Nonlinear Studies In The Historical Phonology Of French

Haike Jacobs

Nonlinear Studies
In
The Historical Phonology Of French

Nonlinear Studies
In
The Historical Phonology Of French

een wetenschappelijke proeve op het gebied van de letteren

Proefschrift

ter verkrijging van de graad van doctor aan
de Katholiek Universiteit te Nijmegen
volgens besluit van het college van decanen in het
openbaar te verdedigen op
maandag 2 oktober 1989
des namiddags te 3 30 uur

door

Hendrik Marinus Gertrudis Marie Jacobs
geboren
op 1 augustus 1961 te Venlo

Promotor: Prof. Dr. B.H. Bichakjian

Co-referent: Dr. W.L.M. Wetzels

for Hai and Tiny

CONTENTS

Chapter Three: The Interaction Between The Evolution Of Syllable Structure And Foot Structure From Latin To Old French

Chapter Four: A Nonlinear Analysis Of The Evolution Of Consonant + Yod Sequences In Gallo-Romance

Chapter Five: Early French Lenition: A Formal Account Of An Integrated Sound Change

PREFACE

This thesis would not have been possible without the moral and intellectual support of many people both inside and outside the field of linguistics.

Unfortunately, I am not allowed to thank my teachers, especially those who taught me phonology. Maybe it is true that they just did their jobs, but there are several ways of doing it. I am glad that I am not the only one who knows how much they contributed to the success of this thesis.

I am allowed and happy to thank Carlos Gussenhoven, René Kager, Wus van Lessen Kloeke, Wim de Haas, Ben Hermans, Ben Salemans, Engin Sezer, Norval Smith, Willebrord Sluyters and Jetty Wester for their support both as friends and as fellow linguists

I am indebted to Pascale Francort and Jeroen van de Weijer for correcting my English and to Wouter Kusters for correcting my Dutch.

Furthermore, I would like to thank all members of the French Department for creating a stimulating academic environment.

Finally, I would like to thank NWO for giving me the opportunity to spend one month as a research associate at the Linguistics Department of Harvard University.

INTRODUCTION

This thesis contains a collection of nonlinear studies dealing with various aspects of the historical phonology of French. The aim of these studies is twofold. On the one hand, it will be demonstrated that a nonlinear analysis of phonological processes such as syncope, apocope, palatalization, affrication, palatal diphthongization, and lenition leads to a better understanding of these processes and provides a deeper insight into the relations holding between them than traditional descriptions do. Chapter one, for instance, deals with syncope and apocope. Hitherto thought of as two separate phenomena, both processes can, if described in the theory of metrical phonology, be conceived of as manifestations of one and the same mechanism: foot-based vowel reduction. Moreover, as will be demonstrated in chapter two, the theory of metrical phonology enables us to interpret the deletion part of the syncope process as paving the way for a change in the accent system from a marked to an unmarked stress system. In chapter three, this new conception of the evolution of the foot structure turns out to be essential in providing an explanation of the evolution of French syllable structure. These studies also have a second aim. Nonlinear phonology does not represent one single theory in a definite form, but rather consists of a number of subtheories such as those of underspecification, of stress, of feature representation, etc, each of which is still being developed and characterized by a number of competing descriptive models. By applying these nonlinear models to traditionallly described processes, the studies collected in this thesis not only shed new light on various aspects of the historical phonology of French but also offer us suitable testcases for evaluating the empirical validity of the various subtheories involved. For example, chapter one discusses two alternative stress theories: the tree theory of Hayes (1981) and the grid-only theory of Prince (1983). The description of syncope and apocope as manifestations of one and the same mechanism is shown to be possible only in a theory which recognizes the foot as a primitive element of its descriptive vocabulary and therefore the proposed analysis of syncope and apocope provides evidence for making a principled choice between two competing theories on the formal representation of stress.

This thesis can broadly be divided into two parts. The first three chapters deal with prosodic processes such as syncope, apocope, and with the evolution of foot- and syllable structure, in the historical phonology of French. The last two chapters are concerned with segmental processes such as palatalization, affrication, palatal diphthongization, and lenition.

The actual organization of the dissertation is as follows. Chapter one presents a metrical analysis of syncope and apocope. Section 1.1 starts out with a description of the accentual system of Classical Latin and introduces the stress theories of Hayes (1981) and Prince (1983). In section 1.2.1, a detailed description of the syncope process is presented The process will be analyzed as being conditioned by prosodic structure above the syllable, that is, it will be formalized as a foot-based reduction process Finally, the consequences of syncope for the stress system will be touched upon. Next, in section 1.2.2, it will be demonstrated that apocope can be described by the same foot-based vowel reduction rule needed for syncope. Section 1.3 shows that the generalization that syncope and apocope are manifestations of one and the same process cannot be captured in a grid-only theory, but only in a metrical theory in which the foot is a primitive element of the descriptive vocabulary.

Chapter two deals with the relative markedness of stress systems and presents a critical examination of the revised metrical theory proposed in Hayes (1987). Section 2.1 illustrates how bounded stress systems are analyzed in Hayes' (1981) theory and how they are analyzed in the revised theory. In section 2.2.1, it will be argued that a reanalysis of Quantity-Insensitive right-dominant (QI-rd) stress systems according to the revised theory brings up a number of formal and empirical problems. We will propose an alternative way of describing these QI-rd stress sytems which not only disposes of these problems, but also captures their relative markedness in a straightforward manner. Next, in section 2.2.2, the revised theoretical account of Quantity-Sensitive left-dominant (QS-ld) stress systems is examined. We will revisit the syncope process of chapter one in order to show that a reanalysis of QS-ld stress systems as moraic trochees raises a number of problems. First, the assigned constituent structure cannot be empirically motivated. Second, vowel reduction is predicted not to apply in the evolution from Latin to French and can no longer be described as a foot-based process. Third, the deletion part of syncope can no longer be interpreted as contributing to a change from marked to unmarked foot structure. We will defend an alternative analysis of QS-ld stress systems which remedies the objections mentioned above. Finally, section 2.3 discusses how other stress systems involving moraic trochees can be analyzed.

Chapter three is devoted to the interaction between foot structure and syllable structure in the historical evolution of French. Section 3.1.1 presents a detailed analysis of the syllable structure of Classical Latin. In section 3.1.2 and 3.1.3, it will be shown that in the evolution from Classical Latin to Late Latin the syllabic structure became considerably simplified. Section 3.2.1 analyzes the syllable structure of Gallo-Romance that had become complicated again. The explanation for this "pendular" movement of the syllable structure will be provided in section 3.2.2, where it will be argued that the particular evolution of the syllable structure can only be understood if the evolution of the foot structure is taken into account. More specifically, it will be claimed that changes occurring at one level of prosodic representation and leading to a simplification of structure on that level, may entail a complication of structure at another level of prosodic representation. Finally, section 3.3 analyzes the syllable structure of Old French and deals with the formal expression of the simplification of syllabic structure. More specifically, it will be claimed that, if simplification of language must be formally expressed as simplification of grammar, a theory of the syllable is required in which the phonotactic generalizations of a language are stated in terms of distinctive features rather than in terms of degree of sonority.

Chapters four and five deal with segmental aspects of the historical phonology of French. Chapter four presents a detailed analysis of the evolution of consonant + yod sequences. In section 4 1 we present and discuss the fairly intricate facts of palatalization and affrication of consonant + yod and of velar + front vowel sequences, as well as the relation between these rules and the rules of lenition. In section 4.2.1, a nonlinear analysis of palatalization and affrication is provided. Section 4.2.2 describes the further evolution of affricated consonant + yod sequences as the consequence of two more processes: Serialization of Complex Articulation and Coda Attraction. In section 4.2.2 it will be demonstrated that the proposed analysis provides an explanation for the different ways in which the lenition rules affected affricates resulting from intervocalic *kj*, from intervocalic *tj* as well as those resulting from velars before front vowels. Moreover, the proposed analysis provides a straightforward explanation for the differential behavior of velars with respect to affrication during the First and

Second Velar palatalizations: that is, the relation between spirantization and affrication is shown to follow as a natural consequence of our analysis in which affrication is conceived of as a contour-creating process. Section 4.3 provides independent motivation for the SCA and CA processes by showing that both processes are also needed to account for the evolution of sonorant and *s* + yod sequences. Finally, section 4.4 discusses the theoretical implications of the proposed analysis. More specifically, it will be claimed that a proper description of paltalization argues in favor of a feature geometry in which the palatal glide as well as the front vowels are considered to be complex segments, that is in which they are specified for both a dorsal and a coronal articulator node.

Chapter five deals with lenition, a set of changes consisting of the spirantization of intervocalic voiced stops, the voicing of intervocalic voiceless obstruents, and the degemination of geminates. We will propose an underspecification analysis of lenition which formally captures the structuralist view that the constituting parts of lenition represent a unified sound shift. In section 5.1 the main facts of lenition are presented. Section 5.2 discusses a number of recent theories of underspecification and some nonlinear ways of formalizing spirantization and voicing. Section 5.3 examines to what extent nonlinear phonology is able to formally express the integrity of lenition. In section 5.3.1, the relevance of syllable structure to lenition will be discussed. In section 5.3.2, it is claimed that every single step of the lenition process affects a feature whose phonetic realization, as a consequence of the preceding step, has become predictable by redundancy rules. By formulating a number of principles we succeed not only in describing lenition as a unified sound shift, but also in explaining why, once spirantization was accomplished, the steps that followed represented a logical consequence.

Metrical Structure And Phonological Domains: Evidence From The Evolution Of Unstressed Vowels From Latin To Old French

1.0. *Introduction*

The aim of the present chapter is to show that syncope and apocope in the historical phonology of French are processes that are sensitive to prosodic structure and, if they are described within the representational framework of metrical phonology, can be considered as manifestations of one and the same mechanism; namely foot-based vowel reduction.

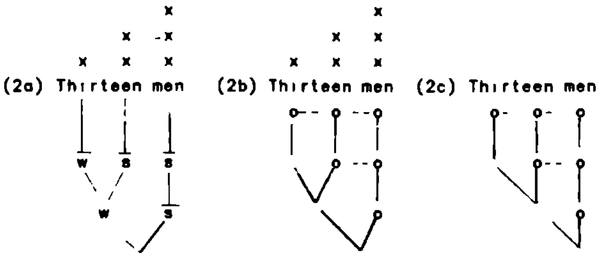
Metrical phonology uses two types of hierarchical structure: the metrical tree and the metrical grid. In order to express the fact that stress is a matter of relative prominence among syllables, rather than an absolute characteristic of each individual vowel, binary branching tree structures are used whose pairs of sister nodes are labeled *s*(trong) or *w*(eak). Hayes (1981), trying to characterize the class of unmarked stress rules, proposed a universal inventory of unmarked metrical trees, specified by a set of parameters, such as Quantity Sensitive/Quantity Insensitive, Left-dominant/Right-dominant, and Maximally binary/Unbounded, to which we shall return in section 1.1 below. The metrical grid, derived from the tree by means of the Relative Prominence Projection Rule (cf. Liberman and Prince, 1977:316) provides the basis for a temporal-rhythmic interpretation of the trees. (For a more detailed discussion the reader is referred to the quoted studies).

Recent theoretical discussions focus mainly on the question whether, given the availability of grids, trees are necessary or can be dispensed with. Prince (1983) claims that trees are superfluous and that stress should be represented directly in terms of the metrical grid. On the other hand, Hayes (1984) argues for the need for trees as well as for grids, stating that both represent separate aspects of metrical structure. The former represents linguistic stress, whereas the latter represents rhythmic structure. The rules of rhythmic phonology (called rules of eurhythmy) refer to specific targets and are formulated in terms of the grid. Since in Hayes' opinion the metrical grid only forms a rhythmic representation, phonological rules cannot refer to it and have to be formulated in terms of metrical tree structure. Rhythm Rule and Beat Addition are two such rules. Hayes gives examples of utterances which have identical grids, but different trees, and which react differently when such rules are applied to them (Hayes, 1984:60-65). One of Hayes' important contributions to the study of English stress is based upon the insight that the Beat Addition rule and the Rhythm rule are, in fact, instances of a more general metrical phenomenon, which he formally expresses as the rule of Rhythmic Adjustment. Finally, Hammond (1984) observed that the English destressing rules (see section 1.1 below) proposed by Hayes (1981) as well as rules of Rhythmic Adjustment share the same goal: the resolution of clashes. This observation leads him to a formal and universal definition of rules manipulating tree structure which should all be of the form 'Prune Alpha'. The eurhythmy rules proposed in Hayes (1984) are interpreted by Hammond as eurhythmy conditions (except Hayes' disyllabic rule) on the application of Prune Alpha. In Hammond's theory this does not mean that metrical grids are needed, since he formalizes the notion 'Designated Terminal Element (DTE)' (1984:53) and characterizes the temporal alignment of beats with a string in the trees themselves, by means of the following DTE-tree notation.

(1) *Temporally align DTE's with their daughter-DTE's (1984 155)*

Both Hayes (1984) and Liberman and Prince (1977) used the notion DTE to account for grid alignment. The metrical grid allowed a direct representation of the notion 'stress clash', a notion which is not directly available in metrical trees since stressed syllables are not labeled uniformly. Stressed syllables with no sisters are not marked *s* since *s w* labeling is thought of as a matter of relative prominence. In (2b) the DTE's are marked by a small circle. Representation (2b) is translated into (2c) by (1), leading to a representation that Hammond calls an 'arboreal grid' (clashes of stress are indicated by means of hyphens).

In a way, trees and grids are translated into one formalism. However, the argumentation in deciding whether or not trees are redundant is based mainly on the facts of rhythmic phonology. Now, if there are other processes where, in order to capture important generalizations, we crucially need information defined in trees, but not available from grids, these would constitute evidence for the



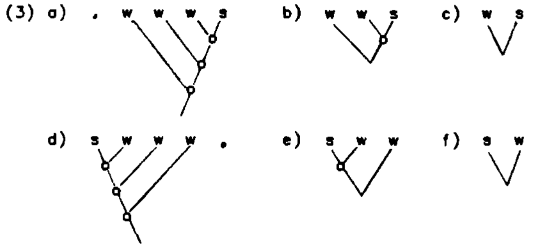
fact that metrical trees cannot be dispensed with in phonological theory. This chapter purports to show that syncope and apocope are such processes. The proposed analysis leans heavily upon the recognition of the foot as a primitive element of the descriptive vocabulary of phonological theory. It will be shown that the two processes can only be explained as manifestations of one and the same mechanism, if they are formulated in a metrical formalism using feet.

This chapter is organized as follows. First, in section 1.1, the accentual system of Classical Latin will be described. Next, in section 2.1, we will present an an analysis of syncope, which, as will be demonstrated, is without further modifications suitable for describing apocope. Finally, after contrasting in section 1.3 the proposed analysis with a grid-theoretic account, section 1.4 summarizes the main results of this chapter.

1.1. *The Accent in Classical Latin*

In Latin, the position of the accent was predictable on the basis of syllable weight. In disyllables the penultimate syllable always received the main stress, as in, for example, *cása* 'cottage, shed,' and *héri* 'yesterday.' In longer words, the main accent fell on the penultimate syllable if it was heavy (i.e. the syllable was closed or contained a long vowel or a diphthong), as in, *òrnaméntum* 'equipment,' *amícus* 'friend, kind,' and *acquáero* 'get, acquire.' In all other cases, it was the antepenultimate syllable that received main accent: *cólaphus* 'blow with the fist,' *dóminus* 'master,' *dòrmitórium* 'bedroom.' The primary accent never fell on the final syllable, except in monosyllabic words. A secondary accent fell on the initial syllable of words containing one or more pretonic syllables between the initial and the stressed syllable (cf. Meyer-Lübke, 1890:273). The Latin accentuation rule has been formalized in a metrical framework by Hayes (1981:72-74).

As mentioned above, Hayes (1981) proposes a universal inventory of unmarked metrical trees, specified by a set of parameters. First, there is the direction of dominance parameter according to which all metrical rules must specify whether in the structures they create it is the right nodes or the left nodes that are dominant. Second, there is the size parameter. In Hayes (1981) only two sizes are possible for metrical trees: maximally binary or unbounded. Binary feet are produced by specifying that dominant nodes must be terminal. If dominant nodes need not be terminal, unbounded feet are produced. In order to explain this, let us consider the metrical structures in (3).



The metrical structures in (3a-c) are specified as right-dominant and those in (3d-f) as left-dominant. Since Hayes (1981:47) proposes a general constraint according to which recessive nodes may not branch, the circled nodes in (3) cannot be made recessive, because as recessive nodes they would branch. Therefore they can only be made dominant. However, if it is specified that dominant nodes must be terminal, then only (3c) and (3f) are possible metrical structures, because if the circled nodes in the other structures of (3) were made dominant, they would not be terminal. Ternary feet are thus excluded in principle from Hayes (1981) inventory of possible metrical trees. In languages which may have accent on the antepenultimate syllable, the notion of extrametricality is introduced to maintain this restrictive inventory of tree-sizes.[1] An extrametrical constituent (segment, rime, syllable) is treated by the stress rules as "if it were not there." In Latin, where the main accent can occur on the antepenultimate syllable, there is evidence for a rule marking the last rime as extrametrical. Hayes (1981:72)

---

[1] Because ternary feet are assumed never to be applied iteratively, but are only assumed to occur at the right- or left-edge of a stress domain, Hayes (1981) does not want to enrich stress theory by permitting the direct generation of ternary feet. For the same reason of restrictiveness, extrametrical constituents may only appear at the edges of a stress domain.

formulates this rule as in (4).

$$(4) \quad R \longrightarrow [+ex] \; / \; \_\_ \Big]_{word}$$

Rule (4) causes the last syllable to be skipped by the stress rule. In order for monosyllables to receive a degree of prominence, it is assumed that extrametricality rules are blocked if their application would mark the entire stress domain as extrametrical.

Besides the size parameter and the dominance parameter, there is also the criterion of syllable prominence. The stress rules are assumed to apply on a level of representation where only the rimes of syllables are formally represented, the rime projection.[2] Stress rules may treat all syllables in the same way, in which case no attention is paid to the weight of the syllable, or they may be sensitive to whether the syllables are heavy or light The Latin stress rule, because it skips light penults, but not heavy ones, is sensitive to syllable weight This property of Latin accent can be accounted for by making foot construction sensitive to the absence or presence of a branching rime structure, that is by specifying the stress rule as Quantity-Sensitive.

Indeed, the construction of a left-dominant, quantity sensitive, binary foot on the rime projection at the right edge of the word accounts for the correct placement of main stress in Latin. As for the remaining syllables, they are given a degree of prominence by the construction of a right-dominant word tree (cf. Hayes, 1981:100). Finally, the extrametrical syllable receives a degree of prominence by a universal Stray-Syllable-Adjunction principle (henceforth SSA) which is formulated as in (5).

(5) *Adjoin a stray rime as a recessive node of an adjacent foot.*

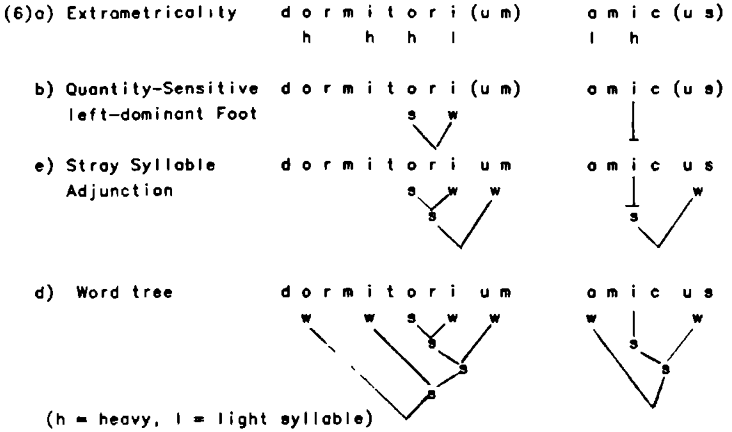
According to the metrical rules mentioned above, the Latin words *dòrmitórium*

---

[2] The application of stress rules on the rime projection is the unmarked case However, there are languages where CV and CVC syllables are treated with respect to stress as light and CVV and CVVC syllables as heavy The stress rules are then assumed to apply on the [+syll] projection, which is a subprojection of the rime projection (cf Hayes, 1981 41–43)

[3] Besides the iterative assignment of binary feet over a word, Hayes' (1981) theory also permits the construction of a single foot with the concomitant

'bedroom' and *amícus* 'friend' will be assigned the representations in (6).[3]



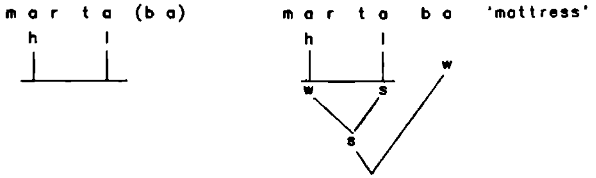
In *dòrmitórium* a binary quantity-sensitive left-dominant foot is constructed over the rime projections of the antepenultimate and penultimate syllables. If the antepenultimate and penultimate syllable in *amícus* were combined into one foot, then, because the foot is specified as left-dominant, the recessive node of that foot would dominate the branching rime of the penultimate syllable. Since recessive nodes may not branch a monosyllabic foot must be constructed as in (6).

With regard to the rules in (6), two remarks are in order. The first concerns the SSA principle (5). As it turns out, a stray syllable can be incorporated into metrical structure in two different ways: it can be joined to an adjacent foot (as we did in (6)), but also be incorporated into the word tree. Hayes gives an example of the latter type of adjunction when he discusses the stress pattern of Cairene Arabic (1981:115-117). Formulated as in (5), the SSA functions as a structure-preserving constraint in the sense that it imposes feet to be uniformly either left-dominant or right-dominant. If a foot is right-dominant a stray rime could not be adjoined to its right-side, since as a right node it would not be recessive. If a foot is left-dominant no stray rime could be adjoined to its left-side, since as a left node it would not be recessive. This function of the SSA can be observed in Cairene Arabic, where word-final rimes are made

----

grouping of the remaining syllables in a word tree, as in this case.

extrametrical. Because the feet are specified as right-dominant, the extrametrical rimes cannot be adjoined to the preceding foot and are consequently incorporated into the word tree, as illustrated in (7) (cf. Hayes, 1981:151)

(7) 

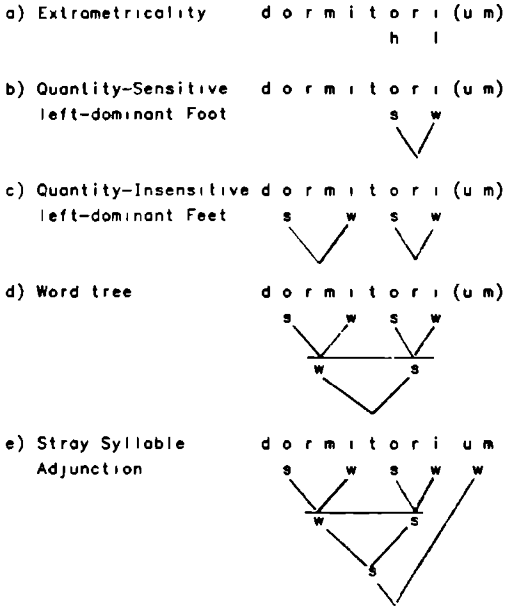
The SSA receives independent motivation from its use in destressing processes, since it also becomes operative after the application of destressing rules. These rules delete the metrical structure of a foot, leaving its syllables to be adjoined to another foot by the SSA in (5) (cf. Hayes, 1981). As mentioned above, Hammond advocates one single metrical transformation: Prune Alpha. Constituents whose metrical structure is pruned by this transformation, are reattached to the metrical tree by a version of the SSA, which Hammond (1984.151) reformulates as in (8).

> (8) *Stray Syllable Adjunction*
> *A pruned constituent is remoored to the tree as a weak sister, preferably to the left.*

If we do have the possibility of adjoining a stray rime either to the foot or to the word tree, nothing in the formulation of (8) stipulates which possibility should be chosen. For example, with respect to Latin, we might ask why word-final extrametrical rimes should be attached to the preceding foot rather than to the word tree. Below, arguments will be given for the claim that in Latin stray syllables must be adjoined to the word tree as weak members.
The second remark with respect to Hayes' account of Latin stress concerns the place of secondary accent. In Latin, the initial syllable received a secondary accent, if not directly followed by the one with main accent. In (6) above, all syllables preceding the one with main stress are labeled *w* and are incorporated directly into the word tree. According to Hayes (1981:55,123) the interpretation of the weak nodes of a tree is a language specific matter The weak nodes of a tree may be interpreted as prominent in either inverse or direct proportion to their degree of embedding, or they may be interpreted as equal. Therefore,

instead of adjoining the remaining syllables to a word tree, we propose to group them in quantity-insensitive, left-dominant feet from right to left, in a way similar to the English stress rule (cf. Hayes, 1981). A word like *dòrmitórium* now receives the metrical reprsentation of (9).

(9) Latin stress rule

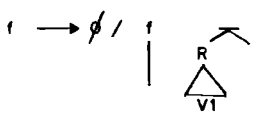


Let us now consider the stress pattern displayed by the words in (10).

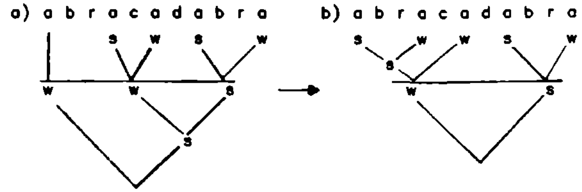
(10) sìmilitúdinem 'resemblance'
cònsuetúdinem 'custom, usage'
sùbitaméntum 'suddenly'
tèmperaméntum 'moderation, temperament'

The first foot of these words is trisyllabic, since two unstressed feet mediate between the primary and secondary stressed syllable. Ternary feet are excluded from the unmarked inventory of stress rules and the rules formulated for Latin may only produce maximally disyllabic feet. A comparable case exists in English. In words like *àbracadábra*, the first foot is trisyllabic and is explained by Hayes (1981:178-180) as a result of a Post-stress Destressing rule formulated as in (11).

(11) Post-stress Destressing

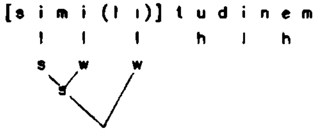


This rule converts (12a) into (12b).

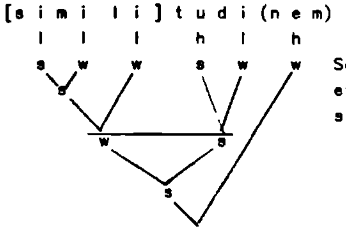
(12) 

After the deletion of the second foot in (12a) by rule (11), the SSA in (8) is applied twice to produce the output in (12b).

In order to account for the Latin examples above, it is perhaps not necessary to postulate a Post-stress destressing rule, since in these words the surface presence of ternary feet might be a consequence of cyclic application of the Latin stress rules, as shown in (13).

(13) a) 

First cycle; final syllable extrametrical, Latin stress rule.

b) 

Second cycle; final syllable extrametrical, Latin stress rule, word tree.

Let us next consider the stress pattern displayed by the words in (14) in order to show that Latin stress should not be applied cyclically.

(14) a) nĕ́gat 'he denied'

b) rĕ́nĕgat 'he denied again'

c) fắcit 'he makes'

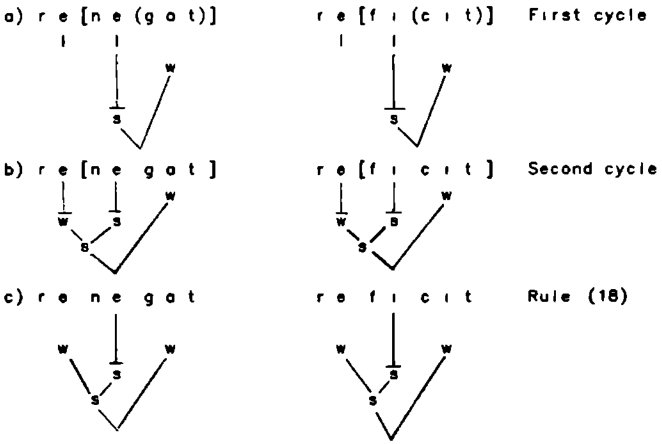
d) rĕ́fĭcit 'he makes again'

e) fécit 'he made'

f) rĕfécit 'he made again'

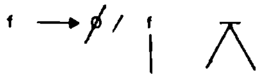
In the forms in (14b) and (14d), the main stress falls on the prefix. Cyclic application of the Latin stress rules, however, would yield the wrong results, as illustrated in (15).

(15)



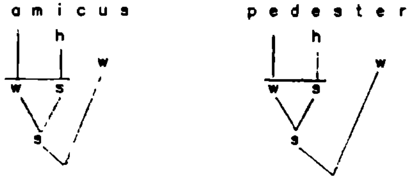
It is for this reason that we must assume that cyclic stress assignment does not work for Latin and that stress in Latin is post-cyclic, which, in turn, necessitates the adoption of a Post-stress destressing rule. The Post-stress Destressing rule, as it is formulated in (11), is restricted in its application to open syllables only. Since forms like *dòmesticáre* 'to tame' with a second heavy and *sìmilitúdinem* 'resemblance' with a second light syllable must have had the same stress pattern, we will abandon this restriction for Latin. The Latin Post-stress Destressing rule consequently takes the form of (16).

(16) Latin Post-stress Destressing



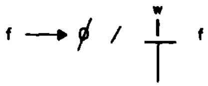
Independently of the question whether the Latin stress rules apply cyclically or post-cyclically, we need a destressing rule in order to get rid of unwanted secondary stress on the initial syllable of words like *pedéster* 'on foot' and *amícus* 'friend,' which according to the rules of Latin accentuation, would have the representations in (17).

(17)



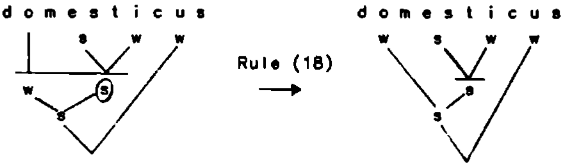
In (17), the first syllable of both forms is dominated by a monosyllabic foot. Therefore, it receives secondary accent (cf. Hayes, 1981:102-103). However, initial syllables in Latin only receive secondary accent if they are separated from the primary stressed syllable by at least one other pretonic syllable (cf. Meyer-Lubke, 1890:273). For similar cases in English, Hayes (1981:171) postulates the Pre stress Destressing rule (18), which we will also adopt for Latin.[4]

(18) Pre-stress Destressing



This rule deletes a monosyllabic foot, after which the remaining syllable is adjoined to another foot by the SSA. It should be noticed that neither of the two rules (16) and (18) can delete a foot in a metrical strong position (cf. Hayes, 1981:178). Rule (16) and (18) are in complementary distribution, since rule (18) only applies when rule (16) cannot apply, as in, for instance, *doméstìcus* 'belonging to the house.' This is illustrated in (19).

(19)



---

[4] Although the clash-based motivation for this rule is directly observable in Hammond's theory, we will not use his tree notation in the remainder of this chapter, since it is not relevant for the analysis which will be presented here

In (19), rule (16) cannot apply since it would erase a foot in a strong position -the circled *s* node-- therefore rule (18) applies.

In conclusion, the Latin stress system can, in the theory of Hayes (1981), be described by the post-cyclic application of the rules in (9) and by the destressing rules (16) and (18).

The stress pattern of Latin can, of course, also be described in a grid-only theory, such as the one advocated by Prince (1983). In discussing how to grid heavy syllables, Prince (1983:61) assumes that Quantity-Sensitivity -heavy syllable stressing-- takes priority over filling out the grid, and that Perfect Grid Construction, in languages which are sensitive to syllable weight, works on forms in which some stress structure "is already evident and fills in the blank stretches maximally up to clash." A plausible analysis for Latin would follow from the assumptions in (20).[5]

(20) a) Final Syllable extrametrical
b) Quantity-Sensitivity
c) ER (I,σ) End Rule Initial at the syllable level
d) PG (RL,tr,FCO) Perfect Grid construction from Right to Left, Trough first, Forward Clash Override
e) ER (F,Wd) End Rule Final at the word level

To see how this works, let us consider the derivations in (21).

In (21), the prosodic categories syllable (σ), Foot (Σ), and Word (Wd) are used to name the hierarchical levels in the grid At the lowest level, the σ-level, every syllable has one beat. Stressed syllables have an additionnal beat at the Σ-level, and the syllable with main stress is the only syllable which has a beat at Wd-level. After Final Syllable Extrametricality, Quantity-Sensitivity, and End Rule Initial (20a-c), Perfect Grid Construction (20d) applies. Its essential function is to create, in words that are long enough, a layer of alternating stressed and stressless syllables at the Σ-level. The option Forward Clash Override (FCO) means that a stress clash may be ignored when the offending stress has not yet been reached in the leftward scan of the word. This is necessary in order to

---

[5] Although we have not indicated this in the formulation of (20), it should be noticed that in Latin the quantity of a syllable, for stress purposes, is only relevant in the penultimate syllable

[6] Had we ordered (20d) prior to (20c), the option FCO could be dispensed with in the Latin Perfect Grid Construction, but then the End Rule Initial should be

(21)	x x x x x x	x x x x	x x x x x x	σ-level
	si-mi-li-tu-di-nem	re-ci-pi-o	li-be-ra-ti- o- nem	
	h l	l l	h	
(a)	x x x x x (x)	x x x(x)	x x x x x (x)	σ-level
(b)	x x x x x (x)	x x x(x)	x x x x x (x)	σ-level
	x		x	Σ-level
(c)	x x x x x (x)	x x x(x)	x x x x x (x)	σ-level
	x x	x	x x	Σ-level
(d)	x x x x x (x)	x x x(x)	x x x x x (x)	σ-level
	x x x	x x	x x x	Σ-level
(e)	x x x x x x	x x x x	x x x x x x	σ-level
	x x x	x x	x x x	Σ-level
	x	x	x	Wd-level

derive antepenultimate stress in words like *récipio*.[6] It should be observed that the rules in (20) must be supplemented with a grid-theoretic translation of the destressing rules discussed in this section. These destressing rules will not be discussed here, because they are irrelevant for the purposes of this chapter.

In this section we have provided a metrical analysis of the Latin stress system. It has been shown that both a tree- and a grid-only analysis are equally successful when it comes to account for the distribution of stresses. In the following sections, however, it will be shown that, in order to capture important generalizations, constituency information, which is available from trees but not from grids, is needed.

1.2. *The evolution of unstressed vowels from Latin to Old French*

In broad outline, the evolution of unstressed vowels from Latin to Old French may be summarized in the following way. In the unstressed penultimate syllable (i.e. in proparoxytones), all vowels were reduced and subsequently deleted (as in, for example, *cámeram* > *[kamǝra] > *chambre* '(bed)room'). If there was one

---

specified as FCO in order to derive correctly initial stress in words like sìmilitúdinem.

pretonic, open syllable between the initial and the accented syllable, its vowel was also reduced and effaced (as in, for instance, *dòrmitórium* > *[dormətorju] > *dortou* 'bedroom') (cf. Fouché, 1958:433-496). If there were two pretonic syllables between the initial and the stressed syllable, one of them lost its vowel. This happened generally in the first of these two syllables (as in, for example, *sìmilitúdinem* > *[simlitudne] > *sembletune* 'resemblance'), but again, only if it was open (cf. Fouché, 1958:477-479). There are almost no examples of three pretonic syllables between the initial and the accented syllable (cf. Pope, 1956:111 and Rheinfelder, 1963:58-59). Unstressed final vowels, except *a*, were lost also in the history of French, but only if they did not have to serve as what is traditionally called "voyelle d'appui" (i.e. a support vowel). The latter process is generally referred to as apocope, whereas the former process is known as syncope. Romance scholars, in general, agree on the relative chronology of these processes. First, there is a chronology within the process of syncope itself. The deletion of unstressed penults is thought to have started earlier than the syncope of vowels in other positions. The syncope process is dated between the end of the fourth and the end of the sixth century (cf. Richter, 1934:202, Pope, 1956:114-115, Fouché, 1958:466-471, and Gerhards, 1913:54). Second, the process of syncope preceded the process of apocope. The loss of final vowels is dated between the end of the seventh and the end of the ninth century (cf. Richter, 1934:236, 243-246, Pope, 1956:113-114, and Fouché, 1958:501). Within both processes, the unstressed vowels were first reduced and only later completely lost (cf. Richter, 1934:91,244 and Pope, 1956:112-113).

1.2.1. *Syncope*

1.2.1.1. *A process not induced by syllable structure*

The first occurrences of syncope occurred, as mentioned above, at the end of the fourth century. At that time the Classical Latin accentuation had not changed yet, except in two cases, which are described by Pope (1956:100) as follows: "In accordance with a very general tendency to stress more heavily the lower of two juxtaposed vowels, the accent moved forward on to the lower vowel in words of the type *mulierem*, *filiolum* i.e. in words in which the penultimate syllable was short *e* or *o* in hiatus with an antepenultimate *i* and *e* (now unstressed) consonantalised to *j*, thus *mulíerem* > *muljérem*, *filíolum* > *filjólum*" and, concerning the second case: "in proparoxytones of the type *íntegrum*, *tónitrum* [...] the stress was ordinarily moved forward on to the penultimate syllable." Concerning the first case it is worth noting that a quite similar situation appears to exist in Chicano Spanish and Old Portuguese, where two syllables in hiatus are merged into one single syllable by a process of resyllabification without causing a change in the rule of accent placement as such (cf. Clements and Keyser, 1983 for Chicano Spanish, and for Old Portuguese, cf. de Haas, 1988). The second case has been explained by Richter (1934) as the result of the epenthesis of a vowel between the plosive and the liquid. On the other hand, Fouché (1958) has suggested that the first member of these clusters became a geminate consonant, thus closing the penultimate syllable.[7]

The important thing to observe is that apart from the two cases mentioned above, the place of the accent in a word had not changed, not even by the time when vowel quantity was replaced by qualitative distinctions, which according to Fouché (1958:214-217) happened during the fourth and fifth century.

The process of syncope, operative at this time, affected the vowels in metrically weak positions, independently of syllable structure. These vowels were first reduced and only later deleted (cf. Richter, 1934:91 and 244).

Before presenting an analysis of this process, we first wish to show, contrary to Klausenburger (1970), that syncope was not conditioned by syllable structure. Klausenburger defines syncope as follows: "Syncope in L[ate] S[poken] L[atin] [i.e. until the end of the eight century] affected both the pretonic antepenult of paroxytons (*bonitate* > *bontate*) and the post-tonic penult of proparoxytons (*viride* > *virde*)" (1970:44-45). He then gives a list of words undergoing this process and concludes that "all thirty-six two-member consonant combinations resulting from syncope fit into the existing phonotactic framework of Late Spoken Latin."

Let us now briefly present arguments supporting the view that syncope did not necessarily result in consonant combinations that integrated into the phonotactics of Late Latin.

First let us consider the evolution of the forms in (22).

---

[7] We will not deal with this last case here, but return to it in more detail in the next chapter.

(22) víncere > *[venk'ere] > *[venk're] > veintre 'to conquer'
plángere > *[plang'ere] > *[plang're] > plaindre 'to pity'

In these forms, the deletion of the unstressed vowel in the penultimate syllable took place after palatalization, but before affrication of the velar plosives (cf. Pope, 1956:126, Richter, 1934:171-175, Fouché, 1958:465-466 and chapter four). The resulting consonant sequences cannot be divided into a permissible syllable-final and syllable-initial cluster, and that is why they have been simplified.

Second, the deletion of unstressed penults sometimes caused, as in *cámeram* > *[camra] > *chambre*, a bad syllable contact, in the sense of Murray and Venneman (1983). By means of an intrusive stop, the language repairs this bad syllable contact. For an exhaustive non-linear description of this process, we refer to Wetzels (1985).

Third, the group *tl* resulting from syncope was consistently replaced by *kl*, as proved by the following quotations taken from the Appendix Probi: "*vetulus non veclus*" and "*vitula non vicla*". Having shown that syncope was not conditioned by syllable structure, we will, in the following section, present an analysis of syncope, which observes prosodic structure above the syllable.

1.2.1.2. *The facts*

Post-tonic syncope only affected vowels in proparoxytones, that is in words having a light penultimate syllable, thus containing a short vowel. In paroxytons, the post-tonic vowel (i.e. the final vowel) was not affected. The list in (23) is based on Pope (1956), Fouché (1958) and Richter (1934) and presents some examples of post-tonic vowel reduction and deletion.

(23) Class Lat Old French

cámeram	>	*[kamәra]	>	chambre	'bedroom	
pérdere	>	*[pɛrdәrɛ]	>	perdre	'to lose'	
árborem	>	*[arbәrɛ]	>	arbre	'tree'	
cólaphum	>	*[kɔlәpu]	>	colp	'blow with the fist'	
ásinum	>	*[asәnu]	>	asne	'donkey, ass'	
cómputat	>	*[kɔmpәtat]	>	conte	'he counts, he tells'	
pedéster	>	*[peðɛstɛr]	>	peestre	'on foot'	

Unstressed vowels in pretonic syllables also were subject to syncope. If there was a single open syllable, between the initial and the stressed syllable, its vowel was reduced and subsequently deleted, as illustrated by the forms in (24).

(24) Class Lat — Old French

a)	dòrmitórium	>	*[dɔrmətorju]	>	dortoir	'bedroom'
	dùbitáre	>	*[dubətorɛ]	>	doter	'to doubt'
	cìvitátem	>	*[tsivətatɛ]	>	citet	'city'
	bònitátem	>	*[bɔnətatɛ]	>	bonte	'goodness'
	còmputáre	>	*[kɔmpətorɛ]	>	conter	'to count, to tell'

b)	vòluptátem	>	volupte	'voluptuousness'
	tàbernárium	>	tovernier	'innkeeper'
	àppelláre	>	opeler	'to call upon, to invoke'
	pàpiliónem	>	povillon	'butterfly, bell tent'

In the forms of (24a), the second pretonic syllable is open, whereas in the forms of (24b) it is closed. It should be noticed that the last form in (24b) also has a second pretonic closed syllable, since, in Gallo-Romance, palatalised *l* probably was a geminate cluster [ʎʎ] (cf. Wetzels, 1985).[8]

It is important to observe that in the unstressed penultimate syllable all vowels were reduced and later on deleted, whereas in the pretonic unstressed syllable all vowels but *a*, were reduced and deleted.[9] This is illustrated by the forms in (25).

(25) Class Lat — Old French

a)	òrnaméntum	>	* [ɔrnamɛntu]	>	ornement	'embellishment'
	sàkraméntum	>	* [sakramɛntu]	>	sairement	'oath'
b)	cólaphum	>	* [kɔləpu]	>	colp	'blow with the fist'
	álapam	>	* [aləva]	>	alve	'side-bar (of a saddle)'
	bálsamum	>	* [balsəmu]	>	balme, basme	'balm'

Now, if there were two unstressed pretonic syllables between the initial syllable and the stressed one, only one of them lost its vowel.[10] According to Fouché, it

---

[8] In chapter three, a more detailed account of Late Latin and Gallo-Romance phonotactics will be provided.

[9] In pretonic syllables, the reduced vowel did not become deleted after consonant+liquid clusters (cf. Pope, 1956:113). We will return to this question in section 1.2.2. below.

[10] Examples with more than two such pretonic syllables are very hard to find. A word like lìberatiónem was reduced to five syllables before syncope became productive (cf. Rheinfelder, 1963: 59).

was generally the first of these two syllables whose vowel was reduced and subsequently deleted (1958:477-499). However, if the first of the two syllables was closed, it was the second one that underwent these processes. Let us consider the evolution of the forms in (26a), (26b) and (26c)

(26) a) Class Lat — Old French

sìmilitúdinem	> * [simǝlitudnɛ]	> sembletume	'resemblance'
sùbitaméntum	> * [sɔbǝtamɛntu]	> soutement	'suddenly'
tèmperaméntum	> * [tɛmpǝramɛntu]	> temprement	'moderately'
àrboriscéllum	> * [arbǝrisjɛllu]	> arbroissel	'shrub'
lìberatiónem	> * [livǝratsjɔnɛ]	> livraison	'delivery'

(26) b)

dòmesticáre	> * [dɔmɛstǝsjarɛ]	> domeschier	'to tame'
mìnisteriális	> * [menɛstǝrjalɛ]	> menestrel	'servant, minstrel'
càballicáre	> * [tšjaballǝtšjarɛ]	> chevalchier	'to ride on horseback'
ìmpastoriáre	> * [impostǝrjarɛ]	> empoistrier	'to shackle'
*àdcosturáre	> * [adkostǝrarɛ]	> acostrer	'to arrange'

(26) c)

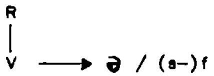
*ìmpremutáre	> * [impremǝtarɛ]	> emprunter	'to borrow'
*còminitiáre	> * [kɔminǝtsjarɛ]	> comencier	'to begin'
*àdripáre	> * [arivarɛ]	> ariver	'to arive'

The forms in (26a) and (26b) display a perfectly regular behavior: in (26a) the second pretonic syllable is open, hence there is reduction and effacement of the vowel; in (26b) the second pretonic syllable is closed and accordingly the following pretonic syllable loses its vowel. However, if we look at the forms of (26c), we observe that the vowel of the second syllable is not reduced, although this syllable is open. In the first two forms of (26c), it is the vowel in the third pretonic syllable that becomes reduced and in the last form of (26c), there is no reduction at all. The forms in (26c) all behave as if they had a second closed syllable. Now that we have presented the main facts of the syncope process, in the next section we will present a metrical formalization of syncope, which accounts in a straightforward way for the cases discussed so far.

1.2.1.3. *The description*

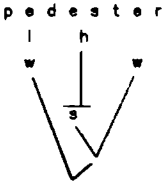
In this section we will formalize the facts of syncope discussed above. Since unstressed vowels first become reduced and only later deleted, it seems reasonable to divide the process in two parts: reduction and deletion.
The generalization behind posttonic and pretonic syncope apparently is the fact that the syllable has to be open in order for the reduction of vowels to take place. This could be formulated by rule (27).

(27) Vowel reduction

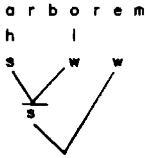


Rule (27) says that every vowel in a non-branching rime and dominated by a weak node in a foot, becomes reduced. In order to see how this works some relevant examples from (23) are reproduced in (28) with their metrical tree structures according to the Latin stress rules.

(28) a)



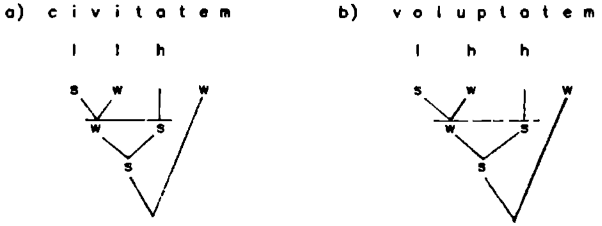
b)



In (28a), rule (27) cannot apply since the metrical structure of (28a) does not satisfy the structural description of (27). In (28b), the only vowel susceptible of being reduced is the one in the unstressed penultimate syllable. It should be noticed that all these vowels in proparoxytons are short and, by rule (9) are dominated by the weak node of a foot. The final syllables of (28a) and (28b) are attached to the word tree and not to the foot; hence they do not become reduced. For this reason we assume that, in Latin, extrametrical rimes were attached to the word tree rather than to the adjacent foot (see section 1.1). Had we attached extrametrical rimes to the adjacent foot, they would have been part of it, and they would have triggered the application of rule (27) being dominated by a weak node in a foot.

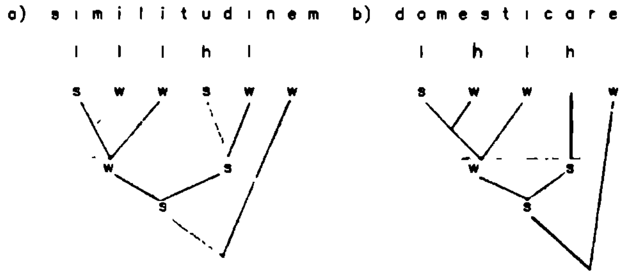
The same rule (27) is also able to account for the reduction of vowels in the data of (24). Some relevant examples with their metrical tree structures have been listed in (29).

(29)



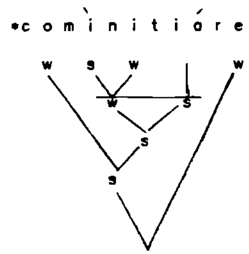
In (29a), the application of (27) is possible, whereas in (29b) rule (27) cannot apply, since the only vowel in a weak position of a foot is dominated by a branching rime. Rule (27) furthermore is capable of describing the reduction in the forms of (26a) and (26b) of section 1.2.1.2. To see this, let us consider the metrical representations of the two forms in (30).

(30)



Application of (27) reduces the two forms in the correct way: *sìmilitúdinem* > *[simƏlitudne] > *sembletune* and *dòmesticáre* > *[domestƏcare] > *domeschier*. From the way in which reduction applies in (30a) and (30b), it is rightly concluded that rule (27) must be interpreted as a domain span and not as a domain limit rule (cf. Selkirk (1980)). In other words, rule (27) not only reduces a vowel dominated by a non-branching rime in a weak position of a foot that is immediately adjacent to a strong position, but rather it reduces, from left to right, any vowel dominated by a non-branching rime in a weak position within the domain of a foot.

The forms in (26c), however, remain problematic. The application of (27) would reduce the vowel in the second pretonic syllable, which evidently is not the desired result. A straightforward explanation of their unexpected behavior is however possible. The forms listed in (26c) are all verbal derivatives. Now, in Late Latin, these types of verbs became affected by a shift of the secondary accent from the prefix to the stem vowel (cf. Pope, 1956:101). A verbal derivative like **cominitiare* 'to start' has now the metrical representation of (31).

(31) 

Accordingly, it is the vowel in the third pretonic syllable that reduces. Finally, it is important to note that we have not yet explained the forms in (25). We will return to the different behavior of the low vowel in the next section.

Let us now briefly discuss the consequences of syncope for the Gallo-Romance accent system.[11] In Gallo-Romance, by the end of the sixth century, syncope had changed most of the proparoxytones in paroxytones. There were still some proparoxytones left, which syncopated later. Fouché places syncope in the remaining proparoxytones after the Germanic invasions of the fifth century (1958:411). We will return to these cases in the next section. By reducing almost all vowels in unstressed penults, which were subsequently deleted, the language lost most of its proparoxytones. This means that, after syncope, the last two syllables of every word consisted of an extrametrical syllable preceded by a monosyllabic foot. In addition, the loss of distinctive vowel quantity rendered the classical accent system opaque.[12] It comes then as no surprise that the joint

---

11 In the next chapter we will discuss the relation between syncope and the changing accent system in more detail.

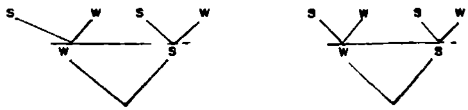
12 One might wonder, since quantity distinctions are lost at the same time that vowel-reduction was operative, whether the rules in (9) were still productive. To the extent that they were no longer productive, they might be considered as lexical redundancy rules (cf. Hayes, 1981:145). However, even if main stress assignment was no longer predictable, secondary stress remained predictable on the basis of main stress. This matter too will be dealt with in more detail in the next chapter.

effects of these two phenomena brought about a new accent system. The accent rules of Latin are changed in two respects. First of all, since vowel quantity was replaced by qualitative distinctions, the stress rule became Quantity-Insensitive. In addition, syncope eliminated antepenultimate accent. Therefore, once these changes were accomplished, rule (4) which marks the last rime of a word as extrametrical, can be dispensed with. It goes without saying that this is a quite natural and expected change. Typologically, languages with ternary feet are highly marked. Ternary feet are therefore excluded from the restricted inventory of unmarked metrical trees (cf. section 1.1) and have to be handled with a marked rule such as (4). The new accent rule can be formalized in metrical terms as in (32).

(32) Construct maximally-binary, quantity-insensitive, left-dominant feet, starting at the right edge of a word.
Group the feet in a right-dominant word tree.

To see how this works, consider the derivations in (33).

(33) a) s e m b l e t u d n e   d o m e s c a r e



The description for syncope given in this section can be extended to apocope without further modification as will be shown in the following section.

1.2.2 *Apocope*

As noted above, unstressed final vowels except *a* became reduced and subsequently disappeared between the end of the seventh and the end of the ninth century. As in the case of pretonic syncope, the low vowel *a* behaves exceptionally. In the beginning of this study we observed that final vowels were not deleted if they had to serve as a support vowel. The conditions under which a support vowel was necessary are well known, and can be formulated as (34) (cf. Pope, 1956:114).

(34) a) Before the final group -nt
b) After the denti-palatals tš and dž and the groups consisting of consonant + r or l

In the preceding section, we have divided the process of syncope in reduction and deletion parts. We assume that the same division exists in the process of apocope; the deletion part of both processes then, may, historically, have been subject to syllable structure, as may be concluded from footnote 9 and the conditions in (34), of which (34b) in particular suggests a syllable conditioned process. The position which will be adopted here consists in assuming that a context-free process of deletion eliminated all schwas and that the support-vowels have been synchronically reinterpreted as a competing rule inserting schwas in specific environments, defined with reference to the syllable.

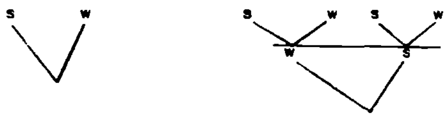
Let us now consider the evolutions in (35) showing the effects of the weakening stage preceding apocope

(35)

Clas Lat		Old French	
muros	> *[murəs]	> murs	'wall (nom sg, obj pl)'
debet	> *[deivət]	> deit	'he must, he owes'
colaphum	> *[kɔlpə]	> colp	'blow with the fist (nom pl, obj sg)'
fortem	> *[fɔrtə]	> fort	'strong
patrem	> *[pɛðrə]	> pere	'father'
similitudinem	> *[simlətudnə]	> sembletume	'resemblance'
dormitorium	> *[dɔrtɔrjə]	> dortoir	'bedroom'
nitidum	> *[nɛtə]	> net	'clean, clear'

Without further adaptations, rule (27) can account for most of the forms listed in (35). In order to see this, let us consider the derivations in (36).

(36) a) k ɔ l p ə   b) s e m b l ə t u d n ə



It should be noticed that the application of (27) predicts that in forms like (36b) the vowel in the remaining unstressed pretonic syllable of words which originally contained two of them reduces also. In fact, this happens without exceptions, but only if that remaining unstressed pretonic syllable is open, as predicted by (27) (cf. Fouché, 1958:481-492).

Rule (27) apparently fails to cover those cases where apocope takes place even if the final vowel is followed by a consonant (i.e. in a closed syllable) as for example in the first two forms of (35). With respect to the other forms listed in (35), it is important to note that word-final *m* was lost, just like the other sonorants, long before apocope became productive (cf. Fouché, 1958:650-651). As for word-final *s* and *t* in the other forms in (35), they occur as inflectional endings. In general, inflection is not included in the domain of syllabification. On this assumption it follows that rule (27) also accounts for apocope.

There is, however, one class of exceptions to apocope not discussed yet: proparoxytones that had not been reduced to paroxytones in Late Latin or Early Gallo-Romance (cf. Pope, 1956:114 and also Fouché, 1958:466). Let us look at the pair of forms in (37).

(37) Clas Lat Old French

tépidum	>	tiede	'lepid, lukeworm'
nítidum	>	net	'clean, clear'

The second form in (37) had syncopated in Late Latin or Early Gallo Romance, subsequently its final vowel was reduced and deleted by apocope. The first form syncopated later and was only reduced by apocope. It should be noticed that proparoxytones, which had not become reduced in Late Latin or Early Gallo-Romance, are exceptions to the stress rule (32). We assume that they are marked for having antepenultimate stress in the lexicon. In (38) the evolution of the forms in (37) is illustrated.

A final remark has to be made about the exceptional behavior of the vowel *a*. In pretonic and final syllables it is never deleted, but always becomes reduced (cf. Fouché, 1958:482-484 and 500-501). It seems then that the low vowel in all these positions only reduces later than the other vowels (cf. Pope, 1956:115). The reduction of unstressed penultimate *a* is attested, according to Pope (1956:115), in the seventh century, reduction of *a* in other positions in the ninth century (cf. Fouché, 1958:501). Given that *a* always reduces in open syllables, there is no reason to include the fact that *a* reduces later in every position in the mechanism expressed by rule (27). The fact that neither in the pretonic nor in the final syllable *a* is deleted may be explained by assuming that deletion was no longer productive at the time when *a* weakened to schwa.

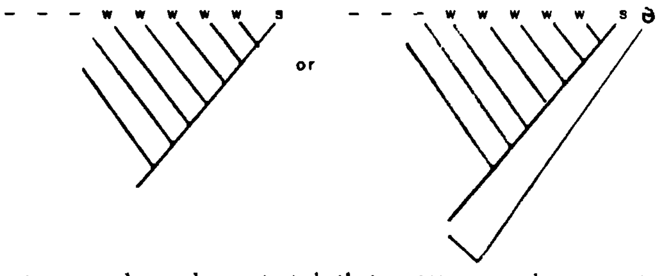
(38) Period	Rule	Example	
Class Lat	(9)	a) tepidum	b) nitidum
Late Latin	(27) (b only)	tepidu	nitədu
Gal-Rom (5-6 cent)	-deletion (b only)	tiebidu	nettu
Gal-Rom (7-8 cent)	-(27)(a and b) -deletion (a and b)	tiebədu tieddu	nettə net
Gal-Rom (8-9 cent)	-(27)(a only)	tieddə	net
Old French		tiede 'lukewarm'	net 'clean, clear'

The consequence of the apocope process for the stress system of Old French is evident. The language no longer has proparoxytones and the paroxytones all contain a schwa in their final syllable (cf. Pope, 1956:102). This can be expressed by a rule like (39).

(39) Construct an unbounded right-dominant foot at the right edge of a word, with the restriction that schwa is always a recessive node

Rule (39) gives the two possible structures of (40).

(40)

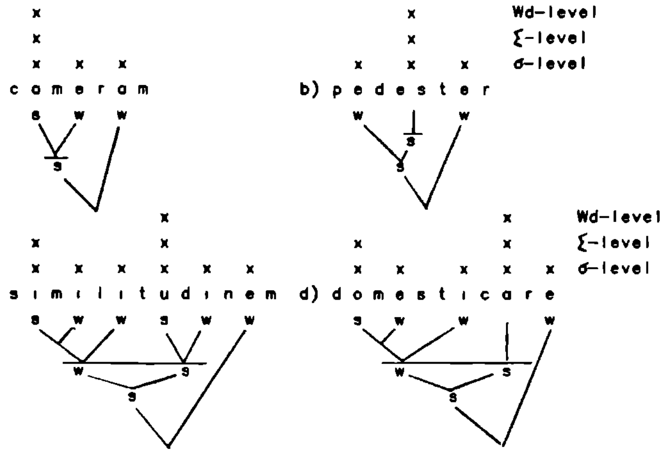


In this section we have demonstrated that apocope can be accounted for by the same rule we needed for syncope. These two processes are now explained as manifestations of one and the same mechanism. The fact that apocope is, diachronically, posterior to syncope has been explained by the loss of extrametricality. In this section it also became clear that the evolution of accent placement form Latin to Old French can be characterized (as proved by (9), (32) and (39)) as an evolution from a highly marked stress rule (9) to a completely unmarked one (39) (cf. Hayes, 1981:56). In the next section we will examine whether the generalization that syncope and apocope can be conceived of as manifestations of one and the same mechanism can also be captured in a grid-only theory.

1.3. *A Grid-only Account*

In the preceding section an analysis of syncope and apocope has been proposed that made a crucial use of the notion foot defined in metrical trees, and that enabled us to explain both processes as instances of one and the same mechanism: reduction in the domain of the foot. It is now time to examine whether an analysis in a grid-only theory is capable of giving the same type of description. In (41) a number of relevant forms, discussed in 1.2.1.3, are listed with their metrical representations in trees as well as in grids.

(41)



It is not clear to us how the context of rule (27) should be translated in a context based on grids. We need a rule stating that a vowel dominated by a non-branching rime becomes reduced in a metrically weak position. These positions can simply be read off the grid: those that only hold one grid position. It should be clear that not every vowel holding one grid position should become reduced, because this would reduce the vowels in the initial syllables of words like (41b), and the vowels of final syllables. In order to prevent final vowel reduction, it will be assumed that extrametrical syllables receive a relative prominence interpretation at word-level, by a rule like (42).

(42)
```
                                          x
     x      x                  x          x
     x x    x x    (x)  ──►    x x        x x      x  Wd-level
```

In order to prevent initial vowel reduction, we might formulate the vowel reduction rule in such a way that it only applies if the vowel holding one grid position is preceded by a vowel holding two grid positions (one at σ-level, and one at Σ-level), as in (43)

(43) Vowel reduction
```
R
|              x      Σ-level
V ──► ə /     x x     σ-level
                |
                _
```

The vowel reduction rule (43), however, is unable to correctly reduce the forms like (41d). It seems that in order to obtain the foot-domain functioning of vowel reduction, we need to divide the grid into feet. According to Prince (1983:87) a grid could, eventually, be divided into feet in the following way: "A falling or left-headed foot starts with a Σ-level grid entry and runs rightward until another such entry is encountered, or the end of a domain. A rising or right-headed foot is the mirror-image opposite." The main reason for the development of a grid-only theory, however, was the fact that constituency, defined in trees, lacked independent empirical motivation. Let us suppose that we do supply the grid with constituent structure and express syncope by a rule which says that every vowel holding only one grid position within a foot, defined on the grid, becomes reduced, as in (44).

(44) Vowel reduction
```
R
|
V ──► ə / (x – ) Σ
```

Rule (44) seems to be the only possible grid-theory translation of rule (27), that captures the fact that syncope and apocope are manifestations of one and the same mechanism. However, in order for rule (43) to function properly, it must be assumed that grids do contain constituency structure. This assumption is not only contrary to a grid-only theory, but undermines its *raison d'être.*

1.4. *Conclusions*

In this chapter we have provided a straightforward account of the reduction of unstressed vowels in the evolution from Latin to Old French. Syncope and apocope, traditionally thought of as two separate processes, are now explained as two manifestations of one and the same mechanism: foot-based vowel reduction. Both processes can be understood as the effect of one and the same rule applying on different, independently motivated, metrical structures. This generalization can only be captured in a metrical theory recognizing the notion of foot as a primitive element of its descriptive vocabulary. Moreover, we have demonstrated that a grid-only theory account fails to capture this generalization and thus obscures the relation between the two processes. The proposed analysis, therefore, constitutes an argument in favor of a metrical theory using feet to express stress and for the fact that feet cannot be dispensed with in phonological theory.

On Markedness And Bounded Stress Systems

2.0. *Introduction*

In Hayes (1987) a revised parametric metrical theory is proposed as an improvement of the stress theory advanced in Hayes (1981). The old theory permitted four basic bounded stress types, yielded by the following two parameters: (i) Quantity-Sensitive (QS) vs. Quantity-Insensitive (QI), (ii) direction of dominance (i.e. right-dominant (rd) vs. left-dominant (ld)).
Normally, in QS stress systems the dominant nodes are constructed and labeled strong irrespective of properties of syllable structure. However, there are also QS stress systems in which not all dominant nodes are labeled strong. Dominant nodes in these systems are labeled strong depending on whether they branch or not (dominant nodes strong if and only if they branch). The latter parameter is termed 'Labeling-based-on-branching' (LBOB). This latter parameter gives us two more possible iterative stress systems. Hayes (1985) observes that QI-rd feet are assigned iteratively only in a few languages, whereas no known cases exist of iterative QS-ld foot assignment. From a typological point of view then these foot types must be considered marked. Hence, it can be concluded that among QS stress systems the option **rd** is the unmarked parameter setting, whereas for QI stress systems the option **ld** is the unmarked option. It is for this reason that Hayes (1987) proposes a revision of the theory, and stipulates a new inventory of metrical core units, which is claimed to be superior because marked and unmarked stress systems can be straightforwardly described as such.
This chapter compares the theories of Hayes (1981) and Hayes (1987), discusses some problematic aspects of the way in which marked stress systems are accounted for in the revised theory and proposes a new way of achieving the results of Hayes (1985) without the disadvantages of the revised theory. Section 2.1 illustrates the treatment of the four basic bounded stress types mentioned above under the standard theory and the revised theory. In section 2.2, we will demonstrate that an alternative analysis of the marked QI-rd and QS-ld stress

systems must be preferred on both formal and empirical grounds. Section 2.3 focuses on the way in which the QS stress systems that label dominant nodes as strong if and only if they branch, are treated under the revised theory. Subsequently, it will be shown how the Uniformity Parameter put forward by McCarthy and Prince (1986) can describe bounded stress systems that, in the standard theory, involved labeling-based-on-branching. If we adopt this parameter, however, stress systems are predicted to occur which are, in fact, unattested A closer look at such systems suggests a principled explanation for this gap. Finally, section 2.4 summarizes and discusses the proposals of the present chapter.

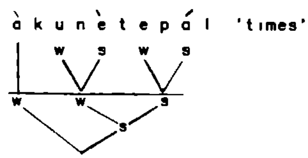
2.1. *A parametric metrical theory and its revisions*

The two parameters QS-QI and rd-ld yield four basic bounded stress systems which are illustrated on the basis of Weri, Warao, Tübatulabal and Classical Latin, in (1)-(4) below. In Weri, the main stress falls on the final syllable and secondary stress on each alternating preceding syllable. The Weri stress facts are accounted for by right-to-left assignment of QI-rd feet and by grouping these feet into a right-dominant word tree as illustrated in (1) (cf.Hayes, 1981:52-53).[1]

(1) Weri

-QI-rd, R-L

-rd word tree



Warao has primary accent on the penultimate syllable and secondary stress on each alternating preceding syllable The construction of QI-ld feet, from right to left, and of a right-dominant word tree, will correctly describe the stress facts of Warao, as shown in (2) (cf. Hayes, 1981.51-52).

Hayes (1981.60), basing himself on Voegelin (1935), describes stress in Tubatulabal as follows. stress falls on (a) final vowels, (b) long vowels, (c) short vowels lying two syllables to the left of a stress As illustrated in (3), QS-rd

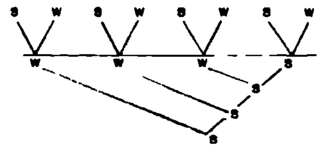
----

[1] Following Hayes (1981), the feet have, for expository reasons, been separated from the word tree by a horizontal line

(2) Waroo y à p u r ù k i t à n e h ó s e 'verily to climb'

-QI-ld, R-L

-rd word tree



feet are constructed from right-to-left. All stresses are claimed to be equal in prominence, so no word tree is constructed.

(3) Tubatulabal í i? í i i? áa ni cá 'he will meat-fast'

h h l h l l

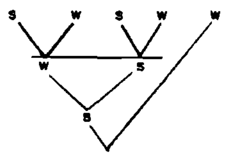
-QS-rd, R-L

Classical Latin illustrates the last possibility. Main stress falls on the penultimate if that syllable is heavy, and otherwise on the antepenultimate. Secondary stress falls on each alternating preceding syllable. A standard metrical analysis of Classical Latin will be as follows: (a) the final syllable is marked as extrametrical, (b) at the right edge of a word, a QS-ld foot is assigned, (c) QI-ld feet are assigned from right to left,[2] and (d) all feet are grouped into a right-dominant word tree.

(4) Classical Latin d ò r m i t ó r i (u m) 'bedroom'

h l

-Non-iterative QS-ld, right edge
-Iterative QI-ld, R-L
-rd word tree



Hayes' (1981) theory predicts that all four stress types, exemplified in (1 4), should be equally common among the world's languages. However, Hayes (1985) found that QI-ld and QS-rd feet are assigned iteratively in numerous languages, whereas QI-rd feet are rarely and QS-ld feet are never applied iteratively. It is for this reason that for QI stress systems the option **ld** must be considered the unmarked parameter setting, while for QS stress systems **rd** is the unmarked

---

2 In section 2 2 2, we will deal with the treatment of secondary stress in Latin in more detail

setting. Hence, the relative markedness and rarity of systems such as Weri and Classical Latin remained unaccounted for in the standard theory. These markedness considerations led Hayes (1987) to revise his original theory and to account for the unmarked stress types by the core metrical units in (5). In order to capture the generalizations made possible by tree- as well as grid-theories, "bracketed grids" are used, that is, feet [sw] and [ws] are represented by the bracketed grids (x .) and (. x), respectively (cf. Hammond (1984), Hayes (1987) and Halle and Vergnaud (1987) for more details).

```
(5)                        (x  )                        ( )
  a) Syllabic Trochee     Form σ σ if possible, otherwise form σ

                           (x  )                 (x  )
  b) Moraic Trochee       Form m m if possible, where m m is

                             (x  ) (x)               ( )
                          either l l or h , otherwise form l

                           (  x)                        (x)  ( )
  c) Iamb                 Form l σ if possible, otherwise form h or l


        (Where ( ) is a stressless foot, (x) = stressed foot,
         σ = syllable, m = mora, l = light syllable, and
         h = heavy syllable)
```

Hayes (1987) suggests that the metrical grouping of sequences corresponding to the core metrical units in (5) derives from two general laws of rhythm. In a language where heavy and light syllables are treated equally by bounded constituent construction rules (i.e. no attention is paid to the quantitative distinctions among syllables so that all syllables count as equal for stress purposes) the more prominent element of a binary constituent will be the **first** element (left-dominant). In a language where heavy and light syllables are not treated alike by stress rules (i.e. quantitative distinctions among syllables are relevant so that not all syllables count as equal for stress purposes) the more prominent element of a binary constituent will be the **last** element (right-dominant). Hayes (1987) characterizes the former way of metrical grouping as **trochaic** or **even duration** grouping and the latter as **iambic** or **uneven duration** grouping. The laws of trochaic (even) and iambic (uneven) rhythm dictate, then, that prominence contrasts based on **uneven duration** lend themselves more generally to iambic rhythm, whereas prominence contrasts based on **even duration** lend themselves more generally to trochaic rhythm. These rhythm laws are also operative in other cognitive domains and underlie the core metrical units in (5). The iamb (5c), by not allowing heavy syllables in weak position, creates, wherever possible, feet of which the syllables contrast in duration. The syllabic trochee and the moraic trochee (5a, 5b) create feet of which the syllables are phonologically equal in duration.[3] Stress systems that in the theory of (1981) were analyzed by QI-ld and QS-rd feet (henceforth former QI-ld and former QS-rd) clearly obey these laws, and, hence, can be straightforwardly analyzed by using syllabic trochees and iambs respectively, as illustrated in (6) for Warao and Tübatulabal.

```
(6)  Warao        y à p u r ù k i t à n e h á s e
                   (x    ) (x    ) (x    ) (x    ) Syllabic Trochee R-to-L
                   (                        x    ) End rule Final

     Tubatulabal  íi?  íi   i?  áa  ni  cá
                   h    h    l   h   l   h
                  (x)  (x)  (    x) (    x)   Iamb, R-to-L
```

Stress systems that in the theory of (1981) were described by using QI-rd and QS-ld feet (henceforth former QI-rd and former QS ld stress systems), however, clearly violate the laws of iambic and trochaic rhythm and must therefore be analyzed differently. The remainder of this chapter discusses how these marked systems are analyzed in the revised theory and shows that an alternative way of formally expressing the relative markedness of these systems is preferable to the revised theory approach on both formal and empirical grounds. Section 2.2.1 addresses the question of how the marked former QI-rd stress systems are reanalyzed as instances of syllabic trochee assignment, after that, section 2.2.2 discusses the moraic trochee (5b), a device for handling former QS-ld stress systems. The moraic trochee has also been claimed to make possible the elimination of the labeling-based-on-branching parameter. This parameter and the extent to which the revised theory is successful in achieving this last goal will be discussed in section 2.3.

---

3 In a language using syllabic trochees, all syllables are claimed to be phonologically equal in duration (Hayes, 1985)

2.2. *Former QI-rd and QS-ld stress systems*

2.2.1. *Former QI-rd stress systems*

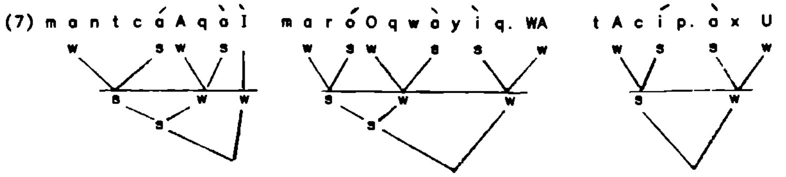
Let us, to begin with, consider how the marked QI-rd stress systems are reanalyzed in the revised theory. Hayes (1987) proposes to reanalyze former QI-rd stress systems as instances of syllabic trochee assignment by using independently needed mechanisms such as extrametricality and monosyllabic feet. The resulting reanalyses of former QI-rd stress systems are more complex and are therefore claimed to be justified because they provide a formal account of the more heavily marked status of QI-rd languages. However, it will be shown, on the basis of the stress systems of Southern Paiute and Yidiɲ, that similar reanalyses complicate metrical theory and, as such, express the markedness of former QI-rd systems in an unnecessarily difficult way. Moreover, it will be shown that, if former QI-rd stress systems are reanalyzed as instances of syllabic trochees, the generalization made in Hayes (1985:441) that rules which lengthen stressed vowels, rules which lengthen consonants following stressed vowels and rules which reduce alternating stressless vowels are absent among trochaic languages, cannot be maintained. Furthermore, the presence of these rules in just those languages that must be reanalyzed as syllabic trochee assignment can no longer be explained. Next, an alternative way of describing these marked systems will be presented, which does not burden metrical theory, which captures the markedness of former QI-rd systems in a straightforward way, and which permits us to maintain the generalization mentioned above.

Let us now consider the stress facts of Southern Paiute as described by Sapir (1930), Wheeler (1979) and Hayes (1981). Main stress falls on the second vowel and secondary stress on each alternating vowel thereafter. The final syllable, however, is never stressed. In (7) some examples, taken from Wheeler (1979) have been reproduced. The construction of QI-rd feet from left to right --followed by a Final Weakening Rule that changes a word-final [ws] foot into a [sw] foot in words with an even number of syllables-- and the assignment of a left-dominant word tree correctly accounts for the stress facts of Southern Paiute

---

[4] Since in Southern Paiute the final syllable is never stressed, the final monosyllabic foot, in words with an odd number of syllables, such as mantcóAqàI in (7), has to become destressed and incorporated as a weak member into the word

(cf. Wheeler, 1979:154-155).[4]

(7)


'to hold out one's hands' 'stretch it' 'when it was evening'

In the data in (7) a capital letter indicates a devoiced vowel and a dot a geminated consonant. Wheeler (1979) discusses a Vocalic Devoicing rule (VD) and a Gemination rule (GEM) and claims that both rules are closely related to the alternating stress pattern and sensitive to the metrical structure of Southern Paiute. In (8) Wheeler's rules are reproduced.

(8a) Vocalic Devoicing

W | V → [−voice] / − { # , [+cons, −voice] }

(8b) Gemination

S | V [+cons, −voice] → S | V [+cons, −voice, +long]

According to Hayes' (1987) revised theory former QI-rd stress sytems must be reanalyzed as instances of syllabic trochee assignment. The only reanalysis of Southern Paiute as an instance of syllabic trochee assignment which would make it possible to maintain the formulation of VD and GEM as in (8) is very complicated and requires the following steps:

(a) mark the initial syllable as extrametrical
(b) assign a single syllabic trochee at the right edge of the word
(c) iteratively assign syllabic trochees from left to right
(d) if no syllabic trochee can be assigned, form a monosyllabic stressed foot (x)
(e) apply the End Rule Initial

---

tree. This destressing takes place prior to the application of the rules in (8) (cf. Wheeler, 1979:154).

5 Rene Kager has pointed out (personal communication) that (b) should precede (a) given the fact that disyllabic words in Southern Paiute receive main stress on their initial syllable, as in qánI "house" and túq.U "panther".

In (9) the data of (7) are given with the metrical structure according to this revised analysis[5]

```
(9)m a n t c á A q à l     m a r ó O q w à y ì q  WA     t A c í p  à x  U
 a) (σ)                    (σ)                           (σ)
 b)               (x )                      (x    )              (x    )
 c)          (x  )              (x  )
 d)                                     (x)                   (x)
 e) (        x       )     (     x                  )    (     x         )
```

Now, for an analysis like (9) to work, the inventory of the revised metrical theory must be expanded, that is, the syllabic trochee needs to be modified in such a way that it becomes possible on a language-specific basis to construct a monosyllabic stressed foot (x), as in (9d), instead of a stressless foot (.) in case no syllabic trochee can be assigned. Before discussing the use of monosyllabic stressed feet in more detail, let us first discuss another instance of QI-rd feet: stress in Yidin^j.

Hayes (1981,1982), basing himself on Dixon (1977), analyzes Yidin^j by means of a left-to-right construction of QI-rd feet. A Penult Lengthening (PL) rule (10) is proposed which lengthens the vowel in the penultimate syllable of words that have an odd number of syllables.

(10) Penult Lengthening

$$V \rightarrow VV / \overset{s}{\underset{\_}{|}}\ (C)\ \sigma\ \#$$

Long vowels in Yidin^j do not only arise as a result of (10), but also by a pre-suffix and a pre-yotic lengthening rule (cf. Hayes, 1981:99). The interesting fact about Yidin^j stress is that words that contain an even number of syllables and which have not acquired long vowels by any of the lengthening rules, are predicted to have a [ws] stress pattern. However, these words have a trochaic [sw] pattern. Hayes (1982.105) posits the Stress Shift rule (11) to account for the stress pattern of these words.

(11) Stress Shift

Relabel all sister nodes [sw], unless there is a strong node dominating a long vowel

To see how this works, consider the forms in (12).[6]

```
(12)                gu dá ga    'dog'        gu dá ga ngú    'dog-ergative'
a) QI-rd             w  s  w                  w  s  w  s
   L-to-R            \/  /                    \/    \/
                      \/
b) PL (10)          gu dá  ga                  n o
                     w  s  w

c) Stress Shift       n o                    gú da gá ngu
                                              s  w  s  w
                                              \/    \/
```

The interesting question that now arises, of course, is how to reanalyze Yidin in the framework of the revised theory using syllabic trochees. Suppose we make the first syllable extrametrical, assign syllabic trochees from left-to-right, replace **s** by **x** in (10), and reformulate Stress Shift in such a way that foot structure is erased and syllabic trochees reassigned, without initial extrametricality, from left-to-right in words that have no strong nodes dominating a long vowel. This would yield for the two example forms in (12) the metrical derivations in (13).

```
(13)                gu da ga    'dog'        gu da ga ngu    'dog-ergative'
a) initial          ( )                      ( )
   EM

b) Syllabic         gu dá ga                 gu dá ga ngu
   Trochees L-R     ( )(x   )                ( )(x   )( )

c) PL               gu da ga                   n o
                    ( )(x   )

c) Stress Shift       n o                    gú da gá ngu
                                             (x   )(x   )
                       ↓                          ↓
                    gu dá  ga                gú da gá ngu
                    ( )(x    )               (x   )(x   )
```

In words which contain a strong node dominating a long vowel such as *gudá.ga* no relabeling takes place, and, consequently, the first two syllables do not constitute one foot, but are part of two different feet. There are, however, as

----

[6] After the application of (12a) one further rule is needed which destresses the final syllable in words with an odd number of syllables and which incorporates it as a weak memeber into the word tree, for a rule deleting final syllables to be stated in metrical terms

Hayes (1982:102,109) notes, a number of rules which require the first two syllables of a word to constitute a single foot. First, there is an optional Stress Fronting rule which shifts stress from the second to the first syllable, as in, for instance, *galí na* > *gáli:na* 'go-purposive.' This rule, as Hayes (1982:102) states can be formulated "as a very simple relabelling, provided that the first two syllables of a word always constitute a foot." Second, reduplication in Yidiɲ can, if the first two syllables of a word constitute a single foot, be formulated as the copying of the stem-initial foot (cf. Hayes, 1982:119). Third, Dixon (1977:41) observes that one of his informants missed, when recording a song, one word-initial disyllabic unit every time he took breath. Again, this can only be understood as the omission of a word-initial foot, if the first two syllables of a word constitute a single foot (cf. Hayes, 1982:109). It is clear then that, although the Yidiɲ stress facts can be analyzed as syllabic trochee assignment, such an analysis would make an insightful formulation of the rules mentioned above impossible. Therefore, a reanalysis in terms of syllabic trochee assignment lacks independent motivation.

Another way of dealing with Yidiɲ stress consists of constructing disyllabic constituents from left-to-right without labeling them and making Penultimate Lengthening sensitive to the right boundary of the last disyllabic constituent in a word with an odd number of syllables. After the application of the rules creating long vowels, labeling must then proceed in such a way that words in which no long vowels occur in the final syllable of a foot are labeled (x .) and words which contain a long vowel in the final syllable of some foot are labeled (. x). It is precisely for this case that McCarthy and Prince (1986) propose clause (ii) of the Uniformity Parameter (UP) in (14).

(14) *Uniformity Parameter*

A language may require that all feet have the same labeling

(*i*) *everywhere*

(*ii*) *within the word*

So far, we have shown that Southern Paiute can be reanalyzed using syllabic trochees, but that in order to do so metrical theory must become more complicated in allowing, on a language-specific basis the construction of stressed monosyllabic feet, and, that Yidin̄ can be analyzed if one allows the construction of unlabeled feet. However, apart from the desire of not expanding the formal apparatus of metrical theory, there is another more important reason to look for an alternative way of describing former QI-rd stress systems, which is based on the fact that it is no longer possible to provide an explanation for the existence of the Gemination rule (8) and the Penult Lengthening rule (10) in the phonologies of Southern Paiute and Yidin̄.

As mentioned above, the iamb derives directly from the law of iambic rhythm. However, as Hayes (1987) observes, an iambic stress rule may also group two light syllables into one constituent, resulting in a foot of even duration. Typically, as Hayes observes, languages with iambic rhythm often have segmental rules which serve to increase the durational contrast of a foot, such as rules lengthening short stressed vowels, geminating consonants after stressed vowels, or reducing alternating stressless vowels. According to Hayes, these rules are absent from trochaic languages and rightly so, because they would destroy the even duration character of trochaic rhythm. Hayes (1985:441) claims that rules of this kind are not typical of quantity-sensitivity, but rather of iambic rhythm. However, in Hayes (1985), iambic rhythm equals right-dominance since it is stated that this kind of lengthening and reduction rules may also occur in a quantity-insensitive language "provided that it has iambic [i.e. last element prominent] stress" (cf. Hayes, 1985:441). In Hayes' (1987) revised theory, however, iambic rhythm is a composite of both uneven duration and right-dominance, and quantity-insensitive iambic rhythm is excluded in principle. The consequence of reanalyzing the former QI-rd stress systems as instances of syllabic trochee assignment therefore is that we are no longer able to provide an explanation for the existence of stress-sensitive gemination or reduction rules in these reanalyzed stress systems. Moreover, the presence of these rules in languages with iambic stress rules can no longer be related to the enhancement of a durational contrast because they also occur in trochaic stress languages. In other words, the generalization that these rules are typical of iambic stress, but absent in trochaic stress systems can, in Hayes' (1987) theory, no longer be upheld.

In order to remedy the objections mentioned above, we will account for the markedness of former QI-rd feet by allowing the construction of **reversed** syllabic trochees as marked metrical units. The reversed syllabic trochee should then be considered as a marked metrical unit of the form in (15).

```
(15)                 (. x)                    (.)
```

Reversed syllabic trochee: Form σσ if possible; otherwise form σ.

A reversed syllabic trochee does the same descriptive work as the former QI-rd foot, but must be considered as marked in the sense that it deviates from the law of trochaic rhythm in making the **last** (instead of the first) element of a binary constituent based on even duration the more prominent. Hence, the markedness of the reversed trochee need not be stipulated, but follows directly from the general laws of rhythm underlying the revised theory. Furthermore, the reversed syllabic trochee differs from the former QI-rd foot in making a monosyllabic foot stressless instead of stressed. We will return to this latter point in more detail below.

The reversed trochee (15) has two immediate advantages. First, metrical theory need not be made more complex, as it is not necessary to allow for monosyllabic stressed feet, nor for the construction of unlabeled constituents in accounting for the stress facts of Southern Paiute and Yidin̩ʲ. The assignment of a syllabic trochee at the right edge of a word followed by the left-to-right assignment of reversed syllabic trochees and the End Rule Initial, as illustrated in (16a-c), correctly describes the stress facts of Southern Paiute, and, if 's' and 'w' in (8) are replaced by 'x' and '.' respectively, leaves Wheeler's formulation of VD and GEM intact.

```
(16)   mant cá  A qò I   ma ró  O qwà yì q.WA    tA cí  p.ò  x.U
 a)              (x  )                (x     .)           (x     .)
 b)    (.    x)(.)       (.  x)(    x)               (.  x)
 c)    (     x       )   (   x               )       (   x       )
```

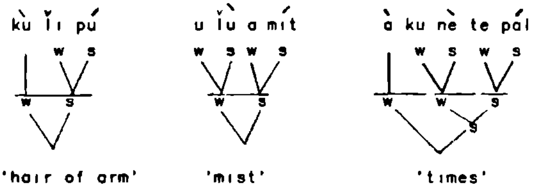
The Yidin̩ʲ stress facts discussed above can be analyzed as in Hayes (1981/1982). Secondly, and more importantly, the generalization that rules lengthening stressed vowels, geminating consonants after stressed vowels, or reducing alternating stressless vowels do not occur in languages which have a trochaic stress rule, but do occur in languages having an iambic stress rule can be maintained. The existence of these rules in languages that have a reversed trochaic stress rule, such as the rules of Gemination (8b) and PL (10) in the grammars of Southern Paiute and Yidin̩ʲ can now easily be explained. Rule (8b) in the phonology of Southern Paiute has the effect of creating surface iambic feet, that is, feet of which the elements contrast in duration. The effect of PL (10) in Yidin is similar, the only difference being that in Yidin words in which no surface iambic feet have been created are labeled trochaically. In other words, the metrically conditioned rules of consonant gemination and penult lengthening can be related to the creation of proper iambic rhythm and can be interpreted as converting a marked deep structure stress pattern into an unmarked surface structure stress pattern. In this respect, it is interesting to discuss the behavior of long vowels in Southern Paiute. According to Sapir (1930) the Southern Paiute stress system is based on the count of morae and not of syllables. The stress rules may, consequently, divide long vowels between feet, as illustrated in, for instance, *mantcáAqàI* and *maróOqwàyìq.WA* in (7) above. Hayes (1981:53-54) claims that the morae of Southern Paiute must be regarded as separate syllables in underlying representation, given that a number of allophonic rules apply to only one half of a surface long vowel.[7] The rule creating long vowels out of adjacent identical vowels must be considered a rather late phonetic rule according to Hayes. McCarhty and Prince (1986) point out that these long vowels always have stress on their initial mora and they take this to be "the result of a rule erasing syllable-internal foot structure and assigning prosodic status to the syllable, which allows the normal prominence structure of the syllable to assert itself." They add "if this is right, the Southern Paiute system does indeed contain the crucially iambic foot [l h]. At prominence assignment, uniformity may be invoked to guarantee iambic labeling." However, it can be shown that the UP cannot label the feet only after the application of the rule creating long vowels from adjacent identical vowels, because the feet must crucially be labeled prior to the application of this rule for the Gemination and Vocalic Devoicing rules to apply properly. If disyllabic constituents are assigned from left-to-right, then, without any labeling, the Gemination rule must be reformulated in such a way as to refer to the right boundary of word-internal disyllabic constituents, but to the left boundary of absolute word-final disyllabic constituents, that is, in words with an even number of syllables. Similarly, the Vocalic Devoicing rule must, if no labeling is provided, be reformulated so as to refer to the left boundary of word-internal disyllabic constituents, but to the right boundary of absolute

---

[7] It should be noticed that VD (8b) too applies to only one half of a surface long vowel.

word-final disyllabic constituents. The resulting disjunction of contexts in the rules completely obscures the stress-sensitive nature of both processes. Hence, we conclude that labeling must take place prior to the rule which creates long vowels out of adjacent identical vowels and that the effect of this rule as well as of the Gemination rule consists of converting the underlying marked reversed trochaic stress pattern into an unmarked surface iambic stress pattern.

Let us finally discuss the fate of monosyllabic constituents in quantity-insensitive languages. In the discussion of Southern Paiute above, it was observed that, if no reversed syllabic trochees are used, it must be possible to construct monosyllabic stressed feet on a language-specific basis. However, the way the stressed foot is used in Southern Paiute makes an empirical prediction which we believe to be false. Every time the stressed foot is used in the derivations in (9) above, a stress clash results This leads one to expect cases of secondary stress clashes resulting from the right-to-left application of syllabic trochees in words with an odd number of sylables. We have checked this for a number of languages, viz. Garawa (Hayes, 1981:54-55), Lenakel (Hammond, 1986), Malakmalak (Birk, 1976:16-17), Nengone (Tryon, 1967:1), Nyawaygi (Dixon, 1983:443), Spanish (Harris, 1983), Warao (Hayes, 1981:51-52) and Wargamay (Dixon, 1981:20-21), but we have found no cases in which a stressed foot must be used to create adjacent secondary stress clashes. On the contrary, it seems that monosyllabic constituents are made stressless in order to avoid such secondary stress clashes. If it is true that a stressed foot is never used to create such clashes, then (if only syllabic trochees are used) clash-avoidance cannot be a guiding principle in restricting the language-specific choice of how to treat monosyllabic constituents, given the fact that in Southern Paiute the stressed foot is used to create stress clashes. The reversed syllabic trochee, on the other hand, allows to dispense with a stressed foot in the analysis of Southern Paiute, and permits us to use clash-avoidance as a restricting principle in determining the fate of monosyllabic constituents in quantity-insensitive languages. However, if we no longer need a monosyllabic stressed foot in the analysis of Southern Paiute, the question arises, of course, whether we ever need a monosyllabic stressed foot in quantity-insensitive languages. This might be necessary in a language having a stress rule that assigns syllabic trochees from left-to-right, and, in which words with an odd number of syllables receive a secondary stress on their final syllable. Aranda (Strehlow, 1942/44:47-49), Classical Latin (below), Dıyarı (Austın, 1981:30-31), the Mpakwıthı dıalect of Anguthımrı (Crowley, 1981:156) and the Western Desert language (Douglas, 1959:8) have stress rules of this kınd, but words wıth an odd number of syllables do not receıve secondary stress on the fınal syllable. In Werı and Maranungku, however, secondary stress falls on the ınıtıal and fınal syllable, respectıvely, ın words wıth an odd number of syllables. Werı has fıxed fınal and Maranungku fıxed ınıtıal stress. Let us brıefly dıscuss Werı, ın order to ıllustrate the fact that ıt ıs perhaps not a monosyllabıc stressed foot, but rather a prıor applıcatıon of the End Rule that ıs needed In Werı, as mentıoned ın sectıon 2.1, prımary stress falls on the last syllable and secondary stress on each alternatıng precedıng syllable Hayes (1981), as ıllustrated ın (1), uses QI-rd feet, assıgned from rıght to left and a rıght domınant word tree to descrıbe Werı stress. Some sample derıvatıons are lısted ın (17).

(17)


A reanalysıs of Werı ın terms of syllabıc trochees could ınvoke neıther ınıtıal nor fınal extrametrıcalıty, because maın stress ıs fınal and secondary stress ıs on the ınıtıal syllable ın words wıth an odd number of syllables A possıble reanalysıs would consıst of assıgnıng maın stress fırst (by the End Rule Fınal) and constructıng syllabıc trochees from rıght to left followed by a second applıcatıon of the End Rule as ın (18).

(18)	kù lı pú	u lu a mít	à ku nè te pál
End Rule Fınal	x	x	x
Syl Trochees R–L	(x) x	( )(x) x	(x)(x) x
End Rule Fınal	(x)	(x)	(x)

Maranungku mıght be analyzed ın a sımılar way by applyıng the End Rule Inıtıal both before and after the constructıon of reversed syllabıc trochees from left to rıght. If ıt turns out to be the case that monosyllabıc constıtuents normally end up stressless and that the stressed foot ıs only necessary ın descrıbıng languages such as Werı and Maranungku, then there are some good reasons to analyze these languages along the lines of (18) and adhere to a more restrictive theory according to which monosyllabic constituents in quantity-insensitive languages always end up stressless. First, the resulting theory is more restrictive as no language-specific variation in the treatment of monosyllabic constituents is allowed. Second, Prince (1985) has observed for QS stress systems that destressing rules never apply to heavy syllables only, and stressing rules never to light syllables only, which suggests that stressing and destressing are part of one and the same mechanism. Kager (1988, forthcoming) has demonstrated for English that the rules of destressing and the rules of stressing can be collapsed into one single stress assigning mechanism. The relation between stressing and destressing in QI languages would be left unaccounted for, if the choice of how to treat monosyllabic constituents were a language-specific one, but follows straightforwardly from a theory in which there is no such language-specific variation at all.

In this section, some reanalyses of former QI-rd stress systems according to the revised theory have been discussed. It was demonstrated that, although reanalyses of these systems appear to be quite feasible, there are four main reasons for preferring an alternative analysis. First, the descriptive vocabulary of metrical theory need not be expanded to analyze the stress systems of languages such as Southern Paiute and Yidin^j. Second, in the revised theory the existence of metrically conditioned rules like gemination of consonants after stressed vowels, gemination of stressed vowels, and reduction of alternating stressless vowels can no longer be excluded from occurring in trochaic languages nor can their occurrence in the reanalyzed languages be explained. If the reversed syllabic trochee is used to analyze QI-rd stress systems, then the existence of rules serving to create a durational contrast in feet in languages that have a reversed trochaic stress rule can be straightforwardly interpreted as converting a deep structure marked stress pattern into a surface structure unmarked stress pattern. Moreover, the generalization that rules of this kind are absent from trochaic languages can be maintained. Third, the adoption of the reversed trochee permits us to dispense with the monosyllabic stressed foot in the description of Southern Paiute, and, if the monosyllabic stressed foot is never used to create secondary stress clashes, clash-avoidance can be invoked to guarantee this. Finally, if Weri and Maranungku are analyzed as indicated in (18), we might dispense with the monosyllabic stressed foot altogether in QI languages. This would make it possible to maintain a more restrictive theory in which no stressed feet are used in QI languages Moreover, the relation between stressing and destressing, as far as QI languages are concerned, is then straightforwardly accounted for, given that both stressing and destressing have been made integral parts of the syllabic trochee and its marked reversed counterpart.

2.2.2 *Former QS-ld stress systems*

In this section, we will consider on the basis of Classical Latin how former QS-ld stress systems are treated in the new theory Since QS-ld foot construction never appears to be applied iteratively, Hayes (1987) introduces the moraic trochee (5b) to describe the languages that in the theory of (1981) required QS-ld feet. We will argue in this section, on the basis of Classical Latin, that a moraic trochee analysis for QS ld systems lacks independent motivation Moreover, the phenomenon which will illustrate this, vowel reduction, is claimed to be typical of iambic rhythm only (cf Hayes, 1985, 1987) Furthermore, it will be shown that reduction in the historical evolution of Classical Latin into Old French led to an unmarked stress system and that a moraic trochee analysis of Classical Latin does not allow us to express this formally Next, an alternative way of describing the marked QS ld systems will be presented which both disposes of these problems and captures the markedness of former QS ld systems in a straightforward way

Since QS ld foot construction never appears to be applied iteratively, Hayes (1987) proposes a non-iterative moraic trochee construction (19) for languages such as Classical Latin [8]

(19) a) –Last syllable is marked as extrametrical
b) –From right to left construct moraic trochees non–iteratively (i e until a stress is assigned)

---

[8] The moraic trochee construction rule (19b) must apply non–iteratively in order to prevent secondary stress on the second (heavy) syllable of, for instance, vòluptátem 'voluptuousness ' It should also be noticed that in a language with no final syllable extrametricality, of course, only (19b) is needed to account for stress–placement Rotuman, where main stress falls on the final vowel of a word if that vowel is long and otherwise on the penult vowel, is an example of such a language (cf Hayes, 1981 63)

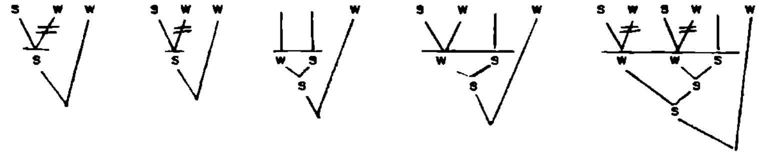
The application of (19) supplemented with the End Rule Final (20d), yields the metrical representations in (20) for words like *árborem* 'tree,' *cámeram* 'room,' *pedéster* 'on foot,' *vòluptátem* 'voluptuousness' and *lìberàtiónem* 'delivery.'

(20)	ár bo rem	cá me ram	pe dés ter	vò lup tá tem	lì be rà ti ó nem
	h l h	l l l	l h h	l h h h	h l h l h h
a)	(σ)	(σ)	(σ)	(σ)	(σ)
b)	(x) ( )	(x)	(x)	(x)	(x)
c)			( )	(x)	(x) (x)
d)	(x)	(x)	(x)	(x)	(x)

The secondary stress facts of Classical Latin have been accounted for by ordering the left-to-right construction of syllabic trochees (20c) after the assignment of primary stress (20b)[9]

In order to show that the constituent structure assigned by a moraic trochee analysis like (19) cannot be independently motivated for Classical Latin, the data of (20) have been reproduced in (21) with the metrical constituent structure they would receive if analyzed by QS-ld foot construction within Hayes' (1981) framework

(21) (a) ár bo (rem) h l h — (b) cá me (ram) l l l — (c) pe dés(ter) l h h — (d) vò lup tá (tem) l h h h — (e) lì be rà ti ó(nem) h l h l h h



The QS-ld feet in (21), starting at the right edge of the word, group together into **one** constituent, a sequence of a heavy and a light syllable (21a) as well as two light syllables (21b). Secondary stress, as in, for instance, *lìberàtiónem* is

---

[9] In a standard metrical tree theory analysis, the secondary stress facts of Classical Latin can be described (cf (4) above and (21) below) by assigning QI-ld feet from right to left after the assignment of main stress In order to obtain the correct stress patterns, however, a Prestress destressing- and a Poststress destressing rule are needed as discussed in chapter one The left-to-right assignment of syllabic trochees as in (20), instead of right to left, allows us to dispense with destressing rules for Classical Latin

[10] It should be observed that words like pedéster (21c) are predicted to receive secondary stress on their initial syllable However, secondary stress in Classical Latin probably only appeared on the initial syllable if the initial syllable was not immediately followed by the one with main stress (cf Allen,

accounted for by the construction of QI-ld feet from right to left.[10]

The derivations in (20) and (21) show that a moraic trochee and the former QS-ld foot are equally successful when it comes to accounting for the distribution of stress In order to see whether there is independent motivation supporting the difference in foot-constituency between forms like *cámeram* and *árborem* as predicted by a moraic trochee analysis and illustrated in (20) or whether there is independent evidence in favor of the foot constituency assigned in (21), according to which forms such as *cámeram* and *árborem* have identical constituent structure, let us look at a stress sensitive process. If a stress-sensitive process treated such forms in the same way, there would be evidence for the constituent structure of (21), but if a similar rule discriminated between these forms, this would plead in favor of the constituent structure of (20).

As discussed in chapter one, in Late Latin a stress-sensitive syncope process deleted all unstressed posttonic vowels in proparoxytones. The syncope process consisted of a reduction and a deletion part (cf Richter, 1934 91) Later on, this process became generalized so as to reduce and delete all non-initial pretonic stressless vowels provided they occurred in an open syllable. The reduction part of this process can, given the metrical representations in (21), be described by rule (22a), and in its generalized form by rule (22b)[11]

(22) Reduction

a) $$\begin{array}{c} R \\ | \\ V \end{array} \longrightarrow ə \,/\, (s\ -)_F\ \sigma\ \#\#$$

b) $$\begin{array}{c} R \\ | \\ V \end{array} \longrightarrow ə \,/\, (s\ -)_F$$

The rules in (22) reduce a vowel dominated by a non-branching rime in the weak position of a foot In (21) above, the vowels affected by the rules in (22) have been indicated by two horizontal lines. Let us now consider how the reduction rule would be stated if a moraic trochee analysis of Classical Latin were adopted. Consider again the data in (23) with the metrical representation according to the rules in (19).

1973 190-191) A Prestress-destressing rule, which we will not discuss here, is needed to remove the secondary stress on words like *pedéster* (21c) (Recall fn 9)

11 Final vowels in proparoxytones and paroxytones are extrametrical and incorporated as weak members into the word tree, which renders them immune to the reduction rules in (22) (cf chapter one for a more detailed description)

```
(23)a) dòr mí tó rí um        b) pe dés ter        c) cá mé ram
       h   h  h  l  h            l   h   h            l  l   l
       (x     )(x)( )(σ)         ( )(x) (σ)           (x    )(σ)
       (        x      )         (   x    )           (x       )

    d) ár bó rem               e) vò lup tá tem     f) lì bé rà tí ó nem
       h  l  h                    l   h   h   h        h  l  h  l h  h
       (x) ( ) (σ)                (x    ) (x)(σ)       (x   )(x  )(x)(σ)
       (x        )                (        x   )       (          x   )
```

It is clear that both a vowel dominated by a dot in (x .) as in, for instance, *cámeram* (23c) and a vowel dominated by a dot in (.) should become reduced, but in the latter case only if preceded by (x) as in, for example, *árborem* (23d). The vowels to be reduced in (23) have been indicated by a slash. Therefore, the reduction rules (22) must be stated as in (24), given the metrical structures of (23).

(24) Reduction

a) $V \rightarrow ə \;/\; x \;\_\_\; \sigma\#$ (V dominated by R; the vowel in the slot is ⊥)

b) $V \rightarrow ə \;/\; x \;\_\_$ (V dominated by R; the vowel in the slot is ⊥)

It almost goes without saying that the difference in constituent structure between forms like (23c) and (23d) does not receive any independent motivation by this stress-sensitive process of reduction. The formulation of reduction as in (24) shows that constituent structure is completely irrelevant to this process. However, the kind of reduction we find in Latin must be conceived of, and described as, a foot-based process according to Hayes' (1987) theory, as will be shown next. That is, the formalization of Latin reduction is as given in (22). This foot-based process shows that an analysis of Classical Latin as a moraic trochee language must be ruled out. The second objection against a moraic trochee analysis of Classical Latin is inseparably linked to the first: reduction itself is predicted not to occur at all, because it is claimed to apply only in languages that have iambic rhythm. As mentioned in section 2.1, for Hayes (1987) iambic rhythm implies **uneven** duration grouping with longer, and more prominent elements **last,** whereas trochaic rhythm implies **even** duration grouping with more intense, and more prominent elements **first.** As already discussed in section 2.2.1, an iambic stress rule may also group two light syllables into one constituent, resulting in a foot of even duration. Therefore, as Hayes states, languages which have an iambic stress rule often have segmental rules serving to increase the durational contrast of a foot, such as, for instance, rules lengthening short stressed vowels and reducing stressless vowels. Hayes (1985, 1987) claims that these rules are absent from trochaic languages since they would annihilate the even duration which is characteristic of trochaic rhythm. It is important to observe that reduction might occur in a language that has a trochaic stress rule, but then any vowel not bearing main stress should be reduced. This kind of reduction is not related according to Hayes (1985) to the creation of durational contrasts. What is excluded from occurring are vowel reduction rules which, in quantity-insensitive alternating stress languages, reduce alternating stressless vowels. It is this kind of reduction that would "destroy the even timing inherent to trochaic rhythm" (cf. Hayes, 1985:441). The data in (21) and (23) show that Latin reduction did not reduce all vowels except the one with primary stress, neither in its initial nor in its generalized form. It is for this reason that, if Latin stress were described using a moraic trochee, reduction as expressed by the rules in (22) would not be expected to occur at all.[12]

The third objection against a moraic trochee analysis is related to the fact that the evolution of metrical structure from Classical Latin to Old French cannot be described as an evolution from a marked stress system to an unmarked stress system. The syncope process resulted in a new accent rule that became general in Gallo-Romance. Since all vowels in proparoxytones were reduced and deleted and because vocalic quantity distinctions had been replaced by quality distinctions, the last two syllables of every word in Gallo-Romance consisted of an extrametrical syllable preceded by a monosyllabic stressed foot. Below we will discuss in more detail this change from a marked to an unmarked stress system. The stress facts of Gallo-Romance can, in Hayes' (1987) theory, easily be accounted for by the right-to-left assignment of syllabic trochees and by the application of the End Rule Final. Some sample derivations are listed in (25).

---

12 Furthermore, it is important to observe that reduction would be expected to occur if Classical Latin were described as having a non-iterative iambic stress rule. However, the constituent structure assigned by an iambic stress rule would not be independently motivated either. The first syllable of, for instance, (23b) pedéster is light and would be grouped into one constituent with the second syllable. Reduction, serving to increase the durational contrast of feet, would be expected to reduce the vowel of the first syllable of (23b), contrary to what happened

```
(25) a) sìm li túd ne   b) dorm  tór ju   c) cól pu   d) vò lup tá te
        (x     )(x    )    ( )   (x     )    (x    )    (x   ) (x    )
        (        x    )    (      x     )    (x    )    (        x    )
```

This particular evolution can, within Hayes' revised theory, be described as an evolution from moraic trochee construction with final syllable extrametricality (Classical Latin) to syllabic trochee construction without final syllable extrametricality (Gallo-Romance).[13] However, since **Id** is the marked option among QS stress systems but the unmarked one among QI stress systems, one would certainly like to be able to express the change in accent rule from Classical Latin to Gallo Romance as an evolution from a marked stress system towards an unmarked one. Unfortunately, in the revised theory it is impossible to formally express this evolution as such, because the moraic trochee (Classical Latin) is not inherently more or less marked than a syllabic trochee (Gallo-Romance).
In order to remedy the objections mentioned above, we propose the abolition of the moraic trochee as a core metrical unit and, instead, allow **reversed** iambs, as a formal reflection of the markedness of former QS-Id systems. These should be regarded as marked metrical units of the form in (26).

```
                          (x  )                          (x)   ( )
(26) Reversed Iamb   Form σ l  if possible, otherwise form h   or l
```

A reversed iamb, just as an iamb, involves **uneven duration** grouping and does the same descriptive work as the former QS-Id foot, but must be considered marked in the sense that it deviates from the law of iambic rhythm by making the **first** (instead of the last) element of a binary constituent based on uneven duration the more prominent. Just as in the case of the reversed syllabic trochee, the markedness of the reversed iamb need not be stipulated, but follows from the general laws of rhythm that underlie the revised theory. In section 2.4, we will return to this point in more detail.
The reversed iamb has at least three attractive consequences In order to show this, the data of (23) have been repeated in (27) with the metrical representation according to (26). In (27-i), final syllables are marked as extrametrical and a

---

[13] The further application of reduction (cf chapter 1) led ultimately to Old French becoming an oxytonic language

reversed iamb is assigned non-iteratively at the right edge. In (27 ii), syllabic trochees are constructed from left to right and, finally, the End Rule Final is applied in (27-iii).

```
(27)   a) dòr mi tó ri um     b) pe dé ter       c) có me rom
          h   h  h  l  h         l  h  h           l  l  l
 i             (x   )(σ)          (x) (σ)          (x   )(σ)
 ii       (x     )               ( )
 iii      (      x      )        (  x   )          (x      )

       d) ár bo rem          e) vò lup tó tem   f) lì be rò ti ó nem
          h  l  h                l  h   h  h       h  l  h  l  h  h
 i        (x   )(σ)                    (x)(σ)                   (x) (σ)
 ii                              (x     )           (x   )(x   )
 iii      (x      )              (        x  )      (            x    )
```

First, the foot-constituency of (27) can be independently motivated by the reduction process, which can now be reformulated as the foot-based processes in (28). The vowels reduced by (28) have been indicated by a slash in (27).

```
(28)   Reduction   a) R                         b) R
                      |                            |
                      V ---> ə / (x   ) σ #        V ---> ə / (x   )
                                   ⊥                            ⊥
```

Second, now that Classical Latin has been analyzed as involving **uneven** duration grouping, (albeit a marked form of uneven duration grouping), one expects to find rules like (28), that is, segmental rules increasing the durational contrast of feet, at least if similar rules are taken to be characteristic of uneven duration grouping rather than of strict iambic rhythm. In other words, stress sensitive reduction and gemination rules are now predicted to occur in languages like Classical Latin. As a matter of fact, the existence of similar rules (reduction, diphthongization, etc.) is well-established in the historical phonology of virtually all the Romance languages. Thus, by analyzing Classical Latin by means of the reversed iamb, we can maintain the claim that rules of this kind are untypical of trochaic, even duration rhythm.

Third, as will be demonstrated next, the evolution of the metrical structure from Classical Latin to Gallo-Romance can now be described as an evolution from marked (final syllable extrametrical and reversed iamb) to unmarked (syllabic trochee). As mentioned above, the syncope process consisted of a reduction and a deletion part. The reduction part of this process may be interpreted as serving to increase the durational contrast of the reversed iambic feet. The deletion part makes it possible to eliminate the markedness of the Classical Latin stress system: by deleting all reduced vowels in proparoxytones Gallo-Romance became a simple penultimate stress language, in which the Classical Latin stress rule was reinterpreted as unmarked right-to-left syllabic trochee assignment. It is important to see that we are not dealing here with a simple case of restructuring, that is, it is not the case that after syncope had gone through as a sound change the data --the last two syllables of every Gallo-Romance word consisted of an extrametrical syllable preceded by a monosyllabic stressed foot-- faced by a child acquiring the language were compatible with a simple syllabic trochee analysis. That the causative factor for the deletion part of the syncope process was, in fact, a reduction in the markedness of the stress system can be concluded from words in which a shift of stress from the antepenultimate to the penultimate syllable took place even **before** the syncope process affected them, as in, for instance, *íntegrum* > *intégrum* > *entier* 'total.'[14] In these words stress must, prior to syncope, have been moved to the penultimate syllable in order for the diphthongization of the vowel in the penultimate syllable to take place. Pulgram (1975:168-171) attributes the stress shift in these case to a "trend towards paroxytony." We think that this is correct, and, because the loss of quantity distinctions among vowels, at some point during the period in which the syncope process was operative, rendered the Latin stress rule partly opaque, the following historical scenario must be envisaged. For some period of the language we must posit lexical stress, and for that period the rules in (27) must be considered lexical redundancy rules conditioning the application of reduction in (28). Shift of stress in the cases discussed above and the deletion part of the syncope process shared one and the same goal: replacing the marked Latin stress rule in its lexicalized form by an unmarked, predictable, simple Gallo-Romance trochaic stress rule.

In this section the way in which former QS-ld stress systems are treated in the revised theory has been discussed on the basis of Classical Latin. It has been

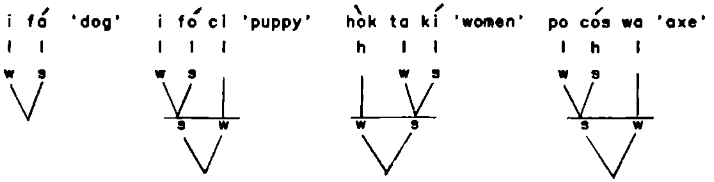
---

[14] Shift of stress in words of this type (i.e. penult short vowel followed by consonant + liquid cluster) was optional. Some Romance words derive from a penult stressed Late Latin source, others from an antepenult stressed one. The above-mentioned Integrum yielded both Old French entre (adj.) 'in good form' from íntegrum and entier 'total' from intégrum (cf. Pulgram, 1975:168-170 and von Wartburg, 1952:734-735).

demonstrated that a moraic trochee analysis of Classical Latin cannot be independently motivated by a stress-sensitive process like reduction, that reduction itself is predicted not to occur, and that the change from the Latin stress rule to the one of Gallo-Romance cannot be described as an evolution from marked to unmarked. After that, it has been argued that these problems can be avoided if the moraic trochee is replaced by a marked metrical unit: the reversed iamb.
However, now that the moraic trochee has been eliminated it can no longer be used to account for the 'labeling-based-on-branching' systems. Hayes (1987) designed the moraic trochee not only to deal with the QS-ld stress systems, but also to be able to eliminate 'labeling-based-on-branching' (henceforth LBOB) from metrical theory. Let us then, in the next section, consider how these QS stress sytems that label dominant nodes as strong if they branch are treated in the revised theory.

2.3. *Labeling based on branching (LBOB)*

This section discusses the way in which QS stress systems that label dominant nodes as strong only if they branch are treated in Hayes' revised theory. First, we will illustrate how the LBOB parameter was used in the standard theory to label the word tree and the feet. Next, the way in which the revised theory manages to get rid of the LBOB parameter will be discussed. Finally, it wil be shown how McCarthy and Prince's (1986) Uniformity Parameter (UP) can describe the QS stress systems which, in Hayes' (1981) theory, used the LBOB to label their feet. However, if we adopt the UP, stress systems are predicted to occur for which no independent evidence is available. This data gap, as one might call it, will be given a principled explanation.
In the standard theory the labeling of dominant nodes may depend on whether they branch or not. The labeling of the Creek word tree, for example, shows this property. QS-rd feet are constructed from left to right and incorporated into a right-dominant word tree, whose dominant nodes are labeled strong if and only if they branch. The Creek stress rules are illustrated with some examples in (29) (cf. Hayes, 1981:61).

(29)


The forms *ifóci* and *pocóswa* in (29) show that the dominant nodes of the Creek word tree are labeled **w** if they do not branch. The form *hòktakí* shows that the dominant nodes of the word tree are labeled **s** only if they branch. This marked way of labeling the word tree was, given the symmetrical nature of the standard theory, extended to the foot. Cairene Arabic, for example, illustrates the use of QS-LBOB feet. The stress pattern of the Cairene Arabic dialect can be summarized as in (30) (cf. among others, McCarthy, 1979, 1982, Kenstowicz, 1980 and references cited there)

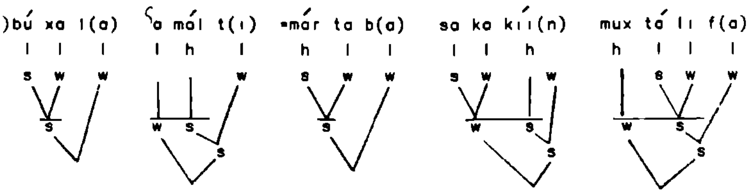
(30) a) –Stress a superheavy ultima
b) –Otherwise stress a heavy penult
c) –Otherwise stress the penult or antepenult, whichever is separated by an even number of syllables from the rightmost nonfinal heavy syllable or, if there are no nonfinal heavy syllables, from the left boundary of the word

Let us next consider the data in (31).

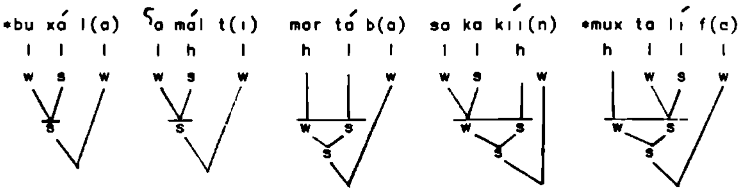
(31) a) bú xa la	b) ʕa mál ti	c) mar tá ba
l l l	l h l	h l l
'misers'	'you (f sg) did'	'mattress'
d) sa ka kíin	e) mux tá li fa	f) sa ja rá tu hu
l l h	h l l l	l l l l l
'knives'	'different (f sg)'	'his tree'

In (31b) and (31d) main stress is on the penultimate heavy and final superheavy syllable, respectively. In (31a), main stress is placed on the antepenultimate syllable, because this syllable is separated by an even number of syllables (viz. zero) from the left boundary of the word. In (31a), main stress cannot fall on the penultimate syllable, because this syllable is separated by an odd number of syllables (viz. one) from the left boundary of the word. Since in (31c) the penultimate syllable is separated by an even number of syllables (viz. zero) from the rightmost nonfinal heavy syllable (i.e. *mar*), main stress is on the penult. In (31e), main stress is on the antepenult, because here it is the antepenult and not the penult that is separated by an even number of syllables from the rightmost nonfinal heavy syllable (i.e. *mux*). Finally, in (31f), main stress is on the penult, because this syllable is separated by an even number of syllables from the left boundary of the word.

Let us now consider how the standard theory accounts for these stress facts. The odd-even count of syllables starting at the left edge of the word implies that binary feet must be constructed from left to right. The distinction between final superheavy on the one hand and final heavy and light syllables on the other, can be captured by making word-final rimes extrametrical and by analyzing superheavy syllables as consisting of two rimes. Final superheavy syllables will then be stressed just like heavy penultimate syllables (cf. Hayes, 1981:115-117). The binary feet must be QS as indicated by (30a) and (30b) and the word tree must be right-dominant in order to derive main stress on one of the last three syllables. If the QS feet, which are assigned from left to right, were **left-dominant** this would result in, among other things, incorrect stress for words of which the antepenult is heavy and the penult is light such as *martába*. This is illustrated in (32). Word-final extrametrical rimes have been indicated by parentheses.

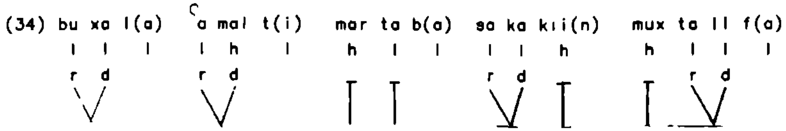
(32)


However, if the QS feet were **right-dominant** this would produce the correct stress pattern for words of which either the penult or antepenult is heavy, but the incorrect stress pattern for words of which both the penult and the antepenult are light such as, for instance, *muxtalifa* or *búxala*. This is illustrated in (33).

(33)


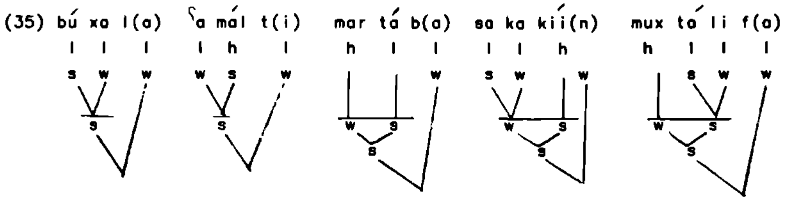
The problem clearly is that in Cairene Arabic the QS feet must be right-dominant in order to correctly stress words of which either the penult or the antepenult is heavy, but left-dominant in order to correctly stress words of which both the penult and antepenult are light. It is for this reason that Hayes

(1981:115-117) uses QS-rd LBOB feet for Cairene Arabic. The Cairene Arabic stress facts are accounted for by making the final syllable extrametrical, by assigning QS-rd feet from left to right, whose dominant nodes are labeled strong only if they branch, and by constructing a right-dominant word tree. In (34) the construction of right-dominant feet has been illustrated.

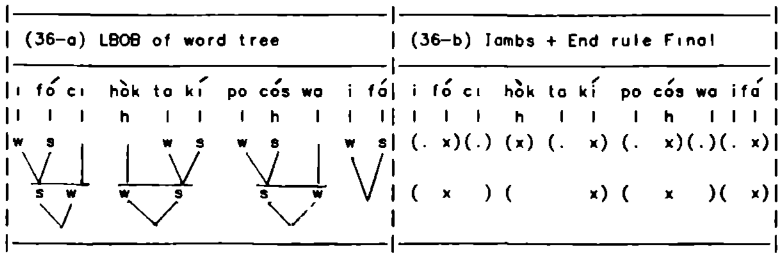
(34)


(Where r = recessive, d = dominant and _ = monosyllabic)

The labeling of the dominant and recessive nodes of feet, which is based on branching, guarantees that if a dominant node of a foot branches --that is if it dominates a heavy rime--, it will be labeled **s**, whereas, if a dominant node does not branch, it will be labeled **w**. In (35), the labeling of the dominant and recessive nodes of feet is illustrated together with the remainder of the metrical derivation.

(35)


Let us now consider how the revised theory makes it possible to dispense with the LBOB parameter. To begin with, let us consider the LBOB as used in the word tree. Hayes (1987) observes that the LBOB of the word tree can be eliminated, because whenever a right node was non-branching in the standard theory, there is now a stressless foot to which the End Rule has no access, because it is not a landing site. In (36) this is demonstrated for Creek.



It is important to observe that a word of which the last two syllables are heavy should be predicted to have prefinal stress by the standard theory (36a), but final stress by the revised theory (36b). For Creek, this prediction cannot be tested, because, as Haas (1977 204) observes, in words of this type morphological rules determine whether it is the penult or the ultima that receives main stress. Compare, for instance, *hátkü* 'white' with *hoktíi* 'woman' In Aklan, on the other hand, which has QS-rd feet and where the word tree is right-dominant and labeled based on branching, words of this type have penultimate stress, such as, for instance, *ʔasírtar* 'lucky' (cf. Hayes, 1981·26). For Aklan, one must posit an additional rule which makes a word-final stressed monosyllabic heavy foot extrametrical.

Let us now consider the use of the LBOB parameter at the foot level The systems that involved this parameter in the standard theory will, from now on, be referred to as bounded LBOB stress systems The Cairene Arabic stress facts can be accounted for by the rules in (37)[15]

(37) –From left to right, parse a word into moraic trochees
–Form a higher–level constituent, assigning its gridmark by the End Rule Final

By applying the rules in (37), the data in (31) receive the bracketed grid structures in (38). Word-final extrametrical moras --but not those in light syllables (recall fn. 15)-- have been indicated by parentheses.

```
(38) bú xa l a    ʕa mál t i    mar tá b a    sa ka kíi(n)    mux tá li f a
     l  l  l      l  h   l      h   l  l      l  l  h         h   l  l l
     (x   ) ( )   ( )(x)  ( )   (x) (x   )    (x   )(x)       (x) (x   ) ( )
     (x       )   (  x      )   (   x    )    (      x  )     (   x       )
```

According to Hayes (1987), a moraic trochee analysis can also describe the Turkish non-final stress facts, which in Hayes' (1981) theory would require a QS-ld LBOB analysis. Main stress in Turkish generally falls on the final syllable.

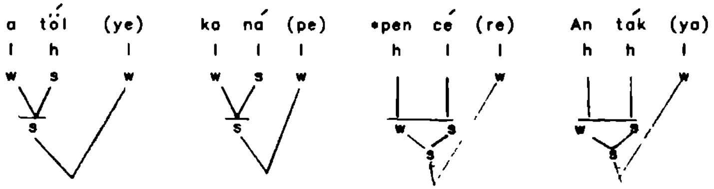
---

15 In Cairene Arabic, as mentioned above, main stress falls on the final syllable if it is superheavy as in, for example, sakakíin 'knives' (cf Kussaim, 1968 Hayes, 1981 and McCarthy, 1979, 1982) This could be accounted for by making the last mora of a word extrametrical, but only if this does not render the entire syllable extrametrical The latter proviso is needed in order to prevent the final syllable of words like martába from becoming extrametrical The final mora of a word must be made extrametrical rather than a word–final consonant, because otherwise it would not be possible to derive penult stress for words that have a long final vowel such as, for example, sajaratahúmaa 'their (dual) tree (nom)'

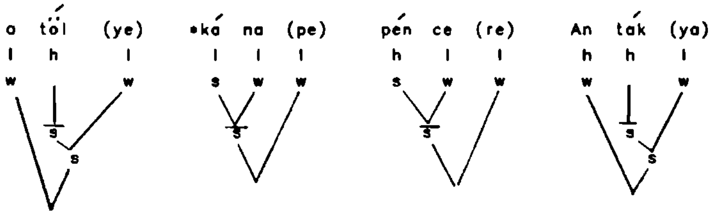
Sezer (1983), however, has drawn attention to a class of words that have non-final stress. This class consists of place and personal names of non-native origin, but also of native place names and other loans. Some relevant examples showing non-final Turkish stress are given in (39).

(39–a)	ka ná pe	'couch'	(39–b)	fa kúl te	'a college school'
	çi ko lá ta	'chocolate'		a tól ye	'workshop'
	jü bí le	'jubilee'		pén ce re	'window'
	tor na ví da	'screwdriver'		An ták ya	city in Turkey

After having shown that the Turkish stress pattern of these words is not identical with the stress pattern of these words in the source language, Sezer (1983:64-67) describes stress as falling on the antepenult if the penult is light and the antepenult is heavy, and otherwise on the penult. Let us first consider how Turkish non-final stress can be accounted for in the standard theory. The final syllable is never stressed, and therefore word-final syllables are marked as extrametrical. The word tree must be right-dominant in order to derive main stress on either the penult or the antepenult. The distinction between heavy and light implies that a QS foot is used. If the QS foot were right-dominant, incorrect stress would be derived for words of which the penult is light and the antepenult is heavy such as, for example, *péncere.* This is illustrated in (40).

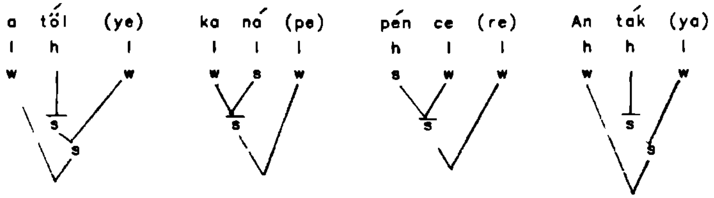
(40)


However, if a QS-ld foot is used, correct stress will be derived for words of which either the penult or the antepenult is heavy, but words of which both the penult and the antepenult are light, such as *kanápe,* will be incorrectly stressed as illustrated in (41).

(41)


Again, it is clear that in Turkish the QS foot must be left-dominant to stress correctly those words that contain either a heavy penult or a heavy antepenult, but that the QS foot must be right-dominant to stress correctly those words that contain a light penult as well as a light antepenult. Therefore, in a standard account of non-final Turkish stress the final syllable is made extrametrical, one QS-ld foot, of which the dominant node is labeled strong only if it branches (LBOB), is constructed at the right edge of the word, and feet are gathered into a right-dominant word tree. Sample metrical derivations are listed in (42).

(42)



However, despite Hayes' claim, Turkish cannot be analyzed using the moraic trochee. It is clear that if the final syllable is made extrametrical, a moraic trochee analysis, whether it applies left to right or right to left, will incorrectly assign initial stress to the data in (39a), which Sezer terms "weak" non-final stress words (viz. words which have both a light antepenult and a light penult) such as *kanápe* or *kenédi* Therefore, in any case, the final syllable should not be made extrametrical But even if final syllables are not made extrametrical, neither left-to right nor right-to-left assignment of moraic trochees produces the correct stress patterns, as is illustrated in (43a) and (43b), respectively.

(43a)	a	tól	ye	*ká	na	pe	*pen	cé	re	An	ták	ya
	l	h	l	l	l	l	h	l	l	h	h	l
Left-to-Right	( )	(x)	( )	(x	)	( )	(x)	(x	)	(x)	(x)	( )
	(	x	)	(x		)	(	x	)	(	x	)

(43b)	a	tól	ye	ka	ná	pe	*pen	cé	re	An	ták	ya
	l	h	l	l	l	l	h	l	l	h	h	l
Right-to-Left	( )	(x)	( )	(.)	(x	)	(x)	(x	)	(x)	(x)	( )
	(	x	)	(	x	)	(	x	)	(	x	)

An iambic analysis seems the only possible way to account for Turkish non-final stress in the revised theory. In (44) the final syllable is made extrametrical, iambs are assigned from right to left, and the End Rule Final is applied.

(44)	a	tól	(ye)	ka	ná	(pe)	pén	ce	(re)	An	ták	(ya)
	l	h	l	l	l	l	h	l	l	h	h	l
	(.	x)	(σ)	(.	x)	(σ)	(x)	(.)	(σ)	(x)	(x)	(σ)
	(	x	)	(	x	)	(x		)	(	x	)

It is important to see why Turkish can be analyzed by using iambs, whereas, in the standard theory, it could not be analyzed by using a QS-rd foot as has been illustrated in (40). The crucial forms are those of which the antepenult is heavy and the penult is light such as *péncere*. The penultimate light syllable of words like *péncere* ends up as a monosyllabic constituent in both (40) and (44). However, in (40) it is stressed, whereas in (44) it is stressless. Now, in order for an iambic analysis of Turkish to work, monosyllabic light constituents must be made stressless as in (44). However, in Tübatulabal (cf. Hayes, 1981:60) monosyllabic constituents must be made stressed in order to derive the correct stress pattern for words such as, for instance, *pṓnihwī́n* 'of his own skunk.' It seems then that, unlike QI stress systems, QS stress systems may vary in whether monosyllabic constituents are made stressed or stressless.

So far, we have illustrated how the LBOB parameter was used in the standard theory, and that in the revised theory this parameter can be dispensed with in the word tree by the use of stressless feet (Creek) or by final foot extrametricality (Aklan) and at the foot level by reanalyzing the old QS-LBOB stress systems by means of the moraic trochee (Cairene Arabic) or the iamb (Turkish). However, since we have presented arguments to dispense with the moraic trochee as a means of describing former QS-ld stress systems (cf. Classical Latin in section 2.2.2), let us next consider an alternative way of describing the old LBOB bounded stress systems.

McCarthy and Prince (1986) propose the Uniformity Parameter (UP) to account for the Cairene Arabic stress pattern. This parameter can only be invoked in QS stress systems, that is in iambic systems. For ease of exposition we repeat the UP in (45) below.

(45) *Uniformity Parameter*

A language may require that all feet have the same labeling

(*i*) *everywhere*

(*ii*) *within the word*

McCarthy and Prince (1986) propose an inventory of feet similar to that in (5) above. QI feet are termed 'balanced' feet and are left-dominant. QS feet are termed 'unbalanced' and are right-dominant. In the unmarked case a QS stress language labels all feet in the same way such as, for instance, Tübatulabal, where both a foot composed of two lights as well as one consisting of a light followed by a heavy syllable are labeled [ws] or (. x). McCarthy and Prince observe that, if the unmarked QI stress labeling is trochaic, that is, [sw], one would expect to find QS stress languages in which constituents composed of a light and heavy syllable are labeled [ws], but in which constituents composed of two light syllables are labeled [sw]. The reason why QS stress languages generally label all feet in the same way is, according to McCarthy and Prince, related to the unmarked case of having uniformity of all feet. The unmarked parameter setting for the UP is therefore yes (i.e. all feet have the same labeling everywhere, or only within the word as in Yidiɲ). If the UP is set to no an iambic stress rule will label the unbalanced feet, that is, the constituents consisting of a light and a heavy syllable, as (. x) or [ws], but the balanced feet, that is, the constituents consisting of two light syllables, will be labeled (x .) or [sw]. This differential behavior of sequences of two light syllables and sequences of a light and heavy syllable with respect to labeling is, of course, exactly what the LBOB parameter on the foot level expressed in Hayes (1981). McCarthy and Prince mention Cairene Arabic as a language in which the UP is set to 'no.' If we translate McCarthy and Prince's (1986) UP in the terms of Hayes (1987), that is, label feet of two light syllables (ll) as (x .) and feet of a light followed by a heavy (lh) as (. x), then the Cairene Arabic data from (31) can be analyzed as in (46). Iambs are assigned from left to right, the UP is set to 'no,' and the End Rule Final is applied (Recall fn 15).[16]

----

[16] Hayes (1987) not only uses a moraic trochee to describe Cairene Arabic, but also to account for the Palestinian Arabic stress facts Palestinian Arabic, according to Hayes (1987), has a rule of final foot extrametricality Except for words with four light syllables, counting from right to left, a rule of final syllable extrametricality and the construction of reversed iambs can also be invoked to account for Palestinian Arabic stress According to Hayes (1987), a Palestinian Arabic word of four light syllables, such as, for example, dárabato 'she hit him' receives initial stress and surfaces after syncope as dárbato The left-to-right construction of moraic trochees, final foot extrametrical and End rule final will correctly place stress on the first syllable of dárabato Brame (1973) presents an analysis of Palestinian Arabic stress in which stress is assigned cyclically He considers person markers as part of the first and object pronoun markers as part of the second cycle As far as we know, words of four light syllables are restricted to the third person feminine singular of CVCVC verbs + a pronominal suffix The correct

```
(46) bú xa l a    ʕa mál t i    mar tá b a    sa ka kíi(n)    mux tá li fa
     l  l  l      l  h   l      h   l  l      l  l  h         h   l  l l
     (x   ) ( )   (  x)  ( )    (x) (x   )    (x   ) (x)      (x) (x  )( )
     (x       )   (  x     )    (   x    )    (        x)     (   x      )
```

However, if the UP is adopted, stress systems are predicted to occur for which a UP-no analysis in combination with a reversed iamb is crucial. The type of stress system that would require such an analysis can, in standard theoretical terminology, be characterized as having QS-ld LBOB feet. As mentioned above, Turkish might be considered such a system in the standard theory. If the UP is switched off or set to 'no', in a language that is analyzed as using reversed iambs, feet containing a heavy syllable followed by a light syllable will be labeled [sw] or (x .), but those consisting of two light syllables will be labeled [ws] or (. x). This then is exactly how Turkish non-final stress has been accounted for in a standard analysis (cf. (42) above). An analysis of Turkish non-final stress involving reversed iambs and the UP-no is presented in (47).

```
(47)        a  tól  (ye)   ka  ná  (pe)   pén  ce  (re)   An   ták  (ya)
            l  h     l     l   l    l     h    l    l     h    h     l
REV/IAMB   ( ) (x)  (σ)   (    x)  (σ)   (x      ) (σ)   (x)  (x)   (σ)
UP-no
End Rule   (    x     )   (    x     )   (x           )  (    x      )
 Final
```

However, as demonstrated above and illustrated in (44), systems that in the standard theory required a QS-ld LBOB analysis can, in Hayes' revised theory, be straightforwardly described by using iambs. Furthermore, we know of no independent evidence from Turkish that would force us to analyze Turkish as having reversed iambs and the UP setting 'no.' From the point of view of learnability it is obvious that Turkish children will make the unmarked

---

stress-pattern of these words such as, for instance, underlying [dárab + at + a] (and surface dárbato) can be accounted for, if a reversed iamb is used, by cyclic application of stress as in (i)

```
(i) First  cycle   [darab +at] +o]]
                           ( )        Last σ extrametrical
                   (x  )              Reversed Iamb
    Second cycle   [darab +at   +o]
                   (x  )        ( )   Last σ extrametrical
                   (x  ) ( )          Reversed Iamb
                   (x)   ( )    ( )   Syncope

                     dárbato
```

hypothesis with respect to the stress system of their language and that they will learn an iambic stress rule, rather than assume that reversed iambs and the UP-no are used. In other words, the adoption of the UP implies a data gap, because, to the best of our knowledge, no language crucially needs a stress rule involving reversed iambs and the UP-no. We believe that, as a matter of fact, no such language could possibly exist, because the data gap entailed by adopting the UP in a theory with iambs and reversed iambs can be explained in a principled way. In order to do so, let us more closely consider a stress rule that would be based on reversed iambs and the UP set to 'no.' It is important to recall from section 2.2.2 that a stress rule that involves reversed iambs deviates from the general law of iambic rhythm in making the first instead of the last syllable of a constituent the more prominent. However, a constituent composed of two light syllables will, in a language using reversed iambs, be labeled in an unmarked trochaic way, that is (x .). A language that would need a stress rule involving reversed iambs and the UP-no would not only deviate from the law of iambic rhythm, but, because a constituent of two light syllables will be labeled like a reversed trochee, that is as (. x), it will also deviate from the law of trochaic rhythm. For an iambic stress rule it makes sense to set the UP to 'no,' because, although there is no uniformity of all feet, in this way constituents composed of light syllables will be labeled in an unmarked, trochaic way. For a reversed iambic stress rule it makes no sense at all to set the UP to 'no,' because, besides not having uniformity of all feet, this will only enhance the markedness of the system by deviating also from the law of trochaic rhythm. In order to express this formally, we propose the Dysrhythmy principle (48).

> (48) *No stress rule that involves uneven duration grouping may deviate from the laws of trochaic and iambic rhythm in making both the marked syllable in a sequence of even duration and the marked syllable in a sequence of uneven duration the more prominent.*

This section has illustrated how the LBOB parameter was used in the theory of Hayes (1981). It has been shown that in the revised theory this parameter can be dispensed with in the word tree by the use of stressless feet (Creek) or by final foot extrametricality (Aklan) and in the foot by analyzing former QS-LBOB stress systems by means of the moraic trochee (Cairene Arabic) or the iamb (Turkish). However, since in section 2.2.2 we argued to dispense with the moraic trochee as a means of describing former QS-ld stress systems, we adopted McCarthy and Prince's (1986) UP to describe the former QS-rd LBOB bounded stress systems such as Cairene Arabic. The adoption of the UP predicted stress systems to occur for which no independent evidence is available. A closer look at this type of stress system (reversed iambs and the UP-no) has suggested a principled explanation, which is related to the extent to which a similar stress system deviates from the general laws of rhythm. The next section summarizes the main proposals of this chapter and discusses in more detail the relative markedness of the metrical units proposed.

2.4. *Summary and Discussion*

Hayes' parametric metrical theory of (1981) yields four basic bounded stress types as illustrated in (1-4). Given the observations of Hayes (1985), which are that only few languages exist in which QI rd feet are assigned iteratively and that there are no cases of iterative QS-ld feet assignment, Hayes (1987) proposed a slightly less parametric theory, with three core metrical units. This chapter has compared the theories of Hayes (1981) and Hayes (1987) and a further reduction of the number of core metrical units is suggested: only the syllabic trochee and the iamb are core metrical units In addition, this chapter has motivated on both formal and empirical grounds another way of accounting for the results of Hayes (1985), by arguing for the adoption of two marked metrical units (the reversed trochee and the reversed iamb), the latter of which replaces the moraic trochee. Furthermore, since the moraic trochee was also needed to eliminate the LBOB parameter from metrical theory, this parameter has been discussed in section 2.3. It has been shown that former QS-rd LBOB bounded stress systems (Cairene Arabic) can be analyzed by incorporating McCarthy and Prince's (1986) UP in the framework of Hayes (1987). However, the incorporation of the UP in a theory using reversed iambs predicts that stress systems occur for which a reversed iamb and the UP-no are crucial. The non-existence of such stress systems has found a principled explanation which is related to their complete deviation of the laws of trochaic and iambic rhythm

The inventory of metrical units in (49) summarizes the proposal of the present chapter.

(49) unmarked	marked
a) TROCHEE (x) ( ) Form σ σ if possible, otherwise σ	c) REVERSED TROCHEE (x) ( ) Form σ σ if possible, otherwise σ
b) IAMB (x) Form l σ if possible, otherwise (x) ( ) form h or l	d) REVERSED IAMB (x) Form σ l if possible, otherwise (x) ( ) form h or l

marked	marked
e) IAMB + UP–no (x) (x) Form l h or l l if possible, otherwise (x) ( ) form h or l	f) REVERSED IAMB + UP–no Excluded by principle (48)

Let us next discuss why the metrical units (49a-b) are unmarked, whereas the metrical units in (49c-e) are marked. The incorporation of (49c-49d) into metrical theory as marked metrical units has been motivated on the basis of the discussion of Southern Paiute, Yidiɲ, and Classical Latin. Yet, one might wonder why exactly the type of metrical grouping expressed by the reversed trochee and the reversed iamb is 'promoted' to marked status, whereas the kind of grouping expressed by (49a) and (49b) is considered unmarked, because nothing in the formalism tells us that this should be the case. Hence, it would seem that the marked/unmarked status is merely a matter of stipulation. Let us recall first that typological, statistical considerations are in suppport of the inventory in (49). Hayes (1985) counts only five languages with QI-rd alternating stress rules. QS-ld alternating stress rules are not attested. Second, Hayes (1985, 1987) has shown, as mentioned in section 2.1, that the metrical grouping of sequences in trochees or iambs (49a-b) derives from two general laws of rhythm: prominence contrasts based on duration lend themselves more easily to iambic grouping, whereas prominence contrasts based on intensity generally lend themselves to trochaic grouping. These general rhythmic laws are not only operative in metrical phonology but also in other cognitive domains. Hayes (1985) reports on psychological experiments showing that, if the prominence contrast is based on intensity, trochaic grouping is the normal pattern followed by subjects. Iambic grouping is general if the prominence contrast is one of duration. What we would like to suggest is that the metrical units in (49c-d), while obeying the general pattern of even and uneven duration grouping respectively, are marked in the sense that they deviate from the general laws of trochaic and iambic rhythm in making, respectively, the **last** and the **first** (instead of the first and the last) element of a binary constituent the more prominent element. This is shown in (50).

```
(50)  a) INTENSITY CONTRAST
           |    |    |    |
      ...(x x)(x x)(x x)(x x)...   standard even duration grouping (49a)
           |    |    |    |
      ... x (x x)(x x)(x x)x ...   marked even duration grouping (49c)

      b) DURATIONAL CONTRAST

      ...___ (_ ___)(_ ___)_...    standard uneven duration grouping (49b)

      ..(___ _)(___ _)(___ _)..    marked uneven duration grouping (49d)
```

A similar motivation is at the basis of considering (49e), that is the option 'no' for the UP, as a marked metrical unit. The integrity of the system, as McCarthy and Prince (1986) put it, is violated by switching off the UP. A language such as, for example, Cairene Arabic, which uses (49e), obeys --although it does not label all constituents in the same way and, hence, does not have uniformity of all feet-- the laws of trochaic and iambic rhythm in labeling constituents composed of light syllables and those composed of a light syllable followed by a heavy syllable as dictated by these laws, that is by using both (49a) and (49b). On the other hand, it has been claimed that no language could use a reversed iamb and the UP-no. The Dysrhythmy principle (48) has been devised to exclude stress rules using both (49c) and (49d) to label their constituents, because such a language would not only be marked by not having uniformity of all feet, but also by deviating from the laws of trochaic and iambic rhythm by using both a marked way of even and a marked way of uneven duration grouping.

It is clear that the set of metrical units in (49) closely resembles Hayes' (1981) theory. However, there is a crucial difference between the present proposal as summarized in (49) and the standard theory. Hayes (1981), as mentioned in section 2.1, predicts that QI-rd and QS-ld stress systems are as marked or unmarked as QI-ld and QS-rd stress systems and it is for this reason that the theory was revised in 1987. The inventory in (49), like the revised theory, correctly predicts that former QI-rd and QS-ld stress systems are typologically uncommon and must be considered marked, because (49c) and (49d) are marked metrical units. Moreover, it is not thwarted by the objections which can be raised against the revised theory. In fact, the inventory in (49) is almost identical to Hayes' original proposal but supplemented with markedness statements that are related to general laws of rhythm.

Finally, one might wonder whether there is a formal way of reflecting the fact that (49a) and (49b) are unmarked, whereas the other metrical units are marked. The rule formalism of Archangeli and Pulleyblank (1986), who propose a formal mechanism to distinguish between marked and unmarked processes, might be suitable to express formally the marked vs. unmarked stress rules. According to Archangeli and Pulleyblank, each rule is characterized by means of its Function, Argument and Condition. The default settings of a rule are not mentioned in the rule's structural description (cf. Archangeli and Pulleyblank (1986) for a more detailed account). In this way, the more marked a rule is, the more complex its structural description will be. This formalism could be extended to stress rules: the Argument for a stress rule is then either iamb or trochee and either End Rule Final or End Rule Initial. The options "UP-yes," "non-reversed," and "iterative" could then be considered default options among the Conditions of a stress rule. In other words, if the UP is set to "yes" this would not have to be mentioned (only if it is set to "no" a stress rule would have to mention this). If a rule constructs IAMBS it is not necessary to mention "non-reversed" (only for a rule that indeed constructs reversed iambs, one would have to mention "reversed") Adopting the rule formalism of Archangeli and Pulleyblank (1986), the rule format of stress rules might be the one in (51).

(51) I FUNCTION - structure

- right-to-left / (left-to-right) default

II ARGUMENT - Iamb / Trochee

- End Rule Final / End Rule Initial

III CONDITION - UP-no / (UP-yes) default

- Reversed / (Non-Reversed) default

- Non-iterative / (Iterative) default

The Tübatulabal stress rule, for instance, would only have to mention "Iamb", whereas the Cairene Arabic Stress rule, for example, must mention "Iamb," "End Rule Final," and "UP-no." Principle (48) will exclude the combination of "Iamb," "Reversed" and "UP-no." It is important to observe that, although we now have accounted for the markedness of former QS-ld stress systems by means of the reversed iamb, we must still account for the fact that neither the former QS-ld feet nor the reversed iamb are applied iteratively. It is perhaps necessary to set up another principle excluding the iterative application of reversed iambs. However, contrary to the exclusion of the combination "reversed iamb" and "UP-no", there seems to be no reason to exclude in principle the existence of reversed iambs. In this respect, it is interesting to mention that in Kager's (1988, forthcoming) analysis of stress in English the feet with which one ends up are iterative, left-dominant, and quantity-sensitive. More research is clearly needed to verify whether the reversed iamb may or may not be applied iteratively.

In conclusion, then, in this chapter we have argued, on both formal and empirical grounds, that metrical theory cannot dispense with constituent construction rules that generate former QI-rd and former QS-ld feet, or, in bracketed grid-terminology, that assign reversed trochees and reversed iambs. Therefore, the revised theory is both empirically and formally less adequate than Hayes' (1981) standard theory. However, since the standard theory is too powerful a tool in not distinguishing between marked and unmarked systems, we have argued that the relative markedness of former QI-rd and QS-ld must not be accounted for by describing them as either complex reanalyses of syllabic trochee assignment or moraic trochee construction, but, rather, that the markedness of these systems is related to the fact that they deviate from the general laws of trochaic and iambic rhythm as to which element of a binary constituent is more prominent. Former LBOB bounded stress systems have been, following McCarthy and Prince (1987), analyzed by using the UP. The nonoccurrence of stress rules involving reversed iambs and the UP-no has been explained by relating the markedness of such a stress rule to the general laws of rhythm. On the basis of the discussion above it seems therefore that the theory of Hayes (1981), with the refinements of this chapter taken into account, is more adequate as a formalization of the results of Hayes (1985) than the theory of Hayes (1987).

The Interaction Between The Evolution Of Syllable Structure And Foot Structure From Classical Latin To Old French

3.0. *Introduction*

One of the main reasons for accepting the syllable as a unit of phonological representation is that it allows for an adequate description of the phonotactic constraints of a language. Although nowadays most phonologists agree in considering the syllable a necessary constituent of phonological theory, there is general consensus neither on the details of its structural representation[1] nor on the question how phonotactic constraints should be expressed. As for the latter question, which is the one we will address here, it is still a matter of debate whether the conditions governing syllabification, whatever format for representing syllable structure is adopted, should be stated in terms of distinctive features or in terms of degree of sonority.[2]

Comparing the phonotactic constraints of a number of successive synchronic stages, this chapter will explore the evolution of syllable structure from Classical Latin to Old French. It will be shown that the often observed pendular evolution (closed ---> open, open ---> closed, closed ---> open) of the French syllable structure cannot be understood if the evolution of foot structure is not simultaneously taken into account. More specifically, the simplification of prosodic structure at the foot level is shown to have been at the basis of an increase in markedness at the syllable level. Since in nonlinear phonology feet and syllables are arranged at different, independent levels of representation, one indeed expects the evolution of foot and syllable structure to take place independently of each other. By highlighting the interplay between the

---

1 Compare, for instance, Kiparsky (1981), Cairns and Feinstein (1982), Clements and Keyser (1983), Harris (1983) and Levin (1985), among others)

2 Compare, for example, Kahn (1976), Clements and Keyser (1983), Itô (1986) vs. Selkirk (1982), Harris (1983), van der Hulst (1984), Levin (1985) among others)

development of foot and syllable structure in the historical phonology of French it becomes possible to provide an explanation for the above-mentioned pendular evolution. More generally, an answer can be suggested to the question as to why, if historical change follows a tendency to simplify all syllables (that is, strives for a preferred CV syllable structure), all languages " do not wind up with simple CV syllables and no others" (Clements, 1988;49).

Furthermore, this chapter purports to show that, if the simplification of syllable structure is to be expressed as grammar simplification, the conditions governing syllabification must be expressed in terms of distinctive features rather than in terms of degrees of sonority.

This chapter is organized in the following way. Section 3.1 discusses and compares the phonotactic constraints of Classical Latin with those of Late Latin. Section 3.2 focusses on the interaction between foot and syllable structure and shows that the simplified Late Latin syllable structure became more complex in Gallo-Romance as a consequence of rules simplifying prosodic structure above the syllable. Section 3.3 describes the evolution of syllable structure from Gallo-Romance to Old French and demonstrates that the observed simplification of syllable structure can only be expressed as grammar simplification if the phonotactic constraints of a language are stated in terms of distinctive features rather than in terms of degree of sonority. Section 3.4 finally summarizes the main points of the present chapter.

3.1. *From Classical Latin to Late Latin: The evolution of syllable structure*

3.1.1. *Classical Latin*

Assuming familiarity with the theory of the syllable proposed in Clements and Keyser (1983), the cooccurrence restrictions on syllable-initial consonant clusters in Classical Latin as exemplified by the data in (1) can be described by the positive and negative syllable structure constraints in (2) (cf. Clements and Keyser,

---

[3] Because the clusters excluded by the negative conditions (2b) and (2c) did not occur as heterosyllabic sequences either, we might omit the reference to the position in the syllable from (2b) and (2c) In formulating syllable structure conditions we have followed the major category feature analysis of obstruents, nasals, l and r proposed in Clements (1988) That is obstruents are [-son,

1983).[3]

(1) tres	[tr]	'three'	*tl	[tl]	
praecipito	[pr]	'I precipitate'	plebs	[pl]	'the people'
crimen	[kr]	'accusation'	clamo	[kl]	'I shout'
frater	[fr]	'brother'	flos	[fl]	'flower'
draco	[dr]	'snake'	*dl	[dl]	
brevis	[br]	'short'	blandis	[bl]	'flattering'
gravis	[gr]	'heavy'	gloria	[gl]	'honour'

(2) PSSC NSSC

a) $_{\sigma}\left[\begin{array}{cc} C & C \\ | & | \\ [-son] & [+approx] \end{array} \right.$ b) * $_{\sigma}\left[\begin{array}{cc} C & C \\ | & | \\ [+cor] & \begin{bmatrix} +approx \\ -cont \end{bmatrix} \end{array} \right.$ c) * $_{\sigma}\left[\begin{array}{cc} C & C \\ | & | \\ \begin{bmatrix} +cor \\ +cont \end{bmatrix} & [+approx] \end{array} \right.$

Condition (2a) allows any obstruent-liquid cluster to occur in syllable-initial position. The non-occurring clusters **tl*, **dl*, **sl* and **sr* are ruled out by the two negative conditions (2b) and (2c). It should be noticed that the conditions in (2) allow *fl* and *fr* to occur in syllable-initial position[4] According to Allen (1973) the statements of traditional grammarians on the tautosyllabicity of *f*-liquid clusters are motivated on the basis of compounds (i.e. prefix + stem) such as *refringo* 'to break open,' *refreno* 'to stem,' *refluo* 'to flow back' and *reflecto* 'to bend' in which the *f*-liquid clusters are tautosyllabic. In these cases the morpheme boundary, just as in the case of stop-liquid clusters, coincides with the syllable boundary. Allen (1973:137) then supposes, without providing any evidence, that *f*-liquid clusters are heterosyllabic in stem internal position. Classical Latin words with word-internal *f*-liquid clusters are either compounds like the ones above or, in a few cases, loans like *vafer, vafri* (gen.) 'smart' and *rufer, rufri* (gen.) 'red' (cf. Niedermann, 1931:125-126 and Safarewicz, 1969:99-100). *F*-liquid clusters pattern with stop-liquid clusters with respect to syllabification across prefix and stem boundaries in that the syllable boundary coincides with the morpheme boundary. *S*-stop clusters are always heterosyllabic, no matter whether the *s* is the last element of the prefix or the first element of

-----

−cont, −approx], nasals are [+son, −cont, −approx], l is [+son, +approx, −cont] and r is [+son, +approx, +cont]

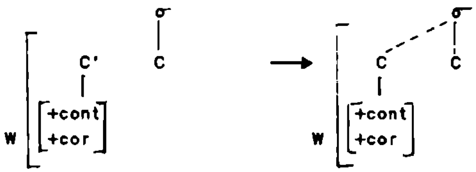
4 In this respect, we deviate from Steriade (1982) who, basing herself on Devine and Stephens (1977) and Allen (1973), precludes these clusters from occurring in syllable-initial position, except when word initially

the stem. The difference between *res-piro* 'to take breath' and *re-fringo* 'to break,' in which *sp* is heterosyllabic and *fr* tautosyllabic, and where both *f* and *s* are part of the stem, shows in our opinion that *s*-stop clusters, but not *f*-liquid clusters, which are always syllabified like stop-liquid clusters, deserve a special treatment with respect to syllabification.
Let us next consider the word-initial *s*-stop clusters in (3).

(3)	scindo	[sk]	'to tear apart'	scriba	[skr]	'clerk'
	stella	[st]	'star'	stratum	[str]	'pavement'
	spes	[sp]	'hope'	spretio	[spr]	'to contempt'
	splendeo	[spl]	'to sparkle'	scloppus	[skl]	onomatopea

All forms in (3) consist of an *s* followed by a stop or stop-liquid cluster permitted by the conditions in (2). Given the heterosyllabicity of these clusters in word-internal position, which can be deduced from the Classical Latin stress facts (such as penult stress in *pedéster* 'on foot'), *s* is considered to be extra-syllabic in the forms of (3). In order to prevent its deletion by the Stray Erasure Convention[5], we will assume, following Steriade (1988:382), the Stray Adjunction rule (4) to account for the word-initial syllabification of *s*.

(4)



Let us now consider the forms in (5) which contain word-initial consonant sequences not discussed so far.

(5)	gnatus	[gn]	'born (adj.); son (subst.)'
	gnarus	[gn]	'able'
	psallo	[ps]	'to play the zither'
	psalterium	[ps]	'sort of zither'
	ptisanarium	[pt]	'sort of barley'

The last three forms in (5) are Greek loans. Assuming that *p* was pronounced in these words, we suggest that they be accounted for by a rule similar to (4). The

---

5 (Cf. Steriade (1982), Harris (1983), among others).

first two forms alternated in Classical Latin with forms without initial *g* (cf. Safarewicz, 1969 43). Again a rule of Stray Adjunction, optional this time, will assure the surfacing of this consonant.

Let us subsequently turn to the structure of the coda In Classical Latin all consonants except k^w, g^w, *f* and *h* may occur syllable finally.[6] However, except for function words like *ab* 'from,' *ob* 'to(wards),' *ad* 'at' and *et* 'and,' *volup* 'comfortable' is the only example for word-final *p*, *caput* 'head' the only example of a nonflectional word-final *t*, and, word-final *k* occurs only in *lac* 'milk' and in the imperatives of verbs like *facere* (*fac*) 'to make' and *dicere* (*dic*) 'to say.' This difference in frequency between word-internal and word-final coda consonants might be understood as the consequence of Classical Latin being a synthetic language, in which the lexical categories almost always occur with an inflectional ending.

Some examples of word-internal syllable-final consonant clusters are listed in (6).

(6) sculptor	[lp]	'(id)'	indulxit	[lk]	'to admit (perf 3 sg)'
temptare	[mp]	'to touch'	sanctus	[ŋk]	'holy'
carptus	[rp]	'to pick (partc)'	arcto	[rk]	'to draw tighter'
*-rs], -rt], *-lt], *-nt]					

In order to account for the possible clusters in (6), we propose the syllable structure condition in (7).[7]

The positive syllable structure condition (7) allows a sonorant followed by a stop to occur in syllable-final position. Although condition (7) allows syllable-final

---

6 The non-occurrence of f in syllable-final position is due to the historical phonology of Latin (cf Safarewicz, 1969 99-100) The absence of k^w and g^w in syllable-final position might be accounted for if it is assumed that these labio-velars are derived by rule The fact that h is not permitted in syllable-final position is certainly not a property specific to Latin

7 Alternations like demo, dempsi, demptum 'to take away (pres , perf , partc)' and hiems~hiemps 'winter' which provide evidence for assuming that after m the p before t and s, as in the forms in (6) and (9), is epenthetic (cf Niedermann, 1931 210, 220-221) might lead one to assume that only liquid-stop clusters occurred in syllable-final position However, it cannot be assumed that k after n and before t and s, as in the forms in (6) and (9), is epenthetic, because then we could not explain its systematic presence in forms like vincio, vinxi, vinctum 'to tie (pres , perf , partc) ' Moreover, since we need to account for final k after n as in forms like nunc 'now' and tunc 'then' we will simply assume, as formalized in (7), that in syllable-final position sonorant-stop clusters did occur The syllable-final stops in clusters like those illustrated in (6) were already in Classical Latin subject to elimination Some of them have been reintroduced under the influence of the literary language (cf Niedermann, 1931) Whether the syllable structure condition in (7) should be considered to reflect literary Classical Latin rather than actually spoken Latin during the Classical period is not clear to us

(7) PSSC

C C

σ

[+son] [−son, −cont]

sonorant-coronal stop clusters, there are, as indicated in (6), no surface manifestations of these clusters. We will return in more detail to this point below.

In word-final position, sonorants and *s* may be followed by an inflectional *t* as in the forms in (8).

(8)

vult	'he wants'
fert	'he brings'
sunt	'they are'
est	'he is'

Furthermore, in word-final position, *s* as an inflectional ending may follow any permissible word-final consonant and any of the clusters permitted by condition (7). Some relevant examples are given in (9).[8]

(9)

hiemps	[mps]	'winter'	ars	[rs]	'art, science'
urbs	[rps]	'city'	puls	[ls]	'sort of food'
*lps			frons	[ns]	'forehead'
falx	[lks]	'scyth'	inops	[ps]	'helpless'
coniunx	[ŋks]	'husband,wife'	audax	[ks]	'undaunted'
merx	[rks]	'merchandise'	*ts		
*–rts, *–lts, *–nts					

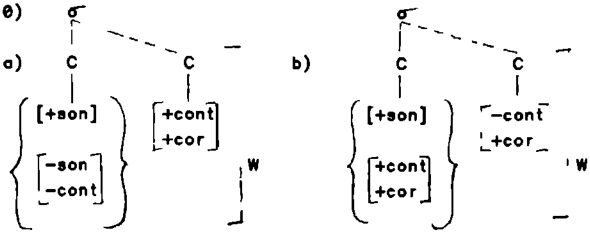
The syllable affiliation rule in (10a) allows the inflectional morpheme *s* to be syllabified in word-final position after a stem ending in a sonorant, in a stop or in a sonorant-stop cluster permitted by the condition in (7). Rule (10b) accounts for the syllabification of inflectional *t* in word-final position after a stem ending in a sonorant or *s*.

As indicated in (9), there are no surface manifestations of word-final clusters ending in *s*, in which *s* is preceded by a coronal stop or a sonorant-coronal stop cluster. The non-syllabification of *t* in clusters like underlying /ts/, /lts/, /rts/

---

8 We follow Sommerstein (1974) in considering the absence of word–final –lps an accidental rather than a systematic gap

(10)



and /nts/ can be motivated on the basis of the nominative and genitive forms of masculine and feminine nouns of the third declension such as those in (11).

(11a)

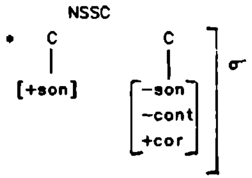
Nom sg	Gen sg	
cohors	cohortis	'cohort'
mons	montis	'mountain'
puls	pultis	'sort of food'
lis	litis	'fight'
palus	paludis	'swamp'

b)

Nom sg	Gen sg	
arx	arcis	'stronghold'
urbs	urbis	'city'
lanx	lancis	'disk'
falx	falcis	'scyth'
lex	legis	'law'
ops	opis	'power'

If one compares the forms in (11a) with those in (11b), it appears that *t* before *s* was systematically deleted. A possible way to account for the surface absence of the underlying /ts/, /lts/, /rts/ and /nts/ sequences would be adding the negative syllable structure condition (12) to the positive condition in (7).

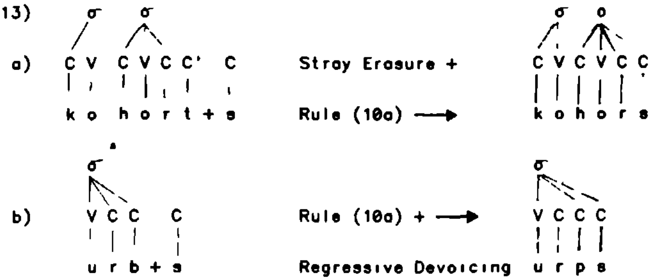
(12)



The negative condition (12) rules out syllable-final sonorant-coronal stop clusters. Furthermore, if we include the feature [-cor] in (10a), then word-final *s* may only be adjoined to a stem ending in a sonorant, in a non-coronal stop or in a sonorant-non-coronal stop cluster. A possible derivation of *cohors* and *urbs* would then proceed as in (13).

In (13a), the stem-final *t*, left unsyllabified by (12), is stray-erased by general convention, whereas in (13b) the stem-final *b* is syllabified according to condition (7). However, it is important to observe that in order to account for the deletion of *t* before *s* in forms like *lis, litis* in a similar way, we must prevent not only sonorant-coronal stop clusters, but also coronal stops from occurring in

(13)



syllable-final position. This then would make it impossible to explain the final *t* in *caput*. It is important to recall that since neuter nouns of the third declension do not take *s* as the nominative singular marker, the underlying form is not /caput+s/, but /caput/.

Another way to account for the surface absence of the underlying /ts/, /lts/, /rts/ and /nts/ clusters would be keeping the condition (7) as it stands --that is neither adding the negative condition (12) nor changing rule (10a)-- and describing the non-surfacing of *t* in the cases above by a rule that assimilates *t* before *s* to *ss*. The degemination of *ss* to *s* would then follow from the fact that non-intervocalic geminates are not permitted in Classical Latin.[9] The non-surfacing of *t* in underlying /ts/, /lts/, /rts/ and /nts/ clusters is closely related to a general constraint on obstruent sequences in Classical Latin. It is not only before *s*, but for any obstruent, that a coronal stop does not occur. Word-internal obstruent sequences either consisted of *s* followed by a stop, or of a non-coronal stop followed by a coronal obstruent. Thus, we find sequences like *st* (*festa* 'feast'), *sp* (*asper* 'rough'), *sk* (*osculum* 'little mouth, kiss'), *pt* (*opto* 'to choose'), *ps* (*capsa* 'chest, bin'), *kt* (*octo* 'eight') and *ks* (*uxor* 'wife'), but we do not find sequences like *ts*, *tp*, *tk*, *pk* and *kp*. Sommerstein (1974:79) postulates

---

9 A comparison of the sigmatic perfects of verbs like dico 'to say' and concutio 'to shake' points to the fact that [ts] sequences were generally avoided in Classical Latin The perfect of concutio is concussi where the stem-final t has been deleted before s, whereas the perfect of dico is dixi ([diksi]) where stem-final k before s has not been deleted (cf Niedermann, 1931 189)

10 It should be noticed that the constraint (14) allows for bd and gd The absence of gd is considered by Sommerstein to be an accidental gap On the other hand, bd occurs only across a prefix-stem boundary We suppose that this last observation is made by Sommerstein just to give ground to his accidental gap argument, because the restriction on obstruent clusters expressed by (14) does not hold accross prefix stem boundaries as witnessed by forms like adcaptare and adportare From Devine and Stephens (1977) we conclude that the domain of

the constraint (14) to formally express this fact [10]

(14)
$$\begin{bmatrix} +\text{obst} \\ \alpha\text{f} \\ \beta\text{cor} \end{bmatrix} \begin{bmatrix} +\text{obst} \\ -\alpha\text{f} \end{bmatrix} \rightarrow [\beta\text{cont}] \begin{bmatrix} \gamma\text{cor} \\ \delta\text{cont} \end{bmatrix}$$

Conditions

if $\beta = -$ then $\gamma = +$

if $\beta = +$ then $\delta = -$

If we assume the validity of Itô's (1986) Locality Condition, according to which the wellformedness of a cluster must be determined by referring to the syllable, and which does not allow invoking information outside the syllable, a sequential constraint like (14) must be rejected as a linguistically significant generalization. The question then arises how we must formally express the obvious phonotactic constraint of Classical Latin which consists of avoiding coronal stops word internally in syllable-final position.

Itô (1986), basing herself on Steriade (1982), describes a similar constraint on obstruent sequences in Attic Greek, where the coda obstruent is allowed only if the adjacent consonant —the onset of the following syllable-- is a coronal obstruent, as illustrated by the forms in (15).

(15)

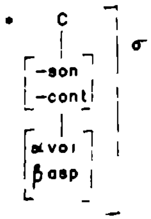
okto	'eight'		
aelptos	'unhoped for'		
ederkhthen	'I was seen'		
hebdomos	'week'		
|kekomidka|	⟶ kekomika	'I have provided'	
|enutka |	⟶ enuka	'I have accomplished'	
|gunaik|	⟶ gunai	'woman'	
|galakt|	⟶ gala	'milk'	
phleps	'vein'		
thoraks	'chest'		

First, Itô (1986) assumes that the Linking Constraint (cf. Hayes (1986)) --according to which association lines in a structural description must be interpreted as exhaustive-- applies not only to rules, but also to conditions.

---

syllabification in Classical Latin consisted of the root + derivational or inflectional morphemes, but that prefix + stem just like compounds fall outside the domain of core syllabification The term word-internal position as it is used here corresponds to domain-internal position

Second, a Laryngeal Feature Assimilation (LFA) rule which spreads the laryngeal features of a coronal obstruent to the preceding consonant is posited. She then postulates the Attic Greek Coda condition in (16), which takes the form of a negative constraint.

(16) 

The interpretation of (16) is then as follows. If there is a coda stop which has singly linked laryngeal features then that coda stop is excluded by (16). On the other hand, if, as a result of the LFA rule, a coda stop shares its laryngeal features with a following coronal obstruent, then that coda stop is not excluded by (16) (cf. Itô, 1986:107-111). Finally, word level Extraprosodicity of *s* is assumed for Attic Greek. Let us now briefly consider how Itô (1986:110-111) accounts for the various sequences in (15).

The difference between forms like *kekomika* and *ederkhthen* is described as follows. On the first cycle [komid] the final consonant *d* is extraprosodic. By the affixation of *-ka*, the *d*, no longer being final, loses its extraprosodic status. Structure Preservation prohibits the coda syllabification and Stray Erasure takes place at the end of the cycle. In *ederkhthen*, on the first cycle [derk] the final *k* is extraprosodic. By the affixation of *-then*, the *k*, no longer being final, loses its extraprosodic status. However, because of the application of the LFA rule, the *k* shares its laryngeal features with the following coronal obstruent. For this reason coda syllabification of *k* is no longer excluded by (16), and consequently there is no Stray Erasure. It should be observed that segments which are neither excluded nor allowed, but to which syllable structure conditions simply do not apply, become syllabified as the automatic result of Prosodic Licensing and the Universal Association conventions (cf. Itô, 1986:3-7).

The difference between forms like *gunai* and *phleps* is described as follows. On the first cycle of [gunaik] the final *k* is extraprosodic, and it appears at the surface when vowel-initial suffixes are added, as in *gunaiki* 'woman (dat.).' If the form enters the word-level in unaffixed shape, final *k* is no longer extraprosodic, because the language-specific extraprosodicity for Attic is restricted to *s*. Structure Preservation still holds at word-level and Prosodic Licensing requires the final *k* to be eliminated by Stray Erasure. On the other hand, in *phleps*, the final *b* is extraprosodic on the first cycle and when the nominative *s* is added, *b* loses its extraprosodic status and the final *s* becomes extraprosodic. However, as a result of the LFA rule, *b* shares its laryngeal features with *s* (/phleb+s/ ---> [phleps]), and coda syllabification of *b* is now allowed. At word level, final *s* is defined as extraprosodic, this time by the language-specific proviso. Final *s* can postlexically be adjoined to the syllable, because postlexically Structure Preservation no longer holds.[11] In this perspective, then, it is the rules of a language that decide whether underlying segments will be syllabified at the surface.

Let us next consider if Itô's analysis of Attic Greek can be extended to the facts of Classical Latin. To begin with, we will formalize the Classical Latin coda condition as in (17).

$$(17)\quad * \left[\begin{array}{c} C \\ | \\ \begin{bmatrix} -\text{son} \\ -\text{cont} \end{bmatrix} \\ | \\ [\alpha \text{voi}] \end{array} \right]_{\sigma}$$

According to (17) a syllable-final stop may not be syllabified if it does not share its voice specification with a following consonant. Now in order to obtain syllabification of non-coronal and to prevent syllabification of coronal coda stops, we must propose a regressive devoicing rule which only applies if the first consonant of a sequence is non-coronal Furthermore, language-specific word-level extraprosodicity of final *s* must be assumed. The difference between forms like *lis* and *plebs* can then be described as follows. On the first cycle [lit] *t* is extraprosodic. When nominative *s* is added, *t*, no longer being final, loses its extraprosodic status and *s* becomes extraprosodic. Since *t* does not share its voice specification with *s*, it is not allowed by (17) and is Stray Erased at the end of the cycle. On the other hand, in *plebs*, on the first cycle *b* is extraprosodic and,

---

[11] Itô (1986) does not explain how underlying /galakt/ in (15) surfaces as gala On the first cycle both k and t are extraprosodic At word-level both k and t are no longer extraprosodic, because language-specific word-level extraprosodicity is restricted to s However, as a result of the LFA rule, one would expect k and t to have shared laryngeal features and one would expect syllabification of k and stray erasure of t

although *b* is no longer extraprosodic after *s* is added, it will not be excluded by (17) because it shares its voice specification with final *s* as a result of the regressive devoicing rule.

In this way, we can account for the loss of coronal stops before *s* as in the forms in (11). However, words like *volup*, *caput*, *lac* and function words like *apud*, *ad*, *et*, *ab* and *ob* would constitute exceptions. The surfacing of word-final *p*, *k* and *t* in Classical Latin, but not in Attic Greek can in Itô's approach be accounted for by stipulating language-specific word-level extraprosodicity for *s* only in Attic, but for **any** obstruent in Latin. However, because there is no independent evidence to suppose that regressive devoicing should be limited to sequences of which the first consonant is non-coronal, it seems that we must look for an explanation for the Classical Latin tendency to avoid coronal stops in syllable-final position which is unconnected with the assimilatory behavior of laryngeal features inside clusters. Clements (1988:39) proposes to relate "the freer privilege of occurrence" that anterior coronals have in initial and final clusters to the fact that these segments are formed at the least marked place of articulation. In English, for instance, as Clements points out, an obstruent may follow an oral stop only if that obstruent is *t*, *s* or marginally *d* or *z*, regardless of whether the cluster is intervocalic or final. The Sequential Markedness Principle (18) is proposed to account for the freer privilege of occurrence of anterior coronals in clusters.

(18) Sequential Markedness Principle (SMP)

> Given two sequences P, Q of equal length, P is less complex than Q if the members of P are less complex than the members of Q, all else being equal

The SMP explains why *pt* and *kt* clusters are less complex and preferred to *pk* or *kp* clusters, because *t* is less complex than either *p* or *k*. Hence, the SMP explains why *pk* and *kp* clusters are absent in languages such as English, Attic Greek and Classical Latin. However, the SMP does not provide an explanation for the fact that *pt* and *kt* clusters are permitted, while *tp* and *tk* are ruled out in English.[12] Clements suggests (1988, fn. 25) that languages exhibiting a

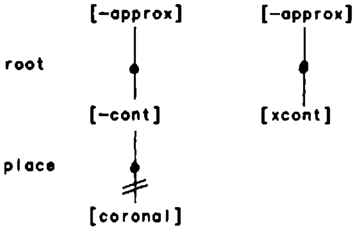
---

[12] The observation that coronal–noncoronal stop clusters are more marked than noncoronal–coronal stop clusters is not new, but can be dated back to at least Sievers (1893 187)

preference for **noncoronals** in certain positions require an alternative explanation However, except for *tz* clusters, as in *pretzel* and *ritz*, English does not allow coronal stops as first members of obstruent clusters either (cf. Clements (1988)) In other words, **stop** clusters in Attic Greek, Classical Latin and English obey a similar constraint: coronal-noncoronal stop sequences are excluded.

From the above discussion it has become clear that neither shared laryngeal features nor the SMP are able to account for the cross-linguistic absence of coronal-noncoronal clusters. A possible way to account for this constraint on stop clusters has been suggested by Wetzels (1989 176), who, discussing consonant clusters in Yakut, proposes the universal Preconsonantal Decoronalization Principle in (19).[13]

(19) Preconsonantal Decoronalization Principle



In Yakut, as Wetzels shows, a stem-final dental stop fuses with a following suffix-initial stop to become a geminate The geminate preserves the major category features of the dental, but takes on the place features of the suffix-initial consonant. Wetzels (1989) considers this latter change to be a language-specific reaction to the universal principle in (19). In this perspective, languages may vary in the way they react to the deletion of a preconsonantal coronal. In Tagalog and Cebuano Bisayan (cf. Blust (1979)) coronal-noncoronal

---

[13] Wetzels (1989 176) assumes that the application of (19) is governed by the LC and that therefore t and n remain unaffected before s However, in order to account for the Latin facts under discussion what we need is precisely the deletion of t before s (cf (11)) There are two possible ways of achieving the correct results Either we could reformulate (19) in such a way as to make it applicable only to stop sequences and account for the deletion of t before s by an independent rule (recall fn 9), or we could assume that (19) is not governed by the LC and make (19) apply to t before stops as well as to t before s We will not try to motivate either of these possibilities here, but leave this issue open for further reasearch In (19), a place-stricture dependency is assumed, as defended in Wetzels (forthcoming) We will neither motivate nor discuss Wetzels' conception of the feature geometry here, but return to it in chapters 4 and 5

clusters become metathesized, in Attic Greek there is deletion and in Classical Latin regressive gemination. Wetzels' Preconsonantal Decoronalization principle not only explains the non-existence of *tp* and *tk* clusters in Latin, but it also immediately explains why non-inflectional *t* exists in absolute word-final position in Classical Latin, as in *caput* and in function words as *ad* and *et*, whereas *t* is excluded from syllable-final position elsewhere. In absolute word-final position *t* is not preconsonantal and, hence, *t* remains unaffected by the Preconsonantal Decoronalization principle (19). Moreover, Wetzels' approach to sequential constraints on clusters can be made to account (recall fn. 13) for the fact that *t* does not surface in the underlying /lts/, /rts/, /nts/ and /ts/ clusters illustrated in (11). It should be noticed that, although the absence of coronal-noncoronal clusters can be explained in this way, the SMP (18) cannot be dispensed with, because it explains the general preference for clusters containing *s* as opposed to other fricatives, as well as the general absence of *pk* and *kp* clusters. The question now arises whether the principle in (19) represents a subpart of the SMP (18) and should be made an integral part of the SMP. In Cebuano Bisayan, as in Tagalog, coronal-noncoronal clusters regularly metathesize, as in *atup~apt-an* 'roof' (cf. Blust, 1979:110 for more examples). However, contrary to Tagalog, Cebuano Bisayan does allow for noncoronal-noncoronal clusters such as *kp*, as in, for instance, *dakup~dakp-an* 'arrest,' which remain unaffected by metathesis. These facts show that a language may deviate from the SMP in allowing more marked clusters such as *kp*, but in not allowing less marked clusters such as *tp* and *tk*. It can thus be concluded that the Preconsonantal Decoronalization principle cannot be made a subpart of the SMP because the two principles account for different linguistic phenomena.

Let us round off our discussion of Classical Latin syllable structure by stating that combinations of consonants did occur in syllable-final position, and, that the limited extent to which they occurred must not be accounted for in terms of syllable-structure conditions, but in terms of an appropriate theory of assimilation along the lines of Wetzels (1989) complemented by the SMP (cf. Clements, 1988). Let us next consider how the syllable structure conditions from Classical Latin were altered in Late Latin

We will start our discussion of Late Latin syllable structure by considering the syllable-initial position. There is compelling inscriptive evidence showing that during the first and second centuries a process of vowel epenthesis was productive. Vowel epenthesis took place before the so-called *s-impurum*, that is, *s* followed by a consonant in word-initial position, as in, for instance, *scola* > *escola* 'school' and *spiritus* > *ispiritus* 'breath' (cf. Hermann, 1923:216, Richter, 1934:78-79 and Steriade, 1988:394-397). Vowel epenthesis has the effect of providing a nucleus with which word-initial *s* can be syllabified and as such it replaces the syllable affiliation or stray adjunction rule (4). As far as the structure of the onset is concerned, the Late Latin syllable structure can be described by the syllable-structure conditions in (2). The reader is referred to Steriade (1988) for ample justification for the point of view that the syllable structure conditions in (2) have remained unchanged throughout the history of French.

Let us next consider the changes that have occurred in the syllable-final position. In (20) a number of quotations from the Appendix Probi (cited from Foerster and Koschwitz (1932)) are listed. These quotations, of which the last two are hypercorrections, show that syllable-final *k* was deleted before *t* and *s*.[14] For more examples the reader may consult Richter (1934:40-43), Pope (1956:144-145) and Schwan-Behrens (1913:29).

(20)	a)	auctor	non autor	(154)
	b)	auctoritas	non autoritas	(155)
	c)	obstetrix	non obstetris	(166)
	d)	locuples	non locuplex	(186)
	e)	miles	non milex	(30)

Inscriptions show that in Late Latin there no longer existed clusters of consonants in syllable-final position: *p* and *k* whether or not preceded by a sonorant were deleted, as indicated by the forms in (21).

---

14 The numbers provided between parentheses refer to the numbering in the Appendix Probi

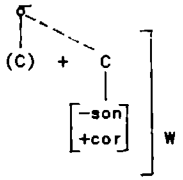
(21) scultus	<	sculptus	'to sculpt (partc)'
temtaverit	<	temptaverit	'he would have touched'
cunti	<	cuncti	'together'
mers	<	merx	'merchandise'

According to Fouché (1961:657) word-final *t* was deleted in Late Latin, as in *caput* > *[tšapu] > *chief* (Old French) 'head.' However, if *t* was an inflectional ending it was not deleted, as in *portat* > *[portaΘ] > (Old French) *porte* 'he bears.' Most of these changes can be accounted for if it is assumed that syllable-final obstruents were no longer permitted to surface in Late Latin. This can be expressed by the positive syllable structure condition (22).

(22) PSSC $\left[V \underset{[+son]}{\overset{}{C}} \right]_{\sigma}$

Given the fact that the inflectional endings *t* and *s* in word-final position were not deleted, the affiliation rules proposed for Classical Latin must have remained unchanged. The rules (10a) and (10b) above have been collapsed into a single rule (23).[15]

(23)



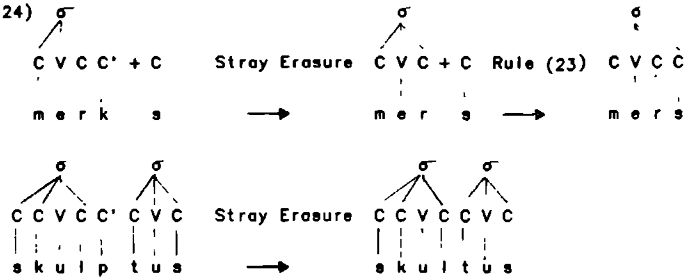
As a result of (22) all syllable-final obstruents preceded by a nasal, liquid or vowel are extrasyllabic in Late Latin. The deletion of these obstruents, as in the forms in (20) and (21), can be interpreted as the automatic result of the Stray Erasure Convention. Some sample derivations are presented in (24).

In the case of the intervocalic obstruent clusters *ps*, *ks*, *pt* and *kt* a geminate *ss* or *tt* must result after the deletion of the noncoronal stop, as in, for instance, *ruptam* > *[rotte] > *route* 'way.' The geminate nature of the resulting segment can

---

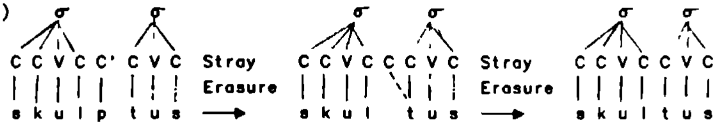
15 The inclusion of the morpheme boundary in (23) excludes stem-final t from being incorporated into syllable structure by the application of (23) Stem-final t, as in caput consequently will be stray erased In forms like portat the word-final t being an inflectional ending will be syllabified by (23)

(24)

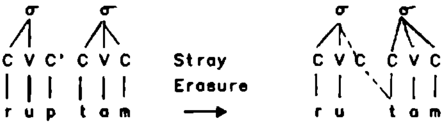


be deduced from the fact that these words did not undergo the effects (i.e voicing and spirantization) of lenition (cf. Pope,1956:147 and chapter five). The geminates in these cases can be accounted for by assuming that Stray Erasure deletes the segmental material, but leaves the skeletal slot (the timing) of the extrasyllabic consonant intact. If possible (i.e. intervocalically), a geminate obstruent will result. Some sample derivations are presented in (25).

(25a)

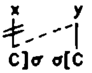


(25b)



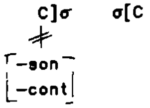
Alternatively, leaving the Classical Latin syllable structure conditions for the syllable-final position unaltered, we could, following Steriade (1988:389), postulate the regressive gemination rule (26).

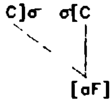
(26) Romance Regressive Gemination



Unless y is of lower sonority than x

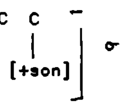
The sonority requirement in (26) prevents the rule's application to heterosyllabic *s*-stop clusters, because fricatives are more sonorous than stops. However, Wetzels and Hermans (1985) in a study of consonant assimilation in Pāli, claim that at least for this language, reference to sonority can be avoided in the formulation of phonological rules. More generally, they claim that "sonority considerations belong to the subcomponent of the phonology where the notion 'well-formed syllable' is defined" (1985:215). Although it is not clear whether it is possible to dispense with sonority in all cases where reference to this notion has been made, it is not difficult to restate rule (26) without a sonority-based condition as the coda deletion rule (27a).

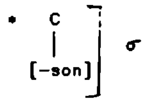
(27a) 

(27b) 

The spreading of the onset matrix to the vacated coda C-slot as in (27b) can be considered as an automatic result of the Universal Association Convention (cf. Clements and Keyser, 1983). Regardless of the way the facts are described, it is clear that Late Latin no longer allowed combinations of consonants to surface in syllable-final position. We assume that, as long as the changes discussed above were optional, the syllable structure condition (7) of Classical Latin remained unchanged, but that after these changes had been completed, (7) became replaced by (22).

There is one problem related to (22) that should not go unnoticed. According to (22) only sonorants may occur in syllable-final position in Late Latin. However, the first part of an intervocalic geminate, as in, for instance, *[rottam] (cf. (25b) above), and *s* of intervocalic *s*-stop clusters, as in *festa* 'party' or *escola* 'school', occurred in syllable-final position in Late Latin. These facts can be accounted for if, following Itô (1986), the LC, as discussed in section 3.1.1, is assumed to apply not only to rules, but also to conditions. According to Itô (1986:32-33) the positive syllable structure condition (22) (repeated here as (28a)) is formally equivalent to the negative syllable structure condition (28b).

(28a) PSSC 

(28b) NSSC 

The interpretation of (28b) is as follows: if there is a syllable-final consonant which is singly linked, its melody cannot be [-son], or, if coda and single link, then not [-son]. Similarly, the interpretation of (28a) is: if there is a syllable-final consonant which is singly linked, its melody must be [+son], or, if coda and single link, then [+son].[16] It is clear that, irrespective of whether (28a) or (28b) is adopted as the correct formalization of Late Latin syllable-final phonotactics, neither of the two conditions has anything to say about the first part of a geminate occurring in syllable-final position. in the case of geminates the feature [sonorant] is doubly linked and therefore the LC discards these stuctures from the domain of the conditions (28a) and (28b) It is important to recall that segments which are neither excluded nor allowed, but to which the syllable structure conditions simply do not apply, become syllabified as an automatic result of Prosodic Licensing and the Universal Association conventions (cf. Itô, 1986.3-7). The intervocalic *s*-stop clusters, however, cannot be described in a similar fashion The feature [sonorant] is not shared by both the fricative and the following stop, because according to current assumptions on feature geometry (cf. Schein and Steriade (1986) and Clements (1988)) the feature [sonorant] is dominated by the root node Only in the case of real geminates, which have a single root node linked to two skeletal slots, do we find the necessary structure Let us suppose then that (28a) should be reformulated as in (29).

(29) NSSC • $\left[\begin{array}{c} C \\ | \\ \begin{bmatrix} -\text{son} \\ -\text{cont} \end{bmatrix} \end{array} \right]_{\sigma}$

The coda condition (29) now correctly predicts that *s* may occur in syllable-final position in Late Latin. However, it also makes the prediction that other fricatives should occur in the same position. This, however, is incorrect, as can be shown by the evolution of Classical Latin *civitatem* 'city'. After syncope of the unstressed pretonic vowel, syllable-final *v* was deleted and a geminate *t* resulted: *[tsivitate] > *[tsivtate] > [tsittate] > *citet* (Old French) 'city'. Let us finally mention that the shared [-voice] specification in the intervocalic *s*-stop clusters is not helpful either in accounting for the occurrence of *s* in syllable-final position. The clusters *ps*, *pt*, *ks* and *kt* also have a shared [-voice] feature which appears not to be a sufficient condition for their maintenance.

---

[16] It might also be assumed that a positive syllable structure condition like (28a) always entails a negative syllable structure condition like (28b) since knowing what is permitted includes knowing what is not

Another way to account for the intervocalic *s*-stop clusters would be leaving the Classical Latin syllable structure conditions unchanged. Then, if only *s* is considered to be extrasyllabic, we could postulate a Stray Adjunction rule which, after the deletion of syllabified material by (26), adjoins *s* in intervocalic *s*-stop clusters as a coda consonant to the preceding syllable. However, because Stray Adjunction rules generally only apply at the edges of a domain, we will assume that the condition (22) is reformulated as (30) in such a way as to permit sonorants as well as *s* in syllable-final position.

(30) PSSC
$$\left.\begin{array}{c} C \\ | \\ \left\{\begin{array}{l} [+\text{son}] \\ \begin{bmatrix}+\text{cont}\\ +\text{cor}\end{bmatrix} \end{array}\right\} \end{array}\right]_{\sigma}$$

In section 3.3, we will return to the patterning of *s* with the sonorants in syllable-final position.

3.1.3. *Simplification*

If the syllable structure of Late Latin is compared with that of Classical Latin, it is obvious that it has been simplified to a considerable extent. In syllable-final position no consonant clusters are allowed to surface and the only consonants that may end a syllable must be either sonorant or *s*, a fact which we have expressed by the condition in (30). In Clements and Keyser (1983), languages are characterized according to syllable structure by adopting the inventory in (31).

(31) type I : CV,
type II : CV, V
type III : CV, CVC
type IV : CV, CVC, V, VC

Furthermore, the syllable structure of each language is determined by defining its maximal syllable as an expansion of the general scheme C(*)V(*)C(*), where * is the maximal number of C's and V's permitted. Both Classical Latin and Late Latin are type IV languages, but they differ in their maximal syllable. The maximal syllable for Classical Latin can be stated as C2,V2,C2 and for Late Latin as C2,V,C-[+son]. It seems clear that the change in syllable structure from

Classical Latin to Late Latin may be considered as part of an evolution from closed to open syllables, that is, as developing towards a preferred CV syllable structure. Whereas one would expect that this evolution would lead to the complete elimination of syllable-final consonants, we will see in the next section that Late Latin syllable structure became more complex again in Gallo-Romance.

3.2. *Gallo-Romance: the interplay between foot structure and syllable structure*

3.2.1 *Syllable structure: complication*

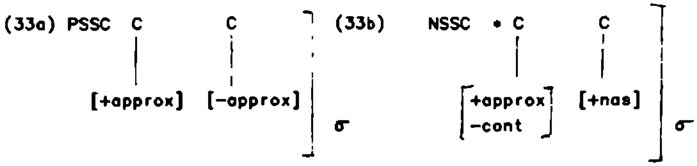
In this section the syllable structure conditions of Gallo-Romance (at approximately the end of the 9th century) will be described. As far as the syllable-initial position is concerned, no changes have occurred (cf. Steriade, 1988). With regard to the syllable-final position, however, a number of changes took place which resulted in a rather complicated set of syllable structure conditions. To see this, let us consider the words in (32), taken from Fouché (1961).[17]

(32)	drap	[p]	'blanket'	colp	[lp]	'blow'	cent	[nt]	'hundred'
	net	[t]	'clear'	folc	[lk]	'people'	blanc	[ŋk]	'white'
	sac	[k]	'bag'	alt	[lt]	'high'	champ	[mp]	'field'
	dos	[s]	'back'	salf	[lf]	'safe'			
	chef	[f]	'head'	*ln,*lm			cresp	[sp]	'crisp'
	bel	[l]	'pretty'	corp	[rp]	'body'	basilisc	[sk]	'basilica'
	fer	[r]	'iron'	porc	[rk]	'pig'	tost	[st]	'early'
	an	[n]	'year'	part	[rt]	'share'			
	faim	[m]	'hunger'	cerf	[rf]	'deer'			
				jorn	[rn]	'day'			
				ferm	[rm]	'strong'			
		(a)			(b)			(c)	

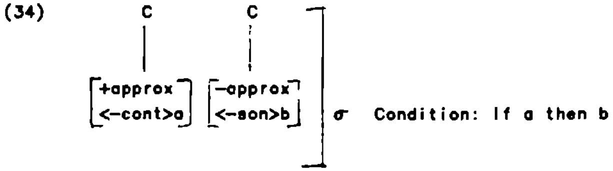
The forms in (32a) show that towards the end of the ninth century any consonant can close a syllable in Gallo-Romance. Syllable-final consonant combinations, as illustrated by the data in (32b) for word-final sequences, can be described by the syllable structure conditions in (33).

---

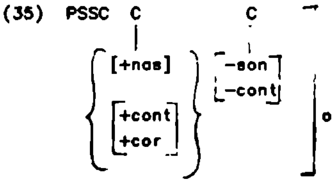
[17] In (32a) the palatal sonorants [ñ,λ] which, as Morin (1986 201) points out, only occurred in word-final position have not been included The fricative [θ] which also only occurred word-finally as the result of a rule of spirantization has also been discarded



The positive condition (33a) permits a liquid to be followed by an obstruent or a nasal in syllable-final position. The negative condition (33b) rules out tautosyllabic syllable-final *ln* and *lm* clusters. The conditions in (33a) and (33b) may be replaced by a single condition as in (34).



The syllable structure condition (35) formalizes the permitted sequences illustrated in (32c).



Condition (35) allows a nasal or *s* to be followed by a stop in syllable-final position. A word-final devoicing rule (cf.Pope, 1956:98) explains why, in the forms in (32), the obstruents are all voiceless. The data in (32c) indicate that nasal-stop clusters are only allowed if the nasals have a linked matrix with the following stop. In order to account for the Gallo-Romance clusters of three consonants which only occurred in word-final position and of which the last consonant always was the inflectional ending *t* or *s*, the Late Latin affiliation rule (23) must be posited for Gallo-Romance also. Clusters of three consonants can be found in words like *corps* 'body (nom. sg. and acc. pl.)' *cerfs* 'deer (nom. sg. and acc. pl.) and *colps* 'blow with the fist (nom. sg. and acc. pl.).' For some more examples the reader may consult Fouché (1961:777).

If one compares the evolutions sketched in (36a) with those given in (36b) (cf.Fouché, 1961:828-829;825;776-777), it becomes clear that the consonant clusters allowed by the conditions in (33)/(34) and (35) were not permitted in word-internal position in Gallo-Romance.

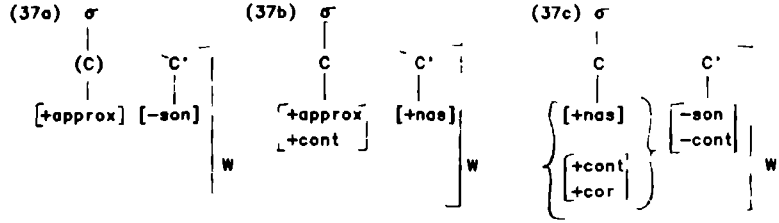
(36a) Class Lat		Late Latin		Gallo-Romance		Old French	
dormitorium	>	*[dɔrmtorju]	>	*[dɔrtojr]	>	dortoir	'(bed)room'
computare	>	*[kɔmptarɛ]	>	*[kɔmter]	>	conter	'to count'
civitatem	>	*[tsivtatɛ]	>	*[tsittɛt]	>	citet	'city'
galbinum	>	*[džalbnu]	>	*[džalnɛ]	>	jalne	'yellow'
fortimentum	>	*[fɔrtmɛntu]	>	*[fɔrmɛnt]	>	forment	'strongly'
hospitalis	>	*[ɔsptalɛ]	>	*[ɔstel]	>	ostel	'residence'

(36b) Class Lat		Late Latin		Gallo-Romance		Old French	
diurnum	>	*[džornu]	>	*[džɔrn]	>	jor(n)	'day'
campum	>	*[tšampu]	>	*[tšamp]	>	champ	'field'
debet	>	*[devɛt]	>	*[deift]	>	deit	'he must'
colaphum	>	*[kɔlpu]	>	*[kɔlp]	>	colp	'blow with the fist'
partem	>	*[partɛ]	>	*[part]	>	part	'side,share'
crispum	>	*[krespu]	>	*[kresp]	>	cresp	'frizzy,crisp'

The forms in (36a) indicate that consonant clusters created inside words by the deletion of unstressed pre- and posttonic vowels, although they obey the conditions in (33)/(34) and (35), are subject to cluster simplification word internally. On the other hand, as the forms in (36b) show, the same clusters —created by word-final vowel reduction and deletion (i.e. apocope)-- were not simplified. For this reason the conditions in (33)/(34) and (35) will be reformulated as in (37) so that they apply only to the word-final position.[18]

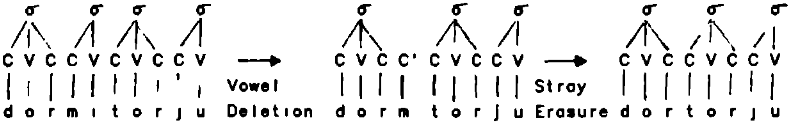
---

[18] The fact that syncope (which was productive between the fourth and the seventh century) chronologically preceded apocope (which was productive between the seventh and the ninth century) is irrelevant to the present discussion, mainly because the main purpose of this section is to determine to what extent the vowel deletion processes have affected the syllable structure of Gallo-Romance by the end of the ninth century The question whether the consonant clusters created by syncope, like the ones in (36a), have been tolerated for some time in Gallo-Romance —in which case the conditions in (33)/(34) and (35) should extend for that period of the language to word-internal clusters also— or whether they became simplified immediately after having been brought about by syncope will not be dealt with here



Word-internal cluster simplification can now be described in the same way as the Late Latin cluster simplification above, that is, as the automatic consequence of Stray Erasure, as illustrated in (38) for the first form of (36a) *[dormtorju].

(38)



The same results can be obtained, if the rules in (37) are restated as language-specific word-level extraprosodicity stipulations adopting Itô's (1986) theory of the syllable, Structure Preservation and Stray Erasure will then take care of the word-internal cluster simplification, whereas Prosodic Licensing and the Universal Association conventions will syllabify the consonant clusters at word-level.

In conclusion, then, as far as the word internal syllable-final position is concerned, the syllable structure of Gallo Romance at the end of the ninth century can be described by stipulating the same coda condition as for Late Latin, that is (30), and by determining its maximal syllable as C2,V,C-[+son] In word-final position the occurrence of inflectional *t* and *s* have been accounted for by the affiliation rule (23) Compared with Late Latin, the three rules in (37) had to be added to describe the permissible word final Gallo-Romance consonant

---

19 Luigi Burzio has pointed out (personal communication) that, because the word-final consonant clusters described by the rules in (37) did not occur word internally, the rules in (37) might be dispensed with, if it is assumed that the word-final consonant clusters in the forms of (32) form the onset of a following syllable containing an empty vowel This approach, however, would force the introduction of ternary feet (cf Burzio (1987)) Moreover, we could no longer explain the limited possibility of word-final consonant clusters As discussed in chapter one, after obstruent+liquid clusters a competing rule inserted schwas that had been deleted by a context-free reduced vowel deletion rule If we adopt the approach using empty vowels, the difference between clusters described by the rules in (37) and the obstruent+liquid clusters discussed in chapter one is unexpected Finally, it is important to notice that either way of describing Gallo-Romance phonotactics would require, in comparison to Late Latin, the addition of supplementary syllabification rules either the rules in (37) or a rule creating word-final empty vowels

clusters.[19] Thus, the simplified Late Latin syllable structure was made more complex again --albeit limited to the word-final position-- in ninth century Gallo Romance, given the fact that clusters of consonants again surface. Below, in section 3.3, it will be demonstrated that the Gallo-Romance syllable structure became simplified again in its evolution to Old and Middle French. Witnessing such an evolution, one cannot avoid questioning why, if languages strive for preferred CV syllables, the reverse is observed in the evolution from Late Latin to Gallo-Romance, that is, why the syllable structure became complicated in Gallo-Romance. Why did Gallo-Romance interrupt the evolution from Classical Latin to Old and Middle French? This pendular movement in the historical phonology of the French syllable calls for an explanation. Since in our view an insightful account of this particular evolution of the French syllable cannot be provided unless the evolution of foot structure is taken into account, the next section will discuss the interaction between the foot and syllable structure in the evolution from Classical Latin to Old French.

3.2.2 *Syllable Structure and Foot Structure: Interaction*

In the first two chapters of this thesis we have argued that the deletion of reduced vowels must be interpreted as paving the way for a change in the stress pattern which evolved from a marked into an unmarked accent system. The syllable final consonant clusters illustrated in (36), of which ninth century Gallo-Romance only permitted those occurring in word-final position (36b), were brought about by syncope and apocope. Given the representational framework of nonlinear phonology, the manipulation of structure at one prosodic level may take place independently of the other prosodic levels. For the specific case of Gallo-Romance this means that, because syncope and apocope are formulated as foot-based processes, they are expected to apply independently of syllable structure considerations. What we observe, then, is that changes occurring at the level of representation where foot structure is expressed and resulting in a simplification of that structure, have caused a complication of the rules of syllabification. In other words, the elimination of marked in favor of unmarked foot structure had the side-effect of creating a more marked syllable structure as is obvious from the evolution of the Late Latin coda condition (30), which had to be complicated with the adjunction rules in (37). We therefore conclude that two competing tendencies were at work in the historical phonology of French prosodic structure: one was to simplify marked foot structure and the other was to strive for a CV-CV syllable pattern. It is the interaction between these two evolutions that provides us with an explanation for the 'zig-zag' evolution of the French syllable and an answer --albeit a language-specific one-- to the question why, despite an undeniable tendency towards a preferred CV-CV syllable pattern, French did not wind up with open syllables and no others.

3.3. *Old French: simplification of syllable structure and its formal expression*

3.3.1 *Syllable structure: simplification*

In this section the syllable structure conditions of Old French (by the end of the eleventh century) will be discussed. Two changes had occurred which altered the phonotactics of Gallo-Romance (cf. Walker, (1971), Morin (1986), among others). First, the word-final consonants and consonant clusters described by the rules in (37) were permitted in Old French only if they were not followed by the word-final inflectional endings *t* or *s*. Second, word-final liquid-nasal clusters (rule (37b)) were no longer possible in Old French.[20] In this section, only the first change will be dealt with, whereas the second will be discussed in the next section, where the question whether the syllable structure conditions of a language must be stated in terms of degree of sonority or in terms of distinctive features will be broached.

To begin with, let us consider the nominal and verbal forms in (39) (cf. Walker, 1971:57 and Pope, 1956.314 among others).

Leaving the word-final liquid-nasal clusters aside for the moment, the rules (37a) and (37c) --repeated below as (40a) and (40b)-- must function unaltered in the phonology of Old French in order to account for forms like those in the left-hand columns of (39a) and (39b). It is important to notice that, according to Morin (1986:168), the distribution of the word-final extrasyllabic consonants

----

[20] The vocalization of syllable-final l, the deletion of preconsonantal z and s, and the deletion of syllable-final nasal consonants further simplified the syllable structure in its evolution from Old to Middle French These changes will not be discussed here, but the reader may consult Morin (1986) for an exhaustive survey of these developments in the various dialects of French

(39a)

Nom pl /Obl sg	Nom sg /Obl pl	
sac [k]	sas [s]	'sack'
corp [rp]	cors [rs]	'body'
clef [f]	cles [s]	'key'
cerf [rf]	cers [rs]	'deer'
colp [lp]	cols [ls]	'blow'

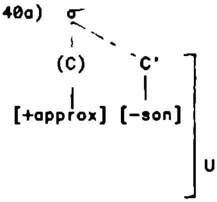
(39b) Present Indicative

1st sg	2nd sg	3rd sg	1st pl	
romp [mp]	rons [ns]	ront [nt]	rompons [mp]	'to break'
serf [rf]	sers [rs]	sert [rt]	servons [rv]	'to serve'
beif [f]	beis [s]	beit [t]	bevons [v]	'to drink'

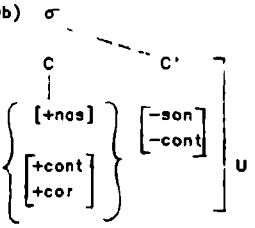
had changed in Old French. Whereas in Gallo-Romance they could be adjoined word finally, they were probably pronounced only in utterance-final position in Old French. For this reason the symbol W has been replaced by U for utterance in the rules in (40). According to Pope (1956.219-221) the pronunciation of final consonants in later Old and Middle French depended on their position in the phrase: "Those consonants that stood at the end of the sense-group, i e at a pause, were at first unaffected and retained their Old French value, but within the phrase, final consonants tended to develop along the lines that had been followed earlier by consonants in the interior of words: Plosive and fricative consonants, final of the word, that stood in the phrase before words beginning with a consonant, became mute, often with compensatory lengthening of the previous vowel. [..] All final plosive and fricative consonants thus tended to have a double or triple pronunciation."

The domain of syllabification in Old French therefore probably was the utterance, whereas in Gallo-Romance it was the word.

(40a)



(40b)

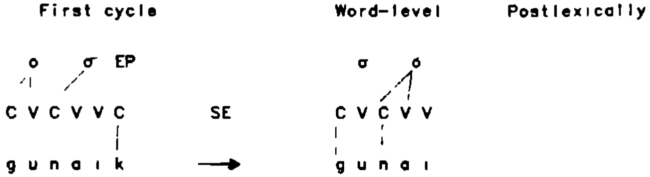


If one compares the forms in the left-hand columns of (39a) and (39b) with those of the right-hand, it is observed that a stem-final obstruent was deleted if it was followed by the inflectional ending *s* or *t*.[21] As a consequence, U-final consonant clusters maximally consisted of two segments in Old French. This restriction on the length of word-final clusters, however, cannot explain why the first of two stem-final obstruents is deleted, which happens, for instance, to stem-final *f* and *k* in forms such as *cles*, *belt* and *sas* in (39). It is interesting to mention that Old French, in the case of stem-final consonant deletion, represents precisely the mirror image of Attic Greek. As discussed above, according to Itô (1986), stem-final obstruents in Attic Greek are deleted unless they are followed by an inflectional ending (*s* in the case of Attic Greek). Compare, for instance, /gunaik/ --▸ *gunai* with /phleb+s/ --▸ *phlebs* [phleps]. In Old French the opposite situation arises: stem-final obstruents are preserved if they are not followed by an inflectional ending, but deleted if they are. Let us here, for ease of exposition, briefly recapitulate Itô's (1986:103-111) description of the Attic Greek facts. Itô assumes the coda condition (16), the laryngeal feature assimilation LFA rule and stipulates language-specific word-level extraprosodicity for *s*. In the case of /gunaik/ --▸ *gunai* 'woman' the stem-final *k* is extraprosodic (EP in (41)) on the first cycle, and it will appear at the surface if a vowel-initial suffix is added. At word-level, if no such suffixes have been added, *k* is no longer extraprosodic (only *s* may be extraprosodic at word-level in Attic Greek) and, because Structure Preservation and Prosodic Licensing do hold at word-level, *k* is stray erased (SE in (41)). In the case of /phleb+s/ --▸ *phlebs* [phleps] 'vein', the stem-final *b* is extraprosodic on the first cycle, but when nominative *s* is added, *b* loses its extraprosodic status, and final *s* becomes extraprosodic. The LFA rule links *b* with the final *s* (viz. /phleb+s/ --▸ /phlep+s/). The coda condition in (16) now no longer excludes *b* from occurring in syllable-final position, because the laryngeal features of *b* (LF in (41b)) are doubly linked. Stem-final *b* can now be incorporated into syllable structure. At word-level *s* is extraprosodic and postlexically it may be syllabified because Structure Preservation does not hold postlexically. In (41) the derivation of these two forms is represented.

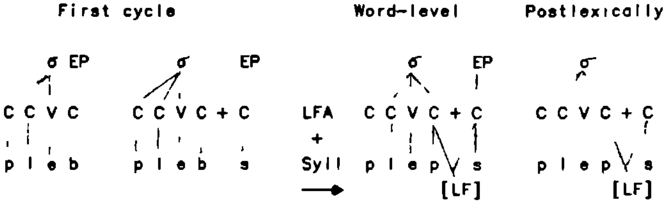
---

21 It should be mentioned that stem-final t and an inflectional ending s formed a single affricated segment (cf Morin (1986)

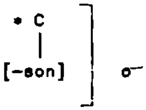
(41a) /gunaik/



(41b) /phleb+s/

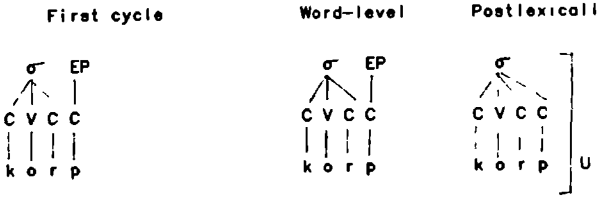


Let us next consider whether the Old French facts can be described in a similar way. To begin with, the coda condition (42) is assumed.

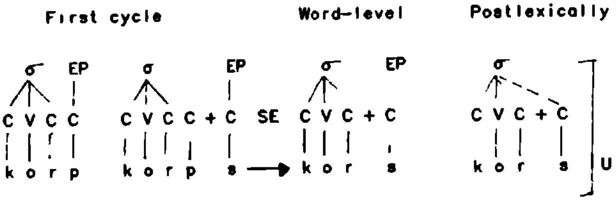
(42) 

Furthermore, language-specific word-level extraprosodicity is assumed for all obstruents. The derivation of the forms *cors* and *corp* is given in (43).

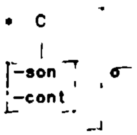
(43a) /korp/



(43b) /korp+s/

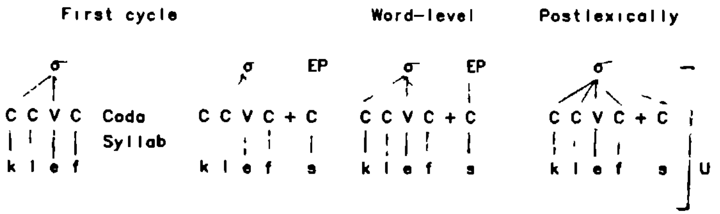


On the first cycle, the stem final *p* is extraprosodic both in (43a) and in (43b) When the suffix *s* is added, stem-final *p* in (43b) loses its extraprosodic status, and, although *p* and *s* share their laryngeal features, *p*, being excluded by the coda condition (42), is not syllabified, but stray-erased. At word-level both *p* (in (43a)) and *s* (in (43b)) are extraprosodic by the Old French word-level extraprosodicity rule and, postlexically, where Structure Preservation no longer holds, incorporated into syllable structure. This way of treating the Old French facts has the advantage of relating stem-final obstruent deletion to the universal Stray Erasure Convention instead of accounting for it by postulating a language-specific deletion rule (cf. Walker, 1971:58) However, the coda condition (42) predicts incorrectly that *s* in *s*-stop clusters, such as *festa* 'feast' and *escola* 'school,' will not be syllabified, but stray-erased. Let us, in order to prevent deletion of *s* in these clusters, reformulate the coda condition (42) as in (44).

(44)


Although in this way *s* is prevented from being deleted, given that condition (44) does allow coda syllabification of *s*, other fricatives can also be syllabified as codas according to (44). This means that words like *clef*, *cles* and *beif*, *beit*, in which stem-final *f* is deleted before *s* or *t*, can now no longer be treated on a par with forms in which a stem-final stop is deleted if followed by an inflectional ending. On the contrary, if we assume the coda condition (44), stem-final *f* in these cases is predicted incorrectly not to be deleted, but to be syllabified, as illustrated in (45)

(45) /clef+s/



On the first cycle, stem-final *f* is not extraprosodic, because *f* is not excluded by the coda condition (44). Hence, *f* is syllabified as a coda and not stray-erased, yielding the incorrect **clefs*. For this reason neither (42) nor (44) is a possible coda condition for Old French and the coda condition (30), repeated here as (46), which was stipulated for Late Latin and Gallo-Romance above, must also be posited for Old French.

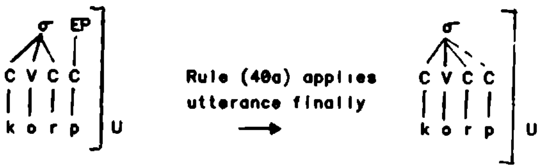
(46) PSSC

$$\left.\begin{array}{c} C \\ | \\ \left\{\begin{array}{c}[+son] \\ \\ \begin{bmatrix}+cont\\+cor\end{bmatrix}\end{array}\right\}\end{array}\right]_{\sigma}$$

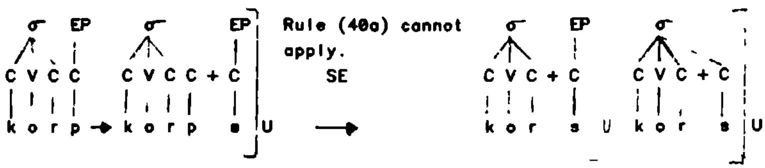
Before discussing in the next section the patterning of *s* with the sonorants and a possible way to define these segments as a natural class, let us first finish the discussion of Old French stem-final obstruent deletion.

As has been demonstrated above, the Old French obstruent deletion facts cannot be described in a way similar to Itô's analysis of Attic. Nevertheless, one would certainly like to retain the overall elegance of her approach, which consists of describing the cases of consonant deletion not by a language-particular rule, but as an automatic consequence of Stray Erasure. This result can be obtained, if we recall that the domain of syllabification had changed in Old French and if the deletion of stem-final obstruents before inflectional *s* or *t* is regarded a consequence of the change in the domain of syllabification. As mentioned above, the Old French syllabification domain was probably larger than the word. Therefore, the rules in (40) have been formulated so as to apply utterance-finally only. As a consequence, they will simply not be applicable to extrasyllabic or extraprosodic stem-final obstruents followed by an inflectional *s* or *t*. A derivation of utterance-final *corp* and *cors* is presented in (47).

(47a) /korp/



(47b) /korp+s/



The coda condition (46), the rules in (40a) and (40b) together with the change in the domain of syllabification have been demonstrated to account for the deletion of obstruents before the inflectional endings *s* and *t*. In the next section, the coda condition (46) will be discussed as well as the second of the two changes mentioned above, that is the loss of nasal consonants after liquids in word-final position.

3.3.2 *Syllable structure: the formal expression of simplification*

The coda condition (30) which has been postulated for Late Latin, Gallo-Romance and Old French involves a disjunction of feature complexes. In order to express disjunctions like these as natural classes, Selkirk (1982) has proposed to eliminate the major class features from phonological theory and to replace them by the sonority hierarchy and the assignment of a sonority index (*n*) to individual segments. By assigning *s* a separate place on the sonority hierarchy as in (48), it becomes possible to refer to the class of sonorants and *s* as a natural class by means of an *n*-ary feature 'sonority', where *n* is the sonority index of a segment according to (48). The class of segments in which *n* is greater or equal to 4 and smaller or equal to 7 would then be the 'natural' class of sonorants and *s* (cf. Selkirk, 1982:112-113).

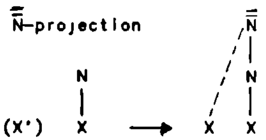
(48) Sonority Hierarchy

a	10
e,o	9
i,u	8
r	7
l	6
m,n	5
s	4
v,z,ð	3
f,θ	2
b,d,g	1
p,t,k	.5

In this way the clustering combinations of segments within a syllable can be stated by indicating the minimal distance in the sonority hierarchy that must separate tautosyllabic adjacent segments. Although classes of segments such as *s* and sonorants can be referred to as natural classes, the use of the sonority hierarchy and minimal sonority distance constraints (henceforth MSDC) in formulating the phonotactics of a language often requires, as Clements (1988) observes, idiosyncratic, language-particular versions of the sonority hierarchy. In this section it will be shown that there is also another reason to reject the use of MSDC's and language-particular sonority hierarchies in describing the phonotactics of a language. More specifically, it will be demonstrated that, unlike a distinctive feature-based account, an MSDC-based account of the phonotactics of Gallo-Romance and Old French does not permit one to formally represent language simplification as simplification of grammar. In order to demonstrate this, the Gallo-Romance and Old French phonotactics will be reformulated in the theoretical framework of Levin (1985), in which the phonotactic generalizations of a language are described in terms of degree of sonority.

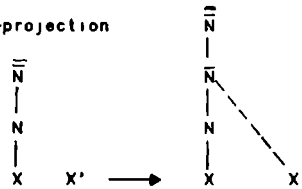
Levin (1985) advocates an X-bar theory of the syllable, in which syllable heads ((N)uclei) are determined by lexical redundancy rules or language-specific N-placement rules. Onset formation is taken care of by $\bar{\bar{N}}$-projection, a universal operation, schematically represented in (49).

(49) $\bar{\bar{N}}$-projection



The occurrence of postnuclear elements in a syllable is accounted for by language-specific $\bar{N}$-projection, as in (50).

(50) $\bar{N}$-projection



These projections of $\bar{\bar{N}}$ and $\bar{N}$ define the core syllables of a language (cf. Levin (1985) for further details). Additional X-slots are syllabified either by

Incorporation or by Adjunction rules. The latter Chomsky-adjoin X-slots to $\bar{\bar{N}}$ and are not subject to sonority hierarchies, and, if they make reference to place-of-articulation features, they may only refer to [+anterior] segments. The former incorporate additional X-slots into $\bar{\bar{N}}$ or $\bar{N}$. Incorporation rules are subject to sonority, which is expressed by using relative, language-specific sonority scales and by designating a MSD for incorporation into $\bar{\bar{N}}$ or $\bar{N}$.

Returning now to the Gallo-Romance phonotactics, let us assume the Gallo-Romance relative sonority scale in (51).

(51) Gallo-Romance sonority scale

r
l
n,m
s,z
f
p,t,k,b,d,g,

The rules incorporating additional X-slots into $\bar{\bar{N}}$ and $\bar{N}$ could be described by stipulating an MSD 3 for incorporation into $\bar{\bar{N}}$, and an MSD 2 for incorporation into $\bar{N}$.[22] The rule syllabifying the word-final inflectional endings *t* and *s* could be described as an adjunction rule, because it refers to [+anterior] segments. The derivation for Gallo-Romance *cresps* is given in (52).

Given the sonority hierarchy of (51) and an MSD setting fixed at 2 for $\bar{N}$-incorporation prevents *l*, but not *r*, from being followed by a nasal in word-final position. However, a filter is needed to exclude nasal-*f* clusters from occurring in word-final position. The MSD 3 for incorporation into $\bar{\bar{N}}$ (onset formation) incorrectly predicts stop-nasal and *sr* clusters to occur in syllable-initial position. Here even two filters are needed to exclude these sequences.

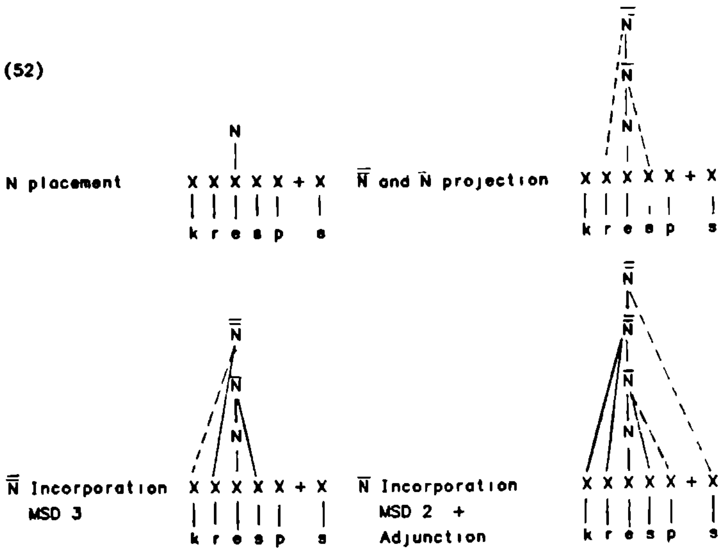
Let us now consider some differences between Gallo-Romance and Old French phonotactics. In Old French, word-final liquid-nasal clusters permitted in Gallo-Romance (cf. rule (37b) were no longer possible. This difference cannot be accounted for by simply changing the MSD for incorporation into $\bar{N}$ (coda formation) from 2 to 3. Such a move would incorrectly exclude the clusters *ls*,

---

22 $\bar{N}$-incorporation must be limited to the word-final position in Gallo-Romance

23 Fouché (1961 782) points out that the omission of word-final n in char (< Gallo-Romance charn 'flesh') in the Chanson de Roland indicates that the deletion of the nasal consonants in word-final liquid-nasal took place in the

(52)



sp, *st* and *sk*.[23] How then can the loss of liquid-nasal clusters be accounted for in an MSD-based account of Old French phonotactics? The most straightforward way is to add a new filter or a new rule to the phonological component of the Old French grammar. This solution, if considered from the point of view of a theory of language change seems undesirable. Syllable structure conditions of the type under discussion are part of the phonological component of Gallo-Romance. As far as we can see, the loss of nasal consonants after liquids has not been the side-effect of some other change in the Gallo-Romance phonological component. The elimination of this cluster is a very specific event, the cause of which must be sought in the relative markedness of the cluster itself. Indeed, according to Clements (1988:47-48) the lack of contrast between liquid-nasal clusters

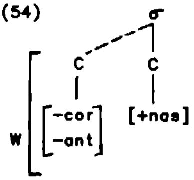
---

preliterary period of the language (that is, before the eleventh century) As a matter of fact, in the Chanson de Roland —the numbers after the forms refer to the lines in the text— n in word-final liquid-nasal clusters is practically always omitted, as in, for example, enfer (1391), jor (3675,3100,915), and jur (19 times without and 3 times with final n) Words with word-final ls or st clusters, such as, for instance, fals (307,3844) and tost (3217,1182) are normally written, and, more important, the vocalization of syllable-final l and the deletion of syllable-final s is dated after the eleventh century (before the middle of the twelfth and in the course of the thirteenth century, respectively, cf. Pope, 1956 151,154) Therefore, in the period of the language that is described in this section, word-final rn clusters should be excluded, whereas word-final ls, st, sk and sp should not disqualifies them as unmarked sequences. We would therefore like to be able to express this change in some way as grammar simplification. However, as it turns out, rule addition is the only way to account for this change in an MSD-based account of Gallo-Romance and Old French phonotactics. To state the problem more clearly, let us briefly discuss another example. In seventeenth century English, velars were lost before nasals in word-initial position. In standard generative phonology this change has been described as an instance of rule addition, that is, by adding rule (53) as a new rule to the phonological component of a synchronic grammar of seventeenth century English (cf. Kiparsky, 1970:48-49).

(53) $k, g, \longrightarrow \emptyset \,/\, \#\!\!\#-\, n$

Since a grammar which allows only obstruent-liquid clusters in syllable-initial position is less marked than one which allows velar-nasal clusters, besides obstruent-liquid clusters, in this position (cf. Clements, 1988:31-32), the deletion of velars before nasals in syllable-initial position constitutes an instance of grammar simplification, which, if accounted for by a rule like (53), is not formally expressed as such. In a grammar where the phonotactic generalizations of a language are stated in terms of distinctive features rather than in terms of degree of sonority, it is not problematical to formally express changes like the ones discussed above for Old French and seventeenth century English as grammar simplifications. The fact that word-final liquid-nasal clusters in Old French were no longer possible, can straightforwardly be accounted for by the loss of rule (37b). Similarly, if the existence of word-initial velar-nasal clusters in pre-seventeenth century English were described by means of an affiliation rule, the change described by rule (53) as rule addition can now be expressed as the loss of the affiliation rule (54).

(54)



In a similar fashion, the deletion of preconsonantal *s* and *z* in words like *festa* > *[festa] > *fête* 'feast' and *insulam* > *[izla] > *île* 'ile' and the deletion of syllable-final nasal consonants (Recall fn. 20) in words such as *campum* > *[tšampu] > [tšamp] > *champ* ([šã]) 'field' can now be understood as the loss of the very complicated rule (40b). It should be noticed that once an MSD-based account of describing the phonotactics of a language is rejected, it is, of course, no longer possible to use it as a means of describing *s* and sonorants as a natural class. This question will not be dealt with here in detail. Let us just note that the SMP, discussed in section 3.1.1, provides an explanation for the fact why *s*, but not other fricatives, may occur in clusters.

In this section, it has been argued on the basis of facts of grammatical change that the phonotactic constraints of a language should be stated in terms of distinctive features, rather than in terms of degree of sonority. As such, it confirms the position defended in Clements (1988), who claims that sonority is not a phonological primitive, but derived from the major class features. We could even go one step further and conclude that the major class features as proposed by Clements (1988) in combination with the manner, place and stricture features have permitted an adequate description of the evolution of the Latin syllable. At a minimum, sonority considerations, whether primitive or derived, have not been proven a tool for a more insightful account of the facts under discussion.

3.4. *Summary*

In this chapter the evolution of the syllable structure from Classical Latin to Old French has been described. The Classical Latin syllable structure conditions became simplified in the course of Late Latin. Subsequently, Late Latin syllable structure became more complex again in Gallo-Romance, and in Gallo-Romance syllable structure underwent a series of simplifying changes in its way to Old French. We have explained this evolution of syllable structure by taking into account the evolution of Latin foot structure. More specifically, we have shown that the instances of syllable structure complication had been brought about by foot-based processes of vowel deletion. Nonlinear phonology, in which feet and syllables are represented on different, independent levels of representation, makes us expect exactly this kind of interaction between foot structure and syllable structure to occur in the evolution of languages. Our study of the interaction between the evolution of syllable structure and foot structure suggests at least a partial answer to the question why all languages do not **directly** evolve into "open-syllable-type-only" languages.

Furthermore, it has been demonstrated that, if simplification of language is to be expressed as simplification of grammar, a theory of the syllable is required, in which the phonotactic generalizations of a language are stated in terms of distinctive features, rather than in terms of degree of sonority.

A Nonlinear Analysis Of The Evolution Of Consonant + Yod Sequences In Gallo-Romance

4.0. *Introduction*

In Late Latin the consonantalization of unstressed nonlow front vowels in hiatus gave rise to consonant + yod sequences. These clusters, which were absent in Classical Latin, became subject to a number of phonological processes as diverse as palatalization, affrication, gemination, palatal diphthongization and lenition. Some of these changes occurred in all dialects, others were limited to a number of them. The primary aim of this chapter is to provide a detailed analysis of these processes in a nonlinear framework. It will focus on the affrication process which, although well-documented in philological studies, has never received a proper formal treatment.

The framework of standard generative phonology, in which affricates were distinguished from stops by the feature 'delayed release', offered two possible ways to formalize affrication. One of these is exemplified in Chomsky and Halle's discussion of the Slavic palatalizations (1968, henceforth SPE). In Slavic, the alternation [k]∾[tš], where [tš] occurs before a front vowel and before yod as a result of the palatalization of velars, is explained by both a feature-changing rule and a linking principle. First, the velar stop becomes palatalized by rule, after which the output feeds into a set of linking principles, which yield the palato-alveolar affricate [tš]. In this way, the palatalization of velars is stated as an assimilation rule which fronts a velar when it is followed by a front vowel or glide. The affrication of palatalized velars, however, is described as a consequence of demarking (cf. SPE: 423-424). A similar mechanism is chosen to account for the alternation [t]∾[tš] in Slavic which resulted from the palatalization of dentals. In Slavic, the dentals are assigned the high tongue-body position of the following glide by an assimilation rule. The output of this rule feeds into a linking principle which converts the segment into a nonanterior consonant, after which the same set of linking conventions that are involved in the palatalization of velars yield the palato-alveolar affricate [tš] as the final output. Again, palatalization is stated as an assimilation rule, whereas affrication is considered a case of demarking (cf. SPE: 429)

Another way of formalizing the affrication process which linear phonology provides for, is to account directly for the relevant alternations by a rule such as (1).

(1) Affrication

$$[-\text{ant}] \rightarrow \begin{bmatrix} -\text{back} \\ +\text{cor} \\ +\text{del rel} \end{bmatrix} \; / \; \_\_ \begin{bmatrix} -\text{cons} \\ -\text{back} \end{bmatrix}$$

This is essentially the way in which Canavati (1970) describes the cases of affrication which occurred in the history of French. There are, however, important reasons to believe that neither of the alternatives given provides a proper characterization of the mechanisms involved. First, if one accounts for affrication as in (1), there is no formal way of expressing why the alternations produced are unmarked. On the other hand, the markedness conventions employed in SPE predict that when velars are fronted, it is to be expected that they manifest themselves as affricated palato-alveolars. As a consequence, it is predicted that alternations such as [t] ~[t'] and [k] ~[k'] before a front vowel or glide should be considered more marked than [t/k] ~[tš], because the linking rules have to be blocked by adding features (cf. Wetzels, 1981 32)

The formalization of affrication that will be proposed in this chapter is one in which an alternation like [t] ~[tš] is not described in terms of a markedness rule, but rather as a contour-creating process Because of the way affricates were represented, a contour-creating analysis of affrication was not available in linear phonology. A different representation of the feature 'delayed release,' which, in line with autosegmental practice, corresponds to a segment-internal feature shift from [-continuant] to [+continuant], will constitute the crucial factor for what I hope is a more adequate description of the affrication process.

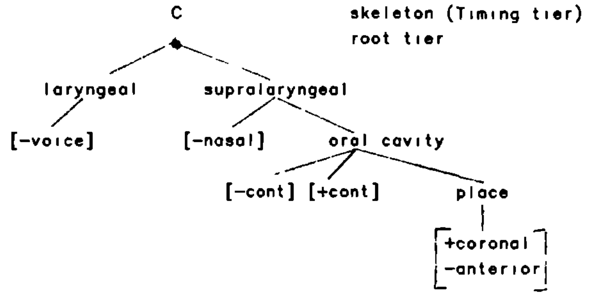
Nonlinear phonology permits a segment to be specified for both the negative and the positive value of a given feature. An affricate like *tš* may thus be

----

[1] Although more ways of representing affricates have been suggested, the representation in (2) will be adopted here because of its consistency with the

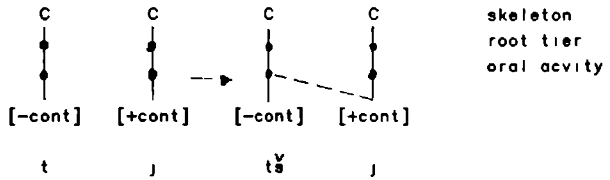
represented as in (2).[1]

(2)



This chapter purports to claim that affrication of consonants before yod is considered a contour-creating process, which can either be formulated as the spreading of the feature [+continuant] to a preceding [-continuant] segment or as the insertion of the feature [+continuant] on a [-continuant] segment. In this chapter, we will first present an analysis of affrication in which affrication is described as a spreading contour-creating process and later, in section 4.4, return to the other possible formalization: affrication as the insertion of the feature [+continuant]. An alternation [t]~[tš], such as the one resulting from the palatalization of dentals before yod in Slavic, can be described by the spreading rule in (3).

(3)



The data discussed here are primarily from Gallo-Romance, but occasionally other Romance languages will be taken into consideration, especially to point out parallel or divergent developments. The discussion will proceed along the following steps. In section 4.1, the main facts of Gallo-Romance will be presented. Section 4.2 will offer an analysis of affrication, which will provide new insights into the evolution of consonant + yod sequences that yielded affricates in Gallo-Romance. The evolution of sonorant and *s* + yod clusters will

---

model of feature representation followed in this chapter.

form the central topic of section 4.3, where it will be shown that the same rules which are needed to account for the development of C + yod clusters, can, without further modification, account for the evolution of sonorant and *s* + yod clusters. Finally, section 4.4 will discuss and summarize the main aspects of the present analysis.

4.1. *The Gallo-Romance facts*

4.1.0. *Preliminaries*

Before the evolution of consonant + yod sequences in Gallo-Romance is discussed, it seems useful to review the chronology of the processes under consideration. The beginnings of palatalization must be placed in Late Latin, whereas the completion of the process is set at a time when the Romance languages were already evolving in their own particular directions. Richter, for example, places the series of sound changes, leading from Clas. Lat. *rationem* to early Gallo-Romance [rajzonə] *raison* 'reason' between the third and sixth century (1931:88,162). Apart from inscriptions and a few grammarians' testimonies, there are no written sources from this period of Romance, and, consequently, it would be hard to establish an absolute chronology for the different stages. Therefore, the order of sound changes, which traditional Romance scholars have established from extant forms and loan words, represents a relative rather than an absolute chronology. The present study which is based on that philological material, intends to give a description of the evolution of consonant + yod sequences. This, however, is not to say that the rules and mechanisms discussed here are to be considered irrelevant to any synchronic state of the grammar at some point in the history of French. Even if some of the rules discussed here did not leave long-lasting traces in the form of morphophonological alternations, we may assume that all of them were part of the grammar at some point, either as variable or as optional rules. Even if a closer study of the relevant synchronic states were to bring rule interactions to light that would lead us to slightly modify the rules proposed here, these modifications would not be essential, as we have concluded from a comparison of our analysis with Canavati (1970), where the author took care to provide a series of full-fledged synchronic grammars.

A last, but important, remark concerns the language under consideration· Gallo-Romance, in fact, represents a group of dialects, of which the Ile-de-France (Francien) dialect ultimately became the standard variety of French. Although in the remainder of this chapter the term Gallo-Romance will be used, the data discussed in this chapter must be considered to be representative of Francien.[2]

4.1.1. *Gallo-Romance*

When discussing the evolution of consonant + yod sequences in Gallo-Romance, one must distinguish between the intervocalic and the post-consonantal position of the group C + yod (cf. table (4), based on Pope, 1956:129-30).[3]

(4)

Clas Lat	Late Latin		Gal-Rom		
rationem >	*[rat'jonɛ] >	*[rats'jonɛ] >	*[rajzonɛ]	raison	'reason'
potionem >	*[pɔt'jonɛ] >	*[pɔts'jonɛ] >	*[pɔjzonɛ]	poison	'beverage'
matteam >	*[matt'ja] >	*[matts'ja] >	*[mattsɛ]	masse	'sledge-hammer
fortiam >	*[fɔrt'ja] >	*[fɔrts'ja] >	*[fɔrtsɛ]	force	'strength'
hordeum >	*[ɔrd'ju] >	*[ɔrdžju] >	*[ɔrdžɛ]	orge	'barley'
radium >	*[rad'ju] >	*[rajju] >	*[rajɛ]	rai	'ray, spoke'
faciam >	*[fak'ja] >	*[fats'ja] >	*[fattsɛ]	face	'face'
bisacciam>	*[bisakk'ja]>	*[bɛsatts'ja]>	*[bɛsattsɛ]	besace	'double bag'
arkionem >	*[ark'jonɛ]>	*[arts'jonɛ]>	*[artsonɛ]	arçon	'sidebar'
corrigiam>	*[kɔrrig'ja]>	*[kɔrrɛjja]>	*[kɔrrɛjɛ]	courroie	'strap, belt'
Georgium >	*[g'jɔrg'ju]>	*[džjɔrdžju]>	*[džɔrdžɛ]	Georges	'Georges'

The first fact to observe in the data presented in (4) is the difference in outcome between intervocalic *tj* and *kj*. In the intervocalic position, *tj*, after being affricated, evolved into a voiced dental affricate [dz] --this change is not indicated in (4)--, followed at some point by a transfer of the glide into the preceding syllable, whereas *kj* in the same environment ended up as a long voiceless affricate [tts].[4] As shown in (4), geminate *kkj* evolved exactly like *kj*.

---

[2] There is some dialectal variation in the results of affrication The reflex of tj, for instance, was not [ts] in all Gallo-Romance dialects Pope mentions, for example, the Northern dialects, where tj and ttj become [tš] and [ttš], respectively (1956·130) Morin (personal communication) points out that intervocalic tj in Walloon regularly developed into [ž] (< [dž] < [tš])

[3] As a result of palatalization, velars did not only become [+high] and [-back] but they also became palato-alveolar (cf Pope, 1956 129-130) This has not been indicated in the data in (4) In section 4 2 this will be explicitly discussed

[4] The consonantalization of unaccented nonlow vowels in hiatus, which created the C + yod combinations, can be dated back to the first and second centuries (Richter, 1931.76)

The palatal glide, however, shows a differential behavior in *ttj* and *tj*: no transfer took place across a geminated dental stop. Traditionally, the difference between the evolution of *kj* and *tj* in the intervocalic position is explained by the postulation of a gemination rule that changed *kj* into *kkj* : the long affricate that arose from it could escape the voicing process that affected single intervocalic stops, including the single affricate which evolved from *tj*. (cf. Martinet, 1949:120, Pope, 1956:130 and, for a different explanation, Posner, 1974).[5] Finally, it is important to mention that the palatalization and affrication of *tj* preceded the palatalization and affrication of *kj* (Lausberg, 1967:55).

Second, according to (4), *dj* and *gj* resulted into affricates only if they were preceded by a consonant, whereas *tj* and *kj* evolved into affricates regardless of a preceding consonant. According to Fouché (1961:909), in the first half of the Late Latin period, an assimilation process changed, the intervocalic *d* + yod and *g* + yod sequences into *jj*, which explains why only postconsonantal *d* + yod and *g* + yod sequences became affricated.[6] Now, because intervocalic yod in Latin probably was a geminate (cf. Niedermann, 1931:150-151, Sturtevant, 1968:147 and Steriade and Schein, 1986:699-704), *dj*, *gj* and *j* [jj] are thought to have developed in the same way (cf. Straka, 1965:135-136). On the other hand, Morin (1979) assumes that intervocalic *j* became affricated into [dž]. After that, the voiced palato-alveolar affricate underwent lenition and diphthongized the preceding vowel. Finally, [ž] is deleted. Hence, the evolution of *maium* > *mai* 'may' has gone through the following stages: *[madžo] > *[maižo] > [maio] and, after apocope, [mai]. As Morin (1979) argues, the reason for assuming this particular evolution of intervocalic *j* is that it provides an explanation for the final schwa in Old French *maire* (<*maior*) 'bigger' and *pire* (<*peior*) 'worse'. Morin (1979) starts out from the assumption that Latin words ending in a single

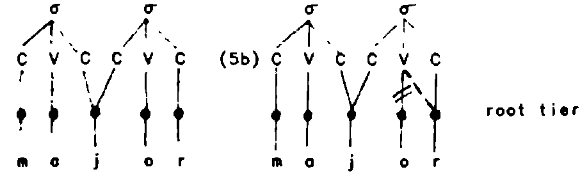
---

5 According to Meyer-Lübke (1890), one has to take into account the position in the word of intervocalic tj Gallo-Romance pretonic tj, according to him, always resulted in a voiced affricate, whereas posttonic tj resulted in a voiceless affricate [ts] This difference is explained by later scholars as the consequence of a final devoicing rule (Schwan-Behrens, 1913 122-23, Pope, 1956 130-31, and Richter, 1931 82) In this study the latter point of view will be adopted
Furthermore, it will be assumed, following, among others, Pope (1956 129-130) and Straka (1965 146), that the reflexes of intervocalic tj and kj were always kept apart in their evolution into Francien In section 4 3 this matter will be taken up again

6 There is inscriptive evidence for the merger of intervocalic dj, gj with j as observed by Straka (1965 135-36) and Pope (1956 131) who states that "the equivalence of dj, gj and j in some positions led to confusions in Low Latin spelling [ ] Madio for Majo, Remidium for Remigium, Trogiae for Troiae "

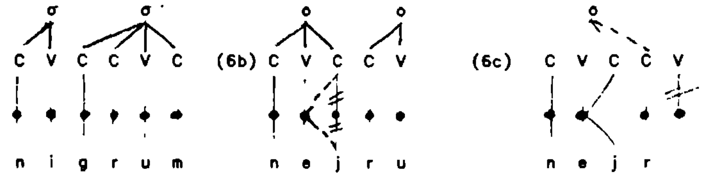
consonant are reanalyzed in Proto-Romance with a final vowel, either because the final consonant had been lost, as in *caput* > [capu] > *chef* 'head', or by the addition of a final vowel, as in *maior* > *[maiore] > *maire* 'bigger'. Since other word-final consonants were generally deleted, only words ending in either *l* or *r* will be assigned an additional final vowel. In the evolution of *maior* > *maire* a reconstructed *[maiore] is thus taken as the source for Old French *maire*. After the affrication of *j* into [dž], the unstressed vowel in the penultimate syllable is syncopated, yielding *[madžre]. The affricate before *r* changes into *d* and diphthongizes the preceding vowel [maidre]. As a result of the lenition rules, *d* disappears and the schwa in *maire* is explained on a par with the schwa in *patrem* > *père* 'father', that is, after obstruent + liquid clusters the retention of schwa is the normal result. Now, if *j* affricates, then it seems reasonable to assume affrication in intervocalic *dj* and *gj* also. However, the only reason for assuming affrication of *j* and intervocalic *dj* and *gj* would be the final schwas in words like *maire* and *pire*. Moreover, by setting up reconstructed *[maiore] and *[peiore] for Latin *maior* and *peior*, stress patterns are introduced which are not only unmotivated, but absolutely untypical of Latin, because words are taken as basic that have antepenultimate stress while they do contain heavy penultimate syllables. Old French *sire* (<*senior*) 'lord (nom.)' and *sieur* (<*seniorem*) 'lord (acc.)' which, in Morin's analysis, both derive from a reconstructed *[seiore] show that the addition of a final vowel does not change the original stress pattern of the words. Therefore, *sieur* must be derived from a reconstructed *[sejóre], whereas *sire* must be derived from *[séjore]. Obviously, if the schwas in words like *maire*, *sire* and *pire* could be explained in a different way, there would be no need for assuming affrication of *j* and of intervocalic *dj* and *gj*, nor would we have to stipulate an otherwise unmotivated rule deleting [ž] in order to derive, for instance, *mal* from *malum* as discussed above. Finally, and most importantly, there would be no need to set up untypical stress patterns for words like *maior*, *senior* and *peior*. Fortunately, there is an easy way to explain the final schwas in these words. First of all, it must be recalled that *j* in these words was a geminate. Hence, *maior* can, in a three-tiered model of the syllable (cf. Clements and Keyser (1983)), informally be represented as in (5a). Rheinfelder (1963:67) assumes that in words of the type *maior*, the final *r* after apocope of the final vowel became syllabic. This has been represented in (5b). According to Rheinfelder, the syllabic consonants lost their syllabic character after the insertion of a support vowel.

(5a) (5b)



In the evolution of *factum* > *fait* 'fact' and *nigrum* > *noir* 'black', the *k* and *g* became fricatives by lenition, and subsequently combined, as a yod, with the preceding vowel into a diphthong as illustrated in (6b). After apocope of the final vowel, word-final *t* and *r* can straightforwardly be integrated into syllable structure as illustrated in (6c). So, unlike the *r* in *major*, the *r* in *nigrum* did not become syllabic.

(6a) (6b) (6c)



Since a better way of explaining schwas in words like *maior* is available, we conclude that affrication did not occur in *j* nor in intervocalic *dj* or *gj* sequences and assume that the evolution of these sequences proceeded along the lines of (4).

Table (7) presents a list of some relevant evolutions of consonant + yod sequences which did not yield affricates.

(7)

Clas Lat	Late Latin		Gal-Rom		
lineam >	* [lin'ja] >	* [liñña] >	[liñɛ]	ligne	'line'
*pinnionem>	* [pinn'jonɛ]>	* [piññonɛ] >	[piñonɛ]	pignon	'gable (end)'
paleam >	* [pal'ja] >	* [paʎʎa] >	[paʎɛ]	paille	'straw'
bulliat >	* [bull'jat] >	* [buʎʎa] >	[buʎɛ]	bouille	'it boil'
aream >	* [ar'ja] >	* [ar'jɛ] >	[ajrɛ]	aire	'surface'
basiare >	* [bas'jarɛ] >	* [baz'jarɛ]>	[bajzier]	baiser	'to kiss'
messionem >	* [mɛss'jonɛ]>	* [mɛs'onɛ] >	[mɛjsɔnɛ]	moisson	'harvest'

As illustrated in table (7), *rj* and *sj* behave exactly like intervocalic *tj* by moving the glide into the preceding syllable. There is no difference between the evolution of *lj* and *llj* or *nj* and *nnj*: they all result in long palatalized sonorants.[7] Finally, it should be observed that according to the evolutions sketched in (7) the transfer of yod across an *s* takes place after the degemination of long palatal *s*. The single palatal consonant resulting from degemination resolves into a glide that combines with the preceding vowel into a diphthong followed by a non-palatal consonant. Sonorant + yod sequences sometimes did, and sometimes did not evolve along the lines of (7), depending on the date of introduction into the language. Three periods must be distinguished the first of which is represented by the evolutions in (7). For clusters introduced in a later period, yod became affricated into [dž] as in, for example, *lineum* > *linge* 'linen.' This change probably took place at the same time when word-initial *j* became affricated and when word-initial *w* became strengthened into *gw* (cf. Pope, 1956:97). Finally, in a third period, sonorant + yod sequences became metathesized as in, for instance, *gloriam* > *gloire* 'glory' (cf. Pope, 1956:230, Fouché, 1961:934-43 and Straka, 1965:145). In this chapter, we will discuss the first development only.

Let us now consider the evolution of labial + yod sequences. A representative sample of words containing this cluster is given in (8).

(8) Clas Lat		Late Latin			Gal-Rom		
sapiam	>	*[sapja]	> *[saptša]	>	[satšɛ]	sache	'I know'(subj.)
Ulpiacum	>	*[ulpjaku]	> *[ulptšagu]	>	[ɔltšɛ]	Ouchy	'Ouchy'(top.)
rubeum	>	*[rubju]	> *[robdžu]	>	[rɔdžɛ]	rouge	'red'
cambiare	>	*[kambjarɛ]	> *[tšambdžan]	>	[tšandžier]	changer	'to change'
caveam	>	*[kaβja]	> *[kaβdža]	>	[kadžɛ]	cage	'cage'
salviam	>	*[salvja]	> *[salvdža]	>	[saldžɛ]	sauge	'sage'
simium	>	*[simju]	> *[sindžu]	>	[sindžɛ]	singe	'monkey'
commeatum	>	*[kɔmmjatu]	> *[kɔndžatu]	>	[kɔ̃ndžie]	congé	'leave'

In the evolution of labial + yod sequences, *j*, rather than palatalizing or affricating the preceding labial consonant, became strengthened into [dž] (cf. Pope, 1956:129 and Straka, 1965:137). Morin (personal communication) has pointed out that in certain Gallo-Romance dialects palatalization was possible in labial + yod sequences and that *p*, just like *k*, geminated before yod. (For an overview of

---

[7] Pope draws attention to the fact that the palatal consonants n' and l' blocked the diphthongization of a preceding short stressed vowel in Gallo-Romance Since normally stressed vowels in open syllables were diphthongized, the nondiphthongization before n' and l' is explained if they are considered long consonants (Pope, 1956:95 and Wetzels, 1985:323).

the evolution of labial + yod sequences in the different Romance languages the reader is referred to Lausberg, 1967:61 and Hall, 1976:148-152).

Finally, affricates did not only originate from C + yod sequences, but, as mentioned above, also from the strengthening of yod in word-initial position, or from the palatalization and affrication of velar consonants followed by front vowels, as in *placere* > [*platsere] > *plaizir* > 'to please.' The former process took place in the fifth century, at the same time when word-initial *w*, mostly of Germanic origin, was strengthened to *gw* (Pope, 1956: 97) and seems to be independent from the palatalization phenomena exemplified in (4) and (7) above, because the strengthening of word-initial yod took place before all vowels, whether back or front, as illustrated in (9) (Schwan-Behrens, 1913:104).

(9) Clas Lat			Gal–Rom				
jam	>	* [dzo]	> [za]	>	[de]ja	'already, now'
juvenem	>	* [dzoven]	> [zovenɛ]	>	jeune	'young, juvenile'
*waddju (Germ)	>	* [gwadzu]	> [gazɛ]	>	gage	'pledge, pawn'
*wardon (Germ)	>	* [gwarder]	> [garder]	>	garder	'to keep'

The other affrication process which involved velars before front vowels enables us to establish a relative chronology among a number of phonological processes. The palatalization of velar consonants followed by front vowels was achieved in two stages. The First Velar Palatalization took place in Late Latin during the fourth century (Pope, 1956:124 29), and its effects can be observed in almost all Romance languages (Rheinfelder, 1963:159). In syllable-initial position before *i* and *e*, *k* was palatalized and affricated. Its voiced counterpart *g* was also palatalized and affricated in word-initial position. Traditionally, palatalization and subsequent affrication of word-internal *g* is assumed to have taken place only if *g* was preceded by another consonant, whereas intervocalic *g* before *i* or *e* became palatalized into a palato-alveolar voiced stop, but not affricated. After palatalization, the voiced palato-alveolar stop opened into [j] (Pope, 1956;124). Morin (1979) has demonstrated that in words like *legere* > *lire* 'to read' and **adaugere* > *aoire* 'to grow' the syncope of the unstressed penult vowel brought the voiced palato-alveolar stop in preconsonantal position. A depalatalization process changed the palato-alveolar stop into a coronal stop and diphthongized the preceding vowel, as in, *adaugere* >*[adodere] >* [adodre] >* [adoidre]. The preservation of final schwa in Old French *aoire* can now be explained parallel to the retention of schwa in *patrem* > *père* (cf. Morin (1979) for a more detailed account). Morin (1979:115) assumes that *g* which remained intervocalic, as in *flagellum* > *flaiel* 'whip' was not only palatalized, but also affricated into [dz]. The further evolution of [dž] is then supposed to have been similar to the evolution of *j* in *maium* > *mai* discussed above. In this study it will be assumed that intervocalic *g* before front vowel was only palatalized, but not affricated. First, because there is no evidence supporting the affrication of intervocalic *g* in this context, and, second, as discussed above, an unmotivated rule deleting [ž] would be necessary. With respect to the further evolution of palatalized intervocalic *g*, we will follow Pope (1956) in assuming that palatalized *g* became weakened as a result of lenition and then combined as yod with the preceding vowel into a diphthong.

The Second Velar Palatalization is limited to Gallo-Romance, and occurred after the change of Classical Latin *a* into front *a* (Pope, 1956:127). This shift of *a* explains why the palatalization and affrication of velars was this time also triggered by the low vowel. Let us next consider the examples in (10).[8]

(10) First Velar Palatalization

Clas Lat	Late Latin		Gal-Rom		
centum	>*[k' entu]	>*[ts'entε]	>[tsent]	cent	'hundred'
placere	>*[plak'erε]	>*[plats'erε]	>[plajzir]	plaizir	'to please
gentem	>*[g'entε]	>*[džentε]	>[džent]	gens	'people'
flagellum	>*[flag'ellu]	>*[flajellε]	>[flajel]	flaiel	'whip'

Second Velar Palatalization

Clas Lat	Late Latin		Gal-Rom		
cantare	> [kantarε]	> [k'antarε]	> [tšanter]	chanter	'to sing'
arcam	> [arka]	> [ark'a]	> [artšε]	arche	'chest, bin'
micam	> [miga]	> [miγa]	> [mijε]	mie	'crumb, scrap'
buccam	> [bukka]	> [bukk'a]	> [buttšε]	bouche	'mouth'
negare	> [neγarε]	> [nejerε]	> [nejerε]	nier	'to deny'
largam	> [larga]	> [larg'a]	> [lardžε]	large	'wide'
*gamba	> [gamba]	> [g'amba]	> [dźambε]	jambe	'leg'

----

8 As a result of palatalization, velars did not only become [+high] and [-back], but also palato-alveolar ([+cor] and [-ant]). This has not been indicated in the data in (10). Furthermore, the result of palatalizion and affrication of k before i and e was [ts] during the First, but [tš] during the Second Velar Palataliztion. Finally, it should be observed that in the evolution of placere > plaizir, the vowel preceding the affricate, just as in the evolution of intervocalic tj, became diphthongized in Gallo-Romance. In section 4.2, this evolution will be explicitly described.

The evolution of *gaudiam* > *joie* shows that the Second Velar Palatalization preceded the reduction of *au* to *o*, which took place before the eighth century (Pope, 1956:128; Bichakjian, 1977:202-203). The evolution of intervocalic *k* to *j*, instead of *ts*, in the context V-*a* shows that the Second Velar Palatalization took place after the voicing and spirantization of intervocalic stops. Compare the evolution of *placere* > [plats'ere] > [pladz'ere] > *plaizir* with *micam* > [miga] > [mi.a] > *mie*. Since intervocalic *k* and *g* did not change into affricates before *a*, voicing and spirantization can thus be dated before the Second Velar Palatalization. Furthermore, the voicing of both the the affricates produced by intervocalic *t* + yod sequences, as well as those originating from intervocalic *k* before *i* and *e* enables us to date affrication before voicing (Martinet, 1949:120-121). This discussion suggests the relative chronology of the velar palatalization, the velar affrication and the lenition rules in (11).

(11) Sound Change	placere	buccam	flagellum	micam
a) Spirantization	plakere		fla ellu	
b) First Velar Palatalization	plak'ere		flaɣ'ellu	
c) Velar Affrication	plats'ere			
d) Voicing	pladz'ere			miga
(+ Spirantization)	plaz'ere			miɣa
f) Second Velar Palatalization		bokk'a		
(+Velar Affrication		bottšɛ		
Gallo-Romance	plajzir	bottšɛ	flajellɛ	mijɛ

In this section the main facts of the evolution of consonant + yod sequences in Gallo-Romance have been presented. It should be recalled that the data presented in this section are taken to be representative of the Francien dialect only, as there exists some variation among the different Gallo-Romance dialects. Finally it is important to mention that various processes (such as syncope and apocope) changed the further development of the affricates resulting from consonant + yod sequences discussed here. In section 4.3, we will return to this matter when discussing the cases in which a yod appeared before a palatalized consonant. In the next section, we will discuss the general properties of palatalization and affrication before yod and, after that, return to the specific Gallo-Romance development of consonant + yod sequences.

4.2. *An Analysis of Palatalization and Affrication in Late Latin and Gallo-Romance*

4.2.1. *Affrication and Palatalization in Late Latin*

In this section, the general properties of palatalization and affrication of consonants before yod will be discussed. First of all, however, we will make explicit some underlying theoretical assumptions about the feature analysis and representation of segments.

The distinctive features that will be used in the present analysis are given in (12). They are based on Halle and Clements (1983), Clements (1976) and Clements (1985), and they represent the Late Latin consonants that are relevant to the present discussion.

(12)	p	t	k	b	d	g	f	v	s	z	m	n	r	l	j	w
sonorant	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+
consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−	−
continuant	−	−	−	−	−	−	+	+	+	+	−	−	+	−	+	+
voiced	−	−	−	+	+	+	−	+	−	+	+	+	+	+	+	+
nasal	−	−	−	−	−	−	−	−	−	−	+	+	−	−	−	−
strident	−	−	−	−	−	−	+	+	+	+	−	−	−	−	−	−
lateral	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
high															+	+
back															−	+
round															−	+
anterior	+		−	+		−	+	+			+					−
coronal	−	+	−	−	+	−	−	−	+	+	−	+	+	+	+	−

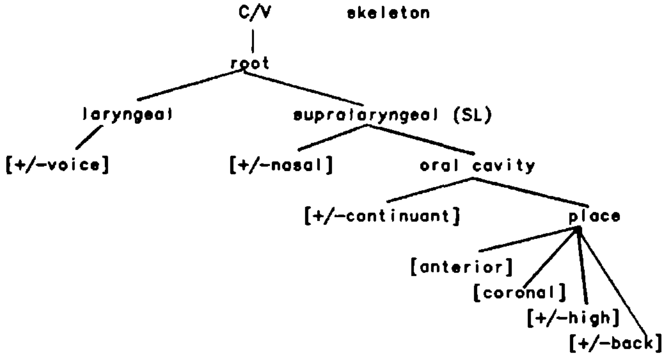
As shown in (12), *l* is assumed to be [-continuant], following Clements (1987). Furthermore, following Clements (1985), all segments but the glides are unspecified for the set of S-features, that is, the vocalic features, such as 'high', 'back' and 'round'. It should also be noticed that the palatal glide, following Clements (1976) and Clements (1985), is characterized not only as [+high] and [-back], but also as [+coronal] and [-anterior]. The reason why *j* must be considered [+coronal] will become clear as the discussion proceeds. Finally, it is assumed that the feature 'anterior' is left unspecified for segments that are [+coronal] and that coronals are provided with the appropriate values for the feature 'anterior' at the end of the derivation by the redundancy rules in (13).

(13) a) [ ] ⟶ [−anterior] / [__ , +coronal, +high, −back]

b) [ ] ⟶ [+anterior] / [__ , +coronal]

In this chapter, we will follow the model of feature-geometry proposed in Clements (1987), which is reproduced in (14).

(14)



Clements (1987) suggests that there may be further structure under the place node. We will first describe the evolution of consonant + yod sequences consistent with the model of feature geometry in (14) and at the end of this chapter return to the implications for the theory of feature geometry of the analysis presented.

Let us now discuss the general properties of palatalization and affrication of consonants before yod. The forms in (15), reproduced from (4) above, illustrate the evolution of those consonant + yod sequences which ultimately resulted in affricates.[9]

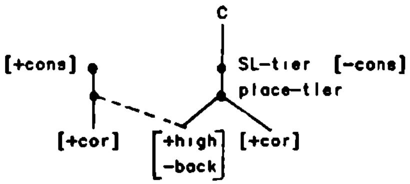
---

[9] In this chapter, it is assumed that the place-of-articulation features characterizing alveolar-dental affricates, such as [ts], are [+ant, +cor], and those defining palato-alveolar ones, like [tš], are [−ant, +cor].

(15)	Clas Lat	Late Latin	
V t j V	rationem	> *[rat'jonẹ] > *[rats'jonɛ]	'reason'
V t t j V	matteam	> *[matt'ja] > *[matts'ja]	'sledge-hammer'
V C t j V	fortiam	> *[fort'ja] > *[fɔrts'ja]	'force'
V k j V	faciam	> *[fak'ja] > *[fats'ja]	'face'
V k k j V	bisaccium	> *[bisakk'ja]> *[bisatts'ja]	'double bag'
V C k j V	arcionem	> *[ark'jonɛ] > *[arts'jonɛ]	'side bar'
V C d j V	hordeum	> *[ɔrd'ju] > *[ɔrdžju]	'barley'
V C g j V	Georgium	> *[g'jɔrg'ju]> *[džjɔrdžju]	'George'

As observed in section 4.1, all nonlabial consonants followed by *j* were palatalized. Since coronals were palatalized only if followed by yod, whereas velars were also palatalized if followed by a front vowel, we need two palatalization rules: a coronal palatalization and a velar palatalization rule. The coronal palatalization rule (C-PAL) can be described as the spreading of the features [+high] and [-back] from the palatal glide to a preceding coronal consonant, as in in (16).

(16) Coronal Palatalization (C-Pal)

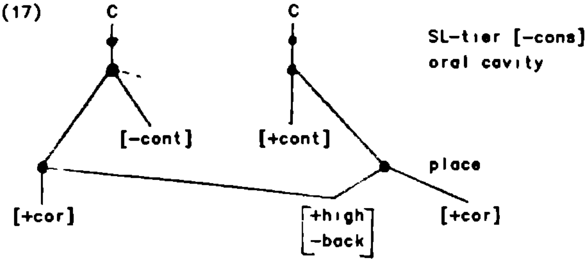


The application of C-PAL (16) to *tj* will result in a palatalized coronal stop The affrication process can be described as the spreading of the feature [+continuant] from the glide to the palatalized coronal and will result, in the case of *tj*, in a representation like (17), where a [-/+ continuant] contour is created on the palatalized *t*. This representation will receive the phonetic interpretation [ts'j].[10]

---

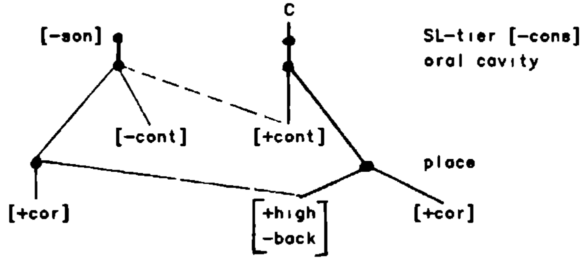
[10] The pronunciation [tsj] is attested in the 4th century by Papirius "Iustitia cum scribitur, tertia syllaba sic sonat quasi constet ex tribus litteris, t, z, i" (Pope, 1956 129) "When we write iustitia, we make the third syllable sound as if it consisted of the three letters t, z, i" [translation provided] Furthermore, it should be noticed that for expository purposes, we have not indicated the effects of Steriade's (1982) Shared Feature Convention, which would merge the two [+coronal] specifications in (17) and (18) below

(17)



Since coronal stops were affricated only before yod, whereas velars were affricated before yod as well as before front vowels, we must again posit two rules: a coronal and a velar affrication rule. The coronal affrication rule (C-AFFR) may be formalized as the spreading of the feature [+continuant] from the palatal glide to a preceding palatalized coronal stop as in (18).[11]

(18) Coronal Affrication (C-AFFR)



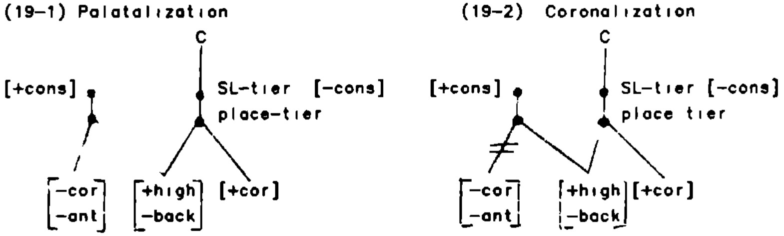
Let us now consider the palatalization and affrication of velars before yod. As mentioned above, velars were not only palatalized and affricated before yod, but also before front vowels In section 4.2.2 we will discuss the palatalization and affrication of velars in more detail. For the moment, we will limit ourselves to the palatalization and affrication of velars before yod. According to Bhat (1978), the effect of palatalization on velars is different from the effect of palatalization on dentals Palatalization of dentals essentially involves tongue-raising, whereas palatalization of velars involves tongue-fronting. With regard to the palatalization of velars, Bhat (1978.72) states: "the consonant may remain as prevelar if the change is slight, but may change into a palatal one (or even an apical-alveolar or

---

[11] If the creation of a [-/+continuant] contour on sonorants can be universally excluded, the specification [-son] may be omitted in the formulation of (18)

dental one) if the change is more marked." In Gallo-Romance (recall fn 3 and fn 8) velars became palatalized into palato-alveolar stops as a result of palatalization. This can be described, as in (19), by making not only the features [+high] and [-back] spread from the glide to the preceding velar as in (19-1), but by making also the feature [+coronal] spread from the palatal glide to the preceding velar as in (19-2).[12]

(19) Velar Palatalization before yod (V-PAL)



The ouput of the rules in (19) feeds directly into the affrication rule (18), but only in the case of velars followed by yod.[13] The spreading of the feature [+continuant] from the palatal glide onto the preceding palato-alveolar stop derived by (19) produces the palato-alveolar affricate [tš]. After the application of C-PAL (16) and C-AFFR (18) to post-consonantal[14] *dj*, and after the application of V-PAL (19) and C-AFFR (18) to post-consonantal *gj* sequences, the redundancy rule (13a) will produce the correct results, that is, in both cases the voiced palato-alveolar africate [dž] will be produced.

However, as shown by the data in (4), in Gallo-Romance *tj* and *kj* evolved into alveolar-dental affricates [ts].[15] If the redundancy rule (20) is added to the rules in (13), and assuming, as mentioned above, that the feature 'anterior' is left unspecified for coronal segments, the correct results will be produced

---

12 In (19), the palatalization of velars has been divided into two steps In (19-1), the velar is palatalized to a prevelar consonant and in (19-2), it is changed into a palato-alveolar stop These changes could also have been described as a single process in which the entire place node is spread from the palatal glide onto the preceding velar In section 4 2 2 we will return to this point

13 In order to account for the affrication of velars before front vowel another rule is needed, which will be discussed in section 4 2 2

14 It should be recalled from section 4 1 that in the intervocalic position, dj and gj had already been changed into [jj]

15 This did not happen in all dialects, cf fn 2

(20) [ ] → [+anterior] / ___
+coronal
+high
−back
−voice
[−cont] [+cont]

The reason why in Gallo-Romance affricates resulting from voiced stops followed by yod became [-ant], whereas those resulting from voiceless stops became [+ant], is not clear (cf. Foley (1977) for some discussion).[16]

The palatalization and affrication rules discussed above should be able to apply to single as well as to geminated nonlabial consonants, as can be observed in (4) and (15) above. Therefore, these processes have been formulated in (16), (18) and (19) in such a way that they are not sensitive to geminate blockage according to Hayes' Linking Constraint (henceforth LC), according to which association lines in a structural description must be interpreted as exhaustive (cf. Hayes, 1986). Let us briefly explain why the LC allows the rules (16), (18) and (19) to apply to single as well as to geminated segments. The difference between a long and a short segment is formally expressed by the association of the root-node to one or to two C-slots on the skeleton. Since in the structural description of the rules above no mention is made of the association between the root-node of the target segment and the number of C-slots on the skeleton, the rules can apply to single as well as geminated coronal stops: exhaustive interpretation of their structural description cannot differentiate between single or geminated segments. Had we explicitly mentioned the association of the root node of the target segment to a C-slot in the structural description of, for instance, rule (18) then that rule could not have applied to a geminated coronal stop: exhaustive interpretation in that case would forbid the application of the rule to a representation in which there is more than one association line between the root node and the C-slot on the skeleton

In this section the general properties of palatalization and affrication have been discussed. In the next section, the Gallo-Romance evolutions of consonants that palatalized and affricated before yod in Late Latin will be discussed in order to

---

[16] In the northern dialects both kj and tj shifted to [tš] (Pope, 1956 487) For these dialects, the rules in (13) alone would suffice to supply all affricates with the appropriate value for the feature 'anterior'

sustain the claim that affrication of consonants before yod must be considered a contour-creating operation.

4.2.2 *The Gallo-Romance evolution of affricated consonants*

This section describes the Gallo-Romance evolution of consonants that palatalized and affricated before yod in Late Latin. Some relevant examples from (4) are reproduced in (21).

(21)

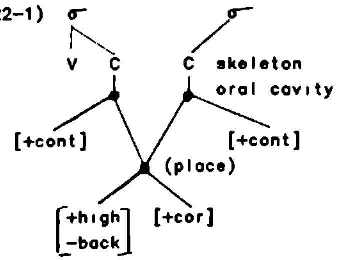
Clas Lat		Late Latin		Gal-Rom			
rationem	> *	[rats'jonɛ]	> *	[radz'jonɛ]	>	[rajzonɛ]	'reason'
matteam	> *	[matts'ja]	> *	[matts'a]	>	[matsɛ]	'sledge-hammer'
fortiam	> *	[fɔrts'ja]	> *	[fɔrts'a]	>	[fɔrtsɛ]	'strength'
faciam	> *	[fats'ja]	> *	[fatts'a]	>	[fatsɛ]	'face'
bisaccium	> *	[besatts'ja]	> *	[bɛsatts'a]	>	[b satsɛ]	'double bag'
arcionem	> *	[arts'jonɛ]	> *	[arts'onɛ]	>	[artsonɛ]	'sidebar'
hordeum	> *	[ɔrdžju]	> *	[ɔrdžu]	>	[ɔrdžɛ]	'barley'
Georgium	> *	[džjɔrdžju]	> *	[džɔrdžu]	>	[džɔrdžɛ]	'George'

In the intervocalic position, *tj* developed differently from *kj*. At some point, the glide moved to the left of the affricate, whereas in the case of *kj* a long affricate [tts] resulted. The switching around of the glide and the affricate which resulted from intervocalic *tj*, and which is traditionally referred to as "infiltration" or "anticipation" of yod, is assumed, following Pope (1956:129-130), to have occurred in Early Gallo-Romance after the voicing and spirantization of the affricate that resulted from intervocalic *t* before yod. Hence, the following stages are posited in the evolution of words like *rationem*, that is, words with intervocalic *tj*: *rationem* >*[ratsjone] >*[radzjone] >*[razjone] >*[rajzone] *raison* 'reason.' The rules in (22) are presented to account for the infiltration of yod.[17]
Let us clarify the rules in (22). In (22-1), the representation of intervocalic *tj* is presented after the application of C-PAL, C-AFFR, voicing and spirantization. In (22-2) the skeletal slot of the palatal glide is deleted, and the preceding palatalized [+continuant] segment is geminated. Subsequently, in (22-3), the

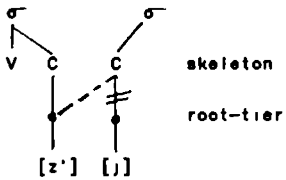
---

[17] This rule, as well as CA below, are inspired by Wetzels' account of the evolution of sonorant and s + yod clusters in Ancient Greek dialects. For a more detailed discussion of the Ancient Greek data and for an exact formulation of the rules involved there, see Wetzels, 1986. Again, for expository purposes, we have not indicated in (22) the effects of Steriade's (1982) Shared Feature Convention.

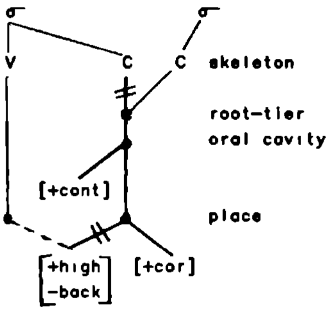
(22-1)



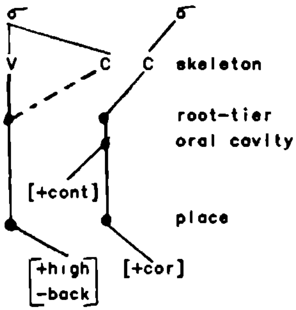
(22-2)



(22-3)



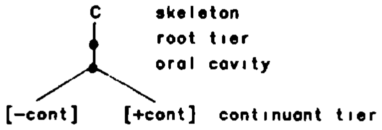
(22-4)



palatalized [+continuant] segment is degeminated and the secondary place features, that is, the features [+high,-back], are spread from the palatalized segment onto the preceding V-slot. Finally, in (22-4) a heavy diphthong is created.

The SCA process must be limited in its application: no transfer of yod takes place across a geminated affricate as in, for instance, *matteam* given in (21). Because, as will be shown in the following section, the infiltration of yod took place also after degemination of long palatalized *s*, as in *messionem* > *moisson*, we cannot attribute the blocking of the SCA process in the evolution of *matteam* > *masse* to the geminate nature of the affricate, because [tts] became degeminated to [ts] probably at the same time when [ss] changed to [s]. It is for this reason that the SCA process in (22) has been formulated so as to apply to [+continuant] coronal segments only. The LC will then block the application of (22) to degeminated [tts], as in *matteam* > *masse*. Let us briefly explain why the LC blocks the SCA's application to a degeminated affricate. In the structural description of the SCA process the association line between the feature [+continuant] and the oral cavity node must, in line with the LC, be interpreted as exhaustive. An affricate, as illustrated in (2) and (3) above and repeated here in (23), has a branching configuration for the feature 'continuant' at the oral cavity node.

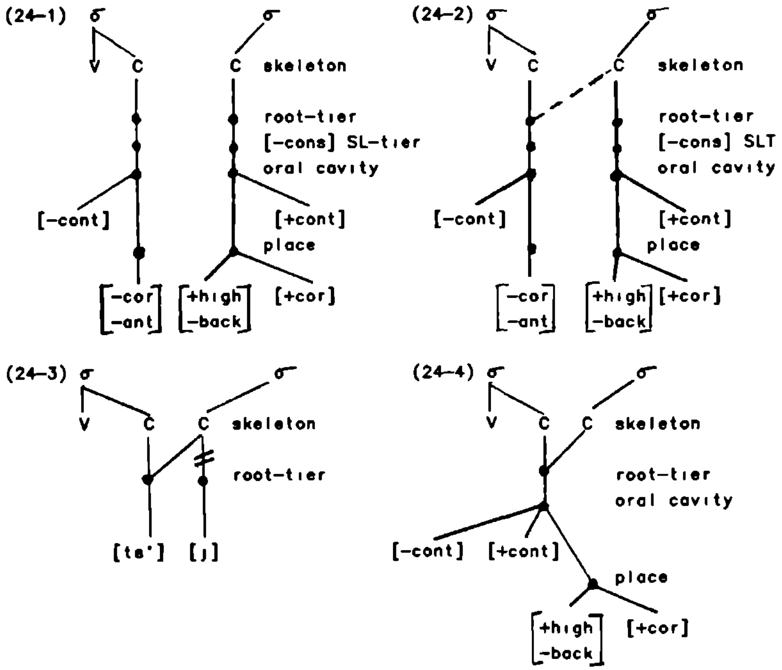
(23)



Since in the representation of an affricate there is --besides the association line between the oral cavity node and the feature [+continuant]-- an additional association line between the oral cavity node and the feature [-continuant], exhaustive interpretation of the structural description of the SCA process will block the application of the rule to an affricate In section 4.3, we will return to the SCA process and discuss the cases in which infiltration of yod occurred in more detail.

Let us now consider the Gallo-Romance evolution of intervocalic *kj* As mentioned above, intervocalic *kj* yields a long affricate, where no trace is left of the glide. The rules in (24) account for the evolution of this cluster.

Coda Attraction (CA)



In (24-1), the representation of intervocalic *kj* is given before the application of V-PAL and C-AFFR.[18] The velar spreads to the C-slot occupied by the glide and becomes geminated (24-2). Subsequently, after the application of V-PAL and C-AFFR resulting in the (informal) representation (24-3), the palatal glide is deleted from its C-slot. Since no free timing unit is available, the glide cannot be incorporated into the syllable and will receive no phonetic interpretation. The resulting representation (24-4) is to be interpreted as a long affricate. In its current formulation, CA (24) fails to apply to geminated velars according to the LC. Given the data in (21), this is, of course, precisely what we want. Finally, in order to prevent the application of CA to intervocalic *tj*, it will be assumed that CA became productive after the affrication of intervocalic *tj*. This assumption, as mentioned in section 4.1, is consistent with the chronology traditionally assumed (cf. Lausberg, 1967:55 and Pope, 1956:129) Now, if *t* in intervocalic *tj* sequences was an affricate at the time of CA becoming productive, the LC will prevent CA --limited to [-continuant] segments– from applying to an affricate [19]

The derivation given in (24) presents one important problem, which is related to its phonetic interpretation. In (24-4), the affricate is specified on the oral cavity tier for a branching configuration [-continuant, +continuant] and linked to two timing slots. The result then is a long segment with a branching configuration for continuancy as repeated in (25).

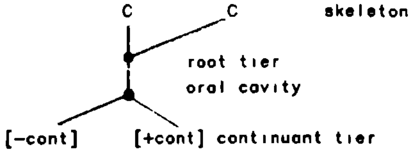
How should we interpret the representation in (25)? It is clear that the branching configuration itself, although linked to two timing points, should not be interpreted in such a way as to create something like [*tsts] Only one of the feature specifications for continuancy must be interpreted as long, and because the correct phonetic result must be [tts] rather than [*tss], it is only the

---

18 It should be recalled from section 4 2 1 that it is only in the case of velars followed by yod, that the output of V-PAL feeds into C-AFFR

19 Since we have explicitly mentioned the place-of-articulation features [-cor,-ant] of the consonant that is geminated in (24), CA would be blocked from applying to intervocalic tj sequences anyway However, as the discussion proceeds, it will become clear that CA not only applied to intervocalic kj sequences, but, in fact, to all non-continuant segments before yod sonorants (l and n) as well as obstruents

(25)



[-continuant] specification that must be interpreted as being associated with the two timing points, and not the entire branching configuration on the oral cavity-tier.

Before attempting to provide a uniform interpretation mechanism for representations like (25), let us first point out that the interpretation problem not only arises as a result of the affrication of geminates, as in (24), but also as a result of the gemination of affricates. Nespor and Vogel (1986) discuss an Italian affrication rule (AFFR), which, after the application of a rule deleting an unstressed vowel before another vowel if the two vowels are separated by a morpheme juncture (VD), changes *t(t)* to *t(t)s* before the suffix *-ione*. The derivations in (26), reproduced from Nespor and Vogel (1986:30), illustrate the affrication and vowel-deletion rules

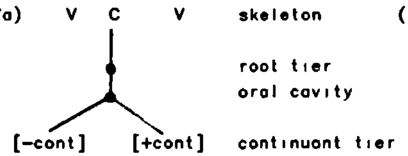
(26) Italian VD and AFFR before -ione

corre[tt]o - ione →VD corre[tt]ione →AFFR corre[tts]ione 'correction'
distin[t]o - ione →VD distin[t]ione →AFFR distin[ts]ione 'distinction'
danna[t]o - ione →VD danna[t]ione →AFFR danna[ts]ione 'damnation'

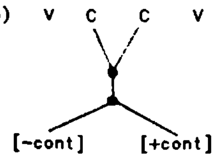
In the last form of (26) a subsequent rule lengthens the intervocalic affricate, yielding *danna[tts]ione* (Nespor and Vogel, 1986:60). The latter rule can be formalized as a change from a singly linked intervocalic affricate (27a) into a doubly linked one (27b).

Intervocalic Affricate Lengthening (IAL)

(27a)

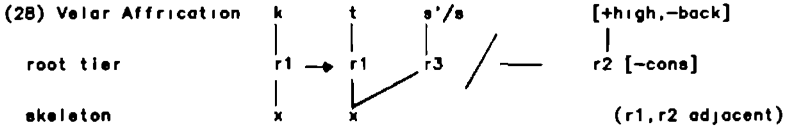


(27b)

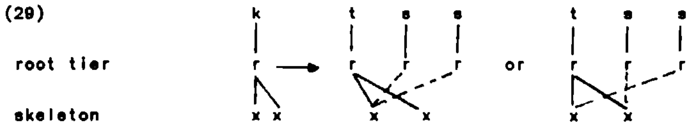


The representation (27b) is identical to the one in (25), and therefore the interpretation problem discussed in relation to (25) results both from the affrication of geminates as well as from the gemination of affricates.[20]

It should be noted that an alternative way of representing affricates, i.e. as consisting of two root nodes and one skeletal slot, does not solve the problem either, but creates a similar conundrum. Morin (forthcoming) discusses Schein and Steriade's (1986) Uniform Applicability Condition in the light of the Gallo-Romance palatalization facts and accounts for the affrication of velars in the history of French by rule (28).



The velar affrication rule (28) creates an additional root node for the fricative release of the affricate. However, as Morin observes, if rule (28) is applied to *kk*, it will yield the ill-formed representations in (29).



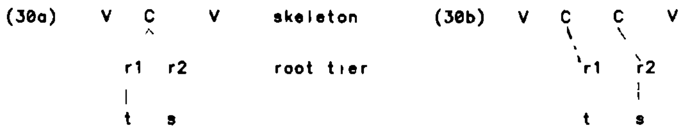
In order to rule out the representations in (29), Morin suggests the adoption of a general convention according to which "an affrication rule applies only to the **rightmost** constituent." This convention, however, seems to solve only part of the problem, because, in order to obtain the correct interpretation of the output of rule (27), one should propose an additional convention stipulating that a rule geminating affricates may apply only to the **leftmost** constituent. Hence, rule (27) above should be reformulated as (30).

One could get rid of the first convention (affrication rules only apply to the rightmost constituent) if the association between the additional root node of the fricative release and the skeleton is not mentioned in rule (28), as in (31a), and if it is assumed that by convention any epenthesis in the context of non-free timing units associates, respecting the no-crossing constraint, to that timing unit

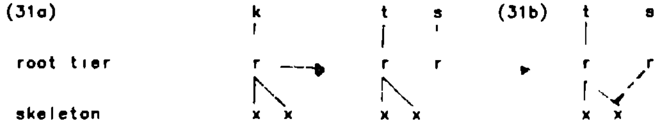
---

[20] A similar example of a rule geminating affricates can be found in Mainstream British English (cf Gussenhoven, 1986 129)

Intervocalic Affricate Lengthening (IAL)



which corresponds to its feature specifications, as in (31b).



However, we still need the second convention (affricate lengthening rules apply only to the leftmost constituent) to obtain the correct output for rules like IAL (30), and therefore an alternative way of representing affricates does not solve either the interpretation problem resulting from the affrication of geminates or the gemination of affricates.

One way of considering the problem would be to take into account the fact that Gallo-Romance only had post-vocalic geminates. This would exclude an interpretation of the representation in (25) as [*tss], but would allow for the correct [tts] interpretation. In this perspective, language-specific principles will then decide in what way (25) has to be interpreted at the phonetic level. However, we believe that this is not necessary, because as Campbell (1974.62) observes, rules that geminate affricates in most languages do not geminate entire affricates, but do geminate only their stop part. Let us therefore tentatively exclude the phonetic interpretation of a long affricate as [*tss] or [*tsts] by the interpretation convention given in (32).

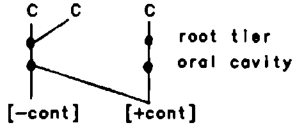
(32) *Long Affricate Interpretation*

If an affricate is associated to two timing slots, only its stop part, but not its fricative release, is interpreted as long

It is assumed, then, that representations like (25) yielded by processes such as CA (24) or IAL (27) constitute the correct **phonological** representation of a long affricate, whose correct **phonetic** interpretation is taken care of by convention (32). Given its application to both the output of rules like (24) and (27), convention (32) takes care of the correct phonetic interpretation of both **a gemination rule applying to affricates** as well as **an affrication rule applying to geminates,** because both rule types yield representations like (25).[21]

Let us now return to the forms in (21). Words such as *matteam* and *bisaccium*, with original long consonants, evolved into long affricates. The following glide was deleted in Gallo-Romance. Application of the rules C-PAL (16), V-PAL (19), and C-AFFR (18) to original geminates results in representations similar to (25), as illustrated in (33).

(33)



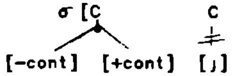
Convention (32) provides the correct phonetic interpretation of (33). Finally, a Glide-Deletion rule (34) is needed to account for the loss of the glide after a long affricate and after an affricate preceded by another consonant as in, for instance, *fortiam* > *[fortsja] > [fortsa] *force* 'strength.'

An important advantage of the analysis of the evolution of *kj* and *tj* as presented here is that it provides an explanation for the fact that affricates

---

[21] In Sagey (1986), a distinction is made between major and minor articulators A major articulator in a segment is an articulator to which the degree of closure features of the segment apply (1986 203) The [−cont, +cont] contour of an affricate, in her view, counts as a single distinctive degree of closure feature because it applies to a single articulator (1986 217) Convention (32) suggests that a distinction in terms of major and minor with respect to the degree of closure features of an affricate should be made If it is assumed that, although the [−cont, +cont] of an affricate applies to a single articulator, the [−cont] degree of closure feature is major in relation to the [+cont] degree of closure feature, convention (32) could be stated as follows If an affricate is linked to two timing slots, only its major degree of closure feature is interpreted as long Finally, it should be noted that (32) does not explain, but only describes how long affricates are to be interpreted It is important to mention that Catford (1977 202) reports that in east Caucasian languages the affrication of tensed and laxed velar stops yields a contrast of "a shorter versus a longer, and stronger, and unaspirated, fricative part, thus /č/ vs /čč/ = [tš] vs [tšš] " We might assume, in order to account for these facts, that the feature [−continuant] in relation to the [+continuant] feature of an affricate is major in the unmarked case and that in the marked case the reverse situation obtains Neither the question as to whether there is a principled explanation for (32), nor the question whether this convention represents a subcase of a more general interpretation convention to which all rules geminating contour segments are subject will be dealt with here, but have to be settled on the basis of further empirical and phonetic research

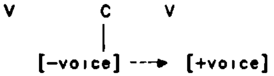
(34) Glide Deletion (GL-DEL)



which resulted from intervocalic *kj* were not voiced, whereas those resulting from intervocalic *tj* as well as those resulting from *k* before front vowels did voice in the intervocalic position. Moreover, the infiltration of yod in both the evolution of intervocalic *tj* and the evolution of intervocalic *k* before front vowels can be described as one and the same process: the SCA process (22). Furthermore, a straightforward explanation for the differential behavior of *k* with respect to affrication during the First and Second Velar Palatalization can be provided.

Let us demonstrate how these results are obtained in the present analysis. To begin with, let us formulate the intervocalic voicing rule, which did not affect geminates, in such a way that the LC prevents it from applying to geminates, as in (35).[22]

(35) Intervocalic Voicing (IV)



In the analysis proposed in this chapter, CA (24), as mentioned above, being limited to [-cont] segments, could not apply to intervocalic *tj*, because, following the traditional chronology, *t* is assumed to have been affricated before the time that CA became productive. It is for this reason that IV can apply to the affricate [ts'] that resulted from intervocalic *tj*, because, as a result of not having undergone CA, it remained linked to a single C-slot. Application of IV will change [ts'], resulting from intervocalic *tj*, into [dz'] as in [rats'jonem] > [radz'jonem] *raison* 'reason' (cf. (21) above). On the other hand, CA is applicable to intervocalic *kj* and, after palatalization and affrication, the result will be an

---

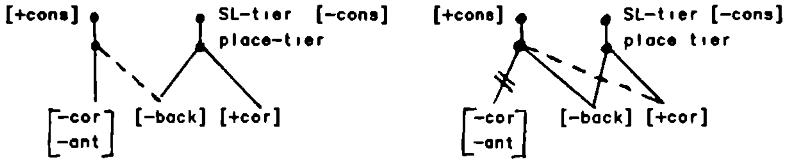
22 Rule (35), IV, requires a more complicated formulation, which is irrelevant for the present discussion A more detailed account of this rule will be provided in chapter five Suffice it to say that the term intervocalic, in the formulation of IV is used, following Martinet (1955 257), to cover all instances of single obstruents preceded by a vowel and followed either by a vowel, a liquid, a glide or a nasal

affricate which is linked to two C-slots. Consequently, IV, which implies geminate blockage, cannot apply to the affricate that resulted from intervocalic *kj*.

Similarly, a straightforward account for the differential gemination and voicing of *k* before yod and *k* before a front vowel can be provided. As noted above, velars palatalized and affricated before front vowels during the First and Second Velar Palatalizations. As expected, this can be described in a way very similar to the palatalization and affrication of velars before yod. The palatalization of velars before front vowels can be described by the rules in (36).

Velar Palatalization (V-PAL)

(36a) Palatalization (36b) Coronalization



In (36a), the feature [-back] is spread from a front vowel to a preceding velar. Subsequently, before turning into an affricate, the velar acquires through assimilation the place-of-articulation features of the front vowel and is changed into a palato-alveolar stop, as in (36b).[23]

The rules in (36) are similar to those in (19) However, contrary to the palatalization of velars before yod (recall fn. 12), we cannot describe the palatalization of velars before front vowels as a single process. If the entire place node were spread from a front vowel onto a preceding velar, then not only would the features [-back] and [+coronal], but also the features 'high' and 'low' be assimilated by the preceding velar. Hence, the palatalization of velars before front vowels must be described in two steps, as in (36). However, because we did not refer to the skeleton in (36), V-PAL (36) accounts for the palatalization of velars before front vowels as well as velars before yod. Furthermore, as shown in (10), V-PAL (36) should be able to apply to geminated as well as to

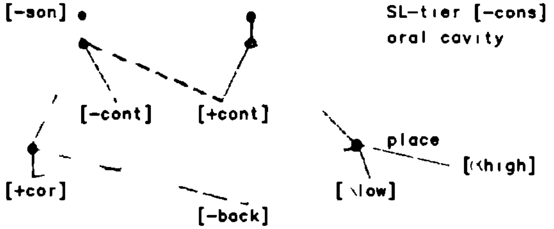
---

[23] It should be recalled from (12) that, following Clements (1976) and (1985), the palatal glide j is considered to be [+coronal] and [-anterior] Following Clements (1985 243), the front vowels, too, are considered to be [+coronal] and [-anterior]

single velar stops Hence, (36) has been formulated in such a way that it does not imply geminate blockage according to the LC

The affrication of velars before front vowels can be described by rule (37)

(37) Velar Affrication (V-AFFR)



In (37), the palato-alveolar stop resulting from V-PAL (36) is affricated as a result of the spreading of the feature [+continuant] from the following front vowel Since in (37) no reference is made, neither for the trigger nor the target, to the skeleton, V-AFFR (37) according to the LC applies to singly as well as to doubly linked palatalized velars, and accounts for the affrication of velars before front vowels as well as before yod Finally, it should be noted that during the First Velar Palatalization the affricates resulting from velars before front vowels became [+anterior] (cf Pope, 1956 128 and (10) above) In order to make rule (13a) and (20) applicable to the output of V-PAL and V AFFR, it will be assumed that the feature [+high] is assigned by the redundancy rule (38) to palato-alveolar affricates resulting from V PAL (36) and V-AFFR (37)[24]

(38) $[\ ] \rightarrow [+\text{high}]\ /\ \begin{bmatrix} \_\_ \\ +\text{coronal} \\ -\text{back} \end{bmatrix}$

Having described the palatalization and affrication of velars, let us now return to the explanation of the differential behavior of velars before front vowel and velars before yod with respect to the rules of CA (24) and IV (35)

Since intervocalic *k* before a front vowel, unlike *k* before yod in intervocalic *kj* sequences, did not become geminated, the result is a single non-geminated

---

[24] During the Second Velar Palatalization, the palato-alveolar affricates remained [-anterior] (cf Pope, 1956 128) This can be accounted for by the loss of the redundancy rule (20)

affricate. The gemination of velars before yod in intervocalic *kj* sequences and the non-gemination of intervocalic velar stops before front vowels is an expected result according to the theory on heterosyllabic consonant sequences presented by Murray and Vennemann (1983). According to these authors, intervocalic consonant+yod sequences constitute bad syllable contacts (i.e. a syllable contact of which the implosive consonant is less sonorous than the explosive consonant). Bad syllable contacts tend to be changed into acceptable ones by various processes such as gemination and metathesis. In section 4.4, we will address this issue in more detail. Suffice it to say here that gemination of intervocalic *k* in *kj* sequences as described by the CA process in (24) is an expected result, as it changes a bad syllable contact into an acceptable one. In the case of intervocalic *k* before front vowel, gemination is not expected to occur because here, of course, there is no bad syllable contact. Now, given that intervocalic *k* before front vowel did not become geminated by CA, it is predicted that IV should apply to the affricates that resulted from intervocalic *k* + front vowel, but that affricates resulting from *kk* before front vowel should not become voiced. Both facts are true (cf. *plakere* > [pladz'ere] *plaizir* (Old French) 'to please'), but *buccam* > [bottše] *bouche* 'mouth.'

Furthermore, affricates that resulted from intervocalic *k* before a front vowel, being linked to a single skeletal slot, became not only voiced, but also spirantized just like intervocalic *tj*. Therefore the SCA process --limited to [+continuant] segments-- may apply to the voiced and spirantized affricate that resulted from intervocalic *k* before front vowel, which, in fact, was what happened.

The idea that affrication should be regarded as a contour-creating process receives corroborating evidence from the evolution of velars before front vowels. As illustrated in (10) above, during the Second Velar Palatalization velars were palatalized and affricated not only before *i* and *e*, but also before *a*. During the **Second** Velar Palatalization, velars were palatalized and affricated only when preceded by another consonant or when word-initial (cf. section 4.1). The particular environment in which the Second Velar Palatalization took place can be understood not in terms of a syllable-based conditioning, but as delimited by the lenition rules, of which IV has already been described (cf. rule 35). Lenition also comprised a spirantization process, which did not affect geminates either, and which, therefore, will be formulated as in (39) in such a way that it does imply geminate blockage according to the LC.[25]

(39) Intervocalic Spirantization (I-SPI)

$$V \quad \begin{bmatrix} C \\ +voice \\ -son \end{bmatrix} \quad V \rightarrow [+cont]$$

As already mentioned in section 4.1.1, when the **Second** Velar Palatalization became operative, intervocalic *k* had already been affected by IV and I-SPI. It was therefore impossible to create a [+/-continuant] contour on intervocalic velars, which had been made [+cont] by I-SPI. On the other hand, during the **First** Velar Palatalization *k* was still a stop and, consequently, V-AFFR was free to apply. This interaction between lenition and affrication is left completely unexplained if one describes V-AFFR not in terms of a contour-creating process, but in terms of a linear rule like (40).

(40) Affrication

$$\begin{bmatrix} C \\ -cont \\ +cor \end{bmatrix} \rightarrow \begin{bmatrix} +high \\ +strident \end{bmatrix} \; / \; \_\_ \begin{bmatrix} -cons \\ -voc \\ -back \end{bmatrix}$$

Rule (40) is part of a linear account of the affrication of velars proposed by Canavati (1970). Canavati argues that, because (40) contains the feature [-cont] in its structural description, affrication failed to apply to [+cont] segments, and in this way she accounts for the interaction between lenition and affrication (Canavati, 1970:23). There is, however, no obvious reason why the feature [-cont] should be included in the structural description of (40). On the other hand, if the affrication of velars before front vowels is described as a contour-creating process (formalized as in (37)), the interaction between lenition and affrication can be straightforwardly accounted for

Let us now, finally, discuss the evolution of labial + yod clusters. As illustrated in section 4.1.1, table (8), these clusters always result in affricates, regardless of their position in the word. It is important to see that these affricates cannot be accounted for by a contour-creating process, because in, for

---

[25] With respect to the term <u>intervocalic</u>, the same holds as for the IV-rule (Recall fn 22)

instance, *caveam* the intervocalic *vj* ([βj] (cf. Pope, 1956.129) sequence consists of two continuant segments both [β] and [j] are [+continuant][26] To account for the affricates that arose from labial + yod sequences, we will follow Canavati (1970:37) by assuming a glide-strengthening rule which changes a palatal glide into [dž] as in, for instance, *caveam* [kaβja] > *[kaβdza] > [kadž] > *cage* 'cage.' The glide-strengthening rule must be ordered after the palatalization rules in order not to affect the palatal glides preceded by other consonants than labials. As a matter of fact, glide-strengthening was a relatively late process occurring at the time when word-initial *w* was strengthened into *gw* (cf. Pope, 1956:96-97). Furthermore, any formalization of Glide-strengthening must mention the features [+high,-back] and the LC will block its application to a palatal glide which, as a result of palatalization, shares the features [+high,-back] with a preceding non-labial consonant.[27]

Finally, if spirantization, as Lausberg states (recall fn. 26), did apply in the evolution of intervocalic *bj*, then voicing must also have applied to intervocalic *pj* yielding incorrectly, for instance, *sapiam* > [sapja] > *[sabja] > *[sabdža] > *[sadž] **sage* instead of *sapiam* > *[saptša] > [sats] > *sache* 'to know (subj.).' Therefore, it must either be assumed that gemination not only occurred in the case of intervocalic *kj*, but also in the evolution of intervocalic *pj* or that glide-strengthening occurred before IV. As mentioned above, glide-strengthening was a relatively late process, and therefore we will follow Lausberg (1967:61) in assuming that gemination also affected intervocalic *pj* The latter assumption is, of course, exactly what one would expect given Murray and Vennemann's (1983) theory according to which [-continuant]-[+continuant] sequences constitute bad syllable contacts.[28] If, in the formulation of CA (24), the place-of-articulation features [-cor, -ant] are omitted (recall fn. 19), then CA can without further modification apply to intervocalic *pj*.

In this section, we have described the evolution of consonant + yod sequences in Gallo-Romance. The proposed analysis provided a straightforward account of the

---

[26] Contrary to Pope (1956 129) who keeps apart intervocalic bj and vj, Lausberg (1967 62) states that in the intervocalic position bj as a result of spirantization merged with intervocalic vj into [βj]

[27] It should be observed that glide-strengthening not only accounts for the evolution of labial + yod sequences, but also for the later development of sonorant + yod sequences, discussed in section 4 1

[28] In the next section it will be shown that gemination, in fact, affected all non-continuant segments followed by yod

behavior of the affricates resulting from intervocalic *tj* and *kj* as well as those that resulted from velars before front vowels with respect to the rules of lenition. Furthermore, the relation between spirantization and affrication was shown to lend independent support to the idea of affrication being a contour-creating process. In the next section the evolution of sonorant and *s* + yod sequences will be discussed and it will be demonstrated that the rules, proposed in this section to describe the evolution of consonant + yod sequences that yielded affricates (i.e. The SCA and CA process), can be straightforwardly extended to account for the evolution of sonorant and *s* + yod sequences.

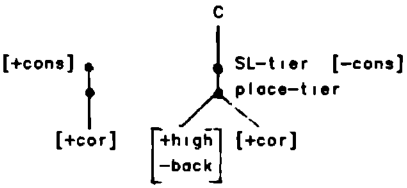
4.3. *The Gallo-Romance evolution of sonorants and s before yod*

This section describes the Gallo-Romance evolution of those consonant + yod sequences which did not yield affricates, that is, the clusters containing a sonorant or *s* followed by yod. Some relevant examples from (7) are reproduced in (41).

(41)	Clas Lat		Gal-Rom		
V n j V	lineam	> * [lin'ja]	> [liññɛ]	ligne	'line'
V n n j V	pinnionem	> * [pinn'jonɛ]	> [piññonɛ]	pignon	'gable'
V l j V	paleam	> * [pal'ja]	> [paλλɛ]	paille	'straw'
V l l j V	bulliat	> * [bull'jat]	> [buλλɛ]	bouille	'it boil'
V r j V	aream	> * [ar'ja]	> [ajrɛ]	aire	'surface'
V s j V	basiare	> * [baz'jarɛ]	> [bajzier]	baiser	'to kiss'
V s s j V	messionem	> * [mɛss'jonɛ]	> [mɛs'onɛ]	moisson	'harvest'

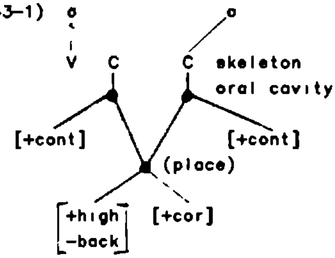
The coronal palatalization rule (16), repeated here as (42), accounts for the palatalization of the consonant + yod sequences in (41).

(42) Coronal Palatalization (C-Pal)

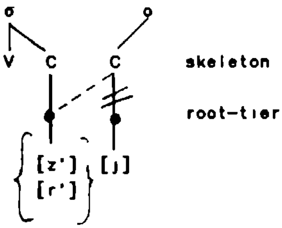


A closer look at the Gallo-Romance developments of the clusters in (41) reveals not only that *rj* and *sj* evolved in a way similar to intervocalic *tj* --the glide appears at the left of the consonant--, but also that *lj* and *nj* evolved in a manner akin to intervocalic *kj*: the sonorants evolved into **long** palatalized sonorants, whereas the velar yielded a **long** alveolar-dental affricate. Since both *r* and *s* are [+continuant] (cf. (12)), the SCA process may apply to the intervocalic *rj* and *sj* clusters. In fact, after the application of C-PAL to intervocalic *rj* and *sj*, the application of the SCA process will produce the correct results, as illustrated in (43).

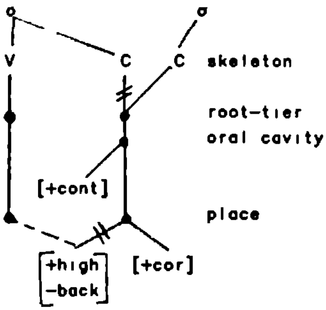
(43-1)



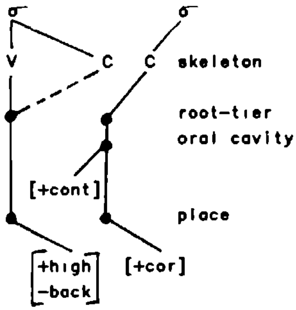
(43-2)



(43-3)

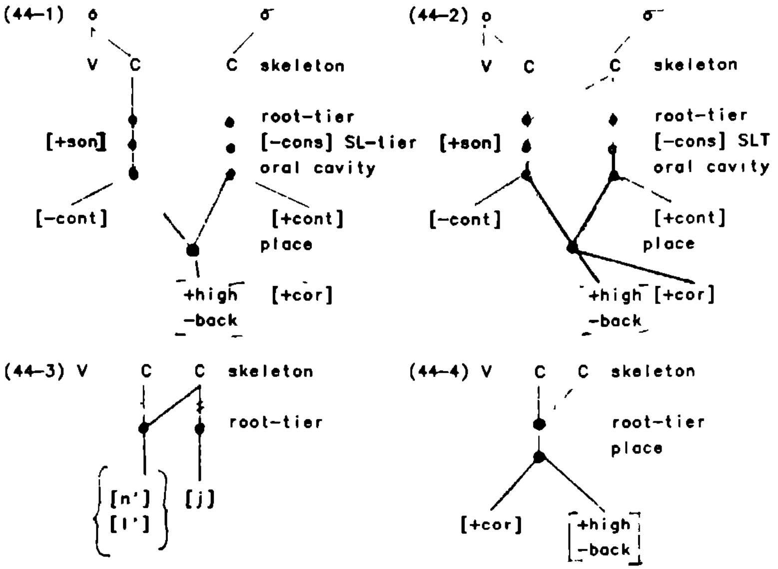


(43-4)



In (43-1), the representation of intervocalic *sj* and *rj* is given after the application of C-PAL. In (42-2) the skeletal slot of the palatal glide is deleted, and the preceding palatalized [+continuant] segment is geminated. Subsequently, in (43-3), the palatalized [+continuant] segment is degeminated, and the secondary place features, that is, the features [+high,-back], are spread from the palatalized segment onto the preceding V-slot. Finally, in (43-4) a heavy diphthong is created. It should be observed that, after spreading of the palatal features onto the preceding vowel, the resulting coronal segment becomes [+anterior] by rule (13b).

Since both *l* and *n* in intervocalic *nj* and *lj* sequences are [-continuant] (cf. (12)), the SCA process cannot apply to them. Instead, the CA process --which is limited to non-continuant segments— applies to intervocalic *nj* and *lj* sequences and yields the the desired output, as shown in (44).



In (44-1), the representation of intervocalic *lj* and *nj* is given after the application of C-PAL. The non-continuant palatalized *n* and *l* are spread to the C-slot occupied by the glide and become geminated (44-2). Subsequently, the palatal glide is deleted in (44-3) from its C-slot. Since no free timing unit is available, the glide cannot be incorporated into the syllable and will not be phonetically realized. The resulting representation (44-4) is to be interpreted as a long palatalized segment. It should be observed that, since the articulation in the case of *nj* and *lj* clusters remains complex, rule (13a) correctly assigns the feature [-anterior] to the long palatalized segments resulting from (44).

It is clear then that the SCA and CA processes, which were proposed to account for the evolution of intervocalic non-labial consonant + yod sequences that yielded affricates, can also account for the evolution of intervocalic non-labial consonant + yod sequences that did not yield affricates: the sonorant and *s* + yod sequences of (41) above.

As explained in section 4.2.1, the coronal palatalization rule (C-PAL) did also apply to geminates and is therefore formulated (cf. (16)/(42)) so as not to imply geminate blockage, according to the LC. Hence, in the case of long *s* followed by yod, as in *messionem*, IV (35) is expected not to apply and indeed fails to apply to this sequence. On the other hand, --and (41) shows that this is correct-- IV is expected to apply to intervocalic *sj* because single palatalized *s*, which did not undergo CA, but SCA, remained linked to a single skeletal slot.[29] The evolution of original long sonorants and long *s* + yod clusters in which yod is deleted after palatalization can be accounted for quite easily by reformulating GL-DEL, as in (45), in such a way that it deletes yod after any syllable-initial palatalized segment (sonorant as well as obstruent). The deletion of the palatal glide might be interpreted as a Gallo-Romance intolerance of tauto-syllabic palatalized consonant + yod sequences. In section 4.4 1, we will come back to this matter.

(45) Gl-DEL revised

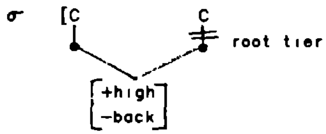


Table (46) summarizes the changes discussed so far.

According to the evolutions summarized in table (46) intervocalic *tj* always yielded Gallo-Romance [jz], that is, following Straka (1965:141), the evolutions of intervocalic *tj* and *kj* are assumed to have always been separate in the evolution of French. This has been expressed by ordering --following the chronology traditonally assumed-- C-PAL and C-AFFR before CA, and by formalizing CA as being limited to non-continuant segments. However, Morin (personal communication) has pointed out some exceptions to this point of view. In the suffix *-itǐa* the intervocalic *tj* sequence always developed into Old French [s] without palatal diphthongization or infiltration of yod as in, for example, *pigritǐam* > *parece* 'laziness.' Furthermore, *platěam* 'street' and *gratǐam* 'favor, grace' have evolved into Old French *place* and *grace* respectively, again with [s] and without infiltration of yod. Most traditional scholars explain the different

---

29 Classical Latin **mansionem** evolved into Gallo-Romance [maizon] **maison** 'house ' It seems, therefore, that **sj** after n evolved like intervocalic **sj**, because both SCA and IV must have applied to **mansionem** in order to yield Gallo-Romance [maizon] However, because n before **s**, already in Classical Latin, was deleted, the evolution of **mansionem** only indicates that n which preceded **sj** was merely orthographic (cf Pope, 1956 73)

(46) Clas Lat	Late Latin	Gallo-Romance	
century	3th	4th	5th
V t j rationem	[rat'jonɛ] >ts'j C-PAL C-AFFR	dz'j > z'j > jz IV I-SPI SCA	[rajzonɛ]
V k j faciam		kj > kkj > ccj > tts CA V-PAL V-AFFR	[fattsɛ]
V r j aream	[ar'ja] C-PAL	r'j > jr SCA	[ajrɛ]
V s j basiare	[bas'jarɛ] C-PAL	z'j > z'j > jz IV SCA	[bajzarɛ]
V n j lineam	[lin'ja] C-PAL	n'j > ññ CA	[liññ]
V l j paleam	[pal'ja] C-PAL	l'j > λλ CA	[paλλɛ]
V k i/e placere		ki/e> ci/e > ts'i/e V-PAL V-AFFR dz'i/e > z'i/e > jzi/e IV I-SPI SCA	[plajzir]

result of intervocalic *tj* in the suffix *-itǐa* by assuming that the *t* of this suffix was lengthened under the influence of the suffix *-icǐa*, and, hence evolved like long *t* before yod (cf. Pope, 1956.131 and Bourciez, 1974:155). The evolutions of ***platěam*** and ***gratǐam*** to ***place*** and ***grace*** are traditionally explained by assuming that ***place*** derives from *[plattea] and that ***grace*** represents a later loanword (cf. Bourciez, 1974:155 and Fouche, 1961:912). Morin (personal communication) suggests that these data might indicate that gemination (CA) was an optional process for intervocalic *tj*. This assumption would make it unnecessary to assume the strict chronological order C-AFFR - CA, as has been done here. If Morin's opinion is justified, the only revision that would be required is that CA should be considered to have taken place very soon after C-AFFR at a time when C-AFFR had not yet, as a result of lexical diffusion, affected all lexical items containing intervocalic *tj*. The *t* of intervocalic *tj* in forms which had not yet been affricated will be subject to CA --of which only the application to affricated *t* is blocked by the LC-- and will develop in the same way as long *ttj* sequences.

Let us next discuss in some more detail the cases in which a yod appeared at the left of a palatalized segment. The SCA process, proposed in section 4.2, has been shown to handle the palatal diphthongizaton that occurred in the evolutions of intervocalic *tj*, *rj*, *sj* and *k* before front vowel. For ease of exposition, we will briefly recapitulate the essential properties of the SCA process. As observed in section 4.2, palatal diphthongization also took place in the evolution of long *s* followed by yod as in, for instance, *messionem* > *moisson*. Because the SCA process is limited to apply to singly linked [+continuant] palatalized segments before yod, it was assumed that in the case of long *s* palatal diphthongization occurred only after degemination of long palatalized *s*. At the time when long palatalized *s* became degeminated, the long affricates resulting from original *ttj* (*matteam*), *kj* (*faciam*) and *kkj* (*bisaccium*) became degeminated also. However, as explained in section 4.2, the SCA process cannot, by virtue of the LC, apply to an affricated consonant whether singly or doubly linked. Furthermore, the SCA process is unable to apply to the degeminated palatalized sonorants *l* and *n* resulting from original *lj* (*paleam*), *llj* (*bulliat*), *nj* (*lineam*) and *nnj* (*pinnionem*) because these sonorants are [-continuant], whereas the SCA process is restricted to [+continuant] segments.

Before briefly discussing a number of cases where vowels were diphthongized under the influence of palatalized consonants, but which cannot be accounted for by the SCA process, let us first consider the way in which Straka (1954,1965) accounts for the infiltration of yod in the cases discussed so far. According to Straka (1965:144-146) the yod which appeared before the palatalized consonant in the evolution of intervocalic *tj*, *rj*, *sj* and *k* before a front vowel is not the result of a metathesis of the consonant and yod, but a transition sound between the vowel and the following palatalized segment. Straka (1965:145) states that the tongue when passing from the articulation of a vowel to the articulation of a following palatal(ized) consonant goes through a number of intermediate positions among which the position of yod. Now, if the tongue movement is sufficiently fast, the transition yod will not be perceptible. However, if the tongue movement is slown down, it will be Why, then, does the tongue movement slow down in some cases, but not in others? According to Straka, palatal(ized) consonants require an extra amount of articulatory energy ("un effort musculaire spécial"), and because *l*, *n* and *k* are less difficult to palatalize before yod than *r*, *s* and *t*, the tongue movement will slow down only when passing from the articulation of a vowel to the articulation of a palatalized *r*, *s* and *t*, but not when passing to a palatalized *l*, *n* or *k* It is for this reason that the transition sound only became perceptible in the former but not in the latter group of consonant + yod sequences. The differential behavior of intervocalic *kj* and *k* plus front vowel sequences with respect to the infiltration of yod is given the following explanation. Straka (1965:146) assumes that palatalized *k* in the case of intervocalic *k* before front vowel was pronounced more anterior than palatalized *k* in *kj* sequences and, therefore, just as in the case of intervocalic palatalized *t* before yod, a transition sound appeared before intervocalic *k* followed by a front vowel, but not before *k* followed by yod Although we do not deny that the palatal diphthongization in the cases discussed so far might be interpreted as a transition sound --in fact, this is precisely what the SCA process does: serializing a complex arrticulation by spreading the secondary, palatal place features from a complex segment onto a preceding vowel-- we do not believe that a description of the process in terms of articulatory energy can be justified. First, since the affricate resulting from *k* before front vowel and *k* before yod in both cases has the same place of articulation features, it is not clear why palatalization of *k* should be different in *k* + front vowel and *k* + yod sequences. Second, and more importantly, Straka's view that *l*, *n* and *k* are less difficult to palatalize than *r*, *s* and *t* before yod is contradicted by Bhat's (1978) universal typology of palatalization Bhat (1978.52) states that "a following front vowel is the strongest environment that induces fronting (and hence palatalization) of a velar consonant, whereas a following yod (palatal semivowel) is an even stronger environment for raising (and hence palatalization) of an apical consonant." One of the languages supporting the statement above is Modern English (cf. Bhat, 1978:52), in which *t*, *d*, *s* and *z*, but not the velars, are palatalized before yod. It is clear then that, if Straka were right in claiming that the infiltration of yod had something to do with the relative ease with which certain consonants palatalize before yod, one would, given Bhat's typology, expect a transition sound to occur before intervocalic *kj*, but not before the other consonants followed by yod, nor before intervocalic *k* followed by a front vowel. Finally, there are a number of cases in which a vowel was diphthongized under the influence of a following palatalized consonant which cannot be accounted for by the SCA process, but which have to be described by making reference to the syllable. Let us consider the data in (47) which are based on Morin (1979) and Straka (1954).

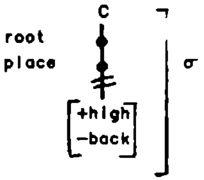
(47)

	Clas Lat		Old French			Clas Lat		Old French	
(a)	vocem	>	voiz	'voice'	(b)	*antĭus	>	ainz	'before'
	nucem	>	noiz	'nut'		infentĭam	>	enfance	'childhood'
	palatĭum	>	palais	'palace'		dignitatem	>	deintie	'dignity'
	cunĕum	>	coin	'corner'		carcĕrem	>	chartre	'prison'
						mulgĕre	>	moudre	'to milk'
						vincĕre	>	veintre	'to conquer'
						plangĕre	>	plaindre	'to pity'

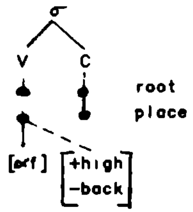
	Clas Lat		Old French			Clas Lat		Old French	
(c)	nascĕre	>	naistre	'to be born'	(d)	ostrĕam	>	oistre	'oyster'
	angustĭam	>	angoisse	'fear'		ebrĭum	>	ivre	'drunk'
	piscĭonem	>	poisson	'fish'					

The forms in (47a) show that a palatalized affricate, a palatalized *n* and a palatalized *s*, when they came to be in word-final position as a result of apocope, were depalatalized and the vowel that preceded them was diphthongized To account for these changes we postulate the rules in (48).

(48a) σ-final depalatalization

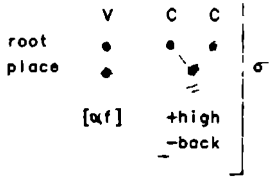


(48b) V-diphthongization



As for the data in (47b), we assume, following Morin (1979), that syllable-final *n* was palatalized by assimilation to a following palatalized consonant. As a result of this, the palatal features [+high] and [-back] are shared by both the nasal and the following consonant. Now, if such a cluster came to be in syllable-final position —which happened in the last two forms of (47b) as a result of syncope and in the first form of (47b) as a result of apocope-- there was again depalatalization of the consonant and diphthongization of the vowel preceding the cluster. Since rule (48a) according to the LC may not apply to delete palatal features that are doubly linked, we propose rule (49) to account for depalatalization and diphthongization in these cases.

(49)



In the second form of (47b), the cluster did not become syllable final (apocope did not apply to word-final *a*). Because rule (49) cannot apply to a hetero-syllabic palatalized nasal+ consonant cluster, as we explicitly mentioned the position of the cluster with reference to the syllable, there is no diphthongization of the vowel and no depalatalization. In words such as *carcerem* and *mulgere*, the palatalized and affricated velar became, after syncope, deplatalized by (48a), but the vowel preceding the liquid in these cases was not diphthongized because neither (48b) nor (49) can apply to diphthongize the vowels in these cases. To account for the data in (47c), we will follow Fouche (1961:913) in assuming that after affrication of the *t* and *k* followed by yod the group *[sts'] was changed into [ss'] (that is, a long palatalized *s*). The further evolution of these data then, is identical to the evolution of long palatalized *s* as in *messionem* > *moisson* discussed above. Finally, in the forms in (47d), the consonantalization of the unstressed non-low vowels in hiatus (cf. section 4.1) would give rise to tri-consonantal word-internal onset clusters, which, in the history of French, were never permitted. The transfer of the yod into the preceding syllable can be interpreted as an alternative way of resolving the vowel hiatus, which normally was resolved by the consonantalization of the unstressed non-low vowel.

In this section, the Gallo-Romance developments of sonorant and *s* + yod clusters have been discussed. It was demonstrated that the SCA and CA rules of section 4.2 are also needed to describe the evolution of these sequences, and thus provides independent motivation for the appropriate formulation of these rules.

4.4.1. *Syllable Structure*

Because affrication and palatalization took place even if a consonant + yod cluster was preceded by another consonant (i.e. if the cluster was in syllable-initial position), it would appear that these processes were independent of, and not conditioned by, syllable structure.[30] However, the **further** modification of C + yod clusters clearly was conditioned by syllable structure. Let us assume that word-internal C + yod sequences were heterosyllablic in intervocalic position. The deletion of the palatal glide that followed a syllable-initial palatalized segment by Gl-DEL might then be interpreted as a Gallo-Romance intolerance of tautosyllabic consonant + yod sequences. Furthermore, SCA applied exclusively to intervocalic [+cont] + yod clusters. Likewise CA applied to intervocalic [-cont] + yod clusters only. Clearly, both SCA and CA were conditioned by syllable structure. One might suggest that their existence is related to heterosyllabic consonant + yod sequences constituting bad syllable contacts in the sense of Murray and Venneman (1983). Bad syllable contacts, that is, heterosyllabic clusters of which the onset consonants are more sonorous than the coda ones, tend to be changed into acceptable ones by phonological processes such as gemination or metathesis. Gemination, as in for instance *bid.ian* > *bid.dian*, in West Germanic, is in their view a phonological process that finds its explanation in the repairing of a bad syllable contact.

The gemination of the consonant in an intervocalic noncontinuant consonant + yod sequence, as described by the CA process, and the change of an intervocalic sequence palatalized continuant consonant + yod into a diphthongized vowel followed by a continuant consonant, as described by the SCA process, may have to find, in my opinion, their ultimate explanation in the perspective of good and bad syllable contacts: both SCA and CA seem to be ways of repairing bad syllable contacts in a similar way as gemination in West-Germanic.

4.4.2 *Affrication as a contour-creating process*

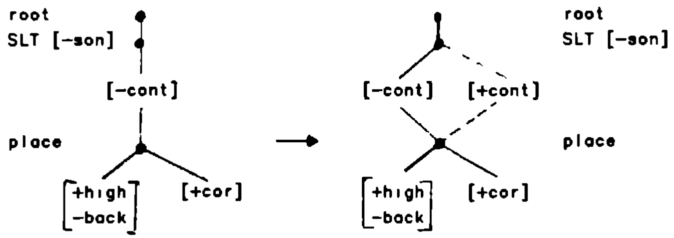
In this chapter it was argued that affrication must be regarded as a contour-creating process. The analysis proposed for the Gallo-Romance evolution of

---

[30] This is also clearly suggested by the formulation of the affrication and palatalization rules. They have been formulated in such a way as to apply to geminates according to the LC. Similarly, the geminate-blocking formulation of both SCA and CA reflect their syllable-conditioned nature

C + yod and velar + front vowel sequences in Gallo-Romance was crucially based upon this view. As such, it allowed an elegant description of the effects of the intervocalic voicing rule (IV) on affricates arising from *k* before front vowels, from *k* before yod, and on those that arose from *t* before yod. Moreover, it followed as a natural consequence of the proposed account that velars that were spriranticized were no longer susceptible to affrication, which had to be stipulated by all previous analyses. The interaction between the lenition rules and the affrication rule has been shown to plead in favor of the conception of affrication as a contour-creating process rather than as a feature-changing process. In this chapter we have formalized this contour-creating process (cf. the rules (18) and (37)) as the spreading of the feature [+continuant] to a preceding [-continuant] palatalized segment. However, Wetzels (forthcoming) proposes a feature geometry which in the case of velars before front vowels excludes the formalization of the creation of a contour by means of a feature-spreading rule. The geometry proposed by Wetzels differs from that in (14) in that the feature 'continuant' directly dominates the place node. This means that the spreading of the feature 'continuant' will always automatically entail the spreading of the place node it dominates, but not vice versa. We will not recapitulate here the arguments Wetzels adduces in favor of this geometry, but refer the reader to Wetzels' study. The affrication of coronals and velars before yod can, in the feature geometry of Wetzels, also be described as the spreading of the feature [+continuant] from the palatal glide to a preceding [-continuant] stop, because the place nodes of the yod and the coronal or velar are already identical as a result of the palatalization rules. In the case of velars before front vowels, as discussed in section 4.2, the place node of the vowel must not be entirely spread to the velar. The velar affrication rule (37) which consists of the spreading of the feature [+continuant] to a preceding velar would in Wetzels' geometry in the case of velars before front vowels exactly have this effect and it is for this reasom that the affrication of velars before front vowels cannot be described as a contour-creating spreading process, but must be described as the insertion of the feature [+continuant] on a palatalized velar. However, instead of describing the affrication of consonants before yod by spreading and the affrication of consonants before vowels by insertion, we might also propose the uniform formalization of affrication in (50).

(50) Affrication as a contour-creating insertion process



Affrication in (50) is conceived of as the insertion of the feature [+continuant] on a palatalized stop, the latter resulting either from C-PAL (16) or V-PAL (36). The insertion of the feature [+continuant] on a palatalized stop might be considered a sort of demarking rule.[31] This interpretation of affrication comes close to the original SPE-approach, but differs crucially from it in the sense that affrication is not considered as a feature-changing (that is, [-delayed release] changes to [+delayed release]) but as a contour-creating feature-insertion process. A similar view on affrication (viz. demarking) is proposed in Sagey (1986). In the last section of this chapter we will briefly discuss her view as well as the implications for the theory of feature geometry of our analyis of Gallo-Romance palatalization.

4.4.3. *Palatalization and the theory of feature geometry*

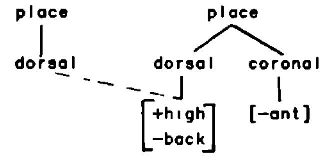
In Sagey's (1986) model of feature representation the palatal glide is specified for a dorsal articulator node only. She predicts that coronals, if they become palatalized, will result in complex segments, because palatalization of a coronal implies, in her analysis, the creation of a supplementary articulator node, i.e. a dorsal node, on the coronal segment (Sagey, 1986:108-110). In languages that do not allow for such complex segments, these segments are made simple again. In Zoque, for instance, the coronal and dorsal combination, resulting through palatalization of coronals, is resolved by the fusion of the two articulators

---

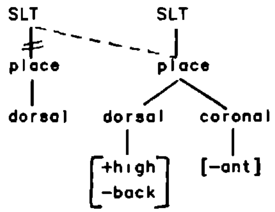
31 In this respect it is interesting to mention the following observation made by Schane (1973 115), which lends some support to the idea that affrication is a demarking process "it is inherently more marked, that is, much more muscular control is needed, to effect complete closure in the palato-alveolar region than in those regions where stops are commonly made "

involved into one [-anterior] coronal articulator node. In Pame, the complex combination is resolved by the deletion of the coronal node. Another way of resolving a combination of coronal and dorsal nodes produced by the palatalization of coronal stops, is given the following account: in languages that lack [-ant] coronal stops, the [-ant] stop derived by palatalization is affricated by redundancy rules (1986:110). Gallo-Romance affrication, however, cannot be treated in this way, because we would be at a loss to explain the affrication of palatalized velars. In Sagey's framework, a velar, just as the palatal glide, is specified for a dorsal articulator node only, and therefore there is no reason why a palatalized velar should become affricated, because palatalization of velars will never result in the creation of a complex segment. If the palatal glide were specified for a coronal articulator node as well as for a dorsal one, the analysis of Gallo-Romance palatalization proposed in this chapter could be reformulated in her theoretical framework. The Gallo-Romance palatalization facts therefore argue in favor of a feature geometry in which the palatal glide and the front vowels are not only specified for a dorsal articulator node, but also for a coronal articulator node. In this perspective, the palatal glide and the front vowels are thus considered to be complex segments. There are a number of arguments in favor of this view. First, there is phonetic evidence. Keating (1988) suggests, on the basis of cross-language evidence from the UCLA X-ray database, that palatals are more complex than palato-alveolars and that they are simultaneously coronal and [+high,-back], while palato-alveolars are coronal but unspecified for tongue body features. Second, corroborating evidence that yod and front vowels are specified for both a dorsal and a coronal articulator node comes from the different effects palatalization can have on consonants. With regard to the palatalization of apicals Bhat (1978:70-71) notes that "as a result of palatalization, apicals are changed into laminal consonants. That is, the articulator is changed from apex to blade, so that a wider surface of the tongue is brought into contact with the alveolar ridge or the hard palate. We have considered this as a case of tongue-raising. The above change is generally accompanied by a retraction of the tongue from dental to alveolar position, and from alveolar to prepalatal position." The effects of palatalization on velars is described (cf. Bhat, 1978:72) as follows "the consonant [the velar] may remain as prevelar if the change is slight, but may change into a palatal one (or even an apical-alveolar or dental one) if the change is more marked." It is clear that if the palatal glide were specified either for only a dorsal or for only a coronal articulator node, one could not describe the difference between a rule palatalizing a velar to a prevelar consonant and a rule palatalizing a velar to a palatal or palato-alveolar consonant (cf. Campbell (1974) for a discussion of the same problem in linear phonology). If, on the other hand, *j* is specified for both a dorsal and a coronal articulator node, then a change $k \longrightarrow k^j$ (prevelar) before *j* can be described as the spreading of the dorsal articulator node (with the features [+high,-back]) from the *j* onto the preceding *k* as in (51a) and a change $k \longrightarrow c^j$ (palatal/palato-alveolar) before *j* as the spreading of both the dorsal and the coronal articulator node (viz. the entire place node) from *j* to a preceding *k* as in (51b).

(51a) $k \longrightarrow k^j / - j$

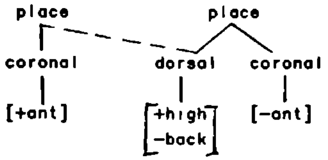


(51b) $k \longrightarrow c^j / - j$

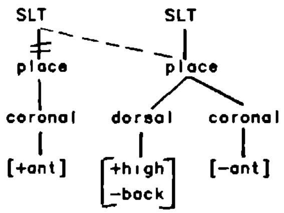


Similarly, the different effects of palatalization on apicals can be described as in (52).

(52a) $t \longrightarrow t^j / - j$

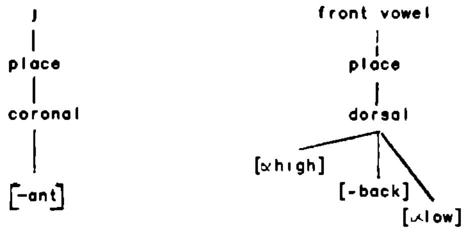


(52b) $t \longrightarrow c^j / - j$



Third, once it is agreed that the palatal glide and front vowels are specified for both a dorsal and a coronal articulator node, it is immediately explained why cross-linguistically velars and coronals are more susceptible to palatalization than labials (cf. Bhat (1978) and Foley (1977)). Bhat (1978:52) distinguishes two kinds of palatalization. First, there is palatalization whereby the primary articulation of the consonant that palatalizes changes and second, there is palatalization which merely consists of adding a secondary articulation without changing the primary place of articulation. Velars and coronals are more susceptible to the first kind of palatalization than labials Finally, there is a related issue that has to be mentioned. As already discussed in section 4.3, Bhat (1978 52) states that "a following front vowel is the strongest environment that induces the fronting (and hence the palatalization) of a velar consonant, whereas a following yod (palatal semivowel) is an even stronger environment for raising (and hence palatalization) an apical consonant." If one wishes the feature geometry to reflect this difference between yod and front vowels, this could be achieved by stipulating that in the underlying representation a palatal glide is specified for a coronal articulator node only, whereas a front vowel is specified for a dorsal articulator node only as in (53).

(53) Underlying representation of j and front vowels



The insertion of a dorsal articulator node on *j* and of a coronal articulator node on front vowels may then be thought of as enhancement rules in the sense of Stevens, Keyser and Kawasaki (1988) who use the feature [+coronal] to enhance the feature [-back] for vowels and the feature 'back' to enhance the feature 'anterior'. However, it is clear that more research is necessary in order to decide whether we need a level of representation in the grammar at which the palatal glide and the front vowels are differenciated in this way.

Early French Lenition: A Formal Account Of An Integrated Sound Change

5.0. *Introduction*

In the evolution of French, a process of lenition occurred which consisted of the spirantization of single intervocalic[1] voiced stops, the voicing of single intervocalic voiceless obstruents and the degemination of geminates.
In this chapter we will regard this classical topic of Gallo Romance linguistics through the prism of recent theories of underspecification. In section 5.1, the facts will be presented and a global description of the phenomenon will be given. Section 5.2 will evaluate the descriptive alternatives offered in the framework of nonlinear phonology. In section 5.3, a choice will be motivated with regard to the alternatives presented In particular it will be shown that an underspecification approach makes it possible to describe the second step in the lenition process as an instance of grammar simplification. It also permits the formulation of a principle that makes degemination a necessary consequence of voicing. Insofar as the analysis defended is capable of viewing voicing as a natural consequence of spirantization, and degemination as a compelling effect of voicing, it corroborates the traditional view according to which lenition should be considered an integrated sound change.

5.1. *The facts*

As noted above, lenition includes the spirantization of single intervocalic voiced stops, the voicing of single intervocalic voiceless obstruents, and the degemination of geminates It is usually assumed[2] that Romance lenition constitutes a set of

---

[1] With respect to the term 'intervocalic', we follow Martinet who uses it to cover all instances of single consonants preceded by a vowel and followed either by a vowel, a liquid, a glide or a nasal (cf Martinet, 1955 257)

[2] For an illustration of this idea the reader is referred to Bichakjian (1972) and Bichakjian (1977) and references provided there

interconnected changes of which the spirantization process forms the opening step, followed by voicing and degemination. In (1) below, the (reconstructed) Gallo-Romance forms illustrate the spirantization process (henceforth SPI).

Classical Latin		Gallo-Romance		French	
(1a) habere	>	* [aβerε]	>	avoir	'to have'
nudum	>	* [nuðu]	>	nu	'naked'
pedester	>	* [peðεstrε]	>	peestre (Old Fr)	'on foot'
negare	>	* [neɣarε]	>	nier	'to deny'
(1b) barbam	>	* [barba]	>	barbe	'beard'
tardum	>	* [tardu]	>	tard	'late'
largam	>	* [larga]	>	large	'large'

As can be observed in (1a), SPI affected all the voiced obstruents in intervocalic position. The data in (1b) show that SPI failed to take place when the obstruent was the second member of an intervocalic consonant sequence, even if the first member was a sonorant.

Let us next consider the examples in (2).[3]

Classical Latin		Gallo-Romance		French	
(2a) librum	>	* [liβru]	>	livre	'book'
tabulam	>	* [tabla]	>	table	'table'
nigrum	>	* [neɣru]	>	noir	'black'
Rhodanum	>	* [roðnu]	>	Rhone	(top)
(2b) membrum	>	* [mεmbru]	>	membre	'part,member'
mordere	>	* [mɔrdrε]	>	mordre	'to bite'
ungulam	>	* [uŋgla]	>	ongle	'nail'

The data in (2a) serve to illustrate that SPI also took place if the voiced plosive was preceded by a vowel and followed by a sonorant. The forms in (2b), on the other hand, indicate that a preceding consonant had the same blocking effect on SPI as it had in the examples given in (1), where the focus was followed by a vowel.

---

[3] Traditional scholars assumed that b before l (original or derived by the voicing of pl) became geminated and that therefore b did not spirantize in this context The fact that stressed o in [doblu] did not diphthongize and the fact that stressed a, as in tábula > table, did not become e, which changes normally occurred in open syllables, seem to support this view Similarly, on the assumption that f doubled before a liquid, it can be explained why f did not voice before a liquid, as in (4b). (see Bourciez, 1974 172–173 and Fouche, 1961 824)

The data in (3) and (4) illustrate the voicing process (henceforth VOI)[4]

	Classical Latin		Gallo-Romance				French	
(3a)	ripam	>	* [ribo]	>	* [riβa]	>	rive	'bank'
	locare	>	* [logare]	>	* [loɣarε]	>	louer	'to rent'
	pesare	>	* [pezare]	>	* [pezer]	>	peser	'to weigh'
	vitam	>	* [vida]	>	* [viða]	>	vie	'life'
	malefatium	>	* [maləvatju]	>	* [malvais]	>	mauvais	'bad'
(3b)	campum	>	* [tšampu]	>	* [tšampε]	>	champ	'field'
	arcum	>	* [arku]	>	* [arkε]	>	arc	'arch'
	portam	>	* [pɔrta]	>	* [pɔrta]	>	porte	'door'
	ursam	>	* [ursa]	>	* [ursa]	>	ours	'bear(female)'
	infernum	>	* [infεrnu]	>	* [infεrnε]	>	enfer	'hell'
(4a)	duplum	>	* [doblo]	>	* [doblε]	>	double	'double'
	aprilem	>	* [abrile]	>	* [aβrilε]	>	avril	'april'
	auriculam	>	* [auriglo]	>	* [oriɣla]	>	oreille	'ear'
	lacrimam	>	* [lagrima]	>	* [laɣrəma]	>	larme	'tear'
	fratrem	>	* [fradre]	>	* [frεðrε]	>	frère	'brother'
	ritmum	>	* [ridmu]	>	* [riðmε]	>	rime	'rhyme'
	insulam	>	* [isula]	>	* [izla]	>	île	'island'
	sifilare	>	* [siflare]	>	* [sifler]	>	siffler	'to whistle'
(4b)	rumpere	>	* [rumpre]	>	* [romprε]	>	rompre	'to break'
	circulum	>	* [tsεrklo]	>	* [sεrklε]	>	cercle	'circle'
	alterum	>	* [altro]	>	* [altrε]	>	autre	'other'

The contexts that triggered VOI exactly match the environments where SPI applied, as is shown by the forms in (3) and (4). If a single consonant was preceded by a vowel, SPI and VOI occurred Furthermore, voiceless plosives became subject to SPI after being affected by VOI. As a result of these changes the only voiceless intervocalic obstruents that remained in later Gallo-Romance were those resulting from the degemination of double consonants.

In (5), examples are given showing that geminates, whether original, as in (5a), or derived by syncope and/or assimilation, as in (5b), were neither affected by SPI nor by VOI. The fact that geminates failed to feed both SPI and VOI permits us to date degemination (henceforth DEG) after these processes (cf. Bichakjian, 1977).

----

[4] If the clusters s'r or z'r were created by syncope as in, for example, essere >*[esr], a stop was inserted between the sibilant and the liquid, which, for this example, yielded estre 'to be' For a comprehensive discussion of this process in a nonlinear framework we refer to Wetzels (1985) and Clements (1987)

	Classical Latin		Gallo-Romance		Old French	
(5a)	abbam	>	* [abba]	>	abe	'abbot'
	*addubbare	>	* [addobberɛ]	>	adober	'to knight a person'
	sufficere	>	* [soffitserɛ]	>	sofire	'to suffice'
	vaccam	>	* [vattsa]	>	vache	'cow'
	cessare	>	* [tsɛssarɛ]	>	cesser	'to cease'
	guttam	>	* [gotta]	>	gote	'drop'
	coppam	>	* [tsoppa]	>	chape	'(over)coat'
(5b)	ruptam	>	* [rotta]	>	rote	'road'
	subtile	>	* [sottilɛ]	>	sotil	'smart,sly'
	subitamentum	>	* [sottomɛntu]	>	sotement	'suddenly'
	capsam	>	* [tsássa]	>	chasse	'chest,bin'

5.2. *Some alternative ways of formalizing SPI and VOI*

5.2.1. *Current approaches to underspecification*

In this section we will show that nonlinear phonology offers three ways of formalizing SPI and VOI. Both processes may be described as feature-filling rules, as deletion-cum-spreading processes or as feature-changing rules. A feature-filling formulation of the rules presupposes a descriptive framework that allows for underspecification. At present, two alternative theories of underspecification are available: one set out by Kiparsky (1982) and elaborated in Archangeli (1984) and Archangeli and Pulleyblank (1986), the other developed by Steriade (1986) and redefined by her in Steriade (1987). There are two basic differences between the two approaches. The first one concerns the extent to which feature values are left unspecified in underlying representation (UR). In the former approach only those feature specifications are present in UR which are both marked and unpredictable. In the latter proposal, only the values which are predictable from feature-cooccurrence restrictions are systematically left out of UR. Distinctive feature values are underlyingly specified, unless there is empirical evidence to the contrary.[5] The second distinction between the two approaches involves the nature of the rules supplying the underlyingly absent

---

[5] The nature of what counts as empirical evidence is related to Steriade's view on how assimilation operates. We shall be more explicit on this issue below.

feature specifications. To illustrate this difference, let us consider the consonant inventory of a hypothetical language L, given in (6).

(6)
```
p t k m n l r
b d g
  s
  z
```

In L, the feature 'voice' is redundant within the class of sonorants. Within the class of obstruents, however, voicing is distinctive. Let us suppose that the consonantal segment inventory is underspecified in the UR of L as in (7).

(7)

	p	t	k	b	d	g	s	z	m	n	l	r
son	–	–	–	–	–	–	–	–	+	+	+	+
voice				+	+	+		+				

The redundancy rules in (8) supply the underlyingly blank feature values for 'voice'.

(8) a) $[\emptyset\text{voice}] \longrightarrow [+\text{voice}] \, / \begin{bmatrix} \_\_ \\ +\text{son} \end{bmatrix}$

b) $[\emptyset\text{voice}] \longrightarrow [-\text{voice}] \, / \begin{bmatrix} \_\_ \\ -\text{son} \end{bmatrix}$

Rule (8a) introduces the non-underlying feature value [+voice] within the class of segments for which the feature value for 'voice' is predictable Rule (8b) supplies the non-underlying [-voice] specification within the class of segments where both values of 'voice' occur freely and where consequently the voicing opposition is distinctive. Steriade (1987:341 342) calls the value which in the given system is introduced by rule (8a) a redundant value (R-value), the rule that supplies it a redundant rule (R-rule), and the segmental class to which the R-value is assigned the redundant class (R-class) with respect to that feature. The value that is introduced by rule (8b) is called a distinctive value (D-value), the rule supplying it a distinctive rule (D-rule), and the segmental class to which the D-value is assigned the distinctive class (D-class) of segments with respect to that feature. So, for Steriade, the relevant distinction among redundancy rules is that between those providing R-values and those providing D-values. Archangeli and

Pulleyblank (1986) distinguish two types of redundancy rules: Default and Complement rules. The former not only express what they consider to be universal restrictions on feature cooccurrence, but also introduce the feature values that are considered to be universally unmarked. The latter are language-specific rules and assign the opposite value of an underlying specification for a feature in case no Default rule is available to accomplish this, a situation which might occur if there is language-internal evidence to select an unmarked feature value as the underlying value for a given feature. The basic difference between Default and Complement rules is then a distinction between universal and language-specific redundancy rules. Steriade's R-rules and D-rules introduce nondistinctive and distinctive feature values on a language-specific basis. Hence, a feature-cooccurrence restriction need not be universal in order to define an R-class of segments for a given feature.

Let us briefly illustrate the differences between the two approaches by means of the sibilant harmony rule of Ineseño Chumash. On the basis of Poser's (1982) study, Steriade (1987) observes that Chumash maintains a lexical contrast between *s* and *š* provided by the feature 'anterior'. The coronals *t*, *l* and *n* are always alveolar. Within a word, the rightmost sibilant, whether *s* or *š*, triggers 'anterior' harmony in the preceding sibilant. Intervening segments, even *t*, *l* and *n*, are transparent to the harmony rule, as illustrated by the data in (9).

(9)a) ksunonus 'I obey him' /k + sunon + us/

b) kšunotš 'I am obedient' /k + sunon + š /

c) šapitš'olit 'I have a stroke of good luck' /s + api + tš o + it/

d) sapits'olus 'He has a stroke of good luck' /s + api + tš'o + us/

Since underlying *s* turns into *š*, as in (9b), and underlying *š* changes to *s*, as in (9d), Steriade assumes that both values of the feature 'anterior' are present at the stage of derivation where sibilant harmony applies. Moreover, given her claim that phonological rules operate under the condition of strict adjacency between trigger and target, the transparency of *t*, *l* and *n* with respect to sibilant harmony in Chumash is taken as evidence that these segments are unspecified in UR for 'anterior', a necessary condition for the sibilants to be adjacent on the 'anterior'-tier.

Within the Chumash coronal system *t*, *l* and *n* belong to the R-class of segments with respect to the feature 'anterior', which is expressed by the redundancy rule (R-rule) in (10).

(10) R-rule for [anterior] $\quad [0\text{ant}] \longrightarrow [+\text{ant}] \; / \begin{bmatrix} \text{—} \\ +\text{cor} \\ -\text{cont} \end{bmatrix}$

On the other hand, the sibilants *s* and *š* belong to the D-class of segments with respect to the feature 'anterior'. In Archangeli and Pulleyblank's (1986) approach to underspecification the universally marked (negative) value for 'anterior' would be chosen as the unpredictable underlying value. A Default rule, which is part of Universal Grammar, would supply all other Chumash coronals with the then predictable positive value for this feature ([+cor]→[+ant]). However, as Steriade shows, what is required for the description of sibilant harmony in this language is a stage in the derivation where only the sibilants, but not the other coronals, are specified for the feature 'anterior'. Steriade (1987) provides abundant evidence showing in one language after another that, if one wishes to respect the locality condition according to which phonological rules operate under strict adjacency of trigger and target, R-values must be left out of UR. Moreover, since there are only few languages (Lyman's Law in Japanese and Finnish Harmony) where a case could be made for missing D-values in UR, she claims that the unmarked situation for D-values is to be present in UR Deviation from this situation is only possible on the basis of strong empirical evidence.

5.2.2. *Feature filling, Deletion-cum-Spreading and Feature changing*

Let us show next that both VOI and SPI can be formalized as feature-filling processes. Although the kind of underspecification necessary to achieve this is of a radical type, and as such more akin to Archangeli and Pulleyblank's ideas on the matter, we shall nevertheless adopt Steriade's terminology, thereby anticipating upon a more detailed account of Gallo-Romance lenition, which will be closer to Steriade's underspecification principles. In (11) we present a feature analysis of Late Latin and Early Gallo-Romance consonants to the extent which

----

[6] We shall assume that the difference between single consonants and geminates is

is relevant for the present discussion.[6]

(11)

	P	T	K	B	D	G	F	S	M	N	L	R	J	W	VOWELS
son	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+
cont	–	–	–	–	–	–	+	+	–	–	+	+	+	+	+
voice	–	–	–	+	+	+	–	–	+	+	+	+	+	+	+

If we leave the R-values for the features 'voice' and 'continuant' unspecified, the system in (11) emerges as in (12).

(12)

	P	T	K	B	D	G	F	S	M	N	L	R	J	W	VOWELS
son	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+
cont	–	–					+	+							
voice	–	–	–	+	+	+									

The R-rules in (13) will provide the unspecified feature values in underlying structure.

(13) a) $[0\text{cont}] \rightarrow [-\alpha\text{cont}] / \begin{bmatrix} - \\ +\text{son} \\ \alpha\text{nas} \end{bmatrix}$ d) $[0\text{voice}] \rightarrow [-\text{voice}] / \begin{bmatrix} - \\ -\text{son} \\ +\text{cont} \end{bmatrix}$

b) $[0\text{cont}] \rightarrow [-\text{cont}] / \begin{bmatrix} - \\ -\text{son} \\ +\text{high} \end{bmatrix}$ e) $[0\text{cont}] \rightarrow [-\text{cont}] / \begin{bmatrix} - \\ +\text{voice} \\ -\text{son} \end{bmatrix}$

c) $[0\text{voice}] \rightarrow [+\text{voice}] / \begin{bmatrix} - \\ +\text{son} \end{bmatrix}$

If VOI and SPI are to be formalized as feature-filling rules, we need to leave unspecified the D-values for the features 'voice' and 'continuant', which are distinctive in the class of consonants that undergo these rules. We therefore need to start from an underlying system as given in (14).[7]

---

expressed on the timing tier. See (5) above for examples of Gallo-Romance geminates.

7 From the above summary of Steriade's views on underspecification one would correctly conclude that we either have to provide evidence for leaving out D-values from UR or that the feature values that are left unspecified can be considered redundant. In section 5.3.2 below we shall defend the claim that at the point in time when SPI and VOI became productive, 'continuant' and 'voice' could be predicted with R-rules.

(14)	P	T	K	B	D	G	F	S	M	N	L	R	J	W	VOWELS
son	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+
cont							+	+							
voice				+	+	+									

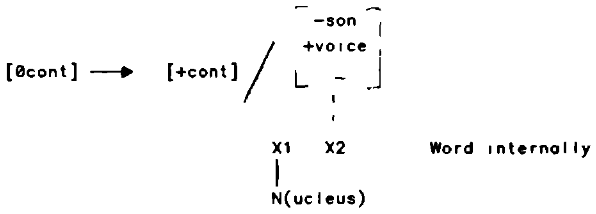
The D-rules in (15) will fill in the missing D-values.

(15) a) [0cont] ⟶ [–cont] / [– ; –son]

b) [0voice] ⟶ [–voice] / [– ; –son]

SPI can now be formulated as the feature-filling process (16).

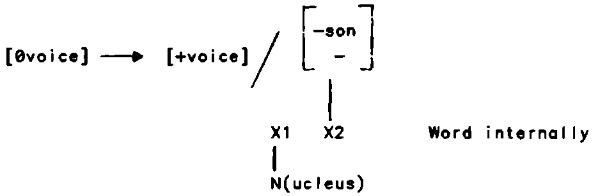
(16) Spirantization as F-Filling



(X1 adjacent to X2)

The feature-filling formalization of VOI is presented in (17).

(17) Voicing as F-Filling



(X1 adjacent to X2)

Some clarifying remarks regarding the rules (16) and (17) seem necessary. First, it should be noticed that the conditioning environment for SPI and VOI has been defined as **postnuclear** position.[8] The adjacency condition stipulated for these

---

[8] Recall fn. 1.

rules will not only prevent 'long distance' effects, but also block the application of either rule to completely as well as to partially geminated clusters As a matter of fact, VOI interacts with at least one other rule of Gallo-Romance, Cluster Voicing, which creates linked structures to which VOI is indeed inapplicable. Given that both timing units of a geminate cannot be adjacent to the X dominated by N, Schein and Steriade's Uniform Applicability Condition (UAC) (cf. Schein and Steriade, 1986:727)[9] will prevent (16) and (17), in the proposed formulation, from applying to geminates, which is precisely what we want in light of the data in (5a) and (5b). Furthermore, because we follow Schein and Steriade (1986:697) in assuming that linear precedence can only be defined between root nodes or between skeletal units, the skeletal units belonging to the left-hand context N(ucleus) and to the target obstruent are included in the structural descriptions of both (16) and (17). Moreover, rule (16) must apply before the D-rule (15a), and rule (17) must apply prior to the D-rule (15b). The appropriate ordering is guaranteed by the Elsewhere Condition (EC) (cf. Kiparsky, 1982). Finally, in Steriade (1986), a constraint is proposed stipulating that, if an intermediate representation contains R-values of a given feature, it contains D-values of that feature as well. This constraint will order a D-rule for a given feature always prior to the R-rule for that feature. In Steriade (1987), this constraint is not discussed, probably because there is little evidence for missing D-values at all. Here we shall assume, in line with Steriade (1986), that, if a D-rule and a R-rule for a given feature co-exist in a language, the D-rule takes precedence over the R-rule. From this assumption, it follows that neither VOI nor SPI could be profitably described as feature-copying or as feature-spreading processes, because in both cases the necessary presence of R-values would force the presence of D-values, annihilating the possible advantages of an underspecification approach.

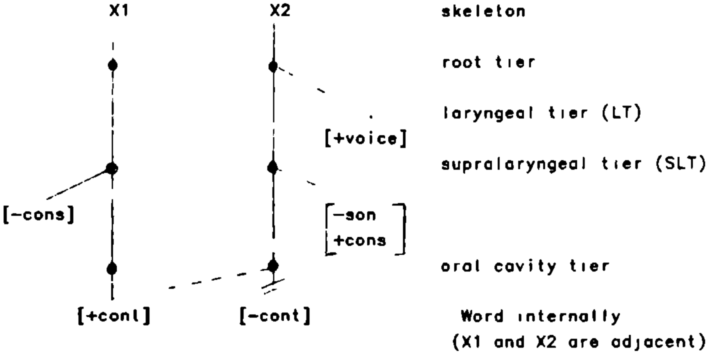
Another way of formulating SPI and VOI which nonlinear phonology makes possible follows from viewing these processes as feature-dissociation rules. In particular, SPI can be formulated as a rule in which the dissociation of the feature [-cont] of the stop goes hand in hand with the spreading of the feature [+cont] from the preceding vowel. Similarly, VOI can be described as the

---

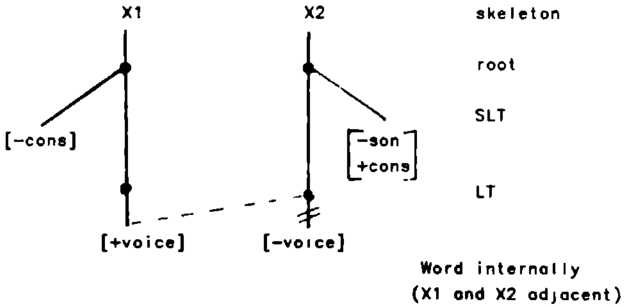
9 Hayes' Linking Constraint (cf Hayes, 1986) would equally prevent the rules from applying to geminates For a discussion of the different implications of the Linking Constraint and the UAC, cf Schein and Steriade (1986)

dissociation of the feature [-voice] of the obstruent with concomitant spreading of the feature [+voice] from the left-hand vowel. Since the presence of the R-values of the features 'voice' and 'continuant' is required on sonorants, both rules can of course only be effective after the application of the R-rules in (13) and, by implication, the D-rules in (15). The formalization of SPI and VOI as feature-dissociation processes might take the form as provided in (18) and (19).[10]

(18) Spirantization as Feature Dissociation



(19) Voicing as Feature Dissociation



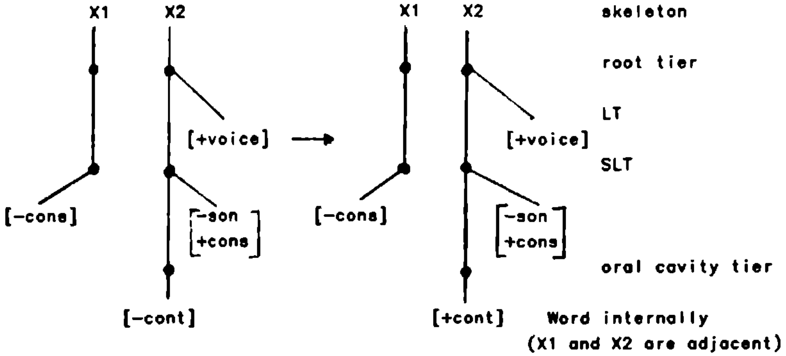
Again, the condition on adjacency between the skeletal slots of trigger and target in the structural descriptions of rules (18) and (19) will, by virtue of the UAC, prevent (18) and (19) from applying to geminates.

---

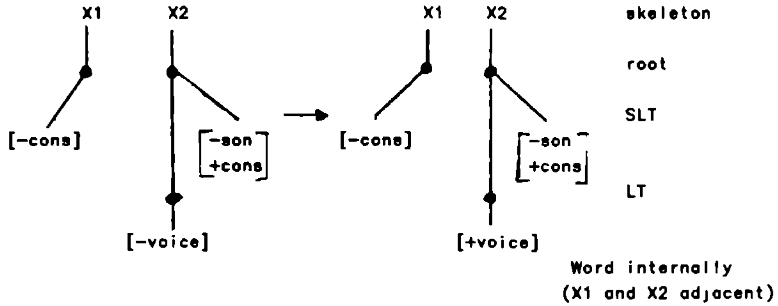
[10] In the representation of the processes, we have followed Clements' model of feature representation (cf Clements, 1987).

A last possible way to formalize SPI and VOI consists of describing both processes as feature-changing rules. SPI might be formulated, after the application of the R- and D-rules, as the change from a [-cont] to a [+cont] voiced stop and VOI as the change from a [-voiced] to a [+voiced] obstruent as illustrated in (20) and (21), respectively.

(20) Spirantization as Feature Changing



(21) Voicing as Feature Changing



The UAC again blocks the application of either rule (20) or (21) to geminate structures. There seems to be no a priori reason for considering one formulation superior to the other. In section 5.3.2 we shall explicitly address this question. Let us just note here that the processes represented in (18) and (19) seem to

---

[11] Pope describes SPI and VOI as follows. "Vowels are all voiced and open, in the early period of the language their characteristics exercised a marked influence

reflect the traditional view of SPI and VOI more closely.[11]

5.3. *The Integrity of Lenition*

5.3.1. *The relevance of syllable structure*

It has often been claimed in historical studies that intervocalic and syllable-final positions must be considered weak positions. With respect to phonological change, this view was meant to provide a kind of explanation for the observation that in these contexts consonantal changes follow a predictable course, of which the final stage is their complete dissolution. In a number of recent studies, instances of lenition, both inside and outside the Romance area, have been described as being conditioned by syllable structure. From the point of view of rule typology it would be worthwhile if it could be shown that all occurrences of consonantal weakening originate in the syllable coda. Here we shall examine whether this idea can be advantageously transferred to the Gallo-Romance situation.

In Amastae (1986) three Spanish dialects are discussed, Northern Mexican, Bogotano Columbian and American-Mexican, where the voiced stops *b*, *d* and *g* in medial obstruent + liquid clusters may be produced as either stops or fricatives. Voiced stops are produced as fricatives more often if they are preceded by a stressed vowel. Since, according to Amastae, a preceding stressed vowel favors the attraction of a following consonant into the coda position, a rule of ambisyllabification is postulated which is sensitive to stress. In this way, the spirantization phenomena of these dialects can be interpreted as cases of syllable-final lenition or, as he also terms it, syllable-final weakening. In Danish /p, t, k, d, g, r,/ are produced as [b, d, g, ð̞, ɣ̞, j̞] in syllable-final position and intervocalically, if the following vowel is reduced and unstressed. Clements and Keyser (1983:80-83) propose a rule creating ambisyllabic consonants in the latter environment. Again, a syllabification rule permits one to subsume the contexts triggering lenition under a single syllable-based generalization.

The examples given in section 5.1 show that SPI and VOI apply to syllable-final

---

on the pronunciation of single breathed and plosive consonants that stood either between vowels or ended a word after a vowel" (1956.136).

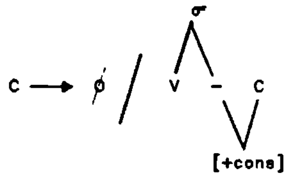
12 Following standard views on syllabification, we have considered a single consonant in intervocalic position to be syllable initial. On the other hand, t

consonants as well as to syllable-initial consonants when preceded by a vowel.[12] All syllable-initial consonants that undergo SPI and VOI can be made syllable-final if we postulate rule (22) which creates ambisyllabic consonants.

(22)

In this way, SPI and VOI could easily be formulated as syllable-final lenition processes. One advantage of interpreting SPI and VOI as syllable-final lenition in Gallo-Romance is that it provides an elegant way of expressing the contextual coherence of these changes with the final step in the lenition process: DEG. Gallo-Romance only allowed geminates intervocalically. Therefore, a theory of the syllable which includes a timing tier would predict that the first timing point of a geminate joins into a rime with the preceding nucleus. Degemination can consequently be formulated as a process deleting the coda slot of a long consonant, as in (23)

(23)



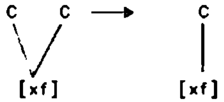
However, it can be shown that there exist some important structural differences between the Gallo-Romance situation and the situation that we find in the dialects discussed by Amastae as well as Danish.

First of all, in Gallo-Romance SPI and VOI took place independently of stress, which is shown by the forms *núdus* and *pedéster* in (1), in which stress precedes the consonant to be weakened in the former example but follows it in the latter. In general, however, rules creating ambisyllabic consonants are almost always

---

as in *ritmum* (>rime) is considered to be a syllable-final consonant, since neither in Classical Latin nor in Gallo-Romance is tm possible word-initially, and no phonological arguments exist to consider tm a possible onset word-internally conditioned by stress, as for instance those postulated by Kahn (1976) and Gussenhoven (1986) as well as those discussed above for Danish and Spanish. Second, it has been claimed that ambisyllabic consonants, in languages with contrastive consonant length, are interpreted as long consonants (cf Vogel, 1977:91). Given the data in (5), clearly what we want is to **prevent** SPI and VOI from applying to geminates. Therefore rule (22) cannot be assumed for Gallo-Romance, because it would have the effect of blocking SPI and VOI in all the cases where they should apply. We conclude therefore that Gallo-Romance does not provide compelling evidence for the reinterpretation of intervocalic position as syllable final position and that the relevant environment for lenition seems to have been postnuclear position. It should finally be noticed that DEG in its simplest possible form can be formulated as the unconditioned rule (24), since geminates only occurred intervocalically.

(24)



If SPI and VOI indeed applied syllable-finally, this context-free formulation would obscure the contextual similarity between DEG and these rules Since, on the basis of the above given arguments this hypothesis has become implausible anyway, this is not too regrettable a consequence. What the straightforward formulation of DEG shows in any case is that a marked configuration is transformed into an unmarked one. In the following section we shall concentrate on this aspect of lenition.

5.3.2. *The relevance of lexical representation*

Probably the most interesting aspect of lenition concerns the question whether or not its different stages represent a unified sound shift (cf. Bichakjian (1972) and (1977)). Functional linguists, like Martinet (1955:267 268), have defended the view that it embodies a sequence of interconnected changes, explaining the phenomenon as a chain reaction caused by the tendency for the geminated series to simplify. Given the chronology of the various steps, which we recapitulate in (25) below, the view of Gallo-Romance lenition as a push chain does not seem obvious. One would in that case expect Degemination to constitute the opening step, immediately followed, already during its variable or optional stage, by Spirantization and Voicing

(25)	pp	p	bb	b	tt	t	dd	d	kk	k	gg	g	ff	f	ss	s
Late Latin 2–3th cent				β				ð				ɣ				
4–6th cent		b				d				g				v		z
5–6th cent		β				ð				ɣ						
7–8th cent	p		b		t		d		k		g		f		s	

The chronology established rather suggests a drag-chain evolution, led off by the spirantization of voiced intervocalic stops. Also the fact that SPI created segments which consisted of a combination of features so far unattested in the language ([strident, +continuant, +voice]) is consistent with a drag-chain view of Gallo Romance lenition. The spirantization of voiced stops simply did not threaten any other segment's territory. On the other hand, the phonological space left vacant by this sound change permitted the voiceless series to adopt a voiced articulation, without loss of phonological distinctness Even if, in a very abstract view, the mere presence of geminates were considered the cause of the system's instability, it would not make much sense to refer to the push-chain principle. We could really only say that the geminates were the cause for some chain of changes to be set in motion, and in this view, then, all chains are push-chains. Also, in the specific Gallo-Romance situation, it would be hard to understand why the pressure of the impending degemination manifested itself first in the voiced stop series This is all the more surprising because voiced geminates were very scarce in Gallo Romance If the geminates really exerted pressure on the system, one would expect, in the absence of some supplementary explanatory principle, this pressure to have been most noticeable in the voiceless series. As a matter of fact, a better explanation can be provided by referring to some notion of naturalness with regard to sound changes: given the pressure exerted by the geminates, the intervocalic consonant system is first affected in its weakest members. If it could be demonstrated that a system exploiting a length contrast on consonants always eliminates the length oppositions by following an evolutionary path prescribed by the consonantal strength hierarchy, rather than by, say, straightforward degemination, such a scenario would have to be envisaged. Although the way in which the Romance languages developed is paralleled by similar evolutions in other languages, for instance Celtic, we doubt if it would be justified to promote this course of events to a universal of phonological evolution. What we do know, however, is that spirantization can be implemented in systems that do not contain geminates. Therefore, the conclusion seems warranted that whatever fact is at the source of spirantization in the latter group of languages might also be capable of triggering spirantization in the former group. As things stand now, therefore, it appears that no strong evidence can be advanced against a down-to-earth drag-chain view of Gallo-Romance lenition, where the initial evolution of the weakest series vacates the necessary space for the voiceless stops to adopt a voiced articulation, etc. The important question, however, is whether a drag-chain view of Gallo Romance lenition will allow us to maintain the supposition that we are dealing with an integrated sound shift. In other words, how can it be explained that, once spirantization was accomplished, the steps that followed represented a compelling, or at least a very likely consequence? This, then, is the central issue that we will address here. Adopting Steriade's principles of underspecification, we will show that each single step in the process of lenition affects a feature whose phonetic realization has, as a consequence of the preceding step, become predictable by R rules.

Let us, to begin with, reconsider the consonantal system as it existed in classical Latin. A representative subpart is given in (26).

(26)	t	d	s	(z)	tt	dd	ss	(zz)
voice	–	+	0	(+)	–	+	0	(+)
cont	–	0	+	(+)	–	0	+	(+)
strid			0	(0)			0	(0)

In (26) we have assumed that the feature 'strident' can only be present in a phonological tree representing a non-sonorant segment and only if the feature 'continuant' is positively specified. This means we can dispense with a R-rule introducing the feature [-strident] for stops. For continuants, stridency can be left blank because it is predictable from feature co-occurrence restrictions. More interesting with respect to the future evolution of the system in (26) are the R-rules that fill in the missing values for 'continuant' and 'voice'. We repeat them in (27a-b).

$$(27\text{-a})\quad [0\text{cont}] \longrightarrow [-\text{cont}] \;/\; \begin{bmatrix} \_\_ \\ -\text{son} \\ +\text{voice} \end{bmatrix}$$

$$(27\text{-b})\quad [0\text{voice}] \longrightarrow [-\text{voice}] \;/\; \begin{bmatrix} \_\_ \\ -\text{son} \\ +\text{cont} \end{bmatrix}$$

It is not difficult to see that rules (27a-b) can only exist in a system that lacks voiced continuants. Had they been present, voicing would have been contrastive for continuants and continuancy for voiced obstruents (It is only for expository purposes that we have included voiced continuants in (26) above). As a matter of fact, given the system in (26), the first step of lenition could be formulated as an event whose effect on the phonological component of classical Latin merely involved a redefinition of the distribution of predictable feature values. The necessary rules are given in (28).

(28)

$$\text{a)}\quad [0\text{cont}] \longrightarrow [+\text{cont}] \;/\; \begin{array}{cc} & \begin{bmatrix} \_\_ \\ -\text{son} \\ +\text{voice} \end{bmatrix} \\ & | \\ \text{X1} & \text{X2} \\ | & \\ \text{N} & \end{array} \qquad \begin{array}{l} \text{Word internally} \\ \text{(X1 adjacent to X2)} \end{array}$$

$$\text{b)}\quad [0\text{cont}] \longrightarrow [-\text{cont}] \;/\; \begin{bmatrix} \_\_ \\ -\text{son} \\ +\text{voice} \end{bmatrix} \qquad \text{Elsewhere}$$

Unfortunately, by analyzing SPI as a feature-filling rule, we have to solve two major problems. One is of a formal nature. It concerns the question whether both rules (28a,b) can function simultaneously in a system like (26). The answer is no. Why this is so becomes clear when we apply the specific case of (28) in order to get the positive value for 'continuant' in (26). At this point of the derivation, rule (27b) cannot function as an R-rule anymore, because it introduces a distinctive value into the class of fricatives. We might try to circumvent the problem by replacing (27b) by a set of R-rules that first introduce the values for 'strident', which will enable us to predict [-voice] for *s* from both [+continuant] and [+strident], as in (29).

It now appears that the problem is still with us, though in a different guise: rule (29b) wrongly claims that [+strident] is predictable for continuants. The reason for the problems is not difficult to discover. If we want a unique underlying system of consonantal contrasts and at the same time predict both *d*

(29) (a) $[0\text{strident}] \longrightarrow [-\text{strident}] \;/\; \begin{bmatrix} \_\_ \\ +\text{voice} \\ +\text{cont} \end{bmatrix}$

(b) $[0\text{strident}] \longrightarrow [+\text{strident}] \;/\; \begin{bmatrix} \_\_ \\ +\text{cont} \end{bmatrix}$

(c) $[0\text{voice}] \longrightarrow [-\text{voice}] \;/\; \begin{bmatrix} \_\_ \\ -\text{son} \\ +\text{cont} \\ +\text{stri} \end{bmatrix}$

and ð, (26) is insufficiently specified. We either have to make 'voice' contrastive throughout the system of obstruents (cf. (30b), or else introduce distinctiveness for stridency, as illustrated in (30a).

(30) a)

	t	ð d	s
voice	–	+	0
cont	–	0	+
stri		–	+

b)

	t	ð d	s
voice	–	+	–
cont	–	0	+
stri		0	0

Rules (28) and (29) can now without any problem apply to (30b) if we add to the SD of (29b) the specified feature [-voice], and eliminate (29c) which has become superfluous. System (30a) can be made to work in a similar fashion. The second problem is of an empirical nature, and regards the way sound changes operate. It would not be realistic to assume that (28a,b) came to replace (27a) instantaneously. Certainly, SPI went through an optional stage, which implies that SPI could not in the beginning have functioned as an R-rule. Only if an unorthodox interpretation of the elsewhere condition were adopted, according to which (28b) were permitted to fill out voiced obstruents as [-continuant] in any context, including the lenition environment (henceforth LE), would we arrive at completely specified surface representations. However, unless properly constrained, this interpretation of the elsewhere condition is certainly undesirable. It can moreover easily be avoided if we admit that SPI was a feature-dissociation or a feature-changing rule as long as it was optional. The rule's optionality itself guaranteed the unproblematic recoverability of underlying *d*. It is important to observe that, if we adopt the feature geometry proposed in Wetzels (forthcoming) which we have discussed at the end of the previous chapter, SPI cannot be described as a feature-dissociation process. As mentioned in the previous chapter, Wetzels' feature geometry differs from the one proposed in Clements (1987) in that the feature 'continuant' directly dominates the place node. As a consequence any manipulation of the feature 'continuant' always effects the place node it dominates. In a feature-dissociation formulation of SPI this means that the spreading of the feature [+continuant] from the vowel to a following voiced intervocalic stop automatically entails the spreading of the place features from the vowel to the following voiced stop, which evidently produces the wrong results. We consequently conclude that optional SPI was a feature-changing rule, possibly described as the feature-changing operation (20), which applied after the blank features had been specified. We propose the principle given in (31).

(31)
A feature-changing rule Rc that changes aFi into -aFi for a (class of) segment(s) Z in the context W is a natural innovation in a grammar where the value of Fi is predictable by an R-rule for Z in W.

With regard to the change *b, d, g* ---> [β, ð, ɣ], principle (31) makes the prediction that it more easily occurs in a system that lacks voiced continuants than in a system which has, for example, *v* and *z* next to *f* and *s*.[13] It is also predicted that the presence of geminates is irrelevant to the matter, because the same R-rules could be formulated in the absence of geminates. One language which is suitable to test these predictions at least in part is contemporary standard Spanish.

In Castilian Spanish the features 'continuant', 'voice', and 'strident' are necessary to distinguish in UR *t, d, s* and *θ*. As in classical Latin, [-continuant] is predictable for voiced stops, and [-voice] for fricatives. In intervocalic position, *b, d* and *g* appear phonetically as [o], [o] and [ɣ]. Since there are no geminates in Spanish, a causal relation between the presence of geminates and the existence of SPI could not possibly be defended. However, because of the predictability of continuancy (*z* and *v* do not exist), (31) predicts that SPI is a natural rule in the phonologv of Spanish.

----

[13] A fully articulated theory of sound change should take into account the context in which a change occurs. This will explain why not all d's change into ð.

There is another early French sound change which deserves attention in connection with principle (31). In voiceless intervocalic obstruent clusters, *k* was spirantized, as in the examples given in (32).

	Class. Latin	Gallo-Romance		French	
(32)	faktum	> *[faxtu]	> *[fajt]	fait	'fact'
	aksem	> *[axse]	> *[ajs]	ais	'plank'

What is surprising about this change is the fact that all other clusters of obstruents assimilate to become geminates. Why, one wonders, did only *k* follow a different course? Traditional scholars (as reported in Pope, 1956:6) have sought the explanation in the Celtic substratum. However, a glance at table (12) tells us that *k* is the only voiceless stop for which the value for the feature 'continuant' is predictable. Therefore, the change *k* ---> *x* can be considered a natural rule addition, which was more likely to occur than, say, *p* ---> *ɸ* or *t* ---> *θ*. It seems then that the explanation for the aberrant behavior of *k* must be sought in the phonological system rather than in the articulatory habits of the Celts.
Let us now consider the situation which emerged when SPI became obligatory. It has become clear from the foregoing discussion that there are a number of ways of describing Gallo-Romance phonotactics that are equally adequate from a formal point of view. We can now decide to make SPI a feature-filling rule that acts upon the underlying systems (30a,b), or we can retain SPI as a feature-changing rule. There is, however, yet another possibility, which is actually the one we want to defend here. In order to see how this possibility is arisen consider the systems in (33) and (34).

(33)	t	ð	s
voice	0	+	−
cont	−	0	+
stri		0	0

R-Rules:

a) $[0\text{cont}] \rightarrow [+\text{cont}] \,/\, \begin{bmatrix} - \\ -\text{son} \\ +\text{voice} \end{bmatrix}$ in LE

(b) $[0\text{cont}] \rightarrow [-\text{cont}] \,/\, \begin{bmatrix} - \\ -\text{son} \\ +\text{voice} \end{bmatrix}$ elsewhere)

c) $[0\text{voice}] \rightarrow [-\text{voice}] \,/\, \begin{bmatrix} - \\ -\text{son} \\ -\text{cont} \end{bmatrix}$

d) $[0\text{stri}] \rightarrow [-\text{stri}] \,/\, \begin{bmatrix} - \\ -\text{son} \\ +\text{voice} \\ +\text{cont} \end{bmatrix}$

e) $[0\text{stri}] \rightarrow [+\text{stri}] \,/\, \begin{bmatrix} \text{—} \\ -\text{son} \\ +\text{cont} \\ -\text{voice} \end{bmatrix}$

(34)

	t	ð	s
voice	0	0	0
cont	–	+	+
stri		–	+

R-Rules

a) $[0\text{voice}] \rightarrow [-\text{voice}] \,/\, \begin{bmatrix} \text{—} \\ -\text{son} \\ -\text{cont} \end{bmatrix}$

b) $[0\text{voice}] \rightarrow [+\text{voice}] \,/\, \begin{bmatrix} \text{—} \\ -\text{son} \\ -\text{stri} \end{bmatrix}$

c) $[0\text{voice}] \rightarrow [-\text{voice}] \,/\, \begin{bmatrix} \text{—} \\ -\text{son} \\ +\text{stri} \end{bmatrix}$

The systems given in (33) and (34) have been set up exclusively on the basis of the lenition environment, where *t* and *s* contrast at the surface with ð. Again, we observe that these systems could not be extended outside LE without serious descriptive consequences. The problems are of a familiar kind If we posit (33) as the unique underlying system, we must add (33b) to the set of R-rules. This, in turn, causes (33c) to introduce a D-value outside LE, which would be in conflict with our premisses. In system (34) [+continuant] has been lexicalized. Formally, this destroys the possibility of predicting *d* outside LE. Again, if 'continuant' is left blank, the introduction of the negative value for this feature will create a class of segments for which 'voice' is distinctive.

We will for the moment ignore the overall implications of having an underlying system that is valid for the lenition environment only and concentrate upon our aim which is to establish a relationship between SPI and VOI The system which enables us to achieve precisely this is the one in (34), because there the feature that is going to be affected by VOI is predictable by R-rules for the entire class of single obstruents. So, if we can make a case for (34), we can refer to principle (31) in order to explain the addition of VOI to the grammar. One question that should be asked is whether a principled choice can be made between (33) and (34). Confronted with a number of alternative systems which are descriptively adequate, the language learner must find a way to decide which system is to be preferred. We will hypothesize that his choice is determined by principle (35).

(35)

Given two alternative systems A and B, both of which contain the redundant as well as the distinctive feature values necessary to describe the class of segments Z in the context W, A is preferred over B, if for some feature Fi in A, the value of Fi is predictable for a class of segments that is larger than the class(es) of segments defined by any of the predictable feature values in B.

Principle (35) will select the system in (34) as the appropriate underlying system in LF, because in (34) [0voice] defines the whole class of single obstruents, whereas no blank feature in (33) identifies a class of segments that is larger or equally large.

We are obviously aware of the fact that the validity of (35) can only be firmly established by a much broader study than the one we are undertaking here. We would like to stress, nevertheless, that the kind of problem we are touching upon is of an empirical nature. Therefore, the fate of (35) depends upon the adequacy of the predictions that it makes in combination with principles like (31).

Let us now return to the functioning of (34) in the overall system of underlying contrasts in Gallo-Romance. The initially obvious argument against (34) is the distributional fact that *d* and *ð́* appear in complementary contexts and that therefore the one ought to be derived from the other This conclusion should not, however, be drawn too hastily. It has long been recognized that complementary distribution cannot by itself decide on the derivational relatedness of segments. It is commonly agreed that, to take an extreme example, *h* and *ŋ*, which in many Germanic languages appear in complementary contexts, do not represent different surface manifestations of a single underlying segment. Although the phonetic similarity between *d* and *ð́* is more obvious than that between *h* and *ŋ*, the difference in phonetic substance involves a feature that is underlyingly contrastive elsewhere in the system, unlike, for example, aspiration in English. Also, word-final voiced stops were lost in Gallo-Romance, except for a small class of function words, confining the occurrence of *b*, *d* and *g* to word-initial position. Furthermore, no paradigmatic alternations existed between *d* and *ð́*, which would force the maintenance of a rule deriving *ð́* from *d* at morpheme boundaries. Finally, it should not be overlooked that the desirability of expressing the complementary distribution of *d* and *ȯ* cannot as such plead for (26). It only pleads for a unique underlying system. If (26) is taken as the basic system, a feature-changing rule is needed which turns *d* into *o* in LE. But one can also choose (34) as the only underlying system and add a feature-changing rule deriving *d* from *o* word-initially. Let us close this discussion with the conclusion that, with regard to Gallo-Romance phonotactics, the complementary-distribution argument became a very relative one, and that, furthermore, it could not be used as a principle to exclude (34) as a possible underlying system. Assuming the correctness of principle (35), we predict that different sets of segments contrasting at the surface in different environments can bring the language learner to select different sets of feature values in UR. It will exclude (30a,b) as well as (33) as possible underlying systems and establish (26) and (34), respectively, in word-initial position and in LE.[14] We do not wish to speculate about the desirability of adapting principle (35) in such a way that it would select (34) over (26) as the unique underlying system for Gallo-Romance. Not only because we have no evidence for the correctness of such a move, but also because it is irrelevant to our purpose.

Let us now return to the lenition process. As in the case of SPI, we will make the uncontroversial assumption that VOI functioned during its optional stage as a feature-changing rule, that applied to a system where the blank features had been filled out by the rules (34a-c). We propose the principle (36), which is similar to (31), though not identical with it.[15]

(36)
A feature-changing rule Rc that changes aFi into -aFi for a class of segments Z in the context W is a likely innovation in a grammar where Fi is predictable by a set of R-rules for Z in W.

---

[14] It is not easy to decide what system must be chosen word-finally We know that at some point in the history of Gallo-Romance word-final t became Θ as in, for instance, portat > portaΘ 'he carries' Even in function words final d was lost before a following consonant-initial word or changed to o when the following word started with a vowel, such as, for example, ad 'at' ([aδ] ## V) ~ a ([a] C) These facts are intimately related to the restructuring of phonological domains that occurred in the course of Gallo-Romance Also a rule of final devoicing was created, making the value for the feature 'voice' predictable in word-final (or phrase-final) position Although it is difficult to establish when exactly this happened, it is clear that there developed in word-final position a system that came very close to the one we proposed for LE

[15] We believe that a rule like C[-son]→[-voice] /in LE —a possibility left open by (36)— will be excluded as a consequence of the Incompatibility of its SC and SD (recall fn 13)

The use of the term "likely" in (36) as compared with "natural" in (31) is related to the different effects that SPI and VOI have on the overall simplicity of the grammar. As we have seen, SPI involved a contextual redefinition of a predictable feature value and as such represented a rule addition. VOI, on the other hand, involves a redefinition of predictable feature values, the effect of which leads to the loss of the rules (34a and b). VOI must therefore be considered an instance of grammar simplification, a fact which we interpret as adding to its naturalness, although the simplification only took effect when the rule became obligatory.

In (37) we sketch the phonotactic situation that emerged as a consequence of VOI becoming obligatory. We now have brought the geminates into the picture, because they became crucial for the further unfolding of the lenition process.

(37)	[d	ð	z	t	d	s]
long	–	–	–	0	+	0
voice	0	0	0	–	+	–
continuant	–	+	+	–	–	+
strident		–	+			0

The most striking aspect of (37) is that, as a consequence of SPI and VOI, a postnuclear consonant system was created that was typologically highly marked. We have arrived at a situation where an elaborated system of geminates contrasts with a class of single obstruents for which 'voice' is nondistinctive. It seems to us that this state of affairs could not be tolerated in any system. To express this fact we propose the principle in (38).

(38) *C cannot exist next to C C in any context*

$$\underset{[0F_i]}{C} \quad \textit{cannot exist next to} \quad \underset{[\alpha F_i]}{CC} \quad \textit{in any context}$$

It follows from (38) that (37) must be further modified. The most straightforward way in which the voicing contrast among geminates could be eliminated would be by degemination of the long consonants. We have no reason to believe that the rephonologization of the voicing contrast of single obstruents through the elimination of the length opposition ought to be considered unnatural in any sense. However, Gallo-Romance chose a subtler, but not less effective solution. As can be seen in (37), length is predictable for voiceless obstruents. Only *dd* maintains a length opposition with respect to *d*. Obviously, if *d* were changed to *ð* the quantitative opposition could be phonologically dispensed with, because it would become predicted by the R-rule (39).

(39)
$$C \longrightarrow CC \,/\, V \left\{ \begin{array}{c} \begin{bmatrix} - \\ -\text{voice} \end{bmatrix} \\ \begin{bmatrix} - \\ -\text{cont} \end{bmatrix} \end{array} \right\} V$$

As is shown in table (25), before Gallo-Romance lost its geminates, a new round of SPI occurred Although it would be hard to claim that the motivation for this change finds its explanation in principle (38), it cannot be denied that SPI2 had the effect of eliminating the length opposition from underlying structure. The complete elimination of the geminates from the Gallo Romance consonant system can now be described as the loss of the R-rule (39), brought about by principle (38), which, we think, must apply both to underlying and surface representations.

5.4. *Conclusion*

In this chapter we have revisited the structuralist notion that sound change is at least in part co-determined by properties of the phonological system (see for example the very clear account in Bynon, 1977 chapter 2). Our reason for taking up this issue was our conviction that underspecification theory could make it possible to formulate predictions that are precise enough to be falsified. Given the rather limited extent to which we have been able to put the principles proposed in this chapter to the test, we cannot pretend to have done more than showing that the structuralist insights can indeed be made explicit On the other hand, the results of the approach taken here could reach further. If the principles proposed turn out to survive a larger number of tests, they will be able to further strengthen the principles of the underspecification theory as defended by Steriade (1987) and the extensions proposed in this chapter by adding evolutionary evidence to its empirical foundations.

In the introduction to this thesis we observed that the studies presented here served two purposes. Not only do they shed new light on various aspects of the historical phonology of French by applying nonlinear theories to traditionally described processes, but they also offer us suitable testcases for evaluating the various subtheories involved. Let us now, in the light of these two aims, summarize the main results of the discussion of the prosodic and segmental aspects which have been dealt with in this dissertation.

In chapter one, we were able to provide a straightforward account of the reduction of unstressed vowels in the evolution from Latin to Old French. We explained syncope and apocope, traditionally thought of as two separate processes, as two manifestations of one and the same mechanism, namely foot based vowel reduction. We argued that this generalization can only be captured in a metrical theory which recognizes the foot as a primitive element of its descriptive vocabulary and that a grid-only account, because it is unable to capture this generalization, obscures the relation between the two processes Therefore we concluded that our analysis constitutes a strong argument in favor of a metrical theory using feet to express stress, and also that feet cannot be dispensed with in phonological theory.

Chapter two dealt with the relative markedness of stress systems and compared the metrical theory of Hayes (1981) with the revised theory of Hayes (1987). We showed that there are four main reasons for describing "former" QI rd stress systems by using reversed trochees rather than as instances of syllabic trochee assignment. First, the reversed trochee permits us to maintain the generalization that rules that serve to create a durational contrast in feet are absent in languages that have a trochaic stress rule. Moreover, the existence of rules of this kind in languages that have a reversed trochaic stress rule can be straightforwardly interpreted as serving to convert a marked deep structure stress pattern into an unmarked surface structure one. Third, the adoption of the reversed syllabic trochee permits us to dispense with the monosyllabic stressed foot in the description of Southern Paiute, and allows us, if the monosyllabic stressed foot is not used to create secondary stress clashes, to invoke clash-avoidance to guarantee this. Finally, if monosyllabic stressed feet turn out never to be necessary, the reversed syllabic trochee makes it possible to give an insightful account of the relation between stressing and destressing in QI languages. Next, we demonstrated that a moraic trochee analysis of Classical Latin cannot be independently motivated by the stress-sensitive vowel reduction process discussed in chapter one, that vowel reduction itself is predicted not to occur, and that the change from the Latin stress system to that of Gallo-Romance cannot be described as an evolution from marked to unmarked. We have shown that these problems can be avoided if the moraic trochee is replaced by the reversed iamb. After thus having argued on both formal and empirical grounds that metrical theory cannot dispense with constituent construction rules that generate "former" QI-rd and "former" QS-ld feet, or, in bracketed grid terms, that assign reversed trochees and reversed iambs, we concluded that the revised theory is both formally and empirically less adequate than Hayes' (1981) theory. Since the standard theory is too powerful a tool in not distinguishing between marked and unmarked stress systems, we claimed that the relative markedness of "former" QI-rd and QS-ld stress systems must not be accounted for by describing them as either complex reanalyses of syllabic trochee assignment or as moraic trochee construction, but must be related to the fact that they deviate from the general laws of trochaic and iambic rhythm as to which element of a binary constituent is the more prominent.

In chapter three, we studied the interaction between the foot structure and the syllable structure in the evolution from Latin to Old French. We claimed that the evolution of syllable structure cannot be explained unless the evolution of foot structure is taken into account. More specifically, we showed that changes occurring at one level of prosodic representation --c.q. the foot-based vowel reduction discussed in chapters one and two-- and which led to a simplification of structure at that level --c.q. the change from the marked Latin to the unmarked Gallo-Romance stress system--, may entail a complication of structure at another level of prosodic representation --c.q. the syllable structure of Gallo-Romance which had become more complex--. Moreover, by studying the interaction between the evolution of syllable structure and foot structure, we have been able to suggest an answer to the question why all languages do not linea recta evolve into 'open-syllable-type-only' languages. Finally, we have demonstrated that, if language simplification must be expressed as simplification of grammar, a theory of the syllable is required in which the phonotactic generalizations of a language are stated in terms of distinctive features rather than in terms of degree of sonority.

Chapter four presented a detailed analysis of the evolution of consonant + yod sequences. It was argued that affrication must be conceived of as a contour creating process. The analysis proposed for the Gallo-Romance evolution of consonant + yod and velar + front vowel sequences was crucially based upon this view. As such, it allowed for an elegant description of the effects of the intervocalic voicing rule on affricates arising from *k* before front vowels, from *k* before yod, and on those that arose from *t* before yod. Moreover, it followed as a natural consequence of the proposed account that velars that were spirantized were no longer susceptible to affrication. It is this interaction between the lenition rules and the affrication rule that was argued to plead in favor of the conception of affrication as a contour-creating rather than as a feature-changing process. Furthermore, we showed that a proper description of the Gallo-Romance palatalization facts argues in favor of a feature geometry in which the palatal glide and the front vowels are not only specified for a dorsal, but also for a coronal articulator node.

Finally, in chapter five we studied lenition and examined the structuralist notion that sound change is at least in part co-determined by properties of the phonological system. We have shown that a description based on underspecification theory makes it possible not only to provide an insightful description of lenition as a unified sound shift, but also to explain why, once spirantization had been accomplished, the sound changes that followed represented a logical consequence. More specifically, an underspecification approach made it possible to describe the second step in the lenition process as an instance of grammar simplification and permitted the formulation of a principle that makes degemination a necessary consequence of voicing.

Allen, W. Sidney. 1973. *Accent and Rhythm*, Cambridge, Cambridge University Press.
Amastae, John. 1986. 'A Syllable-based Analysis of Spanish Spirantization,' O. Jaeggli and C. Silva-Corvalán (eds.), *Studies in Romance Linguistics*, 3-21, Dordrecht, Foris.
Archangeli, Diana. 1984 *Underspecification in Yawelmani Phonology and Morphology*, Ph d.Diss., MIT.
Archangeli, Diana and Douglas Pulleyblank. 1986. *The Content and Structure of Phonological Representations*, (ms.).
Austin, Peter. 1981. *A Grammar of Diyari, south Australia*, Cambridge, Cambridge University Press.
Bédier, Joseph. 1937. *La Chanson de Roland*, Paris, L' édition d'Art.
Bhat, D.N.S. 1978. 'A General Study of Palatalization,' Joseph Greenberg (ed.), *Universals of Language*, vol. 2, *Phonology*, 47-92, Stanford, Stanford University Press.
Bichakjian, Bernard. 1972. *Lenition and Nasalization in the Romance languages*, Ph.d.Diss., Harvard University.
Bichakjian, Bernard. 1977. 'Romance Lenition: Thoughts on the Fragmentary-Sound-Shift and the Diffusion Hypotheses,' *Romance Philology*, 31, 196-203.
Birk, D.B W. 1970. 'The Malakmalak language, Daly river (Western Arnhem Land),' *Pacific Linguistics*, series B, 45.
Blust, Robert. 1979. 'Coronal-Noncoronal consonant clusters: new evidence for markedness,' *Lingua* 47, 101-117.
Bourciez, Edouard. 1974. *Phonétique française: Etude Historique*, Paris, Klincksieck.
Brame, Michael. 1973. 'On Stress Assignment in Two Arabic Dialects,' S.R. Anderson and P. Kiparsky (eds.), *A Festschrift for Morris Halle*, 14-25, New York, Holt, Rinehart and Winston.
Burzio, Luigi. 1987. 'English Stress,' M. Bertinetto and M. Loporcaro (eds.), *Certamen Phonologicum*, 153-175.
Bynon, Theodora. 1977. *Historical Linguistics*, Cambridge, Cambridge University Press.
Cairns, Charles and Michael Feinstein. 1982. 'Markedness and the theory of syllable structure,' *Linguistic Inquiry*, 13, 193-226.
Campbell, Lyle. 1974. 'Phonological Features: Problems and Proposals,' *Language*, 50, 52-65
Canavati, Gloria. 1970. *Application of the theory of Generative Phonology to a diachronic analysis of French*, Michigan, Ann Arbor.
Catford, J.C. 1977. *Fundamental Problems in Phonetics*, Edinburgh, Edinburgh University Press.
Chomsky, Noam and Morris Halle. 1968. *The Sound Pattern of English*, London, Harper & Row.
Clements, G. Nick. 1976. 'Palatalization: Linking or Assimilation,' *CLS* 12, 96-109.
Clements, G. Nick. 1985. 'The Geometry of Phonological Features,' *Phonology Yearbook* 2, 225-252.
Clements, G. Nick. 1987. 'Phonological Feature Representation and the Description of Intrusive Stops,' A. Bosch et al. (eds.), *Parasession on Autosegmental and Metrical Phonology*, CLS, 23, 29-50.

Clements, G. Nick. 1988. 'The Role of the Sonority Cycle in Core Syllabification,' J. Kingston and M. Beckmann (eds.), *Papers in Laboratory Phonology*, 1, Cambridge, University Press.

Clements, G. Nick and Samuel J. Keyser. 1983. *CV Phonology: A Generative Theory of the Syllable*, Cambridge, MIT press.

Crowley, Terry. 1981. 'The Mpakwithi dialect of Anguthimri,' R.M.W. Dixon and B.J. Blake (eds.), *Handbook of Australian Languages*, vol. 2, 147-194, Amsterdam, John Benjamins.

Devine, A. and L. Stephens. 1977. *Two studies in Latin Phonology*, Anma Libri, Ann Arbor, Michigan.

Dixon, R.M.W. 1977. *A Grammar of Yidiń*, Cambridge, Cambridge University Press.

Dixon, R.M.W. 1981. 'Wargamay,' R.M.W. Dixon and B.J. Blake (eds.), *Handbook of Australian Languages*, vol. 2, 1-146, Amsterdam, John Benjamins.

Dixon, R.M.W. 1983. 'Nyawaygi,' R.M.W. Dixon and B.J. Blake (eds.), *Handbook of Australian Languages*, vol. 3, 431-525, Amsterdam, John Benjamins.

Douglas, D.H. 1959. 'An Introduction to the Western Desert Language of Australia,' *Oceania Linguistic Monographs*, no 4.

Duggan, Joseph J. 1969. *A Concordance of the Chanson de Roland*, Ohio State University Press.

Foerster, W. and E. Kosschwitz. 1932. *Altfranzosisches Ubungsbuch*, Leipzig, O.R. Reisland.

Foley, James. 1977. *Foundations of Theoretical Phonology*, Cambridge, Cambridge University Press.

Fouché, Pierre. 1958. *Phonétique historique du français*, vol. 2, *Les voyelles*, Paris, Klincksieck.

Fouché, Pierre. 1961. *Phonétique historique du français*, vol. 3, *Les consonnes*, Paris, Klincksieck.

Gerhards, Joseph. 1913. 'Beiträge zur Kentniss der prahistorischen franzosischen Syncope des Pänultimavokals, *Beihefte zur Zeitschrift für Romanische Philologie*, Heft 55, Halle, Max Niemeyer Verlag.

Goldsmith, John. 1976. 'An Overview of Autosegmental Phonology,' *Linguistic Analysis*, 2, 23-68.

Gussenhoven, Carlos. 1986. 'English Plosive Allophones and Ambisyllabicity,' *Gramma*, 10, 119-141.

Haas, Mary R. 1977. 'Tonal Accent in Creek,' L. Hyman (ed.), *Studies in Stress and Accent*, Southern California Occasional Papers in Linguistics, 4, 195-208.

Haas, Wim G. de. 1988 *A Formal Theory of Vowel Coalescence*, Doctoral Dissertation, Nijmegen University.

Hall, Robert A. Jr. 1976 *Proto-Romance Phonology*, New York, Elsevier.

Halle, Morris and G. Nick Clements. 1983. *Problem Book in Phonology*, Cambridge, MIT-Press.

Halle, Morris and Jean-Roger Vergnaud. 1987. *An Essay on Stress*, Cambridge, MIT-Press.

Hammond, Michael. 1984. *Constraining Metrical Theory: A Modular Theory of Rhythm and Destressing*, Ph.d Diss., University of California, LA.

Hammond, Michael. 1986. 'The Obligatory Branching Parameter in Metrical Theory,' *Natural Language and Linguistic Theory*, 4, 185-228.

Harris, James. 1983. *Syllable Structure and Stress in Spanish: a nonlinear analysis*, Cambridge, MIT-Press.
Hayes, Bruce. 1981. *A Metrical Theory of Stress Rules*, Ph.d.Diss., MIT, Distributed by IULC.
Hayes, Bruce. 1982. 'Metrical Structure as the Organizing Principle in Yidin Phonology,' H. van der Hulst and N. Smith (eds.), *The Structure of Phonological Representations*, Part 1, 97-110, Dordrecht, Foris.
Hayes, Bruce. 1984. 'The Phonology of Rhythm in English,' *Linguistic Inquiry*, 15, 33-74.
Hayes, Bruce. 1985. 'Iambic and Trochaic Rhythm in Stress Rules,' *Proceedings of the Eleventh Annual Meeting of the Berkeley Linguistics Society*, 429-446.
Hayes, Bruce. 1986. 'Inalternability in CV-Phonology,' *Language*, 62, 321-351.
Hayes, Bruce. 1987. 'A Revised Parametric Metrical Theory,' Paper presented at the 17th annual meeting of NELS.
Hermann, E. 1923. *Silbenbildung im Griechischen und in den andern indogermanischen Sprachen*, Gottingen, Vandenhoeck and Ruprecht.
Hulst, Harry van der. 1984. *Syllable Structure and Stress in Dutch*, Dordrecht, Foris.
Itô, Junko. 1986. *Syllable Theory in Prosodic Phonology*, Ph d.Diss., University of Massachusetts at Amherst.
Kager, René. 1988. 'English Stress and Destressing as Rime Adjunction,' P. Coopmans and A. Hulk (eds.), *Linguistics in the Netherlands*, 111-121, Dordrecht, Foris.
Kager, René. (forthcoming). *Stress and Destressing in English and Dutch*, Doctoral Dissertation, Utrecht University.
Kahn, Daniel. 1976. *Syllable-based Generalizations in English Phonology*, Ph.d.Diss., MIT.
Keating, Patricia. 1988. *A Survey of Phonological Features*, IULC.
Kenstowicz, Michael. 1980. 'Notes on Cairene Arabic Syncope,' *Studies in the Linguistic Sciences*, 10, 39-53.
Kiparsky, Paul. 1970. 'Historical Linguistics,' J. Lyons (ed.), *New Horizons in Linguistics*, 302-315, Harmondsworth, Penguin Books, reprinted in *Explanation in Phonology*, 45-55, Dordrecht, Foris.
Kiparsky, Paul. 1981. 'Remarks on the Metrical Structure of the Syllable,' W.U. Dressler et al. (eds.), *Phonologica 1980*, Innsbrück.
Kiparsky, Paul. 1982. 'From Cyclic Phonology to Lexical Phonology,' H. van der Hulst and N. Smith (eds.), *The Structure of Phonological Representations*, Part 1, 131-175, Dordrecht, Foris.
Klausenburger, Jurgen. 1970. 'French Prosodics and Phonotactics', *Beihefte zur Zeitschrift fur Romanische Philologie*, Heft 124, Tübingen, Max Niemeyer Verlag.
Kussaim, S. 1968. 'L'accent de mot dans l'Arabe de Caire,' *Arabica*, 15, 289-315.
Lausberg, Heinrich. 1967. *Romanische Sprachwissenschaft*, vol. 2, *Konsonantismus*, Berlin, Walter de Gruyter.
Levin, Juliette. 1985. *A Metrical Theory of Syllabicity*, Ph.d.Diss., MIT.

Liberman, Mark and Alan Prince. 1977. 'On Stress and Linguistic Rhythm,' *Linguistic Inquiry*, 8, 249-336.

Martinet, André. 1949. 'Occlusives and affricates with reference to some problems of Romance phonology,' *Word*, 5, 116-122.

Martinet, André. 1955. *Economie des Changements Phonétiques*, Bern, Editions A. Francke.

McCarthy, John. 1979. 'On Stress and Syllabification,' *Linguistic Inquiry*, 10, 443-465.

McCarthy, John. 1982. *Formal Problems in Semitic Phonology and Morphology*, Ph.d.Diss., IULC.

McCarthy, John and Alan Prince. 1986. 'Prosodic Morphology,' (ms.)

Meyer-Lübke, Wilhelm. 1890. *Grammatik der Romanischen Sprachen*, vol. 1, *Romanische Lautlehre*, Leipzig, Fues' Verlag.

Morin, Yves-Charles. 1979. 'Maintien du E final dans l'évolution historique des mots du type *faire* et *maire* en français,' *Canadian Journal of Linguistics*, 24, 95-118.

Morin, Yves-Charles. 1986. 'On the Morphologization of word-final consonant deletion in Old French,' H. Anderson (ed.), *Sandhi Phenomena in the Languages of Europe*, 167-210, Berlin, Mouton de Gruyter.

Morin, Yves-Charles. (ms.) 'On the Affrication and Palatalization of geminates in Gallo-Romance.'

Murray, Robert and Theo Vennemann. 1983. 'Sound Change and Syllable Structure in Germanic Phonology,' *Language*, 59, 514-528.

Nespor, Marina and Irene Vogel. 1986. *Prosodic Phonology*, Dordrecht, Foris.

Niedermann, Max. 1931. *Précis de phonétique historique du Latin*, Paris, Klincksieck.

Pope, Mildred. 1956. *From Latin to Modern French*, Manchester, Manchester University Press.

Poser, Wiliam. 1982. 'Phonological Representation and Action-At-A-Distance,' H. van der Hulst and N. Smith (eds.), *The Structure of Phonological Representations*, Part 2, 121-158, Dordrecht, Foris.

Posner, Rebecca. 1974. 'Chronologie de la Palatalisation Romane,' *Atti di XIV congresso internazionale di linguistica e filologia romanza*, Naples, Gaetano Macchiaroli and Amsterdam, John Benjamins.

Prince, Alan. 1983. 'Relating to the Grid,' *Linguistic Inquiry*, 14, 19-99.

Prince, Alan. 1985. 'Improving Tree Theory,' *Proceedings of the Eleventh Annual Meeting of the Berkeley Linguistics Society*, 471-490.

Pulgram, Ernst. 1975. *Latin-Romance Phonology: prosodics and metrics*, Munich, Wilhelm Fink Verlag.

Rheinfelder, Max. 1963. *Altfranzosische Grammatik*, vol. 1, *Lautlehre*, Munich, Max Hueber Verlag.

Richter, Elise. 1934 'Chronologishe Phonetik des Franzosischen bis zum Ende des 8. Jahrhunderts,' *Beihefte zur Zeitschrift fur Romanische Philologie*, Heft 82, Halle, Max Niemeyer Verlag.

Safarewicz, Jan. 1969. *Historische Lateinische Grammatik*, Halle, Max Niemeyer Verlag.

Sagey, Elisabeth. 1986. *The representation of Features and Relations in Nonlinear Phonology*, Ph.d.Diss., MIT.

Sapir, Edward. 1930. 'Southern Paiute, a Shoshonean language,' *Proceedings of the American Academy of Arts and Sciences*, vol. 65, no 1-3.

Schane, Sanford. 1973. *Generative Phonology*, Englewood Cliffs, Prentice-Hall.

Schein, Barry and Donca Steriade. 1986. 'On geminates,' *Linguistic Inquiry*, 17, 691-744.

Schwan, Eduard and Dieter Behrens. 1913. *Grammaire de l'ancien français*, Leipzig, O.R. Reisland.

Selkirk, Elisabeth. 1980. 'Prosodic Domains in Phonology: Sanskrit Revisited,' M. Aronoff and M-L. Kean (eds.), *Juncture*, 107-129, Saratoga, Anma Libri, Studia Linguistica et Philosophica 7.

Selkirk, Elisabeth. 1982. 'On the Major Class Features and Syllable Theory,' M. Aronoff and R.T. Oehrle (eds.), *Language Sound Structrure*, 107-136, Cambridge, MIT-Press.

Sezer, Engin F. 1983. 'On Non Final Stress in Turkish,' *Journal of Turkish Studies*, 5, 61-69.

Sievers, Eduard. 1893. *Grundzuge der Phonetik*, Leipzig, Breitkopf & Hartel.

Sommerstein, Allan. 1974. 'On phonotactically motivated rules,' *Journal of Linguistics*, 10, 71-94.

Steriade, Donca. 1982. *Greek Prosodies and the Nature of Syllabification*, Ph.d.Diss., MIT, Cambridge.

Steriade, Donca. 1986. 'Non-underlying Feature Specifications,' Paper read at the Leiden Workshop on Phonology, june 2.

Steriade, Donca. 1987. 'Redundant Values,' A. Bosch et al. (eds.), *Parasession on Autosegmental and Metrical Phonology*, CLS, 23, 339-362.

Steriade, Donca. 1988. 'Gemination and the Proto-Romance Syllable Shift,' D. Birdsong and J.P. Montreuil (eds.), *Advances in Romance Linguistics*, 371-409, Dordrecht, Foris.

Stevens, Kenneth, Samuel Jay Keyser and Haruko Kawasaki. 1988. 'Towards a Phonetic and Phonological Theory of Redundant Features,' J. Perkell and D.H. Klatt (eds.), *Symposium on Invariance and Variability of Speech Processes*, Hillsdale, Lawrence Erlbaum Association.

Straka, Georges. 1954. 'Encore *ante- *antius*, A.Fr. *ainz*,' *Mélanges de linguistique française offerts à M. Charles Bruneau*, 69-83, Geneva, Librairie E. Droz.

Straka, Georges. 1965. 'Naissance et disparition des consonnes palatales dans l'évolution du latin au français,' *Travaux de Linguistique et de Litterature*, 3, 117-167.

Strehlow, T.G.M. 1942/44. *Aranda Phonetics and Grammar*, The Oceania Monographs, no 7.

Sturtevant, Edgar. 1968. *The pronunciation of Greek and Latin*, Groningen, Bouma's Boekhuis.

Tryon, D.T. 1967. 'Nengone Grammar,' *Linguistic Circle of Canberra Publications*, series B, no. 6, Canberra.

Voegelin, C.F. 1935. *Tübatulabal Grammar*, University of California Publications in American Archeology and Ethnology, vol. 34, 55-189.

Vogel, Irene. 1977. *The Syllable in Phonological Theory: with Special Reference to Italian*, Ph.d.Diss., Stanford.
Walker, Douglas. 1971. *Old French Phonology and Morphology*, Ph.d.Diss., University of California, San Diego.
Wartburg, Walther von. 1952. *Franzosisches Etymologisches Worterbuch*, Band 4, Basel, Helbing und Lichtenhahn.
Wetzels, Leo. 1981. *Analogie et Lexique, le problème de l'opacité en phonologie générative*, Doctoral Dissertation, Nijmegen University.
Wetzels, Leo. 1985. 'The historical phonology of Intrusive Stops: a non-linear description,' *Canadian Journal of Linguistics*, 30, 285-333.
Wetzels, Leo and Ben Hermans. 1985. 'Aspirated Geminates in Pāli,' H. Bennis and F. Beukema (eds.), *Linguistics in the Netherlands*, 213-223, Dordrecht, Foris.
Wetzels, Leo. 1986. 'Phonological Timing in Ancient Greek,' L. Wetzels and E. Sezer (eds.), *Studies in Compensatory Lengthening*, 297-344, Dordrecht, Foris.
Wetzels, Leo. 1989. 'Sonority, major class features, syllable structure, manner features: How much of the same? The case of Yakut,' H. Bennis and A. van Kemenade (eds.), *Linguistics in the Netherlands*, 173-183, Dordrecht, Foris.
Wetzels, Leo. (forthcoming). 'Contrastive and Allophonic properties of Brasilian Portuguese Vowels,' D. Wanner and D.A. Kibbee (eds.), *Selected Papers from the XVIII Linguistic Symposium on Romance Languages*, Amsterdam, John Benjamins.
Wheeler, Deirdre. 1979. 'A Metrical Analysis of Stress and Related Processes in Southern Paiute and Tübatulabal,' J. Lowenstamm (ed.), *Massachusetts Occasional Papers in Linguistics*, 5, 145-175.
Whitney, William D. 1896. *A Sanskrit Grammar*, Leipzig, Breitkopf & Hartel.

SAMENVATTING

Dit proefschrift bestaat uit een verzameling niet lineaire studies waarin verschillende aspecten van de historische fonologie van het Frans aan bod komen Het doel van deze studies is tweeledig. Enerzijds wordt aangetoond dat, in vergelijking met traditionele beschrijvingen, niet-lineaire analyses van fonologische processen als syncope, apocope, palatalisering, affricatisering, palatale diftongering en lenitie leiden tot een beter begrip van deze processen en een dieper inzicht verschaffen in hun onderlinge verhoudingen. Zo wordt in hoofdstuk I betoogd dat syncope en apocope, tot dusverre opgevat als twee verschillende processen, in de historische fonologie van het Frans, mits beschreven in het kader van de metrische fonologie, opgevat kunnen worden als manifestaties van een en dezelfde regel. voet-gebonden klinkerreductie. De studies in dit proefschrift hebben ook een tweede doel Niet-lineaire fonologie is niet een enkele theorie in een definitieve vorm, maar veeleer een verzameling nog in ontwikkeling zijnde deeltheorieen (zoals bijvoorbeeld de onderspecificatie-theorie, de accent-theorie en de theorie omtrent de geometrische representatie van distinctieve kenmerken). Voor elk van deze deeltheorieen zijn er een aantal, elkaar beconcurrerende, beschrijvende modellen voorhanden. Door het toepassen van deze modellen op traditioneel beschreven processen werpen de studies verzameld in dit proefschrift niet alleen een nieuw licht op verschillende aspecten van de historische fonologie van het Frans, maar bieden zij ook bruikbare toetsstenen om de aangewende deeltheorieen op haar empirische waarde te testen Zo behandelt het eerste hoofdstuk twee alternatieve accent-theorieen: de theorie van Hayes (1981) en die van Prince (1983). De beschrijving van syncope en apocope als een en dezelfde regel, werkzaam op verschillende onafhankelijk gemotiveerde metrische structuren, blijkt alleen mogelijk in een theorie waarin de notie voet deel uitmaakt van het begrippenapparaat. De hier voorgestelde analyse van syncope en apocope draagt derhalve bij tot het maken van een principiele keuze tussen twee elkaar beconcurrende theorieen omtrent de formele representatie van accent.

Dit proefschrift valt op te splitsen in twee delen. De eerste drie hoofdstukken behandelen enkele prosodische processen uit de historische fonologie van het Frans zoals syncope en apocope en de ontwikkeling van de voetstructuur en de lettergreepstructuur. De laatste twee hoofdstukken zijn gewijd aan segmentele processen zoals palatalisering, affricatisering, palatale diftongering en lenitie.

In hoofdstuk I wordt een metrische analyse van syncope en apocope gegeven Na een beschrijving van het accentsysteem in het Latijn en na een inleiding op de accent-theorieën van Hayes (1981) en van Prince (1983) in sectie 1.1, geeft sectie 1 2.1 een gedetailleerde beschrijving van syncope Syncope kan worden beschreven als een process dat geconditioneerd is door prosodische structuur boven de lettergreep, en kan worden geformaliseerd als een voet-gebonden reductieregel. Nadat de gevolgen van syncope voor het accentsysteem van het Gallo-Romaans zijn besproken, wordt in sectie 1 2 2 aangetoond dat apocope beschreven kan worden door middel van dezelfde regel die nodig bleek voor de beschrijving van syncope. Tenslotte wordt in sectie 1.3 betoogd dat de generalisatie dat syncope en apocope beschouwd kunnen worden als eén en dezelfde regel niet mogelijk is in een accent theorie zoals die van Prince (1983), maar alleen mogelijk is in een accent-theorie zoals die van Hayes (1981), waarin de voet als eenheid van beschrijving een centrale plaats inneemt.

Hoofdstuk II behandelt de relatieve gemarkeerdheid van accentsystemen en vergelijkt de theorie van Hayes (1981) met een herziene versie daarvan (1987) In sectie 2.2 1 wordt betoogd dat er vier belangrijke redenen zijn om de kwantiteits ongevoelige rechts-dominante accentsystemen uit Hayes' theorie (1981) niet te beschrijven door middel van syllabische trocheeer maar door middel van omgedraaide syllabische trocheeen. Vervolgens bespreekt sectie 2 2.2 de aanname van Hayes (1987) dat de kwantiteits gevoelige links dominante accentsystemen (cf. Hayes (1981)) beschreven moeten worden door middel van morische trocheeen. Een morische trochee-analyse van het Latijn kan niet onafhankelijk gemotiveerd worden door de accent-gevoelige klinkerreductie (besproken in hoofdstuk I); een morische trochee-analyse leidt tot de valse voorspelling dat klinkerreductie niet voorkomt; met deze morische trochee-analyse kan de verandering van het Latijnse accentsysteem in dat van het Gallo Romaans niet beschreven worden als een ontwikkeling van een gemarkeerd naar een ongemarkeerd accentsysteem. Vervolgens wordt een alternatieve beschrijvingwijze voor kwantiteits-gevoelige links-dominante accentsystemen verdedigd die de bovengenoemde bezwaren opheft. Tenslotte wordt in sectie 2.3 besproken hoe andere accentsystemen waarvoor Hayes (1987) de morische trochee heeft voorgesteld, kunnen worden geanalyseerd.

Hoofdstuk III is geheel gewijd aan de interactie tussen de ontwikkeling van de lettergreepstructuur en die van de voetstructuur in de historische fonologie van het Frans. De bestudering van de lettergreepstructuren van het Klassiek Latijn, het Laat Latijn, het Gallo-Romaans en het Oud Frans laat zien dat de ontwikkeling van de Franse lettergreepstructuur zich voltrokken heeft volgens een slingerbeweging (gesloten -> open; open > gesloten; gesloten -> open). Deze slingerbeweging kan alleen worden begrepen in relatie met de ontwikkeling van de voetstructuur Veranderingen die zich op een bepaald niveau van de prosodische representatie voltrekken --de voet gebonden klinkerreductie uit hoofdstuk I en II-- en die daar tot vereenvoudiging van prosodische structuur leiden --de verandering van een gemarkeerd Latijns naar een ongemarkeerd Gallo-Romaans accentsysteem-- kunnen een complicatie veroorzaken op een ander niveau van prosodische representatie --de gesloten Gallo Romaanse lettergreepstructuur, na de Laat Latijnse open lettergreepstructuur--. Deze interactie tussen voetstructuur en lettergreepstructuur verschaft tevens een antwoord op een vraag waarvoor iedere gemarkeerdheidstheorie ons plaatst waarom ontwikkelen alle talen zich niet rechtstreeks tot talen met enkel open lettergrepen, die immers het minst gemarkeerd zijn? Tenslotte wordt in hoofdstuk III aangetoond dat, wil vereenvoudiging van taal formeel uitgedrukt worden als vereenvoudiging van grammatica, een lettergreep-theorie vereist is waarin de fonotactische restricties van een taal geformuleerd worden in termen van distinctieve kenmerken veeleer dan in termen van graad van sonoriteit.

Hoofdstuk IV en V vestigen de aandacht op segmentele processen in de historische fonologie van het Frans Hoofdstuk IV geeft een gedetailleerde analyse van de ontwikkeling van medeklinker + *j* groepen en van de ontwikkeling van velairen voor vóórvocalen. Affricatisering moet worden opgevat als een contourcreatie-process. Deze visie op affricatisering maakt het mogelijk om een elegante beschrijving te geven van de verschillende manieren waarop de lenitieregels van toepassing zijn op affricaten die resulteren uit intervocalische *kj* groepen, uit intervocalische *tj* groepen en uit intervocalische velairen voor vóorvocalen. Als men affricatisering opvat als het creeren van een contour, kunnen het wèl affricatiseren van intervocalische *k* voor voorvocalen tijdens de eerste Gallo-Romaanse palatalisering, en het nièt affricatiseren van intervocalische *k* in dezelfde omgeving tijdens de tweede, op een rechtstreekse wijze worden verklaard. In sectie 4.3 wordt aangetoond dat de regels die nodig zijn om de verdere ontwikkelingen van affricaten te beschrijven ook nodig zijn om de ontwikkeling van groepen van sonoranten en *j* en van *s* + *j* te beschrijven. Sectie 4.4 tenslotte handelt over de theoretische implicaties van de verdedigde analyse met name voor de theorie over de geometrische representatie van distinctieve kenmerken. Betoogd wordt dat *j* zowel als vóórvocalen opgevat moeten worden als complexe segmenten, dat wil zeggen segmenten voortgebracht op een zowel dorsale als coronale articulatieplaats.

Hoofdstuk V is gewijd aan de formele beschrijving van lenitie. Lenitie betreft een reeks veranderingen: de spirantisering van intervocalische stemhebbende explosieven, het stemhebbend maken (voicing) van intervocalische stemloze obstruenten en het degemineren van geminaten. Hier wordt op formele wijze uitdrukking gegeven aan de structuralistische visie dat de onderdelen van lenitie een samenhangende klankverandering vormen. In sectie 5.2 worden een aantal mogelijke manieren besproken die in de niet-lineaire fonologie voorhanden zijn om spirantisering en voicing te beschrijven. Sectie 5.3 onderzoekt in welke mate niet lineaire fonologie in staat is de integriteit van lenitie formeel tot uitdrukking te brengen. Het blijkt dat iedere stap in het lenitieproces betrekking heeft op een distinctief kenmerk dat als gevolg van een vorige stap voorspelbaar geworden is door redundantieregels. Door een aantal principes te formuleren wordt lenitie niet alleen beschreven als een integrale klankverandering, maar wordt ook verklaard waarom, zodra spirantisering zich voltrokken had, de stappen die volgden een logisch gevolg waren. Meer in het bijzonder wordt aangetoond dat een onderspecificatie-analyse van lenitie het mogelijk maakt, voicing als een grammatica-vereenvoudiging te beschrijven en tevens een principe te formuleren volgens hetwelk degeminatie een noodzakelijk gevolg is van voicing.

CURRICULUM VITAE

The author was born on August 1, 1961 in Venlo. In 1979 he graduated from secondary school (Gymnasium-a of the Van der Puttlyceum in Eindhoven). He then began his studies of French Linguistics and Literature at the Catholic University of Nijmegen

In 1983 he received his bachelor's degree and in 1985 his master's degree (cum laude). His major was French Linguistics with minors in Language Philosophy and Computational Linguistics.

From November 1985 he has worked at the Department of French Linguistics and Literature of the Catholic University Nijmegen, investigating the historical phonology of French

Stellingen behorend bij het proefschrift

Nonlinear studies in the historical phonology of French.

1.

Syncope en apocope, traditioneel opgevat als twee verschillende processen, kunnen in de historische fonologie van het Frans beschouwd worden als één en dezelfde regel die werkt op verschillende, onafhankelijk gemotiveerde metrische structuren.

2.

De pendulaire beweging die men observeert in de evolutie van de Franse lettergreepstructuur kan alleen begrepen worden indien men tegelijkertijd de ontwikkeling van de Franse voetstructuur in ogenschouw neemt.

3.

Het wèl affricatiseren van intervocalische *k* voor vóórvocalen tijdens de eerste Gallo-Romaanse palatalisering, en het nièt affricatiseren van intervocalische *k* in dezelfde omgeving tijdens de tweede, kan verklaard worden als men affricatisering opvat als het creëren van een contour in het constrictieregister ('continuant tier').

4.

> The Cairene rule poses some problems for Hayes's foot theory (...) He therefore proposes that the foot is [r d], the very opposite of naïve expectation, with the labeling rule LCPR, "d = s iff it branches." (...) It seems quite implausible to claim that, in a language where the stress pattern is predominantly [s w], the grouping of (for instance) CV́C-CV̌-CV́C is CV́C/CV̌CV́C, while that of CV́-CV̌-CV́C is CV́CV̌/CV́C. (...) The intuition here is that the foot starts with a stress and runs (rightward/leftward) up to the next stress, and that it is defined uniformly in this way for a language (Prince, 1983:69).

> We would expect that quantity-sensitive systems would have both iambic and trochaic feet in them: iambic on the assy-metrical feet, trochaic on the balanced feet. (...) Cairene Arabic has exactly this pattern (McCarthy and Prince, 1986:9).

Bovenstaande citaten illustreren op fraaie wijze hoe theoriegebonden de intuïties van taalkundigen zijn.

5.

Dat timing en melodische eigenschappen onafhankelijke eigenschappen zijn van het fonologische segment, is een inzicht dat ten onrechte wordt toegeschreven aan de autosegmentele fonologie, maar dat in feite al wordt aangetroffen bij de pioniers van de systematische fonologie (cf. Sievers, 1893:259 en Whitney, 1896:84).

6.

Naarmate de vervuiling van het milieu voortschrijdt, zal aan *The Waste Land* van T.S. Eliot een steeds grotere profetische waarde worden toegekend.

7.

In Erasmus' onverbeterlijke woorden uit 1510 kunnen de schaarsbezoldigde AIO's en OIO's van 1989 zich moeiteloos herkennen als de zotten die "sese perpetuo [torquent]: addunt, mutant, adimunt, reponunt, repetunt, recudunt, ostendunt, nonum in annum premunt, nec umquam satisfaciunt ac futile praemium, nempe laudem, eamque perpaucorum, tanti emunt, tot vigiliis, somnique, rerum omnium dulcissimi, tanta iactura, tot sudoribus, tot crucibus" en die "tantis malis redimendum existima[n]t, ut ab uno aut altero lippo probe[n]tur" (Erasmus, *Stultitiae Laus*, cap. L).