed by adding -de to the stem; the stem consists the root and the thematic vowel. Usually when the preceding syllable is 'heavy' the thematic vowel elides. However, in **II** the thematic vowel is retained.

I	Nominative	Genitive	
	syndrig	syndriges	*separate*
II	Infinitive	Preterite	
	bīecnan	bīecnede	*make a sign*
	dīeglan	dīeglede	*conceal*
	frēfran	frēfrede	*comfort*
	hyngran	hyngrede	*hunger*
	symblan	symblede	*feast*
	timbran	timbrede	*build*
	wrixlan	wrixlede	*change*

None of the contemporary researchers cite these data, likely because they have taken the cue from the handbooks and accepted them as 'exceptions'. Data which are 'exceptions' are listed, not analysed.

It is clear that the contemporary analyses must treat these as 'exceptional'. For example, according to the analysis of Keyser and O'Neil, a vowel elides if it follows a foot. Notice, however, that the trees of *wūscide *wish*, to which Syncope applies, and *frēfride *comfort*, to which Syncope does not apply, are identical. In both, the medial vowel follows a foot. However, the medial vowel elides in the former, but not in the latter.

It is not just that the metrical analysis cannot explain why Syncope fails in frēfrede. The metrical analysis cannot represent the difference between words such as wūscte in which Syncope applies and words such as frēfrede in which it fails.

The view that these data are 'exceptions' is a result of the interpretation of vowel elision is Old English as conditioned by syllable weight. The words in I and II should not be considered 'exceptions' but rather counterexamples. They prove that syllable weight is not a distinguishing feature of Syncope.

The reason for the failure for Syncope follows directly from the definition of vowel elision developed in Chapter 2. Vowel elision is conditioned, *inter alia*, by the difference in the relative ρ values of the preceding elements. Vowel elision applies preferentially to vowels which follow a decreasing resonancy gradient. It fails preferentially when the resonancy gradient is increasing. In the words in I and II, the resonancy gradient is increasing.

I	Genitive	$\lvert\varepsilon_1\rvert_\rho - \lvert\varepsilon_2\rvert_\rho$
	syndriges	−3
II	Preterite	
	bīecnede	−2
	dīeglede	−3
	frēfrede	−3/−2
	hyngrede	−3
	symblede	−3
	timbrede	−3
	wrixlede	−2

The data indicate that Syncope fails when Δ (from the condition $\lvert\varepsilon_{\tau-1}\rvert_\rho - \lvert\varepsilon_\tau\rvert_\rho \geq \Delta$) is less than or equal to −2. Notice that Syncope does apply in līexte < *līexide where $\lvert\varepsilon_i\rvert_\rho - \lvert\varepsilon_j\rvert_\rho$ is -1 (x = ks). This indicates that the value of Δ in Old English is -1 in the definition of Syncope.

The data in I and II are not 'exceptional'. They follow from the definition of Syncope, which includes that condition $\lvert\varepsilon_{\tau-1}\rvert_\rho - \lvert\varepsilon_\tau\rvert_\rho \geq \Delta$. This is very strong support for the condition, as it was not formulated to account for Old English data.

The data in I and II provide further evidence for the interpretation of the resonancy gradient as calculated over only the preceding two elements. In all these, there are three elements intervening between the salient vowel and the vowel which is a candidate for elision. The first of these in-

cludes a stop (wrixlede), a nasal (timbrede) and a vowel (frēfrede). There is, however, no evidence that this element conditions Syncope.

w r i k s l e d e	t i m b r e d e	f r e e f r e d e
1 2 3	1 2 3	1 2 3

In only the first of these do the three elements intervening between the salient vowel and the candidate vowel form a truly increasing resonancy gradient. In the others, the ρ value of the element indexed 1 is greater than that of the element indexed 2.

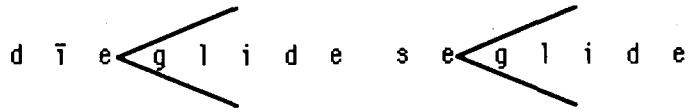
The data in I and II also provide further justification for separating the application of Syncope and Apocope. Although the resonancy gradient conditions Syncope in Old English, it does not condition Apocope; cf. hungrede without Syncope, but *tungl+u > tungol with Apocope. Since the conditions on their application are different, they cannot be the same process.

4.4.5. Application of Syncope after an Increasing Gradient

There are instances where Syncope applies after an apparently increasing resonancy gradient. These are listed in I.

I	bytlan	bytlde	*build*
	efnan	efnde	*level*
	eglan	eglde	*afflict*
	ræfnan	ræfnde	*perform*
	seglan	seglde	*sail*
	þrysman	þrysmde	*suffocate*

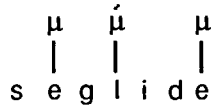
Initially, these seem to contradict the thesis that Syncope fails after an increasing resonancy gradient. The gradient before the medial vowel is apparently identical in dīeglede and *seglide > seglde, yet Syncope fails in the former but not the latter.



In fact, these are only apparent, not real, counterexamples. The derivation *seglide > seglde is like *wætru > wæter. In the latter, it was argued that stress fell on the liquid. This followed from the following considerations:

1. Since the final vowel of *wætru elides, it cannot be stressed.
2. On independent grounds, it was argued that the initial vowel cannot be stressed because it appears before an increasing resonancy gradient.
3. The Alternating Stress rule predicts that a liquid in this position is eligible for stress.
4. The dialectal alternant wæteres for genitive wætres is evidence that the liquid is stressed, because Vocalization applies word internally only to stressed elements.

The same considerations apply to *seglide. The initial vowel cannot be stressed by the Pre-Germanic Stress rule. The medial vowel cannot be stressed because it elides. The μ structure of *seglide is



In chapter 2, I argued that the resonancy gradient is calculated over the elements between an element and a preceding 'salient' element. I left the notion of 'saliency' undefined. Words such as seglde show that the resonancy gradient is calculated back from the vowel over the preceding two elements or to a stressed element, whichever is closer. In *seglide, it is the l which is stressed. Consequently the value of $|\varepsilon_{\tau-1}|_\rho$ - $|\varepsilon_\tau|_\rho$ is 0 and Syncope applies. This contrasts with frēfrede wherein the r preceding the medial vowel is not stressed; consequently the resonancy gradient is calculated over fr and Syncope fails.

This new condition is incorporated into the definition of Syncope as $|\varepsilon_i|_\sigma \geq \Sigma$.

Syncope

Process: $V_1 \rightarrow \varnothing / \varepsilon_i\, \varepsilon_j \_\_ \varepsilon_k V_3$

Conditions:
$|\varepsilon_i|_\sigma \geq \Sigma$
$|V_1|_{\eta\omega} \leq \Omega$
$|V_1|_\sigma \leq \Sigma$
$\Sigma|\varepsilon_j| = \tau \leq T_1$
$|\varepsilon_{\tau-1}|_\rho$ - $|\varepsilon_\tau|_\rho \geq \Delta$
$\Sigma|\varepsilon_k| \leq T_2$

The picture of vowel elision which emerges from this definition is the preferential elision of an unstressed vowel when the resonancy gradient preceding it is flat or decreasing. In the case of medial vowel of *seglide, the value of $|\varepsilon_{\tau-1}|_\rho$ - $|\varepsilon_\tau|_\rho$, the resonancy gradient, is 0. There is no gradient between it and the preceding stressed element. A word such as cierde < *cierride shows that Syncope applies when the value of $|\varepsilon_{\tau-1}|_\rho$ - $|\varepsilon_\tau|_\rho$ is 0. Seglde is not an 'exception' or counter-example to the analysis of Syncope as conditioned by the preceding resonancy gradient. Syncope in seglde falls out from the definition of Syncope and the principles for μ association.

4.5. Athematic Preterites

There is a class of verbs to which Syncope applies to the thematic vowel in the preterite although the root syllable is 'light'. On the analysis that has been argued in this work, these verbs should be stressed and consequently should not elide. The preterite sealde < *sal+i+de should be stressed as *sal+í+de. Since the medial vowel is stressed, it should not elide.

I.

Infinitive	Preterite	
bycgan	bohte	*buy*
cweccan	cweahte	*shake*
cwellan	cwealde	*kill*
dreccan	dreahte	*afflict*
dwellan	dwealde	*hinder*
leccan	leahte	*moisten*
reccan	reahte	*narrate*
sellan	sealde	*sell*
stellan	stealde	*place*
streccan	streahte	*stretch*
tellan	tealde	*count*
weccan	weahte	*awake*
þeccan	þeahte	*cover*

These forms are a problem for every analysis. Analyses which rely on the efficacy of syllable weight cannot explain Syncope after a light syllable, where it is normally retained; cf. clynede. This has lead some (for example, [Campbell, 1962; Wright, 1914]) to analyze these preterites as athematic. If they are truly athematic, then the fact that no vowel appears is not the result of an anomolous application of Syncope.

The claim that these verbs are athematic is not really a solution to the problem. It simply transfers the problem form phonology to morphology. This manoeuvre is legitimate if a morphological analysis is forthcoming, if there is a demonstrable reason that these are athematic. Unfortunately, those who make this claim do not also provide an accompanying morphological analysis.

These verbs are all the more puzzling because their roots end in either a velar or a liquid. There are no verbs with velar or liquid roots which are regular. All such verbs lose the thematic vowel in the preterite. Therefore, it seems that the reason that the vowel elides must be phonological, not morphological.

The notion that stress is relevant does not offer a complete analysis. It does, however, locate the source of the anomaly. It is important to note that the root vowels of sealde, stealde and tealde are broken. It was argued previously that Breaking applies only to stressed vowels. Therefore, the stress pattern of the etyma of these must be *sál+i+de, *strál+i+de and *tál+i+de. Since the root vowel is stressed, the definition of Syncope and the conditions on its application in Old English predict that the medial vowel will elide.

Since all and only those roots which end in velars or l are stressed on the initial vowel in the preterite, there must be a phonological reason for the anomaly. Unfortunately, no obvious reason is forthcoming.

5. CONCLUSION

This study of Old English phonology has made three proposals.

First, I have defined the processes of Old English phonology as universal. I have shown that the phonology of Old English differs from other languages by the parochial conditions on the application of universal processes, that parochial rules peculiar to Old English are not necessary. This generality has been attained without reference to syllable weight, which has been previously thought to be efficacious throughout Old English phonology although the same processes in other languages are transparent to syllable weight.

The second proposal is that Old English stress was not simply word initial as is traditionally assumed. I have argued that it is not possible to provide a coherent phonology of Old English with this assumption, coherent by showing why so many processes seem to be sensitive to syllable weight, something that no syllable-based analysis has been able to do, coherent by showing the relationships among Old English and its sisters Old Saxon, Gothic and Old Norse, and coherent by showing the relationships among Old English and languages of the world. I have argued instead that the facts of Old English can be used to reconstruct a stress system different from that usually assumed, but from which the extant stress system is derived.

There are two methods of reconstructing the linguistic systems of unattested languages. One is comparative reconstruction in which the surface features of the recorded daughter and sister languages are compared for similar features. These features are then assumed for the parent language. A second method is internal reconstruction in which the linguistic systems of daughter languages are examined for features which could exist only if some prior condition held. This prior condition is then assumed for the parent language.

Although the former method has been used in arguments on the reconstruction of stress in Indo-European [Kiparsky and Halle, 1977] it is primarily the latter method of reconstruction that provides traditional arguments. For example, Wright [Wright, 1910] argues that the accent in Indo-European must have been predominantly stress rather than pitch

> "because it is only upon this assumption that we are able to account for the origin of the vowels ĭ, ŭ, ə..., the liquid and nasal sonants ..., and the loss of vowel accompanied by loss of syllable, as in Greek gen. πα–τρ–ός beside acc. πα–τέρ–α; πέτ–ομαι beside ἐ–πτ–όμην; Gothic gen. pl. **aúhs-nē** beside acc. ***aúhsa-ns**." §32

I have taken the latter approach as well. When possible, I have argued for general principles governing a particular process using data from other languages, and then showed that these principles can apply correctly in Old English only under a reconstructed stress system. For exam-

ple, Apocope in Old English does not seem to be sensitive to conditions apparent in other languages. The only way to characterize it as the same process as is apparent in other languages is to assume a different stress pattern. In turn, this stress pattern is supported by similar considerations of other processes in Old English.

In order to characterize the stress rules of Old English, I have argued that Theoretical Phonology must be extended to include the level of representation of the mora. This level is associated directly with the segmental level without the intervening level of the syllable.

Using the level of mora, it is possible to characterize the stress pattern under which much of Old English phonology applies using two rules. Furthermore, it was argued that, of these two rules, one was a generalization of the other and applied in Old English but not in Gothic. The common Germanic Initial Stress was also derived from the primordial rule.

Finally, the level of mora is independently justified by its ability to capture subtle facts about Vocalization and Syncope. Although these facts are given in the traditional handbooks, they are not addressed by contemporary theories.

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